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by

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Gender-specific spatial interactions on Dutch regional labour markets and the gender employment gap

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Abstract

This article analyses gender-specific employment rates and the gender employment gap in Dutch municipalities for 2002. The novelty of this analysis is that it takes into account the extent to which gender-specific education, income and unemployment influence the male and female employment rates and gender gap. The gender employment gap narrows with female education, but widens with higher female to male unemployment. This gap narrows in urban areas and widens with the care-prone age composition of the municipal population. Caretaking, be it for young children or elderly relatives, appears to be an important factor for female employment in the Netherlands.

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1. Introduction

The Dutch population, like those in many Western European countries, is rapidly aging. Increasing resource transfers to the elderly from a smaller working population base will form a serious challenge for the Dutch government (Carey, 2002). To maintain current welfare levels, participation needs to increase. The aim of this article is therefore to gain more insight into the factors that determine participation, particularly employment, or net participation.

Figure 1 shows the development of the gender employment gap over the past four decades in the Netherlands. Throughout the 1970s until halfway into the 1980s, the female employment rate was more or less constant around 30%, while the male employment rate fell from almost 90% in 1970 to slightly below 70% in 1984. During this period the gender employment gap declined from roughly 60 to 40 percentage points. This was however entirely caused by a falling male employment rate. The female employment rate really started to take off from the second half of the 1980s onwards from 30% in 1985 to almost 60% in 2009. Compared to this, the male employment rate increased only gradually and is more cyclical in nature than female employment. During this period the gender employment gap closed further to roughly 15 percentage points in 2009, this time due to the rise in female employment.

Insert figure 1 around here

The increase in female participation during the past decades can be attributed to a combination of factors. On the supply side, women have become better educated, fertility has decreased, and it is more accepted nowadays that women combine paid work with raising children (e.g. De Graaf and Vermeulen, 1997; OECD, 2002). Changes on the demand side of the labour market also contributed to the increase in female participation. Between 1960 and 2009 the female employed labour force more than tripled from slightly less than 1 million to almost 3.3 million female workers. The shift from a manufacturing to a services economy in that period and the tremendous increase in part-time jobs contributed to the possibility of combining paid work with raising children, without leaving the labour market. Henkens et al. (2002) argue that the increase in female participation is almost completely due to the growth in the number of women working part-time. According to Statistics Netherlands, in 2002 20% of the employed women worked in small part-time jobs of less than 20 hours a week, while 47% of the employed women held part-time jobs between 20 and 35 hours a week.

Despite the increase in female employment, the *gender employment gap* still persists. Until now, the *gender employment gap* has mainly been studied at the national level, which does not take into account that labour markets function on a regional scale rather than on a national

scale. The limited spatial range of spatial labour market behaviour is clearly illustrated by the fact that people are only willing to accept a limited daily commuting time (see for example Van Ham, 2002; Turner and Niemeier, 1997). The literature also shows evidence of a gender commuting gap: women commute over shorter distances and times than men (Crane, 2007). According to Elhorst (1996) the national labour market does not exist. Rather, employers and employees or job seekers are limited to a small set of overlapping regional labour markets due to psychological and geographical frictions (Elhorst, 1996, p.210). Furthermore it is well known that there are substantial regional differences in labour market performance. Therefore, our aim is to obtain more insight into the regional variation of gender-specific employment in the Netherlands and more specifically regional variation of the gender employment gap by adopting a spatial econometrics approach that allows us to take also into account interrelated labour markets of neighbouring regions.

Special attention will be paid to the interactions between male and female participation and unemployment. It might be that men and women compete for the same jobs, but it might also be that the labour market status (especially with regard to unemployment) of men exerts an additional worker or discouragement effect on women or vice versa. We will explicitly test for this by including female unemployment rates and the distribution of jobs with regard to female-dominated sectors into the model that explains the employment rates of males and vice versa. Insights into these cross-effects is especially relevant for active labour market policy aiming to stimulate the re-entrance of unemployed workers into employment and to stimulate a further increase in the employment rate, especially for women and men at older ages which is an explicit goal of the Dutch labour policy.

The article is organized as follows. In section 2 an overview of variables determining employment is presented on the basis of a literature review. Section 3 provides a description of the data and the adopted methodology. The empirical results of the regression analysis are discussed in section 4 and 5 presents a summary and conclusion.

2. Determinants of employment

This section presents a short overview of studies on labour force participation, especially those on regional labour markets and female participation. Because we are interested in the gender employment gap we use gender-specific employment, or net participation rates instead of gross participation rates, in which the unemployed are also included. The gender-specific employment rate ($ER_{g,r}$) is defined as $ER_{g,r} = 100 \cdot E_{g,r} / P_{g,r}$,

where $E_{g,r}$ is the proportion of men or women ($g=\{m,f\}$), aged 15-64, with a job of at least 12 hours in region r , and $P_{g,r}$ is the male or female ($g=\{m,f\}$) potential labour force (i.e. population

between 15-64) in region r . Region r refers to place of residence because employment data are measured according to place of residence.

According to Elhorst (1996) the regional participation rate can be interpreted as the proportion of people who are willing to work at the current wage, controlling for a broad range of micro-oriented variables such as taxes and non-wage income, cost of living and socio-economic characteristics such as age, education and household situation. However, he also argues that studies on regional labour market participation generally are not confined to the microeconomic level, but also focus on possible relationships between labour participation and regional indicators, which determine the spatial opportunity structure. Similarly Van der Laan and Van der Bout (1990) argue that regional variation in female participation rates is influenced by the heterogeneity of potential participants in the labour market and by the regional (labour market) context. Based on the results of the meta-analysis by Elhorst (1996) we adopt an eclectic approach and develop an empirical model including all commonly used explanatory variables. The model includes both socio-economic indicators, for example, measures of population composition based on the microeconomic model and variables that describe the regional opportunity structure such as regional unemployment rates. The variables included in the empirical model are described in the following sections in more detail, including the theoretically expected outcomes.

Socio-economic characteristics

Studies explaining labour force participation through a micro-economic approach usually start with the human capital theory (Van Ham and Büchel, 2006). Assuming that people strive for utility maximization, labour force participation can be explained in terms of time and income constraints. Based on the theory of consumer behaviour, leisure and work are weighed against each other, resulting in the decision to participate in the labour market for a certain amount of hours, given the wage that is offered (see among others Groot and Pott-Buter, 1993; Cörvers and Golsteyn, 2003; Henkens et al., 2002). An increase in wages tends to have a positive effect on labour supply (Van der Veen and Evers, 1984). People who are already employed will stay in the workforce and people who are not active on the labour market are stimulated to participate, which can be described as ‘encouraged worker effect’. Only for wages that far exceed average wage levels will the labour supply curve will be backwards-bending. In view of the fact that the units of analysis are regions, only average wage levels will be considered, which implies that a backward-bending supply curve is not very likely. Higher *wage levels* are therefore expected to lead to higher employment rates.

Elaborating further on the human capital theory, higher education results in better access to high productivity jobs and higher wages and consequently in higher opportunity costs of choosing not to work (see among others OECD, 2002; Callens et al., 2000). Those who are higher educated are also likely to search more efficiently and successfully, and given the higher opportunity costs of not working they are likely to be more career oriented (see among others

Siegers and Zandanel, 1981). Furthermore, organizing individual arrangements for required supporting services such as domestic help and childcare, is easier for high income earners (Elhorst and Zeilstra, 2007; Van der Laan and Van der Bout, 1990; Siegers and Zandanel, 1981). In accordance with these findings, we expect that higher *educational attainment* has a positive effect on employment.

Another aspect of labour supply that is often included in studies of labour force participation is the age composition of the population. The age-specific employment pattern tends to follow an inverted U curve (Elder and Johnson, 1999; Fitzenberger et al., 2004). Young people participate less because they are still engaged in their studies and older people participate less because they retire early, are more likely to become ill or disabled, or are unable to find a new job after having been laid off.

For women, their labour market participation is also influenced by the presence of children. According to Vlasblom and Schipper (2004) Dutch women have a strong preference to take care of their own children and the birth of a first child can induce women to withdraw from the labour force. If women decide to withdraw from the labour force permanently, the age-specific employment pattern will take a uni-modal shape. If withdrawal from the labour force is only temporary, during the child rearing years, the age-specific employment pattern will show a bi-modal or M-shaped curve with a clear dip in participation between the age of 30 and 35 (Plantenga, 1997; Fitzenberger et al., 2004). Depending on the population composition of a region, we expect age to have a negative effect on employment when larger shares of the population are still engaged in education or are close to retirement. And we expect higher female employment rates when there is a larger proportion of women in the age group just beyond the typical reproduction period.

According to Moen and Yan (2000) caregiving is not limited to taking care of children but also refers to taking care of other dependent relatives. In a rapidly aging society where women provide the majority of care, the potential increase of, for instance, dependent parents can have a negative effect on the employment rate of women. Although men are undertaking more household chores and caregiving than in the past, women continue to do a greater share (Turner and Niemeier, 1997). These tasks influence female job opportunities because they take up time which consequently is no longer available for jobs that require long commuting hours (Pratt and Hanson, 1991). To take into account the effect of both taking care of children and dependent elderly persons, we include a *demographic pressure* variable in our model. Since women continue to do a greater share of caregiving, we expect higher demographic pressure to exert a negative effect especially on female employment.

Regional opportunity structure

Several authors have argued that individual labour market decisions are influenced by regional characteristics (see for example Elhorst and Zeilstra, 2007; Van der Laan and Van der Bout,

1990). In this section we will discuss the effect of the opportunity structure of the regional labour market on employment. Van Ham and Büchel (2006) found that poor regional labour market characteristics influence the probability of being employed as well as the willingness to work. The characteristics under discussion are unemployment, vacancies, sector composition, urbanization, accessibility to employment and the availability of childcare facilities.

High regional unemployment rates are an indication of poor access to local employment opportunities (Van Ham and Büchel, 2006). Broersma and van Dijk (2002) clearly show that in the Netherlands (like most European countries) labour adjustments due to changes in labour demand mainly take place via changes in the employment rates and not via migration of workers as is often the case in the U.S. In general a positive effect of unemployment is interpreted as an additional worker effect and a negative effect is interpreted as a discouraged worker effect (see among others Euwals et al., 2007; Elhorst, 1996; Van der Veen and Evers, 1984). An additional worker effect occurs when the household income drops to a level that is too low as a result of long-term unemployment of the main wage earner (who is usually male). In this situation, the partner (usually female) accepts a job offer to maintain the household income at an acceptable level (Lundberg, 1985). A discouraged worker effect is defined as the decision to refrain from job search as a result of poor opportunities on the labour market (Van Ham, 2002). High unemployment rates increase the competition for jobs and hence the search costs for suitable jobs. In this context job seekers might get discouraged and decide to stop their search effort. Especially women were found to be sensitive to the discouraged worker effect (Van Ham, 2002). In view of our aim to gain more insight into the cross-effects of unemployment we include both male and female unemployment in the empirical model. We expect that high rates of male unemployment exert a positive effect on female employment as a result of the additional worker effect. Furthermore, we expect high rates of female unemployment to have a negative effect on female employment, that is they constitute a discouragement effect. Similarly, high rates of male unemployment will negatively influence male employment in a region.

Where the unemployment rate reflects the supply side of the labour market, the vacancy rate gives an indication of the demand for labour in a region. When there are more *vacancies* per unemployed the likelihood of finding a job is higher. We expect that a higher vacancy rate leads to higher regional employment shares for both men and women. Employment opportunities are also influenced by the sector composition of employment. Due to occupational segregation, these opportunities differ for men and women. Bowen and Finegan (1969, p.479) first introduced the sector composition of employment “designed to measure structural differences between metropolitan areas in the relative abundance of those jobs commonly held by females”. Regions with a relative abundance of so-called female-friendly *sectors*, such as healthcare and education where more part-time jobs are available and working hours are flexible, are expected to show higher female employment rates.

Another indicator of access to employment opportunities is urbanization. Highly urbanized areas tend to have favourable labour conditions simply because there are more jobs available, which means better opportunities of achieving a positive job match (Van der Laan and van der Bout, 1990; De Meester et al., 2007). Moreover, large firm headquarters and government offices, which customarily employ a large number of women, are predominantly located in highly urbanized areas (Siegers and Zandanel, 1981). De Meester et al. (2007) also mention the positive effect of supporting services in urban areas. Urbanization can also be viewed as a substitute for the degree of emancipation (Van der Veen and Evers, 1984; Van der Laan and Van der Bout, 1990). De Meester et al. (2007) found some evidence of the emergence of a ‘combination model’ in highly urban areas in the Netherlands, whereas the dominant model is the ‘one-and-a-half model’. In the ‘combination model’ highly-educated women and equally or less educated partners divide both paid and unpaid tasks more equally. Similarly, Siegers and Zandanel (1981) argue that societal opposition against female employment is probably lower in urban areas. Regardless of gender, we expect higher levels of *urbanization* to have a positive effect on employment rates.

A higher travel-to-work commute duration in a region is an indication of the relative scarcity of suitable nearby jobs. A shorter commuting time then implies that more suitable jobs are available at a short distance. Women commute a shorter distance and time than men (Turner and Niemeier, 1997; Camstra, 1996; Pratt and Hanson, 1991). In 2003 Dutch men commute on average just over 20 kilometres and for women this is about 12 kilometres (Molnár, 2004). According to Camstra (1996), women usually work fewer hours and earn less, which makes commuting relatively time-consuming and expensive. Furthermore, since women do a large share of the unpaid work, their time available for paid employment and travelling to and from work is far less than for men (Hanson and Pratt, 1990). However, Camstra (1996) and Crane (2007) also found evidence that the gender gap in commuting is converging. We expect a negative relation between a higher average *commuting* duration and employment and we expect this influence to be stronger for women because women are more sensitive to longer commuting times.

As described in the introduction, during the 1970s and 1980s married women entered and remained in the labour force throughout their working lives, combining work with raising children. Still, women do most of the housework including taking care of children. Therefore, access to childcare facilities is expected to be relevant for the employment opportunities of women (Van Ham and Mulder, 2005). We expect that regions with more *childcare facilities* available show higher female employment.

3. Data and methodology

Data

The aim of this article is to obtain more insight into the regional variation in gender-specific employment rates and the gender employment gap. A person is considered employed when he or she works for at least 12 hours a week. Going by this criterion, it implies that part-time jobs covering 12-35 hours a week are included, while people who are looking for a job or temporarily recovering from an injury or illness are excluded.¹ The gender employment gap is defined as the difference between the male and the female employment rate. In order to obtain a better understanding, we also estimated a model for the ratio of the number of employed women vis-a-vis employed men, which is used to operationalize the gender employment gap.

We have analysed employment rates for the year 2002 at the spatial level of Local Area Units² or municipalities. We focus our analysis on 2002 because data on the provision of childcare in municipalities are available only for that year. Ideally we would have liked to base the analysis on all 496 municipalities in 2002 and over a range of subsequent years. However the required data are not consistently available for all municipalities and over a period of several years, in part due to the large number of explanatory variables included in the empirical model. Especially data for education and childcare are not available for small, predominantly rural municipalities. For 2002, the male employment rate is available for 392 municipalities and data on the explanatory variables for 295 municipalities. The female employment rate for 2002 is available for 377 municipalities, and the explanatory variables for 298 municipalities.³ The empirical model of the male employment rate is therefore estimated for 295 municipalities and for the female employment rate for 298 municipalities, which accounts for 80% of the Dutch population. There is a slight bias in the models towards larger municipalities. Most of the excluded municipalities are near the eastern and southern borders. This means that possible disturbance posed by border regions with respect to the spatial dependence structure of the remaining municipalities will be relatively small. We have also estimated the models without childcare and education, thus allowing the inclusion of all municipalities for which the employment rates are available. There were no significant changes in the results other than a smaller adjusted R^2 . Moreover the spatial dependence structure did not change significantly.

¹ In this respect, we follow the Dutch definition of the labour force comprising employed persons with a job of at least 12 hours a week and persons searching actively for a job. The common international definition does not include restriction on the number of hours, but considers all jobs regardless of weekly hours. The main reason for the hours restriction is the fact that persons who work at least 12 hours a week regard employment as their main activity, whereas persons with smaller jobs usually have other main activities. Hence, this definition is closer to the concept of labour market participation.

² The basic components of the NUTS regions consist of Local Administrative Units or LAU. LAU 1 is former NUTS level 4 and LAU 2, used to indicate municipalities, is former NUTS level 5.

³ These different numbers are related to the fact that the Labour Force Survey, which lies at the heart of this analysis, is a relatively small survey where information in densely-populated areas will compromise the confidentiality and reliability of these results. We have chosen the maximum number of observation to be able to specify male and female employment rate models.

Figure 2 shows the regional variation of female and male employment rates and the gender employment gap at the municipality level. It is obvious that there is considerable spatial variation in participation rates as well as different patterns for males and females respectively. For men the employment rate ranges from 63% in the municipality of Groningen up to 90% in Boskoop, with the average lying at 78%. For women the average is much lower at 52% and there is substantial regional variation; ranging from 34% in Laren up to 70% in Ouder-Amstel. Municipalities with relatively high rates of employment are more or less located in the centre of the Netherlands, for both men and women. However, high and low rates between male and female employment often do not occur in the same municipalities; the correlation coefficient is only 0.24.⁴ The difference in employment shares between men and women, i.e. the gender employment gap, appears to be the smallest in municipalities around the larger cities. Heemstede has the smallest difference in participation: for every 100 men, there are 88 women who work. In Laren the figure is only 45 women. On average for the Netherlands as a whole for every 100 men that work, 67 of their female counterparts do the same.

Figure 2 should be inserted around here

The considerable variation in employment rates, which becomes visible at a lower regional scale, strongly supports the relevance of smaller units of analysis, in this case municipalities. However, employment in a particular municipality could also be affected by neighbouring municipalities because of spillover and the possibility of commuting. Therefore we will consider spatial dependence among municipalities.

The occurrence of spatial dependence can be tested by calculating Moran's I (Anselin, Syabri and Kho, 2004). The value of Moran's I depends on a spatial weights matrix in which the supposed spatial dependence is specified. Since we assume that particularly the labour market situation of the adjacent municipalities exerts considerable influence we use a *queen's contiguity matrix* for the analysis. A first-order queen contiguity is represented by a row-standardized weight matrix W , where $w_{ij} = 1$ if municipalities share a common border or vertex and 0 elsewhere. We have considered alternatives to first-order queen contiguity, including second-order contiguity and inverse distance. The results obtained with first-order contiguity proved to provide the best fit, which can be explained by the fact that short distance commuting is most common in the Netherlands.⁵

A *spatial lag* of the labour market can be calculated using this weights matrix, which means a weighted average of the employment rates of neighbouring municipalities. This

⁴ The bivariate correlation matrix is available upon request.

⁵ According to Statistics Netherlands in 2002 men on average commuted 20 kilometres to work and women 12 kilometres.

weighted average or *spatial lag* is used to calculate Moran's I which is defined as $I = \frac{[\sum_i \sum_j w_{ij} z_i \cdot z_j / s_o]}{[\sum_i z_i^2 / N]}$ with $z_i = x_i - m_x$: deviations from mean, N is the number of observations and $s_o = \sum_i \sum_j w_{ij}$: the number of neighbour pairs (Anselin et al., 2004).

Operationalization of the explanatory variables

The majority of the data are obtained from Statistics Netherlands and are supplemented by data on sectors derived from the LISA business register⁶, unemployment and vacancy data provided by the Centre for Work and Income (CWI), and data on the provision of childcare services from Deloitte Consultancy.⁷

For the *wage level* we use gender-specific average disposable income, namely income after tax deductions, for men and women aged 15 and older who received an income during the entire year. The advantage of using disposable income above the gross wage is that the latter does not reflect the purchasing power correctly because taxes and social security contributions differ per household, income and industry.

Education is measured as the gender-specific proportion of those who are lower educated in the total population. Lower education refers to completed primary education and a lower level of secondary education. Ideally we would have preferred to include data for the proportion of higher educated in a municipality but due to the smaller number, data for the higher educated are only available for a considerably limited number of municipalities because of confidentiality regulations of Statistics Netherlands.

Age for men is measured as the proportion of men close to retirement, aged between 50 and 60. And age for women is measured as the proportion of women beyond the typical reproduction period, aged between 40 and 50. To take into account the effect of providing care for children and others, such as the elderly we also include the *dependency ratio* which is measured as: $\frac{\text{No. of persons} < 20 + \text{No. of persons} > 65}{\text{No. of persons } 20 - 65 \text{ years of age}} \times 100$. We have also distinguished between the so-called 'green' (of those below 20 years) and 'grey' (those above 64) pressure. However, a test on the equality of the estimated coefficients of both effects could not be accepted at any reasonable significance level. That is why we continue with the overall demographic pressure.

To measure regional labour market conditions, *the regional unemployment rate*, Bowen and Finegan's (1980) *industry mix* and the *vacancy-unemployment (VU) ratio* are included in the empirical model. Since male unemployment and female labour market behaviour may theoretically affect each other crosswise through additional and discouraged worker effects, gender-specific unemployment rates are included in the model. The percentage of unemployed

⁶ For more information about the LISA data, see www.lisa.nl.

⁷ Childcare data collected by Deloitte Consultancy on behalf of the Ministry of Social Affairs.

men or women is measured as the share of unemployed in the gender-specific labour force. The employment data are measured by place of residence.

The industry mix indicator formulated by Bowen and Finegan (1980) measures the extent to which the regional sector structure i.e. industrial composition is favourable for women in terms of the availability of jobs. The indicator predicts the expected share of female jobs in a region based on the regional industry mix combined with the national ratio of males and females in each sector.⁸ Following Elhorst (2008) we measure the predicted ratio of female employment to total employment as:

$$\text{Mix}^{r,f} = 100 * \sum_{s=1}^6 \frac{E_s^{r,m+f}}{E_{total}^{r,m+f}} \cdot \frac{E_s^{n,f}}{E_s^{n,m+f}},$$

where E refers to employment, s to sector, f to females, m to males, r to region and n to country.

The VU ratio has the drawback that not all vacancies are reported and a lot of vacancies are filled without any public announcement. Nevertheless, this drawback can be partly circumvented by adding the rate of *urbanization*, measured as the average address density of a region. As discussed earlier, urbanization can be seen as an indicator of job opportunities within a municipality. Other regional variables included in the empirical model are *childcare facilities* and *commuting*. The *provision of childcare* is measured by the availability of day-care facilities for children aged 0-12, i.e. the number of day-care slots and after-school-care facilities times 1.7⁹ over the number of children aged 0-12 in a municipality. *Commuting duration* is measured as the average commute-to-work duration, i.e. the average time people commute to and from work.

Table 1 provides an overview of the descriptive statistics of the variables included in the analysis. An overview of the definitions of the variables and the data sources can be found in the Appendix.

Table 1 should be inserted around here

Model specification and spatial dependence

Moran's I is first calculated and it suggests spatial dependence only for the female, not male, employment rate. In the specification analysis of our empirical model we take this possible spatial dependence into account by testing what kind of spatial structure will best fit the data.¹⁰

⁸ In this study jobs are concentrated in 6 sectors, which are all included in the industry mix: agriculture, manufacturing, finance business and other services, distributive services and hotels, healthcare and public administration and education.

⁹ One slot consists of 10 units (five days per week times two segments; morning and afternoon) and is on average occupied by 1.7 children. Based on oral information provided by Deloitte Consultancy.

¹⁰ The specification analysis is conducted with the statistical package GeoDa (Anselin, 2003).

We test whether our specification either can be represented by a spatial autoregressive (SAR) lag structure, i.e.

$$\varphi(W)y = \alpha + \beta X + \varepsilon \quad (1)$$

or by a spatial moving average (SMA) structure on the error process, i.e.

$$y = \alpha + \beta X + \lambda(W)\varepsilon \quad (2)$$

In these specifications, y is the dependent variable (gender-specific employment rate), X refers to the vector of explanatory variables, comprising the socio-economic and regional opportunity variables defined earlier and ε represents the error process. In addition, $\varphi(W) = 1 - \sum_j \varphi_j W^j$ and $\lambda(W) = 1 - \sum_j \lambda_j W^j$, in which W reflects the spatial lag, which is determined by the spatial weight matrix W defined earlier.

We note that the spatial lag structure of (1) and (2) are related since the SAR structure in (1) can be rewritten as an SMA model with an infinite lag. Conversely, the SMA specification in (2) can be rewritten in an infinitely lagged SAR specification. The same holds for the combination of both in a spatial autoregressive moving average (SARMA) model, which is why this latter specification will not be further explored. We test whether model specification (1) or (2) best fits the data concerning the female employment rate and the male employment rate, respectively. Next, we will consider the implications for the gender gap model.

4. Results

Given our numbers of observation, we set the number of spatial lags in (1) and (2) equal to 1, i.e. $j=1$. In testing for the spatial structure in the models of the male and female employment rate in table 2, the presence of a spatial error structure with a single lag cannot be rejected for the female employment rate. For the male employment rate on the other hand no significant spatial structure could be identified. The gender employment gap, defined as the ratio between the male and female employment rates, follows the same spatial structure as for the female employment rate, which is confirmed by the usual LM tests.

Hence, specification (2) is chosen to conduct our analysis for female employment while for male employment no specific spatial structure will be imposed on the model. The estimation results of table 2 for female employment and the gender employment gap indeed show a positive significant effect of λ . The definition of the gender employment gap implies that an obvious adaptation would be to specify the gender gap model also in terms of the ratio of the gender-specific variables, i.e. income, education and unemployment. Testing whether this improves the model revealed that only the ratios of female to male education and unemployment rates

improved the gender gap model as explanatory variables.¹¹ Female and male income are included separately.

The adjusted R^2 from the OLS regressions shows the lowest explained variance for men (0.38), a substantially higher share for women (0.49) and the best fit for the ratio (0.53). Therefore we can conclude that this model is adequate for explaining a large part of the variation in employment by gender as well as the gender employment gap.¹² Let us proceed with a discussion of the results according to the different characteristics we have distinguished for the explanatory variables.

Table 2 should be inserted around here

Socio-economic characteristics

We find that only female *disposable income* has a significant positive effect on the female employment rate and the gender employment gap. Male disposable income has no significant effect. Hence, municipalities with higher levels of female disposable income show a narrower gender employment gap. These results could indicate that for women the substitution effect is larger than the income effect whereas for men income and substitution effects compensate each other.

Municipalities with a relatively larger share of lower *educated* women have lower female employment. This is in accordance with the classical human capital theories where higher education has a positive influence on labour market participation. Higher educated women are more career-oriented and have better access to the labour market than lower educated women. For the gender employment gap we find that municipalities with a high ratio of low educated females to low educated males have a wider gender employment gap than vice versa. This is also in line with human capital theory.

As expected, we found a positive significant relation between the proportion of women *aged 40-50* and female employment and a negative significant relation between the proportion of men *aged 50-60* and male employment. The effect of a higher proportion of women *aged 40-50* on the ratio of female to male employment is also positively significant. This means municipalities with a larger share of women in the age group 40-50, an age group just beyond the typical reproduction period, have higher levels of female employment, also resulting in a smaller

¹¹ Comparing the Schwarz selection criterion of a model with no ratio (SC=-818) with a model with all three variables taken as ratios (SC=-808) is not an improvement, while a model with only ratios of female to male education and unemployment (SC=-824) is.

¹² According to Anselin and Bera (1998), the R^2 is not suitable to measure the fit of the model because unlike the log likelihood it does not take the spatial autocorrelation of the residuals into account. Since the results of the OLS estimations do not differ substantially from the results of the spatial error estimations we can argue that the model provides a good explanation of the variation in participation.

gender employment gap. As discussed in section 2, the age-specific employment pattern of Dutch women resembles an M-shaped curve. Our results support the second rise in the employment curve that takes place after the dip during child-raising ages. This follows from the fact that taking care of children becomes less time-consuming as they grow older, which enables women to return to the labour market. For men we find that in municipalities with a larger share of men in the age group 50-60 the male net participation is lower. Men close to their retirement age more often retire early, which negatively affects the male employment rate.

Related to age and family formation we found a significant negative relation between *demographic pressure* and female employment. Municipalities with a larger share of children and elderly, i.e. higher demographic pressure, show lower female employment rates. Demographic pressure exerts no significant effect on male employment and a negative significant effect on the gender employment gap. A high share of children or elderly people widens the gender employment gap. These results confirm earlier studies showing that Dutch women prefer to take care of their children themselves instead of making use of formal childcare facilities (Vlasblom and Schippers, 2004).

Regional opportunity structure

The relation between net participation and *unemployment* appears to be highly complex. Encouragement, discouragement and competition play a role and men and women are influenced differently. Results indicate that high male unemployment has a significant negative effect on the employment rate of men. The same holds for the effect of female unemployment rate on the female employment rate. These negative relations confirm the theoretical notion of the discouraged worker effect, i.e. refraining from a job search due to perceived poor opportunities on the labour market.

We also find that cross-effects are important: high male unemployment has a significant positive effect on the female employment rate and the same holds for the effect between female unemployment and male employment rates. This confirms the theoretical notion of the additional worker effect: if more men are out of a job then their partners, most likely women, will start working and vice versa. Our results show that these effects can also be identified at the aggregated level of municipalities. Concerning the gender employment gap, we find a negative effect of the ratio of female to male unemployment. Hence, a higher female to male unemployment ratio discourages women to work, thereby widening the gap and vice versa.

A positive significant relation was found between *urbanization* and female employment and the gender employment gap. Hence, the gender employment gap is smaller in urban areas. There is no significant relation between male employment and urbanization.

A favourable industry mix for females appears to have no significant effect on either female employment or the gender gap. It appears to have a slightly negative effect only on the male employment rate. So instead of females benefitting from a favourable structure, it appears that males are disadvantaged by such a structure.

There were no significant effects of the *VU ratio*, *childcare* and *commuting* in either of the models. A possible explanation for the lack of an effect of childcare on female employment rates might be the limited scale of childcare provision in the Netherlands. Te Riele (2006) shows that less than 20% of the households with children younger than 12 years resort to formal childcare. An alternative explanation might be the location of childcare facilities. Before the Childcare Act of 2005, childcare facilities were subsidized by municipalities, while a preference for non-profit organizations was commonly found in smaller municipalities (Noailly et al., 2007). Since the level of use is usually lower in these smaller municipalities, added stimulus to use childcare facilities apparently has not yet resulted in a significant increase in participation rates. A final explanation is the fact that particularly lower educated women benefit from an increase in these facilities. Higher educated women with young children will keep working or search for work in any case. These high-income female workers can afford to pay for childcare, thereby mitigating the possible participation-enhancing effect of childcare facilities for all female workers. Since municipal data on female employment by level of education are not available, we are unable to test this assumption.

The possible lack of a commuting effect may be related to the fact that data on gender-specific commuting duration are not available.

Spatial dependence

Last but not least we attempt to provide an explanation for the spatial error term λ . This parameter indicates that there is an unobserved effect of neighbouring municipalities on the municipal gender employment gap. One way to identify this effect is to add a spatial lag to the explanatory variables of the model and test whether any of the variables in neighbouring municipalities exert influence on a particular municipality's own gender employment gap. We experimented with several specifications, but in no case did we find a significant effect of surrounding municipalities. Another way to identify this effect is to make use the fact that a SMA model with one lagged error term can be rewritten as a SAR model with in theory infinite spatial lags. Estimating a SAR(1) specification instead of our SMA(1)-specification of table 1 also gives no further interpretation of the spatial error process.

5. Summary and conclusion

Since the early 1980s, the Netherlands has experienced a sharp increase in female labour market participation. This rise led to an additional boost to narrowing the gender employment gap. However, this gap has not closed yet; the levels of net as well as gross participation continue to be lower for women. This is not just a Dutch phenomenon, and it also occurs in many other European countries, such as the United Kingdom, Denmark and Germany. In the international literature little attention has been given to the gender aspect of regional variation in participation rates at the level of municipalities. Given the rapidly aging population, the aim of this research

was to provide more insight into the determining factors of regional differences in employment between men, women and specifically the gender employment gap by performing an analysis of gender-specific employment rates at the municipality level for 2002.

From a visual inspection of maps depicting the employment rates at the municipal level it is clear that there is considerable spatial variation and that this pattern differs for men and women. Variation in the gender employment gap provided yet another pattern; regions with low male employment do not necessarily have low female employment. To explain the gender-specific regional variation in employment rates a combination of explanatory variables consisting of socio-economic characteristics and the regional opportunity structure were included in a spatial econometric model of the municipal gender employment gap. The results indicated that the model is capable of explaining a significant part of the variation in net labour market participation. The results also indicated that complex processes of crosswise effects between men and women occur.

Some of the results were as expected; we found a smaller gender employment gap in urban areas and in line with human capital theory, municipalities with a high ratio of low educated females to low educated males exhibit a wider gender employment gap. Other results were however quite unexpected. The provision of childcare facilities made no significant contribution to closing the gender employment gap. In accordance with theoretical expectations we found strong cross-effects of gender-specific unemployment on the gender employment gap. These could be interpreted as complex processes of encouragement, discouragement and competition between men and women. A higher female to male unemployment ratio has a negative effect on the gender employment gap implying a discouragement effect.

In order to fully understand these processes more research is needed using panel data or longitudinal data which are not available at this moment. Longitudinal data would allow us to adopt a life course perspective that provides insight into the different life stages a person goes through and the related decisions with respect to work, provision of care, education or retirement. A multi-level analysis that combines regional data with individual data can provide more insight into the interaction between micro behaviour and macro variables at the regional level. It will however be quite difficult to gather municipal data for a range of years that contains this amount of detail.

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Appendix. Descriptives variables

Variables	Measured	Origin
Employment rates	Men or women with a job for at least 12 hours out of potential gender-specific labour force (three year averages)	Statistics Netherlands (CBS) Based on survey of labour force (EBB)
Disposable income	Includes people over 15 with a year-round salary after tax deductions (gender-specific)	CBS
Education	Number of lower educated as a percentage of the potential labour force of that municipality (gender-specific)	CBS
Age composition	The proportion of women aged 40-50 (after childbearing years) out of the total female population. The proportion of men aged 50-60 (close to retirement) out of the total male population	CBS
Demographic pressure	The share of <i>dependent</i> children and elders over the share of <i>active</i> population (20-65)	CBS
% unemployed	Unemployed jobseekers as a percentage of the labour force (gender-specific)	CWI: Unemployed Jobseekers / CBS: labour force
Vacancies per unemployment ratio	The number of vacancies in 2002 per unemployed	Centre for Work and Income (CWI)
Industry Mix	$\text{Mix}^{r,f} = 100 * \sum_{s=1}^6 \frac{E_s^{r,m+f}}{E_{total}^{r,m+f}} \cdot \frac{E_s^{n,f}}{E_s^{n,m+f}}$ <p>where E = employment, s = sector, f = females, m = males, r = region and n = country. In this study jobs are captured in 6 sectors, which are all included in the industry mix; agriculture, manufacturing, finance business and other services, distributive services and hotels, healthcare and public administration and education</p>	LISA business registry based on adaptations from data of the Dutch board of trade
Urbanisation	Average adress density	CBS
Child care facilities	Number of day care slots and after school care slots *1.7 (average number of children per slot of 10 day segments) over the number of 0-12 year old children in that municipality	Deloitte consultancy ¹³
Duration commute-to-work	Commute duration per person per day	CBS

¹³ This data was collected for the Dutch ministry of social affairs and employment

TABLES AND FIGURES

Table 1. Descriptive statistics

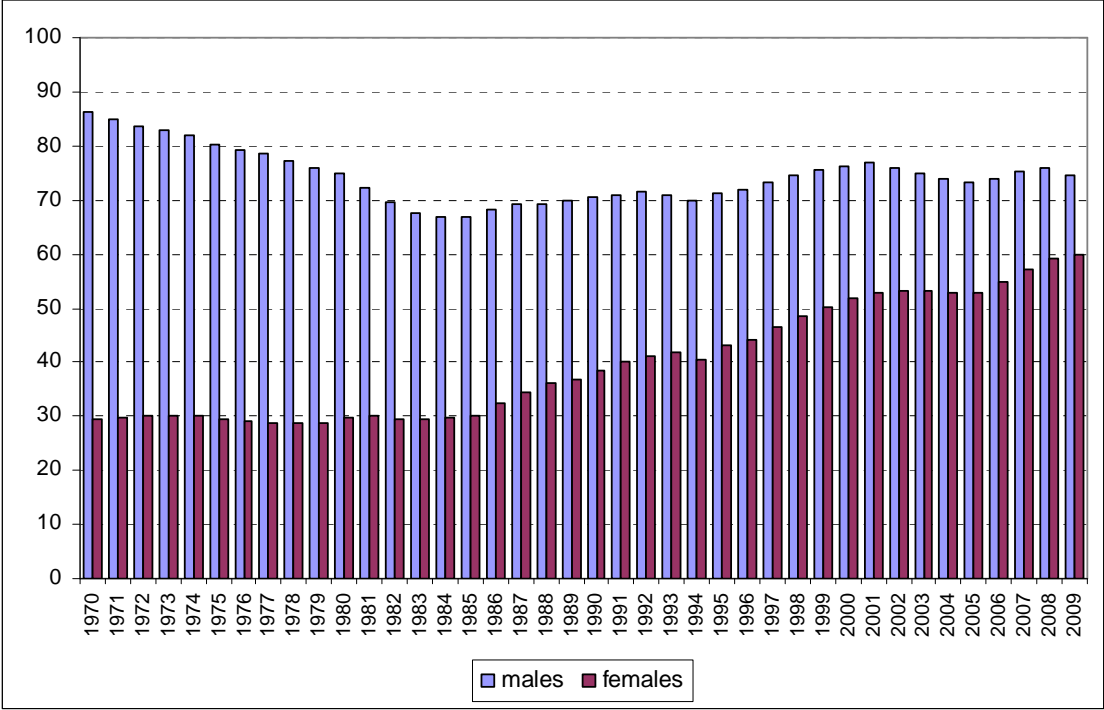
	Mean	Standard deviation	Min-Max
<i>Dependent variables</i>			
Employed women (%)	52,1	5,78	37,6 - 68,0
Employed men (%)	77,6	4,48	63,0 - 90,0
Gender employment gap			
(employed women / 100 men)	67,3	7,49	46,7 - 87,9
<i>Explanatory variables</i>			
Urbanisation (address density)	1091,9	753,84	179 - 6088
Vacancies per unemployment ratio	2,37	1,29	0,3 - 10,1
Industry mix	35,85	4,53	25,4 - 50,9
Unemployed men (%)	5,69	2,89	1,5 - 16,8
Unemployed women (%)	7,66	3,64	2,3 - 22,3
Disposable income men	22,77	2,21	18,5 - 38,3
Disposable income women	13,69	1,18	11,7 - 18,2
Lower educated men	24,5	5,6	11,6 - 44,9
Lower educated women	27,1	5,9	12,1 - 50,4
Proportion women aged 40-50	15,43	1,17	12,4 - 20,6
Proportion men aged 50-60	14,55	1,32	9,9 - 17,6
Demographic pressure	63,88	5,79	45,5 - 84,8
Childcare facilities	0,24	0,13	0,01 - 0,84
Commute-to-work duration (day)	11,64	2,38	7,3 - 21,1

Table 2. Estimation results for models of female and male employment rates and the gender employment gap in Dutch municipalities in 2002

	Female employment rate		Male employment rate		Gender employment gap (=ratio female vs. male employment rate)		
Tests on spatial dependence					Tests on spatial dependence		
LM test on Spatial AR (SAR)	0.001		2.155		LM test on Spatial AR (SAR)	3.295*	
LM test on Spatial MA (SMA)	4.655***		0.165		LM test on Spatial MA (SMA)	4.412**	
Model specification					Model specification		
	coefficient	z-value	coefficient	t-value		coefficient	z-value
Constant	46.57	6.513	101.4	19.46	Constant	0.678	7.873
Female income	0.694	1.840			Female income	0.020	3.166
Male income			0.042	0.280	Male income	0.006	0.197
Female aged 40-50	0.986	3.965			Female aged 40-50	0.008	2.404
Male aged 50-60			-0.551	-2.875	Male aged 50-60	-0.001	-0.382
Demographic pressure	-0.206	-3.905	-0.080	-1.657	Demographic pressure	-0.003	-3.853
VU ratio	0.153	0.744	-0.111	-0.652	VU ratio	0.001	0.325
Industry mix	0.032	0.454	-0.156	-2.712	Industry mix	0.001	0.727
Urbanisation	0.002	3.879	-0.001	-1.015	Urbanisation	1.4E-05	2.024
Childcare facilities	-0.116	-0.059	-2.331	-1.259	Childcare facilities	-0.010	-0.383
Commute duration	0.076	0.590	0.099	0.889	Commute duration	0.001	0.418
Female lower educated	-0.241	-4.928			Ratio of female vs. male		
Male lower educated			-0.083	-2.219	lower educated	-0.087	-5.163
Female unemployed rate	-1.431	-7.166	0.488	2.948	Ratio of female vs. male		
Male unemployed rate	1.216	4.493	-1.352	-6.106	unemployment	-0.115	-9.409
λ	0.603	12.73			λ	0.581	11.92
Log likelihood	-837.7		-785.1		Log likelihood	448.8	
Observations	298		295		Observations	283	

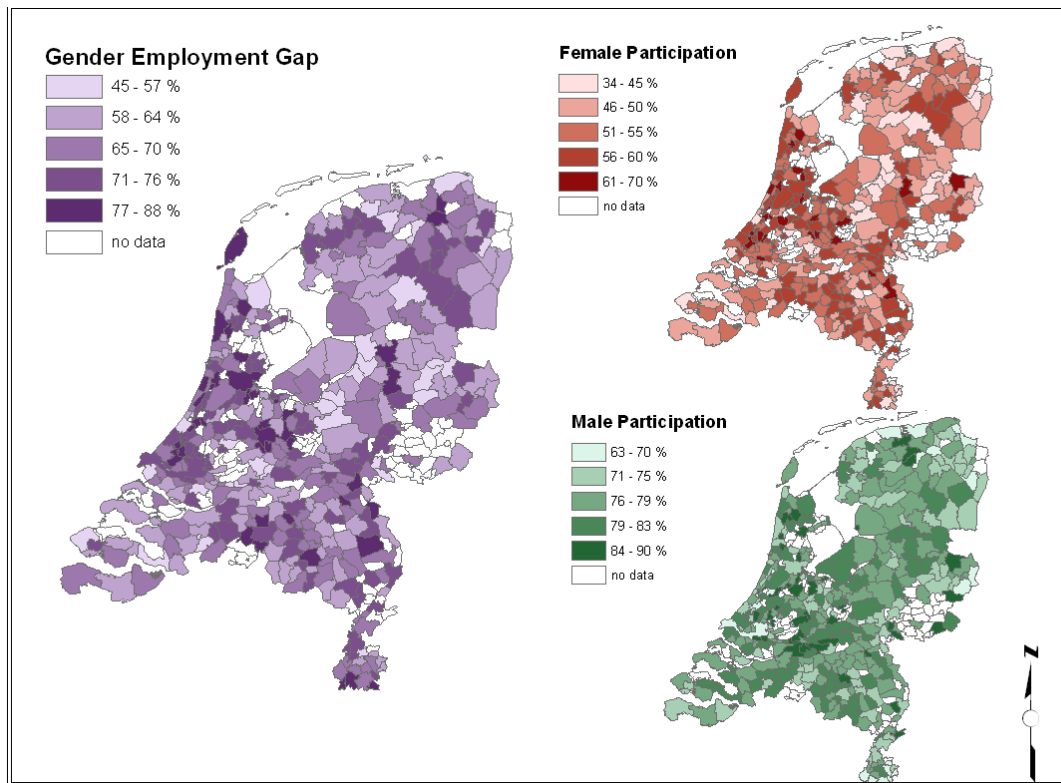
*** p<0.01, ** p<0.05, * p<0.10

Figure 1. Gender employment gap (male and female employment rate)in The Netherlands 1970-2009



Source: Statistics Netherlands

Figure 2. Employment rates for Dutch municipalities 2002



Source: Calculations based on data from Netherlands Statistics

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