ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Bachelor Thesis (Programme: Strategy Economics)

The effect of crime on business entry and exit in The Netherlands between 2011-2021

Name student: Emy Smolders

Student ID number: 577103

Supervisor: Arjun Gupta

Second assessor: Max Coveney

Date final version: 10-07-2023

Abstract

This research is about the effect of crime on business exit and entry in the Netherlands. Locating a business is a key factor for entrepreneurs and this decision is dependent on multiple factors, which also entails crime. In deciding where to locate the business, firms make a cost-benefit analysis based on the costs of crime exposure and the benefits of agglomeration. The central research question is:

How does crime affect entrepreneurial entry and exit per Business Sector in the Netherlands between 2011 and 2021?

This will be analysed by using panel data using fixed effects and random effects models. This research also looks at the differences in business entry and exit between highly and lowly agglomerated provinces using a Z-test.

The conclusion is that the effect of crime on business entry and exit is rather unclear. In most models, multiple negative and positive coefficients were significant, so there is no final answer. Also, between the highest and lowest agglomerated provinces there is no clear answer. There are again multiple significant findings, but again, they are both positive and negative and do not give one clear answer.

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1. Introduction

Settling businesses have gained popularity over the past few years. On January 1st, 2023, The Netherlands counted 2.325.141 active businesses, which yields a growth rate of 6% compared to January 1st, 2022 (Van 't Woud, 2023). One of the most crucial factors in settling a business is the location of the new company. This location is dependent on several factors, such as the availability of skilled labour, costs of utilities, construction costs and transportation facilities (Karakaya & Canel, 1998). Both the availability of skilled labour as well as the utilities is dependent on the agglomeration of businesses. If there are more same-sector businesses in one area, they can benefit from each other's presence. For example, they can utilize the same utilities, share knowledge and attract skilled labour. Agglomeration is also linked to better development and exploitation of firm-specific assets as well as increasing returns (Rigby & Brown, 2015). The downside of agglomeration is that it also attracts criminal activity. Criminal activity is mostly based in 'hot spots' where all businesses are settled together (Sherman, 1995). Recent studies have shown that besides the fact that there are a lot of businesses located in these agglomerated areas, the average loot is higher and the chances of getting caught seem to be smaller (Glaeser & Sacerdote, 1999). If there is crime in an agglomerated area, businesses have a higher chance of getting merchandise stolen (Fe & Sanfelice, 2022). There are also indirect costs concerning less demand due to the higher perceived risk of crime, which lower the overall customer base and the overall demand (Matti & Ross, 2016). Businesses therefore need to decide between settling in an agglomerated area or not. They need to use a cost-benefit analysis to determine whether the benefits of being located in an agglomerated area weigh more than the possible criminal activities and the direct and indirect costs that are caused by these activities.

Earlier research has not shown the relationship between criminal activities on entry and exit in the most important Dutch sectors. This is relevant because if there indeed is a negative impact of crime on entry and/or exit, this could be another argument to battle crime in areas with more businesses. Also in this paper, we will evaluate the effect of the different forms of crime on both entry and exit and we will discuss whether certain types of crime have a higher impact than others. If certain types of crime have a larger impact on business entry and/or exit, this will also be something that needs to be tackled by the government. This leads to the following research question:

How does crime affect entrepreneurial entry and exit the Netherlands between 2011 and 2021?

This research aims to shed light on the effects of crime on entrepreneurial activity. Little research on the link between crime and entrepreneurship has been conducted (Matti & Ross, 2016). This paper is scientifically relevant, as there has been done little research on the effect of crime on business settlings. There are multiple reasons why this is the case, the first being that research faces endogeneity issues, making it harder to evaluate. In the case of the effect of crime on business activity, we deal with the problem of reverse causality because crime has an impact on business location, and because the more

businesses are located in an area, the more crime this area will likely attract. On the other hand, businesses often want to locate together, in a cluster, so they can benefit from multiple agglomeration economics. So, both criminals and entrepreneurs are attracted to certain local areas, which leads to reverse causality. This research will try to minimize this problem by taking the lagged crime variables into account and splitting crime into eight different types of crime.

Another problem that deterred researchers to evaluate the effect of crime is the quality of the data on both entrepreneurship as well as crime. For a long time, both crime data and entrepreneurial-related data were only available at the country level, which leads to a problem. Crime and entrepreneurship are both considered local phenomena, so they both should be studied at the local level instead of the country level to get appropriate results. This research aims to address these issues by using province level data and thereby adding to the scientific literature.

It is important to evaluate the effect of crime on business activity because crime could have a considerable influence on whether a business wants to settle in a more criminal area. Furthermore, crime brings both direct and indirect costs, which could lead to different outcomes considering the location choice. If crime is found to be related to the location choices of a business, this will be a good indicator for policymakers to make better policies to make crime in these areas less important without harming the firms. Therefore, the outcome of this research is socially relevant.

This paper is divided into six sections. First, the literature review will be discussed, where the most important research that is conducted on criminal activity in agglomerated areas is highlighted. Second, we will elaborate on the specific data that is used. Third, the methodology is discussed. Fourth, the results will be presented and interpreted. Fifth, we will focus on the conclusion and sixth will be the discussion section.

2. Literature review

2.1. Settling businesses

There are multiple relevant personal factors for individuals whether they want to become entrepreneurs, such as income, employment status, ethnicity, age and educational level (Evans & Leighton, 1989; Braunerhjelm et al, 2010). Research has shown that besides these personal characteristics, the local attributes of a city conduct a big part of the choice of where to settle the business (Glaeser & Kerr, 2009; Saboe & Condliffe, 2015). Policymakers cannot affect most of these characteristics, but policies can be aimed at attracting businesses, such as for example New Market Credit and bankruptcy regulations (Harger & Ross, 2016; Harger et all, 2016; Paik, 2013; Rohlin & Ross, 2016).

A safe environment constitutes a crucial factor for locating businesses. Crime has a significant impact on the local environment because the cost of doing business can be influenced by crime in the area. The direct costs rise because of the risk of having robberies in the business, but there are also indirect costs

concerning less demand due to the higher perceived risk of crime which lowers the overall customer base (Matti & Ross, 2016). This leads to higher costs for an equal level of profit and production, which causes entrepreneurial opportunities to diminish. Entrepreneurs are not able to perfectly predict the impact crime will have on the business; therefore, crime also raises uncertainty about future profits. The result is that crime reduces the entrepreneurial motivation of individuals due to higher opportunity costs (Kuratko et al, 2000).

2.2. Crime

2.2.1. Criminals in agglomerated areas

Becker (1968) used the cost-benefit analysis to analyse the choices of individuals. This is also applicable to whether someone engages in criminal activities. If the expected utility from engaging in criminal activity is larger than the expected utility in engaging in the available legal activities, someone will choose to engage in said criminal activity. Relevant factors that could impact the utility of engaging in criminal activities depend on factors such as the chance to be caught and convicted, the average punishment, the average loot size and the legal wages if engaged in legal activity instead of criminal activity. Being in an area with a lot of businesses that carry value – such as merchandise – the expected loot of criminal activity rises, which leads to a higher expected benefit for criminal activities (Becker, 1968). These criminal activities will therefore take place around so-called 'hot spots', which are defined as small areas where criminal activities occur often and predictably (Sherman, 1995). Businesses located in these hot spots have a higher chance of burglary and repeated victimization (Yu & Maxfield, 2014).

2.2.2. Crime on business location choice

Businesses need to make a business location choice at least once. Multiple factors are important when making this decision, such as zoning regulations, job accessibility, population density, but also criminal rates (Sakai, Beziat & Heitz, 2020). Crime holds multiple negative factors for businesses, with the first being the unsafe environment it creates for the business, such as the chance of merchandise being stolen or armed robberies taking place. The second factor is that consumers could be reacting negatively to crime in the sense that they limit their venue visits (Fe & Sanfelice, 2022). Both these effects of crime have a negative impact on the business choice of locating a business in an area where a lot of crime is taking place. This leads to the first hypothesis:

H1: There will be less entrepreneurial entry and more exit in provinces with a high amount of crime.

2.3. Agglomeration

Agglomeration refers to the concentration of economic activities and resources in a geographic area. Firms and industries cluster together in specific regions, resulting in spatial economic patterns (Amrhein & Reynolds, 1996). Agglomeration has multiple causes, but one of the main drivers is the presence of positive externalities, which implies spillover effects to neighbouring firms and industries. These externalities can include different things such as knowledge, labour market pooling, shared

infrastructure and access to certain suppliers. Firms benefit from these externalities by locating near one another and therefore increasing both productivity as well as competitiveness (Puga, 2010). Moreover, agglomeration leads to economies of scale, as firms will be able to share infrastructure and utilise resources in the most efficient way. This will lead to cost reductions in production, transportation and distribution processes, which makes the overall region more competitive (Ellison, Glaeser & Kerr, 2010).

An overall economic benefit from agglomeration is the fact that clustered firms are more likely to share knowledge and innovation, yielding a higher likelihood of exchanging ideas, collaborating on research and exchanging knowledge. This can lead to new technological development as well as economic growth in general. Finally, the businesses situated in the cluster increase competition for customers, which drives innovation, quality and lowers costs. This benefits consumers through a greater product variety and lower prices (Rigby & Brown, 2015).

2.3.1. Potential benefits from agglomeration for firms

Earlier research shows that there are many variables correlated with crime and business location, but agglomeration has the largest effect. Agglomeration economies yield both benefits of localization economies as well as benefits of urbanization economies. The localization economies consist of benefits such as sharing common inputs, labour market pooling and knowledge spillovers (Rosenthal & Strange, 2001). Urbanization economies consist of benefits, such as a high local demand sector, cross-fertilization of ideas and lower transaction costs (Glaeser et al, 1992). Both these benefits yield higher business performance in an agglomerated area: this will lead to more benefits a firm can yield compared to lowly agglomerated areas for the same business (Garcia, 2014).

2.3.2. Crime and agglomeration

As discussed above, crime usually takes place in 'hot spots', which have multiple businesses settled together and are usually situated in a highly populated area. These areas also bring benefits for the businesses such as agglomeration benefits, as well as more consumers in general. Businesses therefore need to make a trade-off between the negative effects crime holds and the positive effects of being located in these agglomerated 'hot spots'. This can lead to businesses settling in areas that carry a lot of crime, as the benefits of locating in these populated areas weigh more than the negative effects of crime (Sloan, Caudill & Mixon, 2016). These agglomerated areas also attract criminals since the expected utility of criminal activities is higher in the agglomerated areas. Not only is the large number of businesses in these agglomerated areas favourable for criminal activity but also the fact that the chances of getting arrested are lower and the living conditions correlated with the individuals that engage in criminal activities, such as poverty, seem to have a positive impact on the amount of criminal activity (Glaeser & Sacerdote, 1999).

Businesses need to make a trade-off between the benefits of being located in an agglomerated industry and the disadvantages related to a higher perceived risk of criminal activities. The outcome for firms that can benefit a lot from being located in an agglomerated area might outweigh the disadvantages of the criminal activities in this area. Firms that do not benefit from being located in an agglomerated area might choose to not situate in an agglomerated area since the disadvantages might weigh on them heavier.

As the theory suggested, firms must make cost-benefit analyses of the location choice. Locating in a cluster leads to multiple benefits, such as knowledge spillovers and resource benefits. Crime occurs more in these agglomerated areas, since the average loot of the activity is higher, leading to a higher expected utility of crime in these areas. The businesses, therefore, need to make the trade-off between the benefits of locating in a cluster and the perceived risks of criminal activities. Therefore, the second hypothesis is:

H2: Entrepreneurs in highly agglomerated provinces are affected less by criminal activity than their counterparts in provinces that are lowly agglomerated.

3. Data

In order to answer the research question, there is a need for data on the relevant crime reports, the number of startups and the number of closures on the province level in the Netherlands on a per business sector basis over the relevant years. In this research, we will evaluate crime based on eight distinct categories, established by CBS. A specification of these categories can be found in the Appendix.

As stated in the theory, direct costs of businesses rise due to crimes, such as merchandise being stolen. This increases the direct cost of doing business. Therefore, province-level data of The Netherlands on all sorts of crimes are used as the independent variable in this research. Furthermore, in this paper, all business sectors/industries will be considered that CBS has taken into account. These industries/business sectors are specified in the Appendix.

All data is available on CBS Statline from 2011 onwards to 2021. CBS Statline is a governmentally supported database that reports all sorts of statistics on the Dutch population. CBS provides data on both the Dutch economy and Dutch society and can therefore be used to collect data on the required crime and economic factors. This research uses province-level data because it is favourable to look as local as possible. Municipality data was not available for most control variables, leading to province data being used.

3.1. Control variables

In order to properly answer the research question, there must also be controlled for confounding factors. There are multiple factors that influence both the level of crime and the economic (mal)performance that must therefore be controlled for.

As mentioned in the theory the most important control variable is the agglomeration of businesses. This will be controlled for by looking at the business density of the evaluated sectors. Agglomerated areas lead to more business entries as well as more crime in the area, as mentioned earlier.

The next control variable is the average income per capita per province. As mentioned in the theoretic framework, individuals make a trade-off between expected utilities of outcomes of possible decisions. If an individual already has a lower income, the opportunity costs are probably lower to start a business (Amit, Muller & Cockburn, 1995). A lower average income also decreases the opportunity costs of engaging in criminal activities (Mehlum, Miguel & Torvik, 2006). Thus, average income is negatively related to both business activity and criminal activity.

Another control variable is the average age of the individuals per province. Research shows that there is an inverse U-shaped relation between the age structure and starting a business, which concludes that middle-aged individuals are most likely to start a business (Bönte, Falck & Heblich, 2015; Velilla, Molina & Ortega, 2018). Younger individuals seem to be engaged most in criminal activities compared to older individuals. This is also due to the fact that younger individuals usually have lower opportunity costs (Farrington 1986). Thus, age is positively correlated with business activity and negatively correlated with criminal activities. This will be evaluated using the demographic pressure.

Another control variable is gender. Males are more likely to engage in criminal activities compared to females (Broidy & Agnew, 1997). Men also seem to be more likely to start a business compared to women due to having easier access to resources relevant to a business (Thébaud, 2010).

The last control variable is nationality. Research shows that non-Dutch people are more likely to commit crimes but are also more likely to start a business. Research shows that immigrants have fewer opportunities in the labour market compared to Dutch residents (Bell, Fasani & Machin, 2013). Due to this fact, Beckers (1968) cost-benefit analysis will show fewer opportunity costs for committing crimes for immigrants compared to Dutch people. Other research shows that immigrants are highly entrepreneurial and therefore set up more businesses compared to Dutch residents (Fairlie & Lofstrom, 2015).

This research evaluates on the province level, so provincial population density will also be controlled for. In a more densely populated province, there are more individuals that are likely to start a business, but there will also more likely be more crime, simply because there are more individuals in the area.

3.2. Highly and lowly agglomerated provinces

To test the second hypothesis, it is necessary to distinguish the provinces based on the level of agglomeration. This is done by looking at the number of total business establishments in each province in 2023. The three provinces that amount to the highest number of business establishments in 2023 will be the ‘highest agglomerated provinces’ and the three provinces that have the least of business

establishments in 2023 will be the 'lowest agglomerated provinces' in this research. There is chosen to only look at three in each group because The Netherlands only counts twelve provinces and this research aims to show the biggest, yet reliable distinction in agglomeration level. CBS shows that the most agglomerated provinces in 2023 consist of Zuid-Holland, Noord-Holland and Utrecht. The least agglomerated provinces in 2023 are the provinces Zeeland, Drenthe and Flevoland (CBS, 2023b). This distinction can also be clearly made out from Figure 1 and Figure 2.

3.3 Motivation

As laid out in the Literature Review, it is expected that there is more entrepreneurial exit and less entrepreneurial entry in provinces that suffer from higher levels of crime. In Figure 1 and Figure 2, scatterplots are created that lay out the business entries and exits respectively over the amount of crime per province. Both these graphs need to be interpreted by looking at the colour-coded provinces separately. So for example, in Figure 1 Gelderland needs to be analysed by looking at the green colour, which shows that the total number of business entries decreases as crime rises. Figure 1 shows for almost all provinces a clear downgrading path, which means that overall, the total business entry per year goes down if the total crime rate goes up. Although when comparing all provinces there exists an increasing trend, on a province level there is a clear downward trend visible. Figure 2 shows that exit increases when crime increases as well. For example, when looking at Gelderland, there seems to be a steadily increasing linear trend with a single outlier at the top. All provinces follow such a trend, where if crime rises, business exit rises as well. As we can deduce from these graphs, each province seems to have both a decreasing amount of entrepreneurial entry and an increasing amount of entrepreneurial exit when crime rises, in support of the hypotheses.

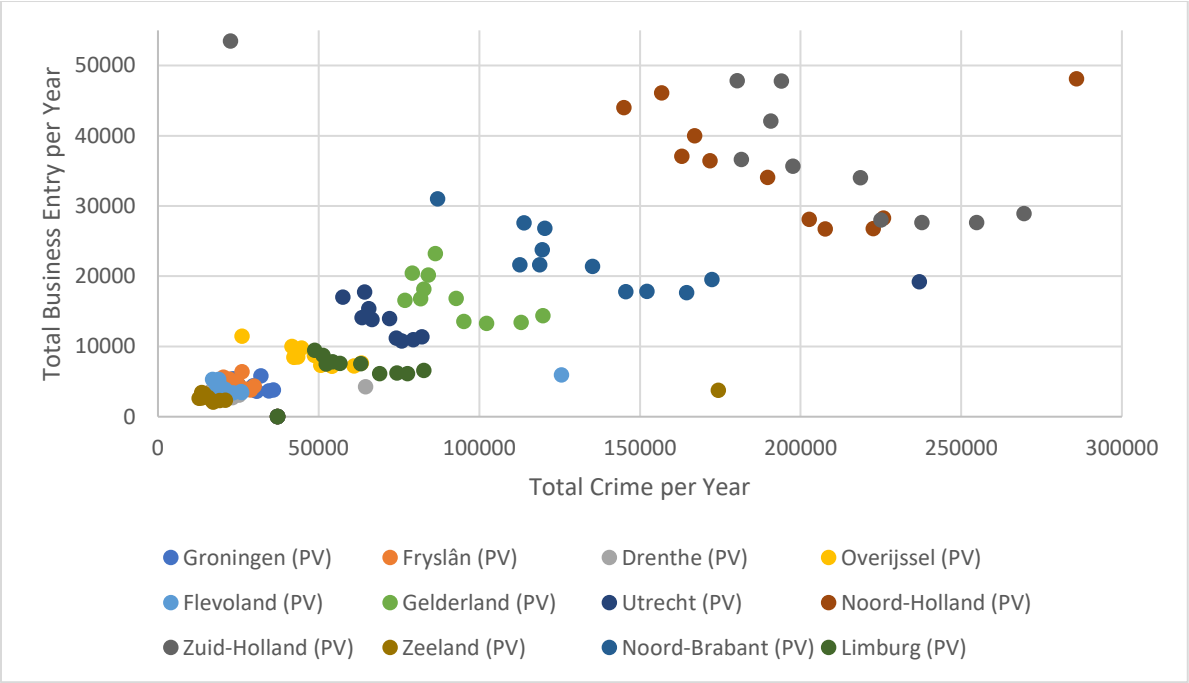

Figure 1 – Scatterplot of Business Entry over Total Crime per Dutch Province in the period 2011-2021

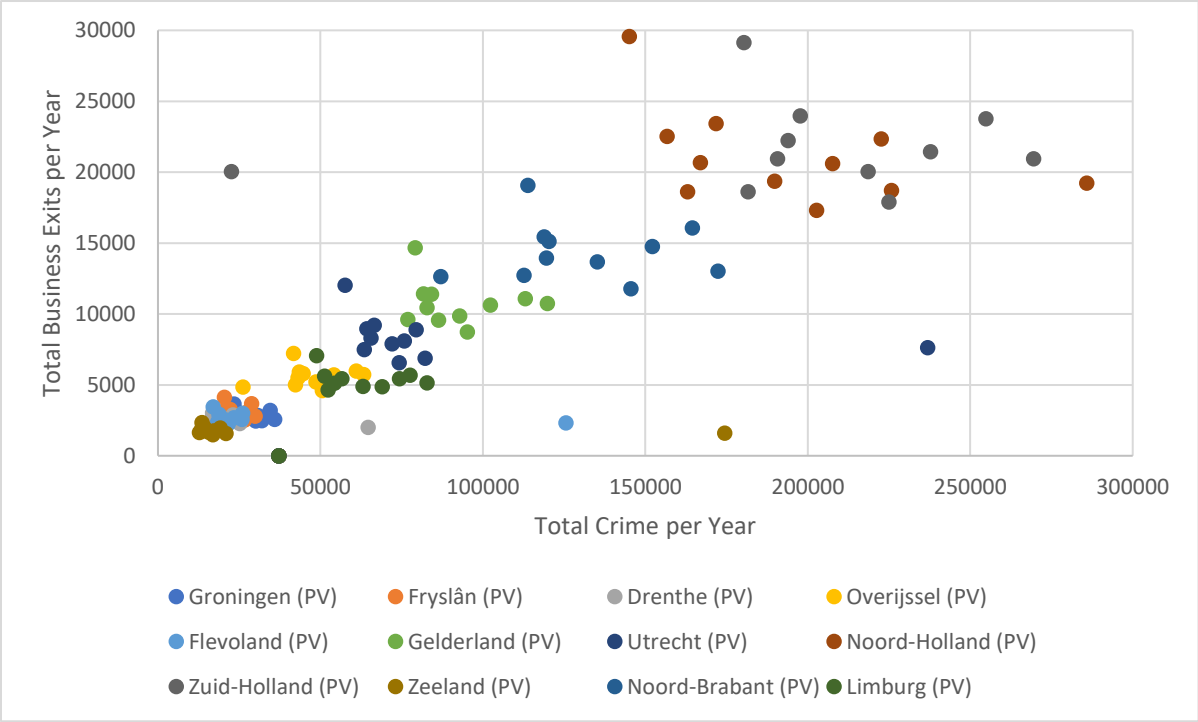

Figure 2 – Scatterplot of Business Exit over Total Crime per Dutch Province in the period 2011-2021

The variables used in this research are summarized in Table 1 with their respective means, standard deviations, minimum and maximum and their observation count. The observations for entry and exit are lower compared to the other variables. This is due to missing values for entry and exit in various sectors for 2011-2014. This also results in fewer observations for all the lags. The observation count does not differ across variables, as the dataset is a balanced panel. The amount of total crime is divided into the specific subsections mentioned earlier: most crime seems to be Property Crimes with 47,398, followed by Public Order Crimes and Traffic Crimes with 10,395 and 10,263, respectively. The number of business entries and exits and establishments differs greatly between the provinces, as seen by the relatively and absolutely large standard deviations.

Table 1 – Descriptive Statistics of used variables per Business Sector per Dutch Province in the period 2011-2021

Variable	Mean	Std. Dev.	Min	Max	Observations
Business Entry	803	1,316	0	10,810	2,364
Business Exit	495	800	0	8,300	2,364
Property Crimes	47,398	42,428	5,875	164,345	2,508
Lag Property Crimes	48,643	43,313	5,875	164,345	2,280
Public Order Crimes	10,395	8,507	1,865	42,300	2,508
Lag Public Order Crimes	10,549	8,634	1,865	42,300	2,280
Violent Crimes	7,693	6,563	1,530	27,305	2,508
Lag Violent Crimes	7,828	6,621	1,670	27,305	2,280
Common Crimes	952	824	150	3,105	2,508

Lag Common Crimes	950	818	150	3,105	2,280
Traffic Crimes	10,263	9,483	2,010	42,600	2,508
Lag Traffic Crimes	10,290	9,555	2010	42,600	2,280
Drug Crimes	1,226	1,069	155	3,940	2,508
Lag Drug Crimes	1,247	1,087	175	3,940	2,280
Firearm Crimes	517	505	85	2,225	2,508
Lag Firearm Crimes	511	494	85	1,910	2,280
Other Crimes	327	264	60	1,270	2,508
Lag Other Crimes	321	256	60	1,125	2,280
Business Establishments	130,758	106,569	25,710	416,590	2,508
Average Income Per Capita	41,333	4,516	33,100	54,100	2,508
Demographic Pressure	0.696	0.054	0.603	0.812	2,508
Population Density	516	357	185	1,380	2,508
Male Proportion	0.497	0.003	0.489	0,502	2,508
Foreign Proportion	0.048	0.020	0.016	0,104	2,508

4. Methodology

The relevant data is analysed using the statistical analysis program Stata. Through using Stata, the influence of crime on startups and closures can be distilled by using regression analysis. In these regressions, either the number of entries or exits will be regressed on the eight different crime variables, while also controlling for the influence of the control variables mentioned in the data section. The used data is, as discussed earlier, a panel dataset. The data must be formatted long in Excel and grouped by industry per province and by year. These nineteen sectors are thus multiplied by the twelve provinces to create 228 panel groups, which are tracked over a period of eleven years from 2011-2021.

To test the first hypothesis, the data is set as panel data using Stata, whereafter a model using fixed or random effects can be used based on the results of the Hausman test. The Hausman test determines whether fixed or random effects are more appropriate; if the p-value is significant, fixed effects are used instead of random effects.

The regression equation for both models is as follows:

$$Y_{it} = \beta_k X_{it} + a_i + u_{it}$$

Where: Y_{it} denotes the outcome of entity *i* on time *t*, β_k denotes the effects of the variables X_{it} of entity *i* on time *t*. The coefficient a_i contains the entity-specific intercepts and u_{it} denotes the error term of entity *i* on time *t*.

The hypothesis is then tested by applying the relevant model on business entry and exit and interpreting the p-value, R^2 and sizes and signs of the coefficients. The first hypothesis is rejected if there exists no significant negative (positive) influence of crime on business entry (exit) on the 5% significance level.

In order to test the second hypothesis, two other regressions are applied to business entry and exit. However, in order to test the difference between effects on highly agglomerated and lowly agglomerated provinces, the three most agglomerated and three least agglomerated provinces are selected. Again, the Hausman test is applied to these two subsamples of three provinces to determine the proper estimations techniques. After applying said technique, the coefficients of the models are tested on differing significantly from the other using a Z-test that divides the difference of the coefficients by the square root of the sum of their squared standard errors (Clogg, Petkova & Haritou, 1995).

$$Z = \frac{\beta_1 - \beta_2}{\sqrt{(SE\beta_1)^2 + (SE\beta_2)^2}}$$

The second hypothesis is rejected if there exists no significantly different effect on the higher agglomerated provinces at the 5% level.

5. Results

5.1. The effect of crime on business entry/exit

5.1.1. Hausman test

The Hausman test concludes that the p-value for business exit is not significant at 0.17, so the random effects estimation will be used in this case. The p-value for business entry is also not significant at 0.70, which indicates that the model using random effects is also more appropriate in this case.

5.1.2. Business Exit

Model 1 in Table 2 shows the results of the model using random effects. Not all types of crime are significant, but the ones that are significant and positive do support hypothesis 1. The significant tested types of crime are both positive and negative. Property crime is significant and positive, which means that if a single extra property crime is committed, business exit rises, on average, by 0.009. The same goes for public order crime, which entails that if public order crime rises by 1, exit rises on average by 0.024. Another significant and positive type of crime is the common crimes category, which means that if common crimes rise by 1, business exit rises by 0.134 on average. The last significant and positive category of crimes consists of firearm crimes. If firearm crimes rise by 1, business exit rises by 0.204 on average.

Now for the significant types of crime that have a negative effect on business exit. The first category is traffic crime, which means that if traffic crime rises by 1, business exit drops by 0.016 on average. The next category is drug crime, which means that if drug crimes rise by 1, business exit will drop by 0.114 on average.

Certain lags of the different types of crimes have a significant and negative effect on business exit. The lag of property crime is significant and negative, which means that the previous number of property crimes has a negative effect of 0.008 on average on business exit in the current year. The lag of common crimes also has a significant and negative impact on business exit. The previous number of common crimes has a negative effect of 0.441 on average on business exit in the current year. The last significant and negative type of lag is the other crimes category. This means that a previously committed other crime has a negative effect of 0.533 on average on business exit in the current year.

Other types of lags have a significant and positive effect on business exit, with the first being the lag of traffic crimes, which states that the previous value of traffic crime has an incremental effect of 0.035 on business exit in the current year on average. The second lag of a specific type of crime that has a positive significant effect is the lag of drug crime, which means that the previous value of drug crime has an effect of 0.073 on average on business exit in the current year.

From the control variables, the number of business establishments is significant and positive, which means that if the number of business establishments rises by 1, business exit rises by 0.003 on average. The foreign population also has a significant and positive effect, which means that if the foreign proportion rises by 1 (0.01), business exit rises by 5,971 (59.71) on average. Population density and income have a significant and negative effect on business exit. For population density this means that if the population density rises by 1, business exit drops by 0.499 on average. For income, this means that if income rises by 1, there is a negative effect of 0.011 on business exit.

The R^2 equals 0.245, meaning that 24.50% of the variance in the data is explained by the model. This is rather low and may be due to over-aggregation.

5.1.3. Business Entry

Model 2 in Table 2 shows the results of the model using random effects. Hypothesis 1 stated that the more crime there is, the less entry there would be. Looking at Model 2, not all results seem to support this hypothesis. Firstly, traffic crime has a significant and positive effect on business entry, meaning that if traffic crime rises by 1, business entry rises by 0.024 on average. Other crime, on the other hand, has a positive and significant effect on business entry. If the other crime rises by 1, the business entry rises by 0.281 on average.

Certain lags of the different types of crimes have a significant and negative effect on business entry, which is in favour of hypothesis 1. The lag of common crime is significant and negative, which means that the previous value of common crime has a negative effect of 0.202 on average on business entry in the current year. The lag of traffic crimes is also significant and negative, which means that the previous value of traffic crime has a negative effect of 0.023 on average on business entry. The lag of other crimes, on the other hand, is significant and positive, meaning that the previous value of other crimes leads to an average increase of 0.385 in business entry.

From the control variables, the number of establishments seems to have a significant and positive effect on business entry. This means that if the number of business establishments rises by 1, business entry will rise by 0.004 on average. Income has a positive and significant effect as well, which means that if income rises by 1, business entry rises by 0.011 on average. Another positive and significant variable is the population density, which means that if the population density rises by 1, business entry rises by 0.784 on average. Demographic pressure and the proportion of the male population both have a significant and negative effect on business entry. For demographic pressure, this means that if the demographic pressure rises by 1 (0.01), the business entry drops by 1,531 (15.31) on average. For the proportion of the male population this means that if the male proportion rises by 1 (0.01), business entry will drop with 38,100 (381.00) on average.

The R^2 equals 0.272, meaning that 27.20% of the variance in the data is explained by the model. This is rather low and may be due to over-aggregation.

Hypothesis 1 stated that there would be less entrepreneurial entry and more exit if there is more crime. This hypothesis cannot be accepted, as there are both multiple significant negative coefficients in Model 1 and positive coefficients in Model 2. However, since many coefficients are either not significantly different from zero or even have the 'opposite' sign, there is not enough evidence to reject the first hypothesis.

Table 2 – Regression results of the effect of Crime on Business Entry and Exit

	Model 1 Random-effects Estimation on Business Exit	**Model 2** Random-effects Estimation on Business Entry
Property crime	0.009*** (0.002)	-0.003 (0.003)
Lag Property	-0.008*** (0.002)	-0.003 (0.003)
Public order	0.024*** (0.008)	0.017 (0.012)
Lag Public order	-0.002 (0.007)	0.003 (0.011)
Violent crime	0.001 (0.017)	0.017 (0.026)
Lag Violent	0.021 (0.019)	-0.032 (0.029)
Common	0.134* (0.073)	0.084 (0.112)
Lag Common	-0.441*** (0.069)	-0.202* (0.106)
Traffic crime	-0.016** (0.007)	0.024** (0.011)
Lag Traffic	0.035*** (0.009)	-0.023* (0.013)
Drug crime	-0.114*** (0.027)	-0.017 (0.041)

Lag Drug	0.073** (0.029)	0.050 (0.044)
Firearm crime	0.204*** (0.060)	0.133 (0.091)
Lag Firearm	-0.001 (0.063)	-0.065 (0.095)
Other crime	0.022 (0.107)	0.281* (0.164)
Lag Other	-0.533*** (0.098)	0.385*** (0.149)
Establishments	0.003*** (0.000)	0.004*** (0.001)
Income	-0.011*** (0.004)	0.011* (0.006)
Demographic pressure	172 (461)	-1,531** (711)
Population density	-0.499* (0.280)	0.784* (0.442)
Male	-2,677 (12,219)	-38,100** (19,064)
Foreign	5,971*** (1,291)	-342 (2,000)
Constant	1,553 (6,072)	19,489** (9,466)
R^2	0.245	0.272
Observations	2,172	2,172

Notes: standard errors between parentheses. Stars indicate significance at respectively 10% (*) 5% (**) and 1% (***).

5.2. The effect of crime on business entry/exit in the highly and lowly agglomerated provinces

5.2.1. Hausman test

As mentioned in the data section, the three highest agglomerated provinces are Zuid-Holland, Noord-Holland and Utrecht, the so-called Randstad provinces. The least agglomerated provinces are Zeeland, Drenthe and Flevoland. For the estimation of business entry in the highly agglomerated provinces, the Hausman test concludes that the p-value is not significant at 0.95, so the random effects estimation will be used. The Hausman test concludes that the p-value for the estimation of business entry in the lowly agglomerated provinces is also not significant at 0.99, which means that the random effects estimation will be used here as well. These models both use random effects estimation, thus we can compare their coefficients using a Z-test.

For the estimation of business exit on the highly agglomerated provinces, the Hausman test concludes that the p-value is significant at 0.008, therefore fixed effects estimation will be used. For the estimation of business exit on the lowly agglomerated provinces, the Hausman test concludes that the p-value is significant at 0.035, so here the fixed effect estimation will be used as well. Since both these models are using the fixed effects estimation, we can compare their coefficients using a Z-test.

5.2.2. Business entry in highly and lowly agglomerated provinces

Model 3 captures business entry in the highest agglomerated provinces. In this model, no type of crime, nor any control variable has a significant effect. Model 4 captures business entry in the lowest agglomerated provinces. This model does not contain any significant types of crime and gives only one significant control variable, which is average income. If the average income rises by 1, business entry rises by 0.009. In Column 4 of Table 3, the difference between the estimated coefficients of Models 3 and 4 is described. The Z-scores indicating the difference are all quite low and are all not significant. There does not seem to exist an identifiable significant effect of crime on business entry in either the highest or lowest agglomerated provinces, and the coefficients do not differ significantly.

The R^2 for Models 3 and 4 is respectively 0.370 and 0.292. This means that the variance in the data is explained for 37.0% in Model 3 and for 29.2% in Model 4. This is both very low and could be due to the fact that only three provinces are taken into account in both models and again, the data is on province level instead of on municipality level.

Table 3 – Regression results of the effect of Crime on Business Entry in Highly Agglomerated provinces and Lowly Agglomerated provinces

	Model 3 Random-effects estimation on Business Entry in Highly Agglomerated provinces	**Model 4** Random-effects estimation on Business Entry in lowly Agglomerated provinces	**Difference between Model 3 and 4**
Property crime	-0.006 (0.011)	0.009 (0.007)	-0.015 |1.147|
Lag Property	0.003 (0.015)	0.001 (0.006)	0.002 |0.111|
Public order	-0.003 (0.055)	0.002 (0.024)	-0.004 |0.073|
Lag Public order	-0.040 (0.046)	0.016 (0.014)	-0.055 |1.153|
Violent crime	0.018 (0.171)	0.037 (0.005)	-0.019 |0.105|
Lag Violent	-0.027 (0.142)	0.018 (0.030)	-0.045 |0.309|
Common	-0.009 (0.603)	-0.151 (0.197)	0.142 |0.224|
Lag Common	0.075 (0.598)	-0.001 (0.134)	0.076 |0.123|
Traffic crime	0.041 (0.041)	0.025 (0.040)	0.016 |0.279|
Lag Traffic	0.002 (0.062)	-0.049 (0.035)	0.051 |0.718|
Drug crime	0.061 (0.185)	0.036 (0.110)	0.025 |0.114|
Lag Drug	0.012 (0.239)	-0.060 (0.052)	0.072 |0.293|
Firearm crime	0.096 (0.397)	0.132 (0.299)	-0.036 |0.072|

Lag Firearm	0.152 (0.388)	-0.112 (0.290)	0.264 |0.545|
Other crime	0.050 (0.916)	0.313 (0.314)	-0.263 |0.271|
Lag other	0.107 (0.895)	-0.113 (0.274)	0.220 |0.235|
Establishments	0.005 (0.003)	0.001 (0.003)	0.004 |0.934|
Income	0.039 (0.060)	0.009** (0.005)	0.030 |0.501|
Demographic pressure	-15,274 (12,100)	1,165 (1,023)	-16,439 |1.354|
Population density	0.965 (2.711)	3.004 (2.113)	-2.039 |0.593|
Male	-10,514 (305,419)	-10,430 (29,855)	84 |0.000|
Foreign	-10,744 (24,882)	-1,087 (2,543)	-9,657 |0.386|
Constant	13,162 (141,190)	3,282 (14,640)	9,880 |0.070|
Observations	543	543	
R^2	0.370	0.292	

Notes: standard errors between parentheses and absolute Z-score between bars. Stars indicate significance at respectively 10% (*) 5% (**) and 1% (***).

5.2.3. Business exit in highly and lowly agglomerated provinces

Model 5 describes the effect of crime on business exit in highly agglomerated provinces. Public order crime as well as firearm crime has a significant and positive effect on business exit. This means that if public order crime rises by 1, business exit rises by an average of 0.062. For firearm crime, this means that if an incremental crime is committed, business exit rises by 0.772 on average. The only type of crime that has a significant and negative effect on business exit is the category of other crime. If the number of other crimes rises, business exit drops by an average of 1.221.

Certain lags of the different types of crimes have a significant effect on business exit. The lag of violent crime is significant and positive, which means that an incremental increase in the previous number of violent crimes leads to an average increase of 0.196 of business exits in the current year. The lag of common crime has a significant and negative effect, which means that the previous value of common crime has a negative effect of 0.949 on business exit in the current year.

From the control variables, only population density and the proportion of foreigners in the population have a significant effect. For the population density, this means that if the population density rises by 1 (0.01), business exit drops by an average of 4,430 (44.30). For the proportion of foreigners in the population, this means that if the foreigners proportion rises by 1 (0.01), business exit rises by 56,935 (569.35) on average.

The R^2 of Model 5 is equal to 0.304, which means that the variance in the data is explained for 30.4%. This is rather low but is again explainable due to the fact that only the three most agglomerated provinces are taken into account as well as that this model is focused on the province level.

Model 6 captures the effects of crime on business exit in the lowly agglomerated provinces. Again, multiple types of crime have a positive and significant effect in this model: property crime and common crime. A remarkable point here is that both of these significant types of crimes are positive as well. For property crime, this means that if property crime rises by 1, business exit rises by an average of 0.017. For common crime, this means that if common crime rises by 1, business exit increases by 0.507 on average.

Certain lags of different types of crimes also have a significant effect on business exit. The lag of traffic crime has the only significant and positive effect on business exit; the previous value of traffic crime has an effect of 0.076 on average on business exit in the current year. The lags of property crimes, violent crimes and drug crimes all have a significant and negative effect on business exit. This means that the previous value of these types of crime has a negative effect of, on average, respectively 0.008, 0.073, 0.082 on business exit in the current year.

For the control variables, only income and the proportion of foreigners are significant. For income, this effect means that if average income rises by 1, business exit drops by an average of 0.009. For the proportion of foreigners in the population, this means that if the foreigners proportion rises by 1 (0.01), business exit rises by 5,528 (552.8) on average.

In Column 4 of Table 4, the difference between the estimated coefficients of Models 5 and 6 is described. For crime, there are four types with a large absolute Z-score, namely the lag of violent crimes, the lag of common crimes, the lag of traffic crimes, firearm crimes and the proportion of foreigners in the population. The influence of firearm crimes is significantly larger for the highly agglomerated provinces. Concerning the different types of lags: the influence of the lag of violent crimes is larger in the highly agglomerated provinces, whereas the influence of the lag of common crimes as well as the lag of the traffic crimes is larger in the lowly agglomerated provinces. The effect of the proportion of foreigners in the population is significantly larger in highly agglomerated provinces than in lowly agglomerated ones.

Hypothesis 2 states that entrepreneurs in highly agglomerated provinces are affected less by crime than entrepreneurs in lowly agglomerated provinces. Table 3 shows us that there exists no significant difference in the effects of crime in business entry between these types of provinces. Table 4 shows that firearm crimes and the lag of violent crimes have a significantly larger effect on business exit in highly agglomerated provinces. On the other hand, the lag of common crimes and the lag of traffic crimes has a larger effect on lowly agglomerated provinces. Hypothesis 2 cannot be accepted, because Table 3 shows there are no significant differences on business entry between highly and lowly agglomerated

provinces and the effect on business exit between these groups is rather unclear. Hypothesis 2 cannot be rejected as well, because the effect on business exit is rather ambiguous, considering the significant positive and negative differences between Model 5 and 6. Models 5 and 6 both show some significantly larger effects for some variables, so in the end there isn't a clear result.

Table 4 – Regression results of the effect of Crime on Business Exit in Highly Agglomerated provinces and Lowly Agglomerated provinces

	Model 5 Fixed-effects estimation on Business Exit in Highly Agglomerated provinces	**Model 6** Fixed-effects estimation on Business Exit in Lowly Agglomerated provinces	**Difference between Model 5 and 6**
Property crime	0.002 (0.008)	0.017** (0.007)	-0.015 |1.450|
Lag Property	-0.001 (0.010)	-0.008* (0.005)	0.008 |0.699|
Public order	0.062* (0.035)	0.000 (0.018)	0.062 |1.587|
Lag Public order	-0.022 (0.033)	-0.011 (0.010)	-0.011 |0.306|
Violent crime	-0.058 (0.127)	-0.082 (0.050)	0.024 |0.174|
Lag Violent	0.196* (0.104)	-0.073*** (0.025)	0.269** |2.517|
Common	0.391 (0.374)	0.507*** (0.163)	-0.116 |0.284|
Lag Common	-0.949** (0.447)	0.058 (0.110)	-1.007** |2.188|
Traffic crime	-0.038 (0.027)	0.030 (0.037)	-0.068 |1.490|
Lag Traffic	-0.025 (0.040)	0.076** (0.031)	-0.101** |1.997|
Drug crime	0.050 (0.162)	0.106 (0.112)	-0.056 |0.283|
Lag Drug	0.009 (0.156)	-0.082** (0.040)	0.091 |0.564|
Firearm crime	0.772*** (0.267)	-0.256 (0.215)	1.208*** |2.999|
Lag Firearm	0.110 (0.284)	0.314 (0.207)	-0.204 |0.580|
Other crime	-1.221* (0.666)	-0.100 (0.232)	-1.121 |1.590|
Lag other	-0.637 (0.565)	-0.137 (0.199)	-0.500 |-0.835|
Establishments	0.000 (0.003)	-0.002 (0.002)	0.002 |0.657|
Income	-0.070 (0.043)	-0.009*** (0.003)	-0.061 |1.390|
Demographic pressure	8,077 (7,966)	-1,257 (784)	9,334 |1.166|
Population density	-4.430*** (-1.674)	-1.766 (2.429)	-2.664 |0.903|
Male	74,236 (214,402)	-6,725 (25,245)	80,961 |0.375|

Foreign	56,935*** (17,443)	5,528*** (1,900)	51,407*** |2.930|
Constant	-37,464 (99,676)	4,939 (12,330)	-42,403 |0.422|
Observations	543	543	
R^2	0.304	0.316	

Notes: standard errors between parentheses and absolute Z-score between bars. Stars indicate significance at respectively 10% (*) 5% (**) and 1% (***).

6. Conclusion

This paper aims to answer the following research question: *How does crime affect entrepreneurial entry and exit in the Netherlands between 2011 and 2021?* The overall answer is that it's rather unclear what the exact effect of crime is on both business exit and business entry, as well as the effect of crime on business exit and entry in highly and lowly agglomerated provinces in The Netherlands. The theory suggested that entrepreneurs base their location of the business on several reasons, one of which being the criminal rates because businesses get directly and indirectly negatively influenced if the criminal rates are high (Fe & Sanfelice, 2022; Matti & Ross, 2016). Crime often appears in so-called 'hot spot' areas, because lots of businesses are settled in these areas. In these areas, the average loot is often higher while the chances of getting caught are smaller, making these areas more favourable for criminals (Glaeser & Sacerdote, 1999). These 'hot spots' can have certain advantages for firms that can benefit from agglomeration. According to Becker (1968), these firms, therefore, need to make a cost-benefit analysis to decide whether they value the agglomeration benefits more than the disadvantages crime brings.

Models 1 and 2 use random effects to estimate the effect of different types of crime on both business entry and exit. Both models have significant results that are positive as well as negative, which leads to no clear result on the impact of crime on both entry and exit. Remarkable is that property crime is said to be one of the most important types of crime for an entrepreneur, but property crime only seems to have a positive significant effect on business exit in Model 1. Besides property crime, also public order crime, common crime and firearm crime have a positive and significant effect on business exit. Besides these types of crimes having a positive and significant effect, the lag of traffic crimes and the lag of drug crimes also have a positive and significant effect on business exit. On the other hand, traffic crime and drug crime both have a negative effect on business exits. Besides these types of crime, the lag of property crime, the lag of common crime and the lag of other crimes also have a negative and significant effect on business exit. In the end, it is therefore unclear what the overall effect of crime is on business exit, because several variables have a significant and positive effect, whereas others have a significant and negative effect.

Model 2 shows the results of the various types of crime on business entry. Remarkable is that the results show that all significant types of crime lead to more business entry, which is not in support of the literature review. The significant and positive types of crime consist of traffic crime and other crimes, while the lag of other crimes has a significant and positive effect as well. However, there are some lags that have a significant and negative effect, which is in line with the theory. These types of lags are common crimes and the lag of traffic crimes. Again, it's rather unclear what the total effect of crime is on business entry, because there are again multiple factors that are negative, but also multiple factors that are positive and therefore not in support of the theory. Remarkable is that only the lags seem to have a negative effect on business entry, so this could be an indicator that crime might not have such a big effect on business entry in general. Hypothesis 1 cannot be accepted, nor be rejected because there are multiple results in favour of the hypothesis, but also multiple results that are not. Further research on this is therefore required.

Models 3 and 4 capture business entry in the highest and lowest agglomerated provinces of The Netherlands. Both models don't contain any significant types of crime or significant lags of crimes. The z-scores indicate that the differences between Model 3 and 4 are all quite low and above all, not significant. This results in no significant difference concerning business entry between highly and lowly agglomerated areas, which is not in line with the literature review.

Models 5 and 6 capture business exit in the highest and lowest agglomerated provinces of The Netherlands. Model 5 captures public order crime and firearm crime to have a significant and positive effect on business exit in highly agglomerated provinces. The lag of common crime had a significant and positive effect on business exit as well. Other crime on the other hand has a significant and negative effect on business exit in the highly agglomerated provinces. Also, the lag of violent crime has a significant and positive effect on business entry in the highly agglomerated provinces. Model 6 captures the effect of crime on business exit in lowly agglomerated provinces. Both property crime and common crime have a significant and positive effect on business exit in lowly agglomerated provinces. Also, the lag of traffic crime has a significant and positive effect. There are no significant and negative crimes in this model, only the lag of property crime, the lag of violent crime and the lag of drug crime have a significant and negative effect on business exit in lowly agglomerated provinces. The difference between the estimated coefficients of Models 5 and 6 gave some significant results. The influence of firearm crimes and the influence of the lag of violent crime is significantly larger for the highly agglomerated provinces. The influence of the lag of common crimes and the lag of traffic crimes is larger in lowly agglomerated areas. Again, there doesn't seem to be a clear result in the end on whether or not crime has a bigger impact in the lowly agglomerated provinces. Hypothesis 2, therefore, cannot be rejected, nor be accepted, since there are both results in favour of and in contrast with the hypothesis.

7. Discussion

The main issue in this research is the reverse causality problem since crime has an impact on business location, and because the more businesses are located in an area, the more crime this area will likely attract. On the other hand, businesses often want to locate together, in a cluster, so they can benefit from multiple agglomeration economics. So, both criminals and entrepreneurs are attracted to certain local areas, which leads to reverse causality. The issue around reverse causality can be solved in a highly fictional environment. This environment should consist of two identical countries, so we have a tested party and a control party which are completely identical, except for the crime rates. Both these parties need to have the exact same municipalities and these municipalities need to be divided in the same highly agglomerated and lowly agglomerated areas, so we can also look at the differences on agglomeration level. The tested party will have the normal crime rates and the control group won't have any crime at all. In this case, the only difference between the tested party and the control group is the crime rate. This will result in a clear comparison between both parties on exit and entry in all different kinds of sectors, while the only reason these entries and exits differ is the effect of the crime rates in the tested party. In this way, we can clearly look at all municipalities and see the exact effect crime has on exit and entry, but we will also have a broader look at the aggregation effect based on the effect crime has in the highly and lowly aggregated areas.

Another issue is that there is no data on the municipality level; this would have most likely led to better results. Both aggregation and crime are two phenomena that happen on a lower base level. Looking at provinces doesn't make the distinction between municipalities or cities but calculates an average. This way the results are not in line with reality since some cities or municipalities have more crime than others. The effects on business exit and entry are therefore most likely different at the municipality level.

In this paper, we looked at the difference between highly and lowly agglomerated areas on the province level. It might be a good idea to do the same but compare different sectors with one another. Some sectors are known for their agglomeration effects, while others don't profit much from these agglomeration effects at all. If you make the distinction this way, it will most likely give a better division for the highly and lowly agglomerated groups, since these groups will have different cost-profit analysis results. This isn't done in this research, because there wasn't enough data available about the different kinds of sectors that would qualify for either highly or lowly agglomerated sectors.

For further research, it also could be possible to dive into the effect of property crime on business entry and exit in more detail. This research doesn't always seem to have an effect of property crime on business entry or exit at all, while theory suggests this type of crime to be the most important one for business locations.

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Appendix

The specification of the crime categories:

1. Property crimes, these include all sorts of theft and burglary. In addition, this category also includes embezzlement, fraud, forgery crimes, extortion and money laundering.
2. Public order crimes. This category consists of arson, all forms of vandalism and crimes against public order and authority, such as sedition, local disturbance, participation in a criminal or terrorist organization and discrimination.
3. Violent crimes, including simple and aggravated assault, threats, sex crimes, murder, manslaughter, hostage-taking and human trafficking.
4. Common crimes, which include all other crimes defined in the Penal Code other than property crime, vandalism, public order crimes and violent and sexual crime.
5. Traffic crimes, including driving under the influence and leaving the scene of an accident.
6. Drug crimes, consisting of all drug offenses including drug possession and drug trafficking.
7. Firearm crimes, which include firearms possession and firearms trade.
8. Other crimes, consisting of other offenses, which do not fall into any of the seven categories.

The specification of the business sectors/industries:

1. Agriculture, forestry and fishing
2. Mining and quarrying
3. Industry; Production and distribution of and trade in electricity, natural gas, steam and refrigerated air
4. Water collection and distribution, waste and wastewater management and remediation
5. Construction
6. Wholesale and retail trade, repair of motor vehicles
7. Transportation and storage
8. Accommodation of food and beverage service activities
9. Information and communication technologies
10. Financial services
11. Renting and trading of real estate
12. Consultancy, research and other specialist business services
13. Renting of movable property and other business services
14. Public administration, public services and compulsory social insurance
15. Education services
16. Health and welfare services
17. Culture, sports and recreation
18. Other services.