A Spatial Analysis of Gender Equality and Fertility

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The availability of geographically referenced data and new statistical and econometric techniques offer the opportunity to document and explain spatial patterns observed in demographic behaviors. As suggested by a number of recent contributions (Boyle, 2003; Goodchild et al., 2004; Castro, 2007; Voss, 2007), this paper adopts a spatial perspective to study the association between fertility and gender equality.

In the spatial regressions models which we will be presenting in this paper, the key lies in establishing to what extent the spread of gender equality leads to a change – and in particular an increase – in fertility. The underlying hypothesis derives from the idea that as we are moving away from a male-breadwinner Beckerian model, to a gender egalitarian society – gender equality might become a pre-requisite for increased fertility. At the macro level, this relationship is reflected by the u-shape relationship between fertility and economic development (measured by the human development indicator) – as suggested by Myrskyla et al (2009). However, it is also the true that in those countries where we see a positive fertility reversal – gender equality is also very high. In other words, in the Beckerian model, higher education among women (and hence higher earnings) predicts fertility decline, but as we move towards the egalitarian model, where the dual-earner couple is the norm, gender equality might generate higher fertility.

Most modern societies are moving towards higher gender equality, a process often referred to the “gender revolution”. Many describe this as a two-step process (e.g. Goldscheider 2000), where in the first step gender equality develops in education and employment, and where women become better integrated in the political processes. This is followed by higher gender equality in the private sphere of the family (Goldscheider et al. 2010). As long as the process of gender equality within the family sphere is not following the same pace as gender equality at the societal level – families are put under pressure – thereby limiting fertility (Goldscheider et al. 2010). A similar argument is made by (McDonald 2000); low fertility in developed countries are the result of high level of gender equality in individual-oriented social institutions, e.g. the educational system and the labor market, and low level or at best moderate level of gender equality in family oriented institutions, especially in the family.

Here we extend the research and focus on several dimensions of gender equality and its relation to regional variations in fertility within a country. We focus on Norway, a country that generally score high on gender equality indexes, e.g. UN’s Gender empowerment measurement, GEM, and have relatively high fertility compared to other industrialized countries. There is however extensive regional variation in gender equality as well as fertility level across the country. We make use of data from 340 municipalities during the period 2000-2008 where we have information about fertility levels and a rather detailed description of gender equality. We use geographically weighted regressions and plan to estimate spatial panel models.

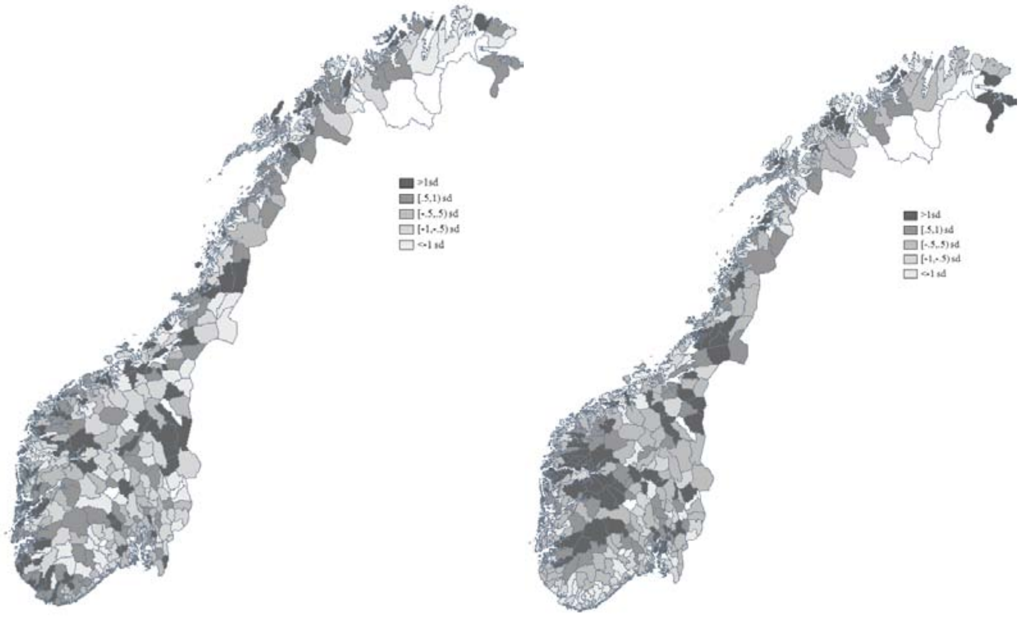
Methods

The Norwegian regional gender equality index consists of six indicators: (1) education $\sum$ female education + education gender ratio)/2; (2) labor force participation ($\sum$ female labor force participation + labor force participation gender ratio)/2; (3) income (women’s income + income gender ratio)/2; (4)

formal childcare; (5) female municipal council representatives; and (6) age gender ratio. Score for each indicator includes four levels measured from quartile levels (score 1 = 1st quartile, 2 = 2nd quartile, 3 = 3rd quartile and 4 = 4th quartile). The Gender Equality Index (GEI) is thereby defined as $\sum$ score indicator 1 + score indicator 2 + score indicator 3 + score indicator 4 + score indicator 5 + score indicator 6)/6.

Figure 1, shows that spatial proximity implies a dependence in both fertility and gender equality. It follows that municipalities cannot be modeled as independent units. Here we explicitly account for spatial dependence among municipalities by the means of spatial regression models. In a first descriptive step we rely on Geographically Weighted Regression (GWR) techniques (for similar applications on fertility, see Işik et al., 2006; Muniz, 2009) i.e. local regressions allowing to estimate heterogeneous relationships between the dependent and independent variables. This technique is particularly useful when the magnitude of a relationship among variables differ from location to location (Fotheringham et al., 2002). With this approach, we are able to estimate a regression equation for each municipality while taking into account spatial dependence in the model.

Figure 1: Total fertility rate (TFR) and gender equality index (GEI), 2008



Note: The legend has to be read in terms of standard deviations from the mean: ">1 sd" indicates provinces whose TFR is one standard deviation (sd) above the mean; "[.5;1)" between .5 and 1 sd above the mean; [-.5;.5) .5 sd around the mean; [-1;-.5) between .5 and 1 sb below the mean; "<-1" 1 sd below the mean. Mean and standard deviations are respectively equal to 1.94 and 0.4 for TFR and 2.51 and 0.52 for GEI.

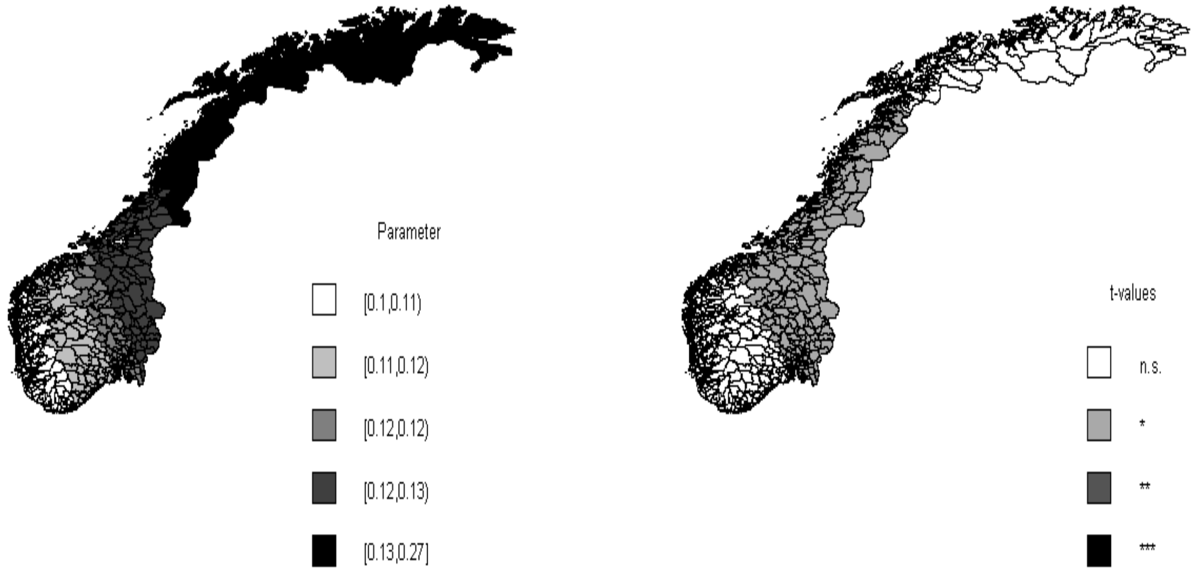
Preliminary results and expected findings

Figure 2 shows the results of the Geographical Weighted Regression (GWR). The key insight here is that the association between gender equality and fertility is not the same across different municipalities. The figure on the left hand side shows the parameter estimates whereas the figure on the right hand side shows the associated significance of the parameter estimates. They are largely consistent with the population density of the country – indicating little significance in sparsely populated areas (mountains and in the North), but also that among the more densely populated areas – the parameter estimates differ.

With the spatial panel regression model (Baltagi et al., 2007) we are able to account for spatial dependence between municipalities in each time period, for serial correlation on each municipality over time and allow for heterogeneity across municipalities using a random effect. Spatial dependence is taken into account through two different effects: a spatial lag on the dependent variable –representing a diffusive process in fertility (Casterline, 2001) – and a spatially autoregressive error term –including unobserved independent variables.

Whereas a simple panel regression model (fixed or random effect), might suggest a significant impact of gender equality on fertility – this is not necessarily the case once spatial autocorrelation is taken into account. In particular, controlling for the diffusion of either fertility and/or gender equality (whose extent we can establish) over time and across municipalities – it is not clear whether gender equality by itself has a causal impact on fertility. With these methods, we are taking a step closer in establishing the causality between gender equality and fertility.

Figure 2: Estimates from Geographical Weighted Regression (GWR) between TFR and GEI.



NOTE: |t-value|: "n.s." <1.64; "*" [1.64,1.96); "**" [1.96, 2.58); "***" >2.58.

Our regional data are particularly rich. As mentioned – we are able to decompose the gender equality index by its components. This means that if gender equality turns out to have a significant impact on fertility, we are able to establish which dimension of the index that matters most. For instance, availability of childcare might matter more than educational levels among women. In addition, we have information about municipality income levels, gender ratio, immigration (split by immigrants from high, medium, and low level TFR countries), population density and the rate of cohabitation among parents. We also have information about religion that is measured by members of the Christian Democratic Party in municipality councils and rates of baptism. We take these measures as proxies for the diffusion of gender equality in the private spheres that will be used to test whether the gap between private and public gender equality leads to lower fertility. We also have fertility rates decomposed by parity one and two and higher.

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