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Fertility mosaic: explaining fertility differences between Dutch municipalities

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Abstract

In the Netherlands, fertility has dropped well below the replacement level since the 1970s, and in 2022 natural population growth has ceased. Despite low average fertility rates, there are regional differences in fertility. The current research aims to explain these regional differences in fertility. Multiple linear regression models using macro data on Dutch municipalities were used to explain municipal fertility rates by examining the influence of different demographic, cultural, socio-economical, contextual, and temporal factors. In line with the compositional theory, the analysis shows that differences in fertility are significantly explained by differences in demographic, cultural and socio-economic composition between municipalities. However, in contrast to the hypotheses, when accounting for both compositional and contextual factors, the contextual factors do not significantly predict municipal fertility rates. This indicates that there is no direct effect of the contextual factors on municipal fertility, but rather an indirect effect through compositional factors. Additionally, the analysis shows a positive relationship between earlier fertility in a municipality and current fertility, suggesting that differences in municipal fertility are persistent over time.

Keywords: fertility | regional difference | compositional effects | contextual effects | path dependency

List of abbreviations

CBS	Centraal Bureau voor de Statistiek (Statistics Netherlands)
GDP	Gross Domestic Product
HBO	Hoger Beroepsonderwijs (Higher Professional Education)
IUSSP	International Union for the Scientific Study of Populations
LFS	Labour Force Survey
MAUP	Modifiable Area Unit Problem
NUTS	Nomenclature of Territorial Units for Statistics
OLS	Ordinary Least Squares
SD	Standard Deviation
SDT	Second Demographic Transition
TFR	Total Fertility Rate
USA	United States of America

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INTRODUCTION

Background

The Total Fertility Rate (TFR) in the Netherlands has been below the replacement level – which is generally assumed to be around 2,1 births per woman – since 1973 (CBS, 2022a). In 2021, the TFR in the Netherlands was 1.6 births per woman. Despite fertility being below the replacement level for a few decades, the Netherlands still experienced natural population growth since 1973. This means that the number of births was higher than the number of deaths. This was possible because of population momentum, where because of a relatively young age structure, a population will continue to grow, despite fertility being below replacement level (Goldstein, 2002).

However, in January 2023 the Dutch national statistics bureau Statistics Netherlands (CBS) for the first time reported a negative natural population growth (CBS, 2023). This indicates that the Netherlands is currently located at the end of phase four of the Demographic Transition or arguably entering phase five. In phase five, both the birth and death rates of a population are low, but the death rate is higher than the birth rate, leading to a negative natural population growth (Hazen & Anthamatten, 2020).

Although fertility rates have dropped throughout the Netherlands, to an average TFR of 1.6 in 2021, there are regional differences. The municipal TFR ranges from 0.41 to 2.81. These regional differences in fertility are shown in Figure 1.

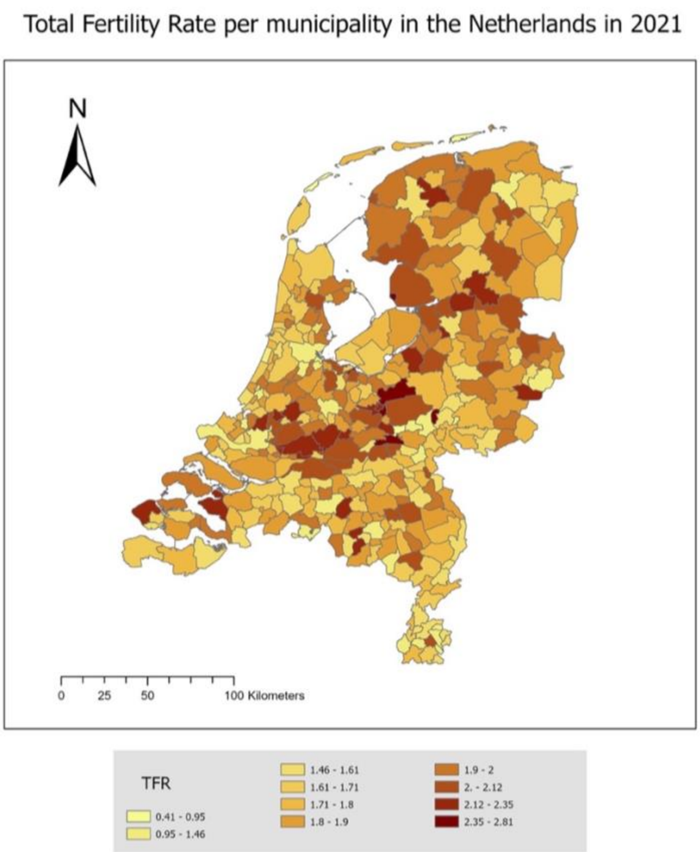

Figure 1: the Total Fertility Rate (TFR) in the Netherlands in 2021. Source: constructed by the author. Data: CBS, 2022

Research objective

The aim of this research is to analyse the differences in fertility between Dutch municipalities as shown in Figure 1 and find out what factors cause these differences to exist. Therefore, the main research question that is answered in this research is: *What are the differences in fertility between Dutch municipalities, and how can these differences be explained?*

This main research question is split up into four sub-questions:

1. How do demographic factors explain differences in fertility between Dutch municipalities?
2. How do cultural factors explain differences in fertility between Dutch municipalities?
3. How do socio-economic factors explain differences in fertility between Dutch municipalities?
4. How do contextual factors explain differences in fertility between Dutch municipalities?

To answer the research question, quantitative research is conducted using macro data on the level of Dutch municipalities provided by the open data portal of Statistics Netherlands (Statline). Using the macro data, regression analysis is performed to find out what causes fertility to differ between municipalities.

Scientific relevance

Although previous research on differences in fertility has been performed, Campisi et al. (2020) report a lack of focus on regional differences in fertility. Moreover, they note that research on regional differences in fertility mostly takes part on the national scale, comparing countries. Therefore, Campisi et al. (2020) call for a better understanding of why fertility differs within countries. Campisi et al. (2020) try to fill this knowledge gap by performing an analysis of fertility in European NUTS3 regions. The current research focuses on an even smaller scale by assessing the regional differences at the level of Dutch municipalities. Moreover, this research includes a time dimension by including previous fertility rates in the analysis to consider path dependency in fertility.

Additionally, literature research indicated a lack of research on the regional differences in fertility in the Netherlands. One slightly outdated article aimed to predict whether fertility differences between small and large cities will decline or remain the same using data from 2002 (De Beer & Deerenberg, 2007). Other research on fertility in the Netherlands focuses on the fertility of specific ethnic, religious, or migrant groups. The current research is unique in that it aims to explain regional differences.

Societal relevance

The results of this study can help policymakers understand the demographic trends and patterns of the Dutch population. Information obtained during this research can aid in the development of policies to address current problems related to ageing and low fertility rates, which more than 40% of the members of the International Union for the Scientific Study of Populations (IUSSP) deem necessary for TFRs below 1.6 (Van Dalen & Henkens, 2021).

Furthermore, findings from the current research can be used to make small-scale population projections more accurate, which could aid in the provision of services that better fits the development of the population.

Theoretical background

Second Demographic Transition

The Second Demographic Transition theory (SDT) is a theory that explains why already low fertility levels drop below the replacement level. The SDT is characterised by: "sustained sub-replacement fertility, a multitude of living arrangements other than marriage, the disconnection between marriage and procreation, and no stationary population" (Lesthaeghe, 2010, pp. 411). The main driver of this transition towards below replacement level fertility is a shift in attitudes and norms towards greater individual freedom and self-actualisation. This shift is shown by increasing divorce rates and abandonment of the idea of life-long commitment. These lead to the postponement of childbearing and voluntary childlessness, along with an increase in non-family living arrangements and a change in attitudes where marriage and family life become 'optional' (Sobotka, 2008). Related to this more optional view of marriage and family life is the decoupling of marriage and childbearing. The change in order of marriage and childbearing, or the absence of marriage in families may be indicative of changes in the meaning of marriage. Currently, long-term cohabitation is almost identical to marriage (Holland, 2017).

Lesthaeghe (2010) argues that fertility cannot be seen loose from the changing patterns in household formation, attitudes, and norms. Starting these changes are three transitions. First, the introduction of hormonal contraception allowed for better planning, postponement, and spacing of births. Second, a sexual revolution took place, which decoupled sex from marriage and procreation, which led the age of first sexual intercourse to decline. Lastly, a gender revolution took place, where women asserted autonomy over their fertility (Lesthaeghe, 2010). Underlying these transitions were a change in norms and a rejection of authority in search of individual freedom. This individualisation then led to a postponement of childbearing, leading to fertility that is below replacement level.

Mulder (2003) identifies two mechanisms through which this individual freedom might lead to lower fertility. First, people who choose to live alone are associated with lower family aspirations. The choice of living arrangement is thus selective. Secondly, living alone is associated with independence, limited household tasks, the opportunity to pursue a career, and freedom in time allocation. By living single, one may learn to appreciate these advantages, leading to lower family aspirations and fertility (Mulder, 2003).

Socio-economic theory

In neoclassical economic theories, children are seen as goods that provide utility to the parents. Fertility is then determined by income, child costs, and tastes. These factors determine the demand for children (Becker, 1960). Within this demand for children, a trade-off is made between quantity and quality (Becker, 1960, 1981).

Economic theory explains why fertility is higher in rural areas compared to urban areas. The costs of children are lower when children contribute to the family income, for example by performing household tasks or working in the family business (Becker, 1981). Therefore, the increase in earning potential in rural areas increases the demand for children in rural areas. However, since farm work has largely been mechanized, leading the economic incentive to have children to be lower, this effect has decreased (Becker, 1981).

Economic theories also argue that having a higher income leads to lower fertility. The reasoning behind this is that the opportunity costs of children – the cost of missed income when choosing to raise a child instead of working – are higher when income increases, thereby suggesting a negative relationship between income and fertility.

Neoclassical economic theory does however leave room for other than economic explanations of differences in fertility because utility from children is assumed to differ by a family's religion, ethnicity, age, etcetera (Becker, 1960).

More recently, Doepke et al. (2022) argue that the ease of combining career and family is an important determinant of fertility. When combining a career with having a family is relatively easy to do, women will both work and have children. Factors that facilitate having both children and a career are marketisation or public provision of childcare, cooperative fathers, favourable social norms, and flexible labour markets (Doepke et al., 2022). When a career and parenthood are easy to combine, the opportunity costs of children are lower, thereby mitigating the negative relationship between income and children as assumed in neoclassical economic theory. Additionally, De Beer & Deerenberg (2007) suggest a positive relationship between income and fertility. They argue that raising children is expensive, which leads people with a low income to have fewer children. As becomes apparent, there is no consensus on the effect of income on fertility, both in explanation and in the direction of the relationship.

Another socio-economic factor that is theorised to explain differences in fertility is education. Being enrolled in education is a factor that largely restricts parenthood because studying is largely incompatible with raising children (Cygan-Rehm & Maeder, 2013). This may lead to the postponement of births, especially amongst those who are highly educated and who have spent more years enrolled in education. In addition, when assuming that being highly educated also increases one's earnings, the opportunity costs of leaving the labour market to raise children are higher for highly educated people compared to lower educated people, thereby leading highly educated people to have fewer children (Cygan-Rehm & Maeder, 2013).

Cultural theory

The cultural hypothesis is that groups have different fertility behaviours because they differ in cultural values (Hirschman, 1994). Even though groups might share the same socio-economic characteristics, some groups might still differ in fertility. For example, because their culture values children more, or because their culture proscribes methods of birth control (Hirschman, 1994). This is captured in the Ideational Theory, which assumes that norms, values, and attitudes can explain differences in fertility trends between populations (Hirschman, 1994). This theory also explains differences in fertility between urban and rural areas. In rural environments with a low degree of urbanisation, norms have a stronger impact because of social control and social influence. Therefore, traditional values are assumed to be rooted in rural environments (De Beer & Deerenberg, 2007; Hirschman, 1994).

These cultural differences tend to be persistent over time, meaning that differences in fertility between regions can be the result of path dependency (De Beer & Deerenberg, 2007).

Fundamentally, path dependency means that the future depends on the past. The past is also of importance for social systems and structures. Even though social systems and structures might change, they are often relatively static (Johnson-Hanks et al., 2011). Klüsener (2015) identifies different mechanisms through which path dependencies of countries and regions work. First, the transmission of family formation norms from older to younger generations acts as a mechanism behind path dependency. The intergenerational transmission of values, experiences, beliefs, and preferences in earlier life shape fertility decisions in later life (Huinink & Kohli, 2014). In contexts with high levels of social and intergenerational control, such as rural areas, it may take longer for divergent behaviour to spread compared to more anonymous cities (Klüsener, 2015). Moreover, religious institutions also have relatively constant views on what is considered to be proper family formation behaviour (Klüsener, 2015).

A large influence on norms, values, and attitudes comes from religion (Beyers, 2017). According to the *particularised theology hypothesis*, differences in fertility exist because of specific doctrinal differences between religions. Religious groups who are aversive towards contraceptive use and abortion, and who favour large families should have higher fertility rates compared to religious groups who do not have these views (Zhang, 2008). Alternatively, the *interaction hypothesis* assumes that religious institutions are a source of social exposure which influences members' fertility behaviour through exposure to certain fertility behaviour, which leads to the copying of that behaviour (Zhang, 2008). Religion is thus assumed to influence fertility. Because of spatial variation in religious denomination and spatial variation in secularization, this might contribute to regional differences in fertility.

Lastly, international migration is also hypothesised to affect fertility. Kulu & González-Ferrer (2014) identify four competing hypotheses in previous research on an individual's fertility behaviour following international migration. First, the *socialisation hypothesis* assumes that fertility behaviour reflects the behaviour that was dominant in one's childhood. Next, the *adaptation hypothesis* assumes that an individual's current social context influences one's fertility behaviour. Third, the *selection hypothesis* argues that those who migrate show similar fertility behaviour to the people in the country of destination, their behaviour and preferences have always been different from that of the population at the origin. Lastly, the *disruption hypothesis* suggests that people who migrated have low fertilities after migration because of economic costs and psychological stress that are associated with migrating. As the four hypotheses show, there are differing theories on the effect of migration on fertility and how migration affects the fertility rates of the place of destination.

Compositional vs contextual influences on fertility

From the available literature, it becomes clear that regional fertility is influenced by a multitude of factors that can be ascribed to two broad categories, namely compositional and contextual factors (Kulu, 2013). The rationale behind compositional arguments of differences in fertility is that fertility is different in places because different people live in different places (Kulu, 2013). An example of a compositional effect is that highly educated people tend to live in more urban places. Therefore, cities in general have a larger share of highly educated people compared to rural areas. Since people with different levels of education show different fertility behaviours, differences in fertility between places might result from a different composition of people based on their educational attainment (Kulu, 2013). It should be noted here that age and sex composition of a municipality do not influence the TFR of a municipality, since the TFR is calculated based on the sum of all age-specific fertility rates. Therefore, age and sex composition are already controlled for.

In addition, contextual effects can also explain why fertility differs between places. The contextual argument argues that fertility differs in places because of factors that are related to the immediate environment in which people live. There are multiple contextual effects that are hypothesised to influence fertility. First, more rural areas are often seen as more child friendly. Especially the presence of green space is often considered to be a child-friendly attribute of a place (Broberg et al., 2013). Therefore, (prospective) parents might migrate away from the city to greener rural areas to raise a child, thereby lifting rural fertility rates (Kulu & Washbrook, 2014). Moreover, housing in rural areas is often more suited for larger families, since multiple-bedroom houses are more common in rural areas (Kulu & Washbrook, 2014). Families might consider the number of children that they deem possible within the limits that the size of their house sets. In urban areas, overcrowding or the expectation of overcrowding may then partly explain why urban fertility rates are low, whilst the availability of larger housing in more rural areas may allow for more children. This may also lead to selective migration, where couples move to housing that they perceive as suiting their childbearing wishes (Kulu & Vikat, 2007).

Lastly, another contextual effect that may influence a municipality's fertility is the regional labour market condition. Someone who is unemployed, or who observes high levels of unemployment in their surroundings, may believe that the risk of unemployment in the future is relatively high. Unemployment would lead to a lower income than one is used to and create expectations of a relatively poor economic situation in the future, which is likely to produce lower fertility rates on both the individual level, as well as the aggregated level (Kravdal, 2002). Since unemployment is by definition involuntary and caused by an imbalance in supply and demand in the regional labour market, unemployment is regarded as a contextual factor.

Previous findings

Previous studies on regional differences in fertility have mostly focussed on differences between countries, or on the NUTS3 level (e.g. Campisi et al., 2020; Vitali & Billari, 2017). For differences in fertility between large and small cities in the Netherlands, De Beer & Deerenberg (2007) performed a study on the municipal level. This section discusses the most important findings of previous research, which rests mostly on findings of (regional) differences in fertility on a scale that is larger than the municipal scale applied in the current study.

Demographic factors

Previous research on fertility has focussed on a multitude of different demographic influences on fertility. First, ethnic groups were found to differ in fertility. In their study of the fertility of women in the Netherlands with different ethnicities, Garssen & Nicolaas (2008) found that the adjustment of fertility levels of first-generation migrants from Turkey and Morocco towards the fertility level of native Dutch women is very slow. The first-generation Turkish and Moroccan migrants even show higher fertility rates than the fertility rates in their country of origin. This finding suggests that first-generation Turkish and Moroccan females display fertility behaviour that reflects the behaviour that was dominant in their childhood, as the socialisation hypothesis argues. For second-generation migrants of the same groups, however, the fertility is closer to that of the native Dutch.

Moreover, marital status also influences fertility (Fiori et al., 2014). In Britain, women who are married and have a husband who is employed show the highest hazard of having a first and second child, whilst, for all other marital statuses, the hazard of having a first and second child is significantly lower. Women who were never married show the lowest hazard of a first, second, and third child (Fiori et al., 2014). Additionally, partnership dissolution also influences fertility. Campisi et al. (2020) include the share of divorced individuals in their analysis of determinants of fertility. They find a negative relationship between the share of divorced individuals and the TFR of a region that could be caused by the disruptive effect of divorce on family formation events.

Lastly, another demographic factor that influences fertility was found by De Beer & Deerenberg (2007), who found evidence for the reasoning behind the SDT that individualisation leads to lower fertility rates since a larger share of women living alone is associated with a lower municipal TFR. This finding is further supported by Mulder (2003) who found that singlehood is associated with postponement of childbearing. Additionally, permanent singles were found to have extremely low fertility.

Socio-economic factors

Campisi et al. (2020) included economic determinants in their analysis of regional differences in fertility between 1134 NUTS3 regions in 21 European countries and found that, in line with neoclassical economic theory, an increase in Gross Domestic Product (GDP) per capita indeed has a negative effect on the TFR of a region. In a study by Vitali & Billari (2017), a negative relationship between regional GDP per capita and fertility was also found for central Italy in both 1999 and 2010. However, moving more toward the north of Italy, the relationship between regional GDP per capita and fertility becomes weaker. There is a positive relationship between regional GDP per capita and fertility in the northernmost part of Italy. Vitali & Billari (2017) conclude that since fertility is higher in the most economically developed area of Italy (the North), "advances in development reverse fertility decline" (p.10). Thus, both studies found a negative relationship between GDP per capita and fertility. However, the Italian study showed that this relationship is reversed for the most economically developed regions. In effect, there are mixed findings on the effect of GDP per capita on a region's fertility.

De Beer & Deerenberg (2007) used other indicators to estimate the effect of socio-economic variables on regional fertility and find that the higher the share of households receiving social benefits, the lower the fertility in the municipality. This effect was found for both large (> 25.000 inhabitants) and small municipalities. However, the effect is almost twice as strong in small municipalities compared to large municipalities. This result confirms their assumption that fertility is lower in low-income families, thereby contradicting neoclassical economic theories on fertility.

This positive relationship between income and fertility is also found by Kolk (2023), who performed a study on the relationship between accumulated income and fertility in Sweden using completed fertility of cohorts between 1940 and 1960. Kolk (2023) finds a strong positive relationship between accumulated income and fertility for men, and a shift from a negative relationship for females born in 1940 to a positive relationship for females born in 1960.

As becomes clear, the currently available literature shows mixed findings on the relationship between economic factors and fertility. Empirical findings indicate both a positive and a negative relationship. An explanation for this can be found in the work of Doepke et al. (2022), who show that the relationship between GDP per capita and fertility has changed over time. Where in 1980 there was still a negative relationship between fertility and GDP per capita in high-income countries, this relationship was reversed in 2000. Therefore, the relationship between GDP per capita and fertility is sensitive to change with time.

In addition to economic factors, previous research also studied the relationship between fertility and education. Hoem (2005) showed that highly educated people on average have fewer children compared to those with a lower level of education. This could be caused by the postponement of childbearing by those who obtained a high level of education since Mulder (2003) showed that in the Netherlands, highly educated females are significantly less likely to be a parent at age 30 compared to those who are low educated. For age 35 the same pattern was found, though this effect was only significant at the 90% confidence level. In addition, Fiori et al. (2014) found the same pattern, where women who obtained tertiary education showed significantly lower hazards for first births compared to women who obtained upper or lower secondary education. For second and third births, this pattern was not found. Lastly, Cygan-Rehm & Maeder (2013) show that in Germany, highly educated people have lower levels of fertility because of postponement during enrolment in education, and this group of people does not catch up in later life.

Cultural factors

In their study of religiosity and fertility patterns in the Netherlands on the level of NUTS3 regions, Sobotka & Adigüzel (2002) show that the ‘bible belt’, a conservative band in the Netherlands that runs from Zeeland, a province in the southwest, northeastwards to Overijssel, has the most traditional demographic pattern. This traditional demographic pattern entails higher fertility rates and higher parities. Thus, large families are more common in the bible belt than in other regions of the Netherlands (Sobotka & Adigüzel, 2002). De Beer & Deerenberg (2007) also included a measure to estimate the effect of bible belt regions on fertility. Because of data restrictions, as an indirect measure of the share of reformists, they included the share of people who voted for orthodox Calvinist parties during elections. They found that the higher the share of orthodox Calvinist party voters, the higher the TFR of the region.

Additionally, the same study also included a dummy variable in their model for municipalities with a low level of urbanisation as a cultural variable to test whether more rural municipalities show more traditional demographic patterns because of higher levels of social control in rural areas. They indeed found that having a low degree of urbanisation has a positive effect on fertility, also when controlling for other variables (De Beer & Deerenberg, 2007).

Lastly, to research the effect of path dependency on non-marital fertility in Europe, Klüsener, (2015) compared the non-marital fertility of 1910 and 2007. The results show that historical patterns are indeed relevant to understand the spatial variation in fertility behaviour (Klüsener, 2015). Additionally, De Beer & Deerenberg (2007) also controlled for path dependency in their study of fertility in large and small municipalities by examining the effect of previous fertility rates in municipalities on current fertility rates. To do so, they included the deviation of the mean fertility at an earlier time as an independent variable in their regression analysis. They found that for all regions included in their analysis, the fertility rates had the same direction of the mean as in the past. They also noted a convergence in fertility, indicating that the effect of path dependency diminishes. However, because of spatial variation in the convergence of fertility, they conclude that the differences in fertility are rather persistent.

Contextual factors

Fiori et al. (2014) stress that compositional factors alone cannot explain spatial variations in fertility. The beforementioned demographic, socio-economic and cultural effects on fertility can only account for part of the regional differences in fertility. Other parts might be explained by contextual factors (Fiori et al., 2013).

First, previous research has found that fertility differs across different sizes of settlements. Kulu (2013) found that in Finland, fertility was higher in small towns and rural areas compared to cities. Fertility was lowest in the capital city Helsinki. Kulu (2013) suggests that part of this difference might be explained by the physical environment of rural areas that is seen as child friendly. The higher fertility might then be a result of selective migration towards more child-friendly places. Evidence for this was found in another study which found that women who moved indeed had a significantly higher birth rate, especially in the year after the move to a new region. This suggests that couples who have childbearing intentions indeed move to regions that they perceive as more child-friendly (Kulu & Washbrook, 2014). However, this selective migration is unlikely to explain regional differences in fertility between regions, since the number of people who move is relatively small. Therefore, on the aggregate level, selective migration is unlikely to play a large role in regional differences in fertility (Kulu & Washbrook, 2014).

Furthermore, previous research also found that the regional labour market conditions of a place influence fertility. On the aggregated level, unemployment was found to lead to lower birth rates in Norway. Kravdal (2002) found that an increase in unemployment from 2% to 6% (on the level of Norwegian municipalities) leads to a reduction in the fertility rate of around 0.08. The negative relationship between unemployment and fertility is also found in the USA (Currie et al., 2014). In their study of the effect of unemployment on fertility, Currie et al. (2014) find that unemployment does not only lead to the postponement of childbearing but also to fewer children being born.

Conceptual model

Based on the reviewed literature, the conceptual model in Figure 2 is created. The different components that are hypothesised to influence the fertility of Dutch municipalities are shown on the left. The research instrument that is discussed in the next chapter will test these influences.

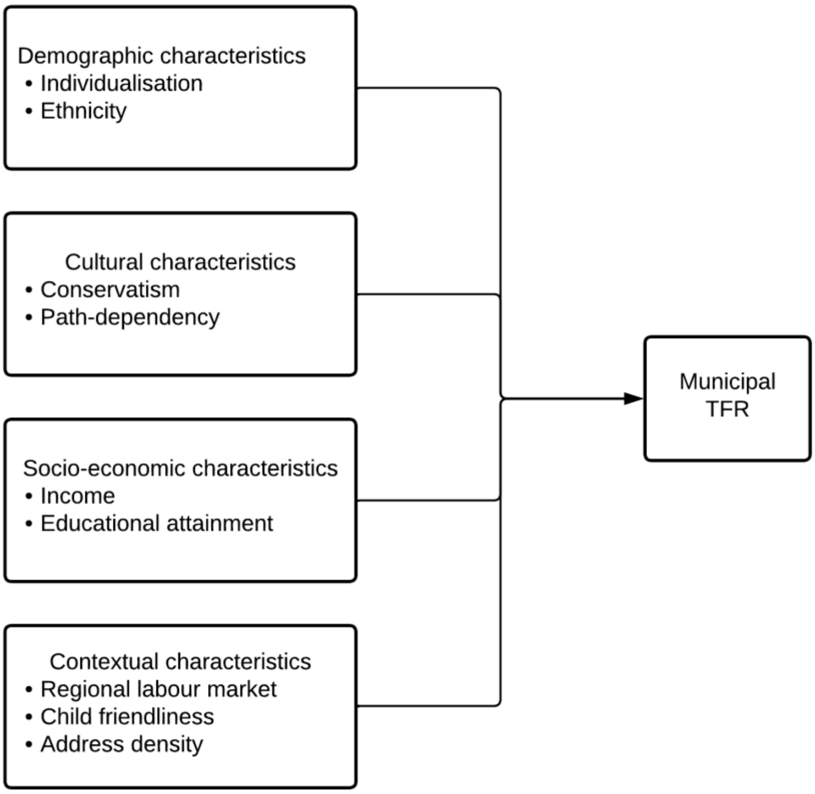

Figure 2: the conceptual model

Hypotheses

Based on the reviewed literature and the formed conceptual model, the following hypotheses are stated that are tested within the research.[1]

H1: Municipalities with higher levels of individualisation have lower fertility rates
H2: municipalities with a larger share of first-generation Turkish and Moroccan females have a higher TFR
H3: Municipalities with a larger share of conservative inhabitants have a higher TFR
H4: Municipalities with a high TFR in the past will have a high TFR in 2021
H5: Municipalities with a higher income have a lower TFR
H6: Municipalities with a larger share of highly educated have a lower TFR
H7: Municipalities with a higher unemployment rate have a lower TFR
H8: More child-friendly municipalities have a higher TFR
H9: More urban municipalities have a lower TFR

[1] Hypotheses 1, 3 and 8 have been formulated on the level of theoretical concepts. For the operationalization of these concepts, see the methods section.

METHODS

To answer the research question and test the hypotheses as stated in the previous section, quantitative research was conducted by performing linear regressions using secondary data provided by Statistics Netherlands.

Research area and context

In 2021, the TFR in the Netherlands was 1.62, meaning that on average, women living in the Netherlands would get 1.62 children in their life when considering the age-specific fertility rates of 2021 (CBS, 2022a). As visible in Figure 3, fertility saw a sharp decrease starting in the 1960s and reached levels below replacement level since 1973. From 1975 onwards, the TFR fluctuated between roughly 1.5 and 1.75. The current research focuses on explaining the regional differences in fertility on the municipal level of the Netherlands in 2021.

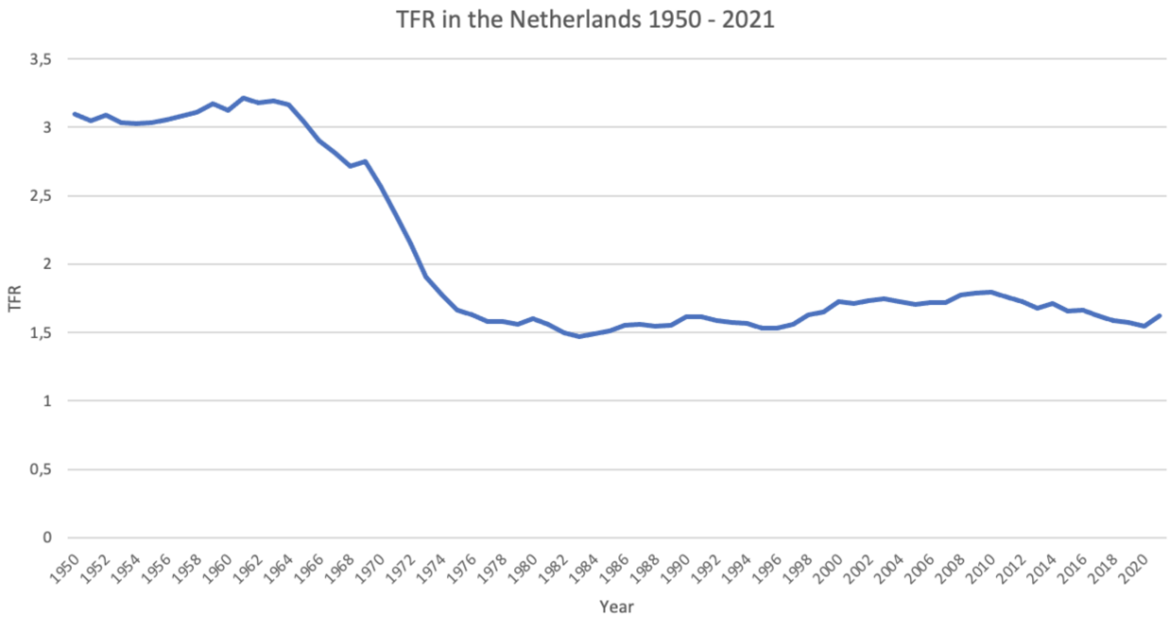

Figure 3: Total Fertility Rate in the Netherlands 1950 - 2021 *Source: constructed by author. Data: CBS, 2022a*

In the Netherlands, municipalities are the lowest administrative unit. The administrative division of Dutch municipalities changes over time, and almost every year changes in municipalities occur. In 2021, the Netherlands was divided into 352 municipalities. Dutch municipalities are varied in size, where the smallest municipality has a population of 931 inhabitants, whilst the largest municipality has a population of almost 875.000 inhabitants. The average population size of the municipalities is almost 50.000. However, this mean is influenced by municipalities with large populations. The median population size in Dutch municipalities is 31.000 people (CBS, 2022b).

As with population, the municipalities also differ in area size. Where some municipalities have a small area where the municipal boundaries roughly correspond to the boundaries of a city (e.g. Gouda), other municipalities contain a city or village and a large hinterland (e.g. Apeldoorn). The mean area of a municipality is 10.707 hectares (SD = 11.333 hectares) (CBS, 2022b).

Data gathering

Data was collected by accessing the open data portal of Statistics Netherlands (Data available from https://statline.cbs.nl). Statistics Netherlands is an independent organisation that publishes statistical information on the Netherlands on a wide range of topics. Because Statistics Netherlands is an independent organisation that gathers data on a large scale, and that has access to data from governmental registrations, the data is of high quality.

The Statline open data portal allows users to compile tables with the required information on multiple scales from the Netherlands down to the neighbourhood level. In the current research, the available data on municipalities was used.

Dependent variable

A multitude of fertility measures is available through Statistics Netherlands. In this research, the Total Fertility Rate is used as an indicator of municipal fertility. The TFR is a measure of the average number of children that a woman would have in her lifetime, given the age-specific fertility rates of a certain year (CBS, 2022a). The TFR is used, seeing as it is a widely used measure of fertility that is also available at the municipal level. Moreover, the TFR is not affected by differences in age and sex structure of a municipality, thereby making it directly comparable across Dutch municipalities. In addition, another advantage of the TFR is that it reflects current fertility patterns and trends because it is a period measure of fertility (Bongaarts & Feeney, 1998). As a period measure, the TFR is a synthetic rate that is not based on the fertility of a cohort, but on current age-specific fertility rates. This means that no group of women will actually experience the fertility rates. However, the TFR is chosen above cohort fertility measures since calculating the average number of children per woman for a cohort would only be possible after a cohort already completed childbearing. Since this group of women is aged 50+ when they end their childbearing period, and most children were born during their 20s and 30s, the cohort fertility reflects a situation of the past. Therefore, the TFR is preferred over cohort measures of fertility for studying current regional differences in fertility. A downside of period fertility measures such as the TFR is that it is influenced by changes in the timing of childbearing. When women delay childbearing, the TFR is lower and vice versa when women forward childbearing (Bongaarts & Feeney, 1998).

Independent variables

As became apparent from the theoretical framework, regional differences in fertility can result from a multitude of factors that can be subdivided into demographic, cultural, socio-economic, and contextual factors. To understand how these factors contribute to differences in fertility at the level of Dutch municipalities, variables of all these groups of factors were used in a regression model.

Demographic variables

As explained, the dependent variable (TFR) is not influenced by the age and sex structure of a municipality. Therefore, it is not necessary to control for differences in age and sex composition between municipalities. However, as suggested by earlier research, other demographic factors are expected to explain the differences in municipal TFRs.

Since the driver of the Second Demographic Transition is individualisation and self-actualisation, the current research includes the share of single-person households in a municipality as a proxy for individualisation. Although the number of single-person households is not a direct measure of individualisation, it is assumed here that individualisation leads to higher shares of single-person households. The share of single-person households is calculated by dividing the number of single-person households by the total number of households.

Additionally, since first-generation Turkish and Moroccan females are hypothesised to influence a municipality's TFR, the share of first-generation Turkish and Moroccan females is included in the model. This figure is calculated by dividing the number of first-generation Turkish and Moroccan females by the total number of females for each municipality.

Cultural variables

Within the bible belt region in the Netherlands, reformism is the dominant religious denomination. Hence, the share of reformist people in a municipality is used as a proxy to explain regional differences in fertility as a result of conservatism.

In contrast to many other variables that Statistics Netherlands publishes, data on religion is not published on the municipal level on a yearly basis. Between 2010 and 2014 Statistics Netherlands conducted a Labour Force Survey (LFS) that also gathered information on religion of around 460 thousand people aged 18 and older. For every municipality there were at least 150 observations. The dataset contains information on the share of people that have a religious meeting at least once a month, the share of religious people, and the share of people that adhere to a particular religion. Because the most recent data on the share of people adhering to a particular religion on the municipal level stem from this survey, these data are used. However, because the data were gathered 7 to 11 years before the dependent variable, results should be interpreted with care. Especially since secularisation continued in this interval (CBS, 2019).

The dataset was used to calculate the share of reformists per municipality. For municipalities that existed both in 2014 and 2021, the value of the survey was directly useable. For municipalities that were affected by reclassification in the period between the survey and 2021, two approaches were used to calculate the value of the newly formed municipality. First, in the case that two or more municipalities were fused where one municipality was much larger than the other(s) (for example, the municipalities of Ten Boer (7 thousand inhabitants) and Haren (20 thousand inhabitants) were fused with the municipality of Groningen (203 thousand inhabitants))(CBS, 2022b), the value of the large municipality was used. When two or more similar-sized municipalities were fused, the average value was calculated as the value for the new municipality.

Moreover, the current research also includes a temporal variable to explore the path-dependency of a municipality's fertility. This is done by adding the TFR of each municipality ten years previous into the model (the TFR of 2011). This variable is also affected by the problem of municipal reclassification. The same method as used for the share of reformists was applied to calculate the TFR of 2011 for municipalities that exist in 2021, but that did not yet exist in 2011.

Socio-economic variables

Income and educational attainment are used to measure the effect of socio-economic determinants on fertility.

The median spendable household income for each municipality is included in the model as a proxy for income. The choice was made to use the median income above the mean income since the mean is affected by outliers, whilst the median is less affected by outliers and the skewness of the data. The median spendable household income is given in yearly spendable household income in thousands of euros. Students were excluded from the calculation of the median spendable household income since their lower incomes compared to working adults would lower the median spendable household income and thereby distort the income distribution in municipalities housing many students.

Furthermore, to measure the effect of educational attainment, the model includes the share of highly educated people. Statistics Netherlands classifies someone as highly educated when someone's highest obtained level of education is a higher professional education (HBO) degree or higher (CBS, n.d.). This definition of highly educated is also used in the current research. The share of highly educated people in a municipality is calculated by dividing the absolute number of highly educated people by the total number people aged 15 till 75.

Contextual variables

Since previous research found that contextual factors also explain regional differences in fertility, the current research includes indicators of the child-friendliness of municipalities and of the regional labour market conditions. Moreover, address density is included in the model to further estimate the effect of the degree of urbanisation on fertility that is not yet captured by other independent variables.

Following Broberg et al. (2013), to objectively measure the child-friendliness of a municipality, the quantity of greenspace is used. The share of greenspace is calculated as the total area of terrain with recreational use (e.g. parks, sports facilities, and day recreation), forest, and open natural train, divided by the total area of the municipality. The choice was made to include both recreational terrain as well as more natural terrain such as forest in the 'child-friendly' green space of a municipality since complex green spaces are part of a child-friendly environment (Jansson et al., 2022). The data on the share of greenspace for each municipality is available for the year 2015. As with the other variables for which the data was not readily available for the year 2021, the data from 2015 was used to calculate the values of newly (re)formed municipalities. To calculate the value for new municipalities that exist in 2021, that did not yet exist in 2015, the green space and total area of the new municipality were calculated based on the (green) areas of the former municipalities that the new municipality consists of. A downside of using the share of greenspace in a municipality as a variable is that the variable is sensitive to the way that municipal boundaries are drawn. This so-called Modifiable Area Unit Problem (MAUP) entails that the value of an area (such as the share of greenspace) is significantly influenced by the shape and the size of the aggregation unit (the municipality). Different ways of drawing an area can result in vastly different values. The values are thus influenced by the unit that is chosen as the aggregation unit, possibly leading to biased results (Dark & Bram, 2007).

Additionally, the current research includes a measure of unemployment as a proxy for the regional labour market conditions. The unemployment rate is not directly available on the municipal level in the database of Statistics Netherlands. Thus, for each municipality, the unemployment rate is calculated by dividing the absolute number of people who receive social benefits because of unemployment by the total number of people in the municipality who are aged 15 to 65 (roughly the working ages). Usually, the unemployment rate is calculated by dividing the number of unemployed people by the total labour force (those who are of working age and either working or looking for a job). However, because the labour force is not available at the municipal level, the total number of people aged 15-65 is used. This leads to an underestimation of the unemployment rate since people who are not actually in the labour force are included in the calculation. Although this is an unusual way to calculate unemployment, it is the best method with the currently available data.

It is important to mention that the method used to incorporate the regional labour market condition in the analysis is based on the share of unemployed individuals, which could be considered as a compositional variable. However, because unemployment is by definition involuntary and the result of labour market conditions, this variable is used to examine the impact of regional labour market conditions on the municipal TFR, which is a contextual factor.

Lastly, the address density is used to explain further differences between more urban and rural municipalities that are not captured by the other variables included in the model. The address density gives the number of addresses per km^2 and is directly available on the municipal level. Because the estimated coefficients for address density are very small, the address density was divided by 1000 to increase the interpretability of the estimated coefficient of address density.

Table 1 provides a summary of the proxies that are used to test the influence of different types of variables on a municipality's TFR.

Table 1: the proxies used to explain the difference in fertility between Dutch municipalities

Type of variable	**Proxy**
Demographic	% single-person households
	% first-generation Turkish and Moroccan females
Cultural	% reformists
	TFR of 2011
Socio-economic	Median spendable household income (thousands per year)
	% highly educated
Contextual	Address density (x1000)
	% greenspace
	Unemployment rate

Method of analysis

The data on each municipality were used to analyse the influence of demographic, cultural, socio-economic, and contextual factors on the TFR of a municipality using multiple linear regression models as specified in equation (1).

$$TFR_i = \beta_0 + \beta_1 X_{1,i} + \cdots + \beta_k X_{k,i} + \varepsilon \qquad (1)$$

The choice for a multiple linear regression model was made because the dependent variable in this research is the TFR of a municipality. The municipal TFR is a continuous variable that in theory can take on any value between 0 and the maximum number of births biologically possible for women. Because of the continuous nature of the dependent variable, a linear regression model can be used that examines the relationship between a continuous dependent variable and multiple continuous or categorical independent variables (Tor & Jakobsen, 2022). The linear regression model uses the Ordinary Least Squares (OLS) method, which minimizes the residual sum of squares, to estimate the constant and coefficients of the model. This way, the model on average estimates as close as possible to the observed values (Tor & Jakobsen, 2022). The analysis is conducted using Stata17 software.

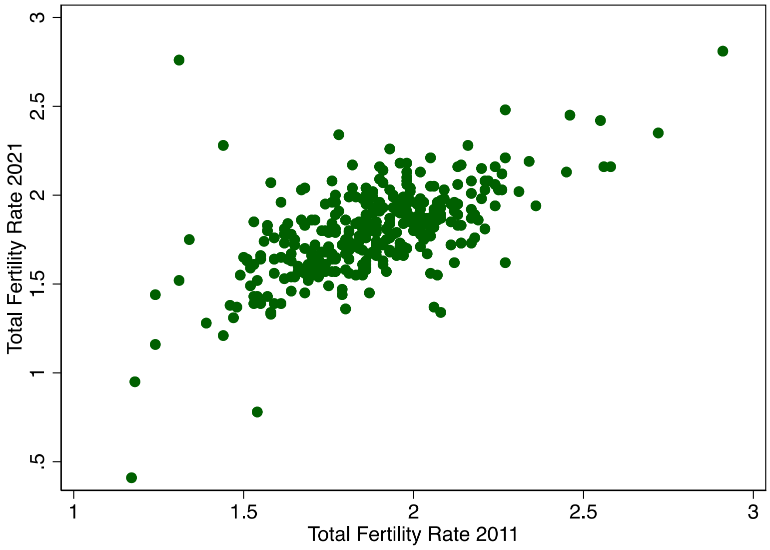

Figure 4: scatterplot of the municipal TFRs in 2011 and 2021 *source: constructed by author. Data: CBS, 2022a*

Figure 4 displays a scatterplot of the TFR of each municipality for the years 2011 and 2021. One would expect that the change in TFR in the period between 2011 and 2021 is not substantial. This is also visible in Figure 4. However, Figure 4 also shows that there are some municipalities where the TFR of 2011 and 2021 are very different from each other. From an examination of these cases, it becomes apparent that these large differences in TFR between the two years only exist for municipalities with relatively small population sizes.

An example of this is the municipality Rozendaal, which had a TFR of 1.3 in 2011 and a TFR of 2.8 in 2021. The reason for this increase is that the number of births in the municipality increased from 9 to 12. With a population of only 1600 inhabitants, this increase in births causes the TFR to increase substantially. From this, it can be seen that the TFR of small municipalities is sensitive to fluctuations due to small changes in the absolute number of

children being born in a particular year. This is visualised in Figure 5, where the TFR of the smallest municipality can be seen to have large fluctuations. This fluctuation is much smaller for municipalities with a somewhat larger population size (> 10.000 inhabitants), and relatively stable for the larger two municipalities.
To reduce the effect of influential small municipalities, municipalities with a population size smaller than 10.000 people were removed from the sample. In effect, the smallest twelve municipalities were not included, leaving 340 municipalities in the analyses.

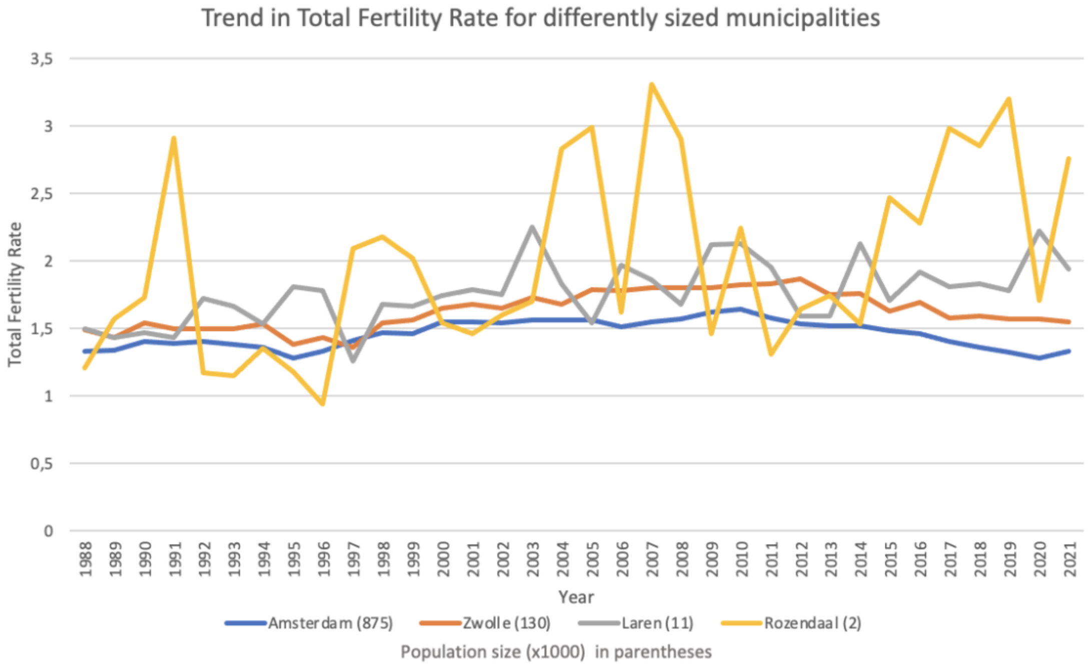

Figure 5: trend in Total Fertility Rate in small and large municipalities Source: constructed by author. Data: CBS, 2022b

The current research estimates four different regression models to test the influence of the different sets of independent variables on the municipal TFR of 2021.
First, Model 1 estimates the effect of the different compositional (demographic, socio-economic and cultural) variables on the municipal TFR of 2021. Secondly, Model 2 estimates the effects of the various contextual variables on the municipal TFR of 2021. Third, Model 3 combines Models 1 and 2 so that the effects of each set of variables are estimated after accounting for the other set of variables. Lastly, Model 4 adds to Model 3 the TFR of 2011 to check the path dependency of a municipality's TFR.

The coefficients of Model 4, containing both compositional and contextual variables, as well as the earlier TFR must be interpreted differently than the coefficients of the earlier models, which estimate the effect of the different variables on the TFR of 2021. The reason for this is that when the earlier TFR of 2011 is included in the regression model, this variable controls for the overlap in TFR at the two different times. As a result, the coefficients of the other variables must be interpreted as explaining the change in the variable between the two different times (Byers, 2005). Therefore, the coefficients of variables in Model 4 must be interpreted as explaining the change in TFR between 2011 and 2021.

In the models, variables are assumed to significantly influence the dependent variable when $p < \alpha$, using $\alpha = 0.05$.

RESULTS

Descriptive results

Table 2 shows the descriptive statistics of the dependent variable and the independent variables. In 2021, the average municipal TFR was 1.80 (SD = 0.25) which is lower compared to 2011 (M = 1.87, SD = 0.23), meaning that the average number of children a woman would have in her lifetime when considering the age-specific fertility rates of both years has decreased. Moreover, there are relatively large differences in TFR between municipalities in both 2011 (Min = 1.17, Max = 2.91) and 2021 (Min = 0.41, Max = 2.81). When comparing the maps of the fertility in municipalities in 2011 (Figure 6) and 2021 (Figure 1), in general lines the same pattern is visible.

Table 2: descriptive statistics of the variables

Variable	Mean	SD	Median	Minimum	Maximum
Total Fertility Rate 2021	1.80	0.25	1.81	0.41	2.81
Total Fertility Rate 2011	1.87	0.23	1.88	1.17	2.91
% single person households	33.18	6.24	31.44	20.10	59.87
% first gen. Turkish and Moroccan females	1.00	1.16	0.55	0.00	6.30
Median spendable household income	43.41	4.97	43.70	31.00	68.90
Address density (per km^2)	1174	780	952	213	6096
% highly educated	28.74	7.96	26.90	11.73	56.56
% reformists	4.18	6.12	1.95	0.00	52.30
% unemployed	1.41	0.27	1.42	0.38	2.37
% greenspace	16.97	13.56	13.35	0.25	69.34

On average, first-generation Turkish and Moroccan females make up only a small part of the total female population in municipalities (M = 1.00, SD = 1,16). However, there are municipalities where this group has a larger contribution to the total female population since the variable is skewed to the right. The median value (0.55) is nearly half of the mean (1.00). Figure 6 shows that municipalities in the west of the Netherlands, where the Randstad (a large conglomeration of large and middle-sized cities) is located, have relatively large shares of first-generation Turkish and Moroccan females. The southern municipalities also have relatively large shares of first-generation Turkish and Moroccan females.

Additionally, reformists are also a group of people that make up a small portion of the total population in most municipalities. On average, reformists make up 4.18% of the population in municipalities (SD = 6,12). However, the mean is influenced by observations of municipalities with a large proportion of reformists. The median share of reformists in municipalities is 1.95, less than half of the average. Some municipalities do not have reformists, whilst the municipality with the largest share of reformists consists of 52.30% of reformists. In Figure 6, the municipalities with a large share of reformists can be seen to run in a belt from the province of Zeeland, located in the southwest of the Netherlands, northeastwards. Moreover, also the Northern municipalities have relatively large shares of reformists.

The average median spendable household income across the municipalities is 43.41 thousand euros per year (SD = 4.97). There are however large disparities between municipalities concerning the median spendable household income. The lowest median spendable household income is 31 thousand euros per year, whilst the highest is almost 69 thousand euros. Figure 7 shows that municipalities with a higher median spendable household income are located in the Randstad as well as in southern municipalities, whilst northern municipalities generally have a lower median spendable household income. In addition, municipalities with large cities show up as having a low median spendable household income. This can be explained by the large share of single-person households in these larger cities since households with single earners are likely to earn less than households with multiple incomes.

The average share of single-person households in municipalities is 33,18% (SD = 6,24). The distribution is slightly skewed to the right since the median (31,44) is lower than the mean. Figure 6 shows that there are indeed municipalities with a much larger share of single-person households compared to other municipalities. These municipalities with a relatively high share of single-person households are municipalities that contain large or medium-sized cities, such as Amsterdam, Utrecht, Groningen, Zwolle and Enschede. These are also municipalities that house large numbers of students because of the presence of universities and higher education schools in these cities.

The share of highly educated people in each municipality shows large differences. On average, 29% of the population in municipalities is highly educated (SD = 7.96). However, the lowest share of highly educated people is 11.73%, whilst the municipality with the largest share has 56.56% highly educated people. One would expect that municipalities with a university show up as housing relatively many highly educated individuals. However, as visible in Figure 7, this is not the case and there is no real spatial pattern visible. This can be explained by the fact that people who are still in education are not yet classified as highly educated, since one is classified according to the highest level of education that one has finished, meaning that most students are not classed as highly educated.

The average address density of the municipalities is 1174 addresses per km^2 (SD = 780). The mean is largely influenced by municipalities such as Amsterdam, ‘s Gravenhage, Rotterdam, and Utrecht, which all consist of large cities with high address densities. The share of greenspace is also skewed, where most municipalities have a share of greenspace lower than 14% (M = 16.97, SD = 13.56). However, there are observations of municipalities with a share of green space up to 69.34%. Especially municipalities around national park the ‘Hoge Veluwe’, located centrally in the Netherlands, have relatively large shares of greenspace (see Figure 7).

Lastly, unemployment is relatively normally distributed. The average unemployment (M = 1.41, SD = 0.27) and median unemployment (1.42) are very similar. Unemployment ranges from 0.38% to a maximum of 2.37%. Figure 7 shows that there is relatively little unemployment in eastern municipalities, whilst municipalities in the north, south and west have more unemployment.

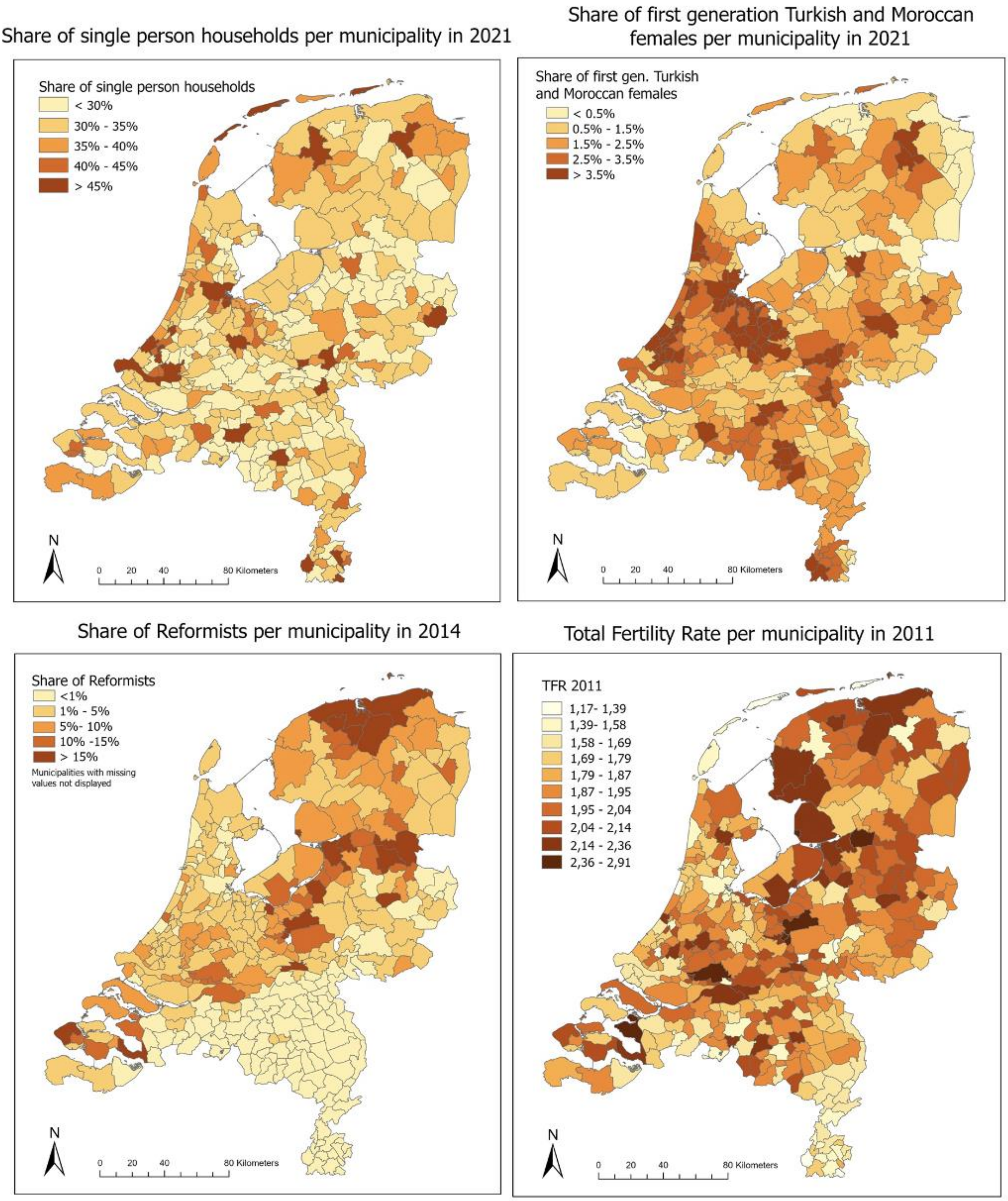

Figure 6: visualisation of the independent variables 1/2 source: constructed by author. Data: CBS 2022b

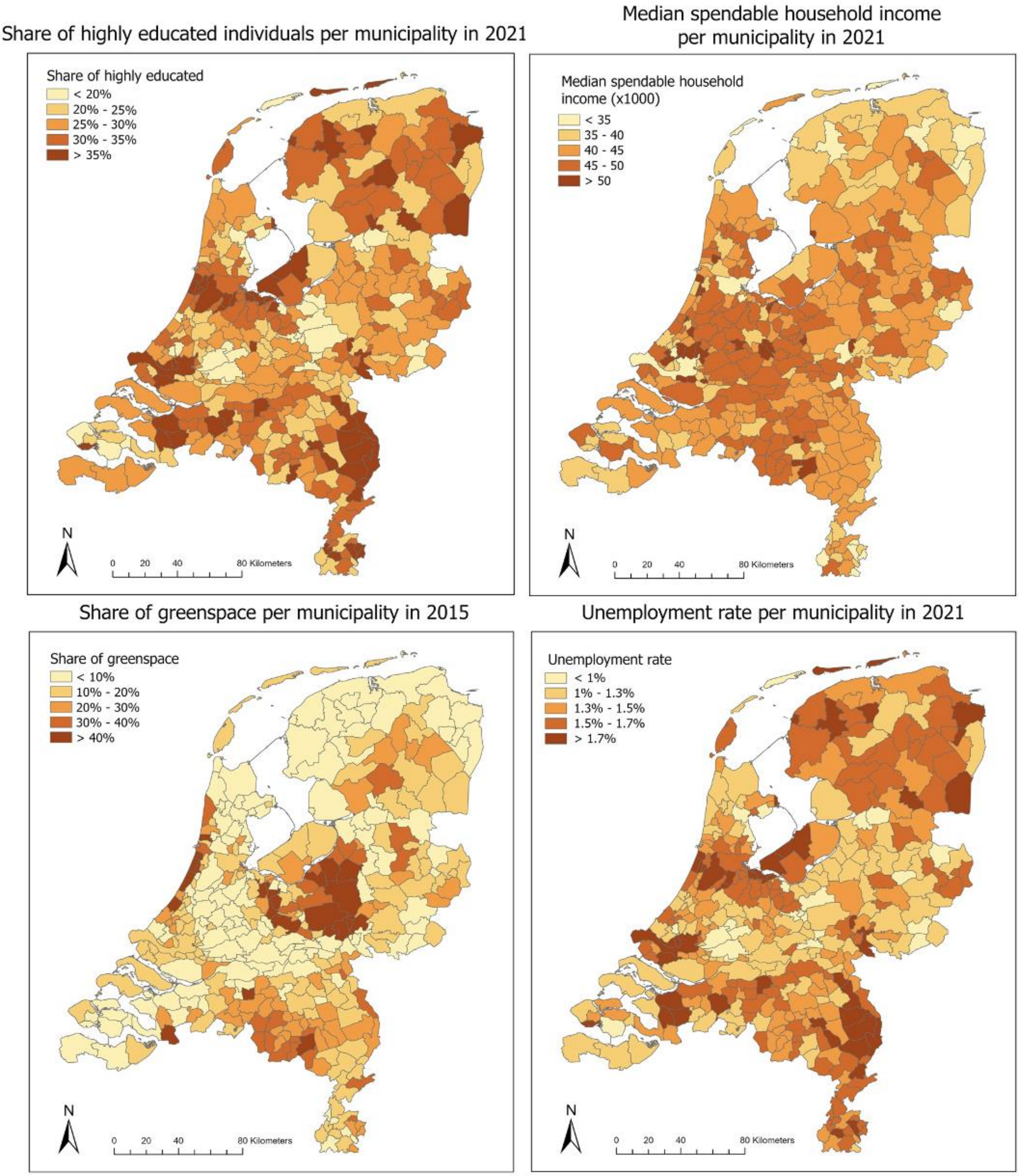

Figure 7: visualisation of the independent variables 2/2   source: constructed by author. Data: CBS 2022b

Testing of OLS assumptions

In the following section, the assumptions of linear regression are tested to assess the correctness of the model estimates. All four regression models largely share the same characteristics and problems concerning the assumptions of a linear regression. So, for simplicity and to avoid repetition, the assumptions are only reported for Model 4 (the most complete model). Where results of other models differed from the results of Model 4, this is mentioned. For the full results of the tests of assumptions of all models, see Appendix 1.1 till 1.5.

Correct specification of the model

In Stata, a linktest can be used to check for misspecification of the model. This test checks whether the wrong forms of the variables have been included. The test runs a linear model (_hat) and a regression with the squared linear predicted value (_hatsq). In a correctly specified model, the variable _hat should be significant ($p < 0.05$) and the variable _hatsq should not be significant (Tor & Jakobsen, 2022). As visible in Appendix 1.1, the test results indicate that the model predicts the dependent variable well and that the model is correctly specified. For Model 2, the variable _hat is not significant, indicating that the model containing only contextual variables does not predict the TFR of 2021 well.

Additionally, Appendix 1.2 shows scatterplots of the bivariate relationships between the dependent variable and the independent variables. All plots show a form of linearity, meaning that the assumed linearity between the dependent variable and the independent variables is justified. However, for the share of greenspace in a municipality (appendix 1.2.7) observations can be seen that deviate from the trend line, meaning that the linearity of the share of greenspace is rather weak.

Absence of multicollinearity

Another assumption of linear regression is that explanatory variables have no multicollinearity (Tor & Jakobsen, 2022). When independent variables are correlated, they take over explanatory power from each other. As a rule of thumb, when correlations are greater than 0.8 or smaller than -0.8, problems arise (Tor & Jakobsen, 2022). Table 3 shows the correlations of all the independent variables in the research. As visible in Table 3, no correlations are greater than 0.8 or smaller than -0.8.

However, some variables might take over some explanatory power from each other. First, the variables 'median spendable household income' and '% highly educated' are expected to take over explanatory power from each other since increased investment in education is associated with higher returns on the investment (Mincer, 1974). When removing either the income variable or the share of highly educated from the model, both significances increase (the p-values decrease, results not shown). Nevertheless, since the correlation is smaller than 0.8, the collinearity is not assumed to be problematic.

Additionally, the share of greenspace might correlate with the address density of a municipality since municipalities with a high address density might have a small share of greenspace and vice versa. However, when removing either one from the regression model, neither the coefficients nor the significances change substantially. Moreover, in Table 3 these variables are also shown to have a low collinearity score.

Table 3: correlation coefficients of the independent variables

	% single-person households	% first gen. Turkish & Moroccan females	% reformists	TFR 2011	Median spendable household income	% highly educated	Address density	% greenspace	% unemployed
% single person households	1								
% first gen. Turkish & Moroccan females	0.54	1							
% redormists	-0.22	-0.15	1						
TFR 2011	-0.58	-0.27	0.54	1					
Median spendable household income	-0.72	-0.39	0.12	0.42	1				
% highly educated	0.39	0.23	0.31	-0.30	0.24	1			
Address density	0.72	0.76	0.12	-0.34	-0.38	0.43	1		
% greenspace	0.14	0.04	0.11	-0.19	0.02	0.28	0.11	1	
% unemployed	0.38	0.32	0.38	-0.44	-0.42	0.15	0.26	0.14	1

Error term has a conditional mean of zero

In linear regression, the mean of the error term is assumed to be zero. Because of the method of estimating (ordinary least squares), the mean error term is always zero.

Error term has a constant variance (homoskedasticity)

This assumption entails that the variance in the residuals must be the same for all values, regardless of their predicted values (Tor & Jakobsen, 2022). The assumption of homoskedasticity can be tested with a Breusch-Pagan test which has the following hypotheses:

H_0: The model errors are homoscedastic

H_1: The model errors are heteroscedastic

The results of the test give Breusch-Pagan $Chi^2(1) = 12.068$, $p < 0.05$ (see appendix 1.4). Since the Breusch-Pagan test gives a significant Chi^2 value (at the 95% confidence level), the null hypothesis is rejected. Thus, the model experiences problems with heteroscedastic errors.

The relationship between the residuals of Model 4 and the dependent variable is shown in Figure 8. Figure 8 shows that the model best predicts values around the mean of the dependent variable (1.8). The model systematically underestimates values below the mean and overestimates values over the mean. This means that the coefficients of the model are biased and should be interpreted with these over- and underestimations in mind.

Normally distributed errors

The last assumption is concerned with the distribution of the residuals. In small samples, normally distributed errors are necessary for valid statistical generalization (Tor & Jakobsen, 2022). To test for the normality of the residuals, a Shapiro-Wilk test is used. This test has the following hypotheses:

H_0: The residuals follow a normal distribution

H_1: The residuals do not follow a normal distribution

The results of the Shapiro-Wilk test (see appendix 1.5) show that the distribution of the residuals is significantly different from normal (W = 0.98678, p < 0,01). However, there are two reasons why this result is not problematic. First, the relatively large sample (n = 340) contributes to the test being significant. Secondly, the large sample makes it less critical to have normally distributed errors (Tor & Jakobsen, 2022). Furthermore, a visual inspection of the distribution of the residuals in Figure 9 shows that the residuals are reasonably normally distributed.

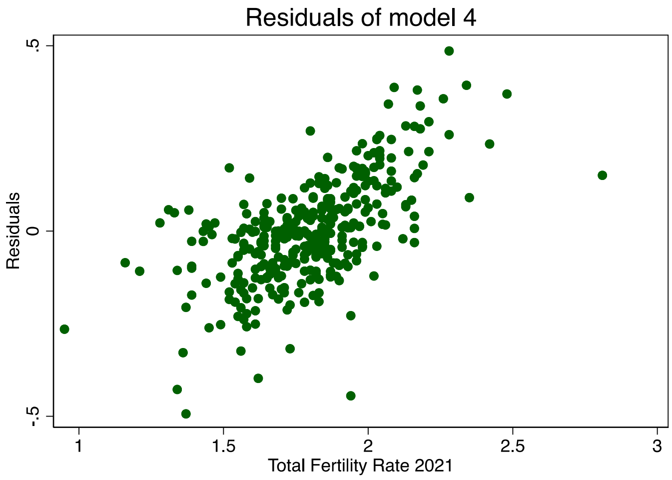

Figure 8: residuals of regression model 4

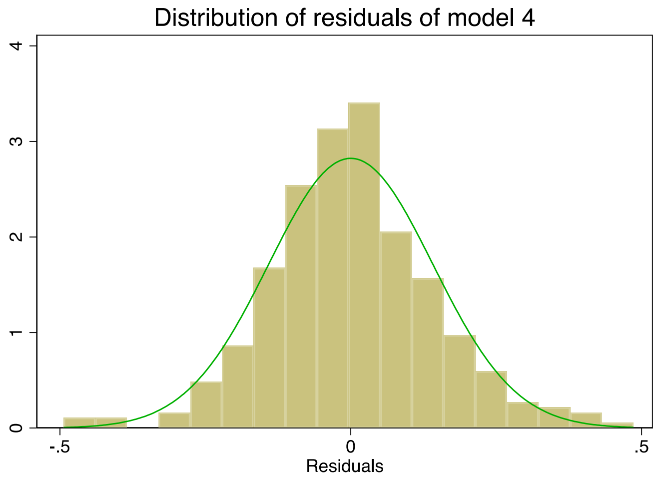

Figure 9: distribution of the residuals of model 4

Regression results

The results of the four estimated models are found in Table 4.

Table 4: regression results

VARIABLES	Model 1		Model 2		Model 3		Model 4	
	b	SE	b	SE	b	SE	b	SE
% Single person households	-0.0156***	0.0037			-0.0137***	0.0041	-0.0083**	0.0041
% First gen. Turkish & Moroccan females.	0.0045	0.0082			0.0143	0.0112	0.0115	0.0108
% Reformists	0.0117***	0.0014			0.0118***	0.0015	0.0082***	0.0016
Median spendable household income	0.0120***	0.0044			0.0124***	0.0048	0.0127***	0.0046
% Highly educated	-0.0018	0.0020			-0.0013	0.0021	-0.00150	0.0021
Address density			-0.111***	0.0137	-0.0269	0.0210	-0.0330	0.0203
% Greenspace			-0.0007	0.0008	-0.0003	0.0007	-1.20e-05	0.0006
% unemployed			-0.245***	0.0400	-0.0140	0.0375	0.0135	0.0366
TFR 2011							0.254***	0.0504
Constant	1.791***	0.254	2.288***	0.055	1.742***	0.299	1.063***	0.319
Observations	340		340		340		340	
R-squared	0.57		0.30		0.58		0.61	
F test	90.12		47.67		56.42		56.66	

*** p<0.01, ** p<0.05, * p<0.1

Model statistics

The first linear regression model was used to test whether compositional variables significantly explain differences in TFR between Dutch municipalities. For this model, the fitted regression model was:

$$TFR_i = 1.791 - 0.0156 * \%\ single\ person\ households + 0.00453 * \%\ first\ gen. Turkish\ and\ Moroccan\ females + 0.0117 * \%\ reformists + 0.0120 * median\ spendable\ household\ income - 0.00175 * \%\ highly\ educated$$

The overall regression model of Model 1 is significant ($F(5, 334) = 90.12$, $p < 0.01$, $R^2 = 0.57$), indicating that Model 1 fits the data significantly better than a model with no predictor variables. In this model, the share of single-person households, the share of reformists and the median spendable household income in a municipality are found to significantly explain the municipal TFR of 2021. No significant relationship was found for the share of first-generation Turkish and Moroccan females and for the share of highly educated individuals in a municipality.

Secondly, Model 2 tests the effects of the set of contextual variables on the municipal TFR of 2021. The fitted regression model for Model 2 was:

$$TFR_i = 2.288 - 0.111 * address\ density - 0.000701 * \%\ greenspace - 0.245 * \%\ unemployed$$

The regression model containing only contextual independent variables also fits the data significantly better than a model without predictor variables ($F(3, 336) = 47.67$, $p < 0.01$, $R^2 = 0.30$). Comparing the R^2 values of Model 1 and Model 2, the model with only compositional independent variables explains more of the variance of the dependent variable ($R^2 = 0.57$) compared to the model with only contextual independent variables ($R^2 = 0.30$). Only accounting for other contextual variables, significant relationships are found between the address density in a municipality and the municipal TFR and the unemployment rate and the TFR. No significant relationship was found between the share of greenspace in a municipality and the TFR.

Third, Model 3 estimates the effects of both compositional and contextual independent variables so that the effects of each set of variables are estimated after accounting for the other set of variables. The fitted regression model for Model 3 was:

$$TFR_i = 1.742 - 0.0137 * \%\ single\ person\ households + 0.0143 * \%\ first\ gen. Turkish\ and\ Moroccan\ females + 0.0118 * \%\ reformists + 0.0124 * median\ spendable\ household\ income - 0.00131 * \%\ highly\ educated\ - 0.0269 * address\ density - 0.000321 * \%\ greenspace - 0.0140 * \%\ unemployed$$

The test statistics show that the overall regression model of Model 3 is again significant ($F = 56.43$, $p < 0.01$, $R^2 = 0.58$). Combining the compositional and contextual independent variables in Model 3 only slightly increases the R^2 value by 0.01 compared to Model 1 with only compositional variables, meaning that the inclusion of both types of variables does not lead the model to explain much more of the variance of the dependent variable. Therefore, the contextual variables do not seem to add much explanatory power to Model 1.

The marginal increase of the R^2 in Model 3 when combining the independent variables from Models 1 and 2 suggests that Model 1 and Model 2 both explain the same variance in the dependent variable. This is also visible when looking at the significance of the contextual variables. In Model 3, all contextual variables became insignificant predictors of the dependent variable after accounting for compositional variables. Thereby indicating that there may not be a direct effect of the contextual variables on the municipal TFR of 2021, but this effect rather operates indirectly through the compositional variables.

In Model 3, the same compositional variables remained significant that were also significant in Model 1.

Finally, Model 4 estimates the effects of the same compositional and contextual variables as Model 3, as well as the earlier municipal TFR of 2011. As already explained, the coefficients of Model 4 must be interpreted as explaining the change in TFR between 2011 and 2021, rather than the TFR of 2021 that the earlier three models explained. The fitted regression model for Model 4 was:

$$TFR_i = 1.063 - 0.00832 * \%\, single\ person\ households + 0.0115 * \%\, first\ gen. Turkish\ and\ Moroccan\ females + 0.00822 * \%\, reformists + 0.0127 * median\ spendable\ household\ income - 0.00150 * \%\, highly\ educated - 0.0330 * address\ density - 0.0000120 * \%\, greenspace + 0.0135 * \%\, unemployed + 0.254 * TFR\ 2011$$

Based on the test statistics, it is found that also Model 4 fits the data significantly better compared to a model without predictor variables ($F = 56.66$, $p < 0.01$, $R^2 = 0.61$). Moreover, the inclusion of the earlier TFR of 2011 increases the proportion of explained variance in the TFR of 2021 by 0.03 compared to Model 3.

Testing of the hypotheses

The results of the regression models in Table 4 are used to test the hypotheses that were stated for the current research. For all the hypotheses the tested hypotheses are:

H_0: there is no relationship between the independent variable and the municipal TFR of 2021
H_1: there is a (positive or negative) relationship between the independent variable and the municipal TFR of 2021
The employed level of significance equals $\alpha = 0.05$.

For hypotheses concerning compositional variables, the results from models 1 and 3 are used to test the hypotheses, because these models contain compositional variables, and the coefficients estimate the effect of the independent variable on the municipal TFR of 2021. For hypotheses concerning contextual variables, Models 2 and 3 are used. Model 4 is only used to test the hypothesis concerning the path-dependency of the TFR.

Hypotheses on compositional effects

In the current research, the following hypotheses were tested with regard to the effect of compositional factors on the municipal TFR of 2021:

H1: Municipalities with higher levels of individualisation have lower fertility rates
H2: municipalities with a larger share of first-generation Turkish and Moroccan females have a higher TFR
H3: Municipalities with a larger share of conservative inhabitants have a higher TFR
H5: Municipalities with a higher income have a lower TFR
H6: Municipalities with a larger share of highly educated have a lower TFR

First, as displayed in Table 4, both in Model 1 and Model 3, a significant negative relationship is found between the share of single-person households in a municipality and the municipal TFR of 2021, which supports hypothesis 1. When accounting for other compositional and contextual variables together, the effect of the share of single-person households on the municipal TFR is -0.016 ($p < 0.01$), indicating that for every point increase in the share of single-person households in a municipality, the average number of children that a woman would have (considering the age-specific fertility rates of 2021) is 0.016 lower.

Secondly, When accounting for other compositional variables, and for other compositional and contextual variables together, no significant relationship was found between the share of first-generation Turkish and Moroccan females and the municipal TFR of 2021. Therefore, no evidence is found of a relationship between the share of first-generation Turkish and Moroccan females and the municipal TFR of 2021. Hypothesis 2 is not supported.

To test hypothesis 3, the share of reformists in a municipality was used as a proxy for the share of conservative inhabitants in a municipality. The share of reformists in a municipality is found to have a significant positive effect on the TFR of a municipality in 2021 in both Model 1 and Model 3. The coefficient estimated for the effect of the share of reformists on the municipal TFR after accounting for other compositional and contextual variables indicates that for every point increase in the share of reformists in the municipality, the TFR is 0.012 higher ($p < 0.01$). Accordingly, municipalities with a larger share of conservative inhabitants are indeed found to have a higher TFR and hypothesis 3 is supported.

Fourth, when accounting for other compositional variables in Model 1, and for compositional and contextual variables in Model 3, the regression results indicate a positive relationship between the income level of a municipality and the municipal TFR of 2021. However, the relationships found in Models 1 and 3 have the opposite direction of the direction stated in Hypothesis 5. A positive relationship was found instead of the hypothesised negative relationship between income and TFR. Model 3 estimates that for every 1000 euro increase in the median spendable household income in a municipality, the average number of children is 0.012 higher. Consequently, hypothesis 5 is not supported. Instead, a positive relationship is found between the income level of a municipality and the TFR.

Finally, in neither Model 1 nor Model 3 a significant relationship was found between the share of highly educated individuals in a municipality and the municipal TFR of 2021. Therefore, no evidence is found of a relationship between the share of highly educated individuals in a municipality and the municipal TFR.

Hypotheses on contextual effects

The following hypotheses stated a relationship between contextual factors in a municipality and the municipal TFR of 2021:

H7: Municipalities with a higher unemployment rate have a lower TFR
H8: More child-friendly municipalities have a higher TFR
H9: More urban municipalities have a lower TFR

To start with, hypothesis 7 stated a negative relationship between the unemployment rate in a municipality and the TFR of the municipality. Table 4 shows that when only accounting for contextual variables, a significant negative relationship was found between unemployment in a municipality and the municipal TFR of 2021. However, when accounting for both contextual variables as well as compositional variables, the negative relationship lost its significance. This indicates that unemployment may not have a direct effect on the municipal TFR, but this effect operates indirectly through the compositional variables. In effect, no evidence of a negative relationship between the unemployment rate of a municipality and its TFR is found.

Secondly, the 8^{th} research hypothesis hypothesises a positive relationship between the child-friendliness of a municipality and the municipal TFR. As a proxy for child-friendliness, the share of greenspace in a municipality was used. In neither Model 2 nor Model 3, a significant relationship was found between the share of greenspace in a municipality and the municipal TFR of 2021. Therefore, no evidence is found of a relationship between the child-friendliness of a municipality and the municipal TFR of 2021.

The last hypothesis with regards to a relationship between a contextual factor and the fertility in a municipality hypothesises a negative relationship between the degree of urbanity of a municipality and the TFR. In Model 2, a significant negative relationship was found between the address density of a municipality and the municipal TFR. However, in Model 3 the address density became an insignificant predictor of the municipal TFR of 2021. This indicates that the relationship found in Model 2 operates indirectly through the compositional variables. Therefore, the hypothesises negative relationship between the degree of urbanity and the municipal TFR is not supported.

Path dependency

The current research also included an earlier TFR to check for path dependency of the fertility in a municipality as stated in hypothesis 4:

H4: Municipalities with a high TFR in the past will have a high TFR in 2021

Model 4 estimates a significant positive relationship between the municipal TFR of 2011 and the municipal TFR of 2021. For every point increase in TFR in 2011, the TFR in 2021 is 0.254 higher ($p < 0.01$). This means that having a high TFR in 2011 is indeed associated with a higher TFR in 2021. Consequently, hypothesis 4 is supported.

DISCUSSION, CONCLUSION AND POLICY RECOMMENDATIONS

Discussion

The outcomes of this research have provided insight into the determinants of fertility at the level of Dutch municipalities to explain the regional differences in fertility between the municipalities.

Contextual effects

The results of the research indicate that there are several significant predictors of fertility in municipalities. Contrary to the expectations raised by the contextual hypothesis, the results of the statistical analyses show no significant effect of contextual factors on the municipal TFR after accounting for the set of compositional factors. This indicates that the effects of contextual factors operate indirectly through compositional factors. This finding is not in line with the contextual hypothesis that the immediate living environment is important in determining fertility (Kulu, 2013). The difference between the findings and the expectations may partly be explained by the operationalisation of the contextual variables.

First, the share of greenspace was used as a proxy for the child-friendliness of a municipality. Although greenspace is indeed seen as a child-friendly attribute of a place (Broberg et al., 2013), the way that the child-friendly greenspace is included in the current research is susceptible to errors. The share of greenspace in a municipality is affected by what is considered child-friendly greenspace. In the current research, ‘complex’ green was used for child-friendly greenspace, such as parks, forests, and open natural terrain since previous research found complex green to be child-friendly (Jansson et al., 2022). Other green structures, such as agricultural land, were left out of the greenspace, which may have influenced the results. Additionally, the share of greenspace in a municipality is affected by the Modifiable Area Unit Problem. Thus, the shape and size of the administrative boundary of the municipality may have created a bias in the results.

Secondly, Model 2 showed that more urban places with higher address densities have a significantly lower TFR, which supports the findings of De Beer & Deerenberg (2007) who found a negative relationship between address density and fertility. However, after accounting for the set of compositional variables in Model 3, the relationship lost its significance. This indicates that there is no direct effect of the address density on the municipal TFR, but rather an indirect effect through the compositional variables that were added in Model 3. Thus, differences in fertility between more urban and rural areas might exist because of compositional differences between urban and rural municipalities. An example of this can be found in Figure 6, where municipalities with large cities and thus high address densities (based on the author's knowledge of the municipalities), have high shares of single-person households. Therefore, the negative relationship between address density and fertility as found in Model 2 may be caused by the higher level of individualisation in the more urban municipalities.

Finally, also the unemployment rate became insignificant after accounting for compositional variables. Thereby indicating that regional labour market conditions do not significantly influence fertility in municipalities. This is not in line with the findings of Kravdal (2002), who found a negative effect of the unemployment rate on fertility. In the current research, the unemployment rate in a municipality is possibly correlated with the income in a municipality. When unemployment rises, the median spendable household income in a municipality might decrease. Thus, the effect of the unemployment rate may be taken over by the inclusion of the median spendable household income in the model.

Compositional effects

The analysis does support the theory that differences in the composition of places in terms of demographic, socio-economic and cultural characteristics cause differences in fertility (Kulu, 2013). Three of the five included compositional variables significantly predicted the TFR of a municipality.

The effects of the share of conservative people in a municipality, as well as the level of individualisation in a municipality, were significant and in the hypothesised direction.

However, contrary to the hypothesised negative relationship between income and fertility deduced from neoclassical economic theories, which argue a negative relationship between income and fertility because of increased opportunity costs associated with an increase in income (Becker, 1981), the current research found a significant positive relationship between income and fertility. This finding is in line with previous findings of Doepke et al. (2022) and Kolk (2023), who showed that the relationship between income and fertility in high-income countries has turned positive.

Moreover, no significant effect was found for the share of first-generation Turkish and Moroccan females. Their presence was hypothesised to lead municipalities to have higher fertility because their fertility reflects the higher fertility of their country of origin conform to the *socialisation hypothesis*. However, because the share of first-generation Turkish and Moroccan females per municipality is relatively small (median = 0.55), the effect of their higher fertility might not show on the municipal scale.

Additionally, the non-significant relationship between the share of highly educated individuals in a municipality is also not in line with the expectation raised by previous findings that higher educated have fewer children (Cygan-Rehm & Maeder, 2013; Fiori et al., 2014; Hoem, 2005). The absence of the relationship may be explained by the presence of other independent variables that are correlated with the level of education, thereby taking over the explanatory power of the share of highly educated in a municipality.

Path dependency

The effect of path dependency was estimated in model 4, where all variables were included, together with the earlier municipal TFR of 2011. According to Byers (2005), when an independent variable is added to a regression model that measures the same as the dependent variable, but at an earlier time, the coefficients of the other independent variables must be interpreted as explaining the change in the variable between the two different times. One would expect that the results of the models that estimate the TFR of 2021, and the results of the model that estimates the change in TFR between 2011 and 2021 are different. However, when comparing the results of Models 3 and 4, both models have the same significant explanatory variables. For two of the significant variables, the size of the coefficient decreases, whilst for the third variable the coefficient marginally increases. Thus, both models tell the same story, even though different effects are expected.

In line with Klüsener (2015), fertility was found to be influenced by earlier fertility in a municipality. Municipalities that had a high TFR in the past, also have a significantly higher TFR in 2021. This supports the theory that social and intergenerational control cause fertility behaviour to be path-dependent (Klüsener, 2015). These results build on existing evidence that fertility differences are persistent over time (De Beer & Deerenberg, 2007).

Conclusion

The current research aimed to explain the regional differences in fertility on the level of Dutch municipalities, making a distinction between compositional, contextual, and temporal effects on fertility. The central research question in this research was: What are the differences in fertility between Dutch municipalities, and how can these differences be explained? This main research question got split up into four sub-questions that together answer the main research question.

1. How do demographic factors explain differences in fertility between Dutch municipalities?
2. How do cultural factors explain differences in fertility between Dutch municipalities?
3. How do socio-economic factors explain differences in fertility between Dutch municipalities?
4. How do contextual factors explain differences in fertility between Dutch municipalities?

Based on a quantitative analysis of macro data on 340 Dutch municipalities it can be concluded that compositional attributes of municipalities are important determinants of municipal fertility. The results indicate that a difference in demographic composition explains differences in fertility between municipalities. Higher levels of individualisation, connected to the Second Demographic Transition, are shown to be associated with lower fertility rates. Additionally, also cultural factors explain differences between municipal fertility rates. Municipalities composed of a larger share of conservative inhabitants, who display more traditional demographic patterns, are associated with higher municipal fertility rates. Lastly, socio-economic factors also explain part of the differences in fertility between Dutch municipalities, where municipalities composed of higher-earning households display higher fertility rates.

The findings of this research challenge the contextual hypothesis, since after accounting for compositional factors, the effects of contextual factors on municipal fertility disappeared. This suggests that the difference in fertility in different contexts is caused by differences in the composition of people between the different regions, rather than the different immediate environments that the people live in.

Lastly, since a positive relationship was found between previous and current fertility rates, it can be concluded that fertility is path dependent. In effect, differences in fertility between Dutch municipalities are likely to be persistent over time.

Policy recommendations

The study found that there is a positive relationship between income and fertility. Municipalities with a higher median spendable household income showed significantly higher fertility rates. According to Doepke et al. (2022), this positive relationship between income and fertility is possible due to the ease of combining a career and a family. People will have more children when it is easy to combine work and family life, because opportunity costs of children are lower. This can be translated into policy recommendations that are focused on increasing fertility by addressing opportunity costs. Increasing fertility is deemed necessary for the Netherlands by 40% of the demographers present at the International Union for the Scientific Study of Populations (IUSSP) (Van Dalen & Henkens, 2021).

First, policies that lower opportunity costs of children could include measures such as affordable and accessible childcare options which allow couples to combine work and family life, or flexible working hours that allow to combine family and work life.

Additionally, another policy recommendation focusing on the lowering of opportunity costs is a lengthy (partly) paid parental leave policy for both parents. Lengthy paid parental leave can also decrease opportunity costs of children since it decreases the missed income in the time that is needed to take care of newly born children. Norway and Sweden are well-known examples of countries with lengthy parental leave policies for both parents. Both countries have parental leave policies that extend to 13 months in the case of Norway, and 15 months in the case of Sweden with high levels of compensation between 80% and 100% of one's income depending on how one wishes to divide the parental leave (Duvander et al., 2019). Norway and Sweden both provide evidence for higher fertility in families where both parents make use of parental leave. The risk of a second child is higher in families where both parents make use of parental leave schemes (Duvander et al., 2019). Learning from the case of Norway and Sweden, egalitarian parental leave which lower opportunity costs to have a child can lead to higher fertility rates.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Limitations

The current study has multiple limitations. First, there are limitations concerning some variables that were used to test the hypotheses in this study. Especially for the concepts of individualisation, conservatism and child-friendliness, the operationalisation used in the current research only captured parts of the concepts since they are very broad. First, the level of individualisation was measured by the share of single-person households in each municipality. However, not necessarily everyone that lives in a single-person household has an individualistic lifestyle or vice versa. Secondly, the effect of conservatism was measured by including the share of reformists in the analysis. Reformists are found to be a group of people with traditional demographic behaviour; however, reformists might not be the only group of people displaying this demographic behaviour. Third, child-friendliness was measured by the share of complex greenspace in a municipality, which is an objective measure of a child-friendly environment (Broberg et al., 2013; Jansson et al., 2022). However, it is arguable how far certain green structures (such as forests) are child friendly.

Another limitation is the unavailability of data for 2021. Since the study used macro data, ideally, the independent variables were all to be measured in the same year as the dependent variable; however, not all data was available for 2021. Therefore, data from earlier years were used for the share of reformists and the share of greenspace. Moreover, since in the interval between the measurement of the independent variables and the measurement of the dependent variable municipal boundaries were subject to reforms, not all data was directly available for all municipalities that existed in 2021. Therefore, some data had to be calculated, which might have caused bias in the results.

Lastly, the Modifiable Area Unit Problem is another limitation of the current study. The MAUP is well-known in geographical research when aggregation units are used in the study. The TFR is modelled for municipalities that, in theory, can take on any shape or size. Therefore, should municipal boundaries have been different, then the results of the current study might also have been different. There is however no solution to accurately quantify the effects of the MAUP (Dark & Bram, 2007).

Future research

The current study performed a macro analysis on the effect of different demographic, socio-economic, cultural, and contextual factors on the fertility rate of municipalities. The research offers a broad perspective on the patterns of fertility on the aggregated level. However, this broad perspective is unable to unravel the effects of individual complexities and unique contexts. Therefore, complementary to the current research, an analysis can be performed on the individual level to study the individual complexity and unique context of places to analyse how these affect regional differences in fertility.

Moreover, the current study can be extended by performing a longitudinal study of fertility differences between Dutch municipalities to check whether the explanations for differences in fertility between municipalities are constant or susceptible to change.

Furthermore, interesting future research could extend the research area or alternatively repeat the research in another context to test the generalisability of the results for other contexts.

Additionally, the current research can be repeated with different operationalisations of the concepts, especially for the concepts of individualisation, conservatism, and child-friendliness. This would give insights into the robustness of the results of the current study.

Lastly, the results of the current study also bring forward a new suggestion for future research. The current research showed that differences in fertility tend to be persistent over time. Klüsener (2015) suggests that more rural areas have more social and intergenerational control, which may restrain fertility behaviour that is different from the norm, whilst, in more anonymous cities, it may be easier to have different fertility behaviour. Therefore, future research can focus on comparing the path dependency of rural and urban regions to test how urban and rural areas differ in mechanisms behind path dependency.

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