On the definition of W in empirical models of yardstick competition

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Abstract

Theoretical models of strategic interaction among local governments are often empirically implemented by the use of spatial econometric techniques. In order to empirically discriminate between different theoretical explanations for strategic interaction it is of importance that the spatial weights matrix reflects the theoretical mechanisms behind the interaction. However, most often the researcher does not have necessary information for such definition. This paper deals with the definition of the elements in the spatial weights matrix $\mathbf{W}$ in empirical models of strategic interaction among local jurisdictions. We present a method how the elements in the spatial weights matrix can be defined to capture interest of local politics in neighboring jurisdictions among inhabitants when this information is not available to the researcher. The results presented in this paper could preferable be used in defining the spatial weights matrix when using spatial econometric models either testing or controlling for yardstick competition across jurisdictions.

Keywords: Spatial econometrics, yardstick competition

JEL: C21, H72, H76, H77, R50

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I. Introduction

Theoretical models of strategic interaction among local governments are often empirically implemented by the use of spatial econometric techniques (e.g. Brueckner, 2003; Revelli, 2005). One challenge for spatial public finance empirics are to discriminate between different theoretical explanations for strategic interaction among local governments; expenditure spillovers (preferences), fiscal competition (constraints) and yardstick competition (expectations) (Manski, 1993). The basic intuition behind expenditure spillovers is that public services provided by one local government enter the welfare function of other jurisdictions, see among many others Case *et al.* (1993), Revelli (2003) and Lundberg (2006). Fiscal competition is based on the hypothesis that in the presence of mobile tax bases, the fiscal policy by one local government affects the budget constraint of other local governments. One example is if an increased local income tax leads to out-migration, this will indirectly affect the budget constraint of other local governments and could give rise to fiscal competition for mobile tax bases. Previous empirical research has focused on tax competition where the optimal tax rate in one jurisdiction depend on the tax rate in other jurisdictions (Brett and Pinkse, 2000; Brueckner and Saavedra, 2001; Hayashi and Boadway, 2001; Revelli, 2001; Esteller-Moré and Solé-Ollé, 2001). Yardstick competition is based on the idea that inhabitants only have imperfect information regarding the honesty and/or competence among the local decision makers (local politicians). Therefore, inhabitants in one jurisdiction will use information on local public expenditures and tax rates in other jurisdictions as a yardstick to evaluate the quality and/or efficiency of their own local decision makers (Salmon, 1987; Besley and Case, 1995; Besley and Smart, 2002).

In order to empirically discriminate between the different theoretical explanations for strategic interaction among local governments it is crucial to realize and empirically capture the different mechanisms that are assumed to cause the interactions. For instance, it is reasonable that information on the road network and the extent the roads are used by inhabitants of other jurisdictions are used in order to be able to test the hypothesis of expenditure spillovers from road expenditures. For example, if jurisdiction i and j share a common border and i spend a large share of it's budget on roads while there are no connecting roads between jurisdiction i and j, it is less likely that inhabitants in jurisdiction j benefits from the road expenditures in jurisdiction i.[1] On the other hand, to test the hypothesis of yardstick competition it is reasonable to have at least some information regarding inhabitant's interest or knowledge about local public expenditures and tax rates in other jurisdictions. This information could be collected through a questionnaire or approximated by, for instance, some measure reflecting the local mass media coverage of local political issues (see for instance Horrigan *et al.* (2004) and Bruns and Himmler (2011) and references therein). However, such information is often very cumbersome and/or costly to collect and therefore, in most cases, not available to the researcher. Instead, in most of the existing literature, the interaction across jurisdictions is based on geographic

1. This is a simplification. There are of course situations where inhabitants in jurisdiction j benefit from road expenditures in jurisdiction i without any direct road connections between the two jurisdictions.

criteria such as the distance between the center of the jurisdictions or if two jurisdictions share a common border which do not necessarily reflect political interest (or information) and hence will not be in line with the theoretical model to be tested.[2]

In this paper a very simple and intuitive way of defining interactions across jurisdictions when testing or controlling for yardstick competition which could be used in a spatial econometric set up is presented. In particular, it is shown that political interest, which is often unknown and not easily collected for the researcher, could be approximated by a simple function of relative population between two jurisdictions, information which is often known or at least relatively easy for the researcher to collect. This definition has two nice properties; 1) it reflects political interest, and 2) it provides exogenous elements of the spatial weights matrix $\mathbf{W}$.[3]

The rest of this paper is organized as follows. In order to give some structure to the rest of the discussion, a simple model of yardstick competition based on Besley and Case (1995) and Revelli (2005) followed by an empirical specification on which the presence of yardstick competition can be tested are presented in Section II. Section III includes empirical evidence that individual's interest of local politics in neighboring jurisdictions could be predicted by geographical distance *and* relative population between the two jurisdictions. Concluding remarks are given in Section IV.

II. A simple model of yardstick competition

Drawing heavily on Besley and Case (1995) and Revelli (2005), politicians are assumed to be either honest or dishonest. To make things as simple as possible and just to fix the basic ideas behind yardstick competition, disregard exogenous shocks and other factors of uncertainty over which the government has no control. This simplification will not have any effect on the empirical specification that we later arrive at. Honest politicians provide public services at cost h_i while dishonest politicians provide public services at cost $d_i = h_i + r_i$ where the political rent from being dishonest, r_i, is restricted to be positive, $r_i > 0$. Assuming re-election at the end of each period and that incumbents will only be re-elected if voters expect them to be honest, which is conditional on their tax setting behavior, a dishonest politician is assumed to maximize it's utility V_i according to

$$V_i = \max_{r_i} \left[v_i (r_i) + p_i (r_i) V_i^{t+1} \right] \tag{1}$$

were $v_i (r_i)$ is the utility from the political rent and $p_i (r_i)$ is the probability of being re-elected. The probability of being re-elected, p_i, is assumed to decrease with r_i, and hence $\frac{\partial p_i}{\partial r_i} < 0$. Informed voters will make the probability of re-election more sensitive to fiscal policies compared with less informed

2. In general, the definition of the elements in the spatial weights matrix (the definition of neighbors) are often neglected or at least not sufficiently discussed in applications using spatial econometrics. This is quite surprising as the interpretation and sometimes the significance of the spatial effect depend on the definition of the spatial weights matrix.

3. If we, which is reasonable in models of yardstick competition where migration is disregarded, accept relative population to be exogenous.

voters, $\left(\frac{\partial p_i}{\partial r_i}\right)_{\text{informed}} < \left(\frac{\partial p_i}{\partial r_i}\right)_{\text{uninformed}}$. Moreover, informed voters uses information on fiscal policies in other jurisdictions as yardstick of their own jurisdiction making the probability of re-election partly depend on fiscal policies in other jurisdictions. It is evident from equation (1) that the only source of interdependence across jurisdictions comes from p_i making the specification of p_i of essential interest when testing for yardstick competition.

The hypothesis of yardstick competition based on the type of theoretical model briefly formulated above are often tested using an empirical formulation such as

$$p_i = \alpha + \beta^t \Delta t_i + \rho \mathbf{W} \Delta t + \mathbf{X}'\beta^x + e_i \tag{2}$$

where Δt is the change in tax rate, $\mathbf{W}$ is an $n \times n$ matrix who's elements $w_{ij} > 0$ if t_j is assumed to affect p_i, otherwise $w_{ij} = 0$. Note also that $w_{ii} = 0$. Preferable, $\mathbf{W}$ should be row-standardized which means that $\sum w_{ij} = 1$ (see Anselin (1988) for further details). Other covariates are included in $\mathbf{X}$ and e_i is white noise. If $\rho > 0$ tax increases in other jurisdictions increases the probability of re-election, which is taken as evidence of yardstick competition.

Even though equation (2) is based on the theoretical model, most tests of yardstick competition are based on estimates of tax reaction functions. The basic idea is that if politicians believe that voters uses fiscal policy outcomes in other jurisdictions as a yardstick, local authorities should mimic each other leading to a positive correlation in, for instance, their tax setting behavior. The empirical formulation then becomes

$$t_i = \alpha + \rho \mathbf{W} t + \mathbf{X}'\beta^x + e_i \tag{3}$$

where $\rho > 0$ is taken as evidence in favor of yardstick competition. This specification is similar to the one used to test for tax competition between jurisdictions.

Irrespective of empirical approach, from equation (2) and (3) it is obvious that the definition of the elements in $\mathbf{W}$ is crucial in this type of models, and maybe more so when estimating tax reaction functions such as equation (3). An incorrectly specified weights matrix $\mathbf{W}$ may lead to incorrect interpretations of ρ. From the theoretical model, w_{ij} should reflect political interest or knowledge, but if this is unknown information for the researcher what is a reasonable approximation? In most cases, w_{ij} is based on the inverse of the geographical distance between i and j or if i and j share a common border. For instance, Besley and Case (1995) and Besley and Smart (2002) uses a definition were $w_{ij} = 1$ if i and j share a common border, otherwise $w_{ij} = 0$. Even if such definition is reasonable, it could be improved. First, if w_{ij} should reflect political interest, is it reasonable that $\mathbf{W}$ is symmetric? Intuitively, individuals living in a small jurisdiction are likely to put more interest in politics in a large neighboring jurisdiction while inhabitants in the large jurisdiction will only put minor interest in politics in the small neighboring jurisdiction. One reason for this is that individuals tend to commute from the smaller suburban areas into the main city. Second, it is reasonable to assume that geographical distance matters making the definition of w_{ij} depend on both relative population *and* distance. Third, it is reasonable to assume political interest to depend on individual characteristics such as education, income, age and gender. In particular, previous empirical analysis suggests education to be one of the strongest predictors for political participation even when other socioeconomic characteristics are controlled for (Shields and Goidel, 1997; Verba et al. 1996). Other studies suggest a nonlinear relationship between age and political interest (Norval and Grimes, 1968).

Irrespective of how w_{ij} is defined it should from a more technical point of view have two properties: 1) w_{ij} should be based on theory, which in the case of yardstick competition means that w_{ij} should reflect to what extend individuals in jurisdiction i is aware of public policies in jurisdiction j, and 2) w_{ij} should be exogenous.

While individual characteristics such as income and education are endogenous, distance is clearly exogenous. Moreover, as yardstick competition models disregard migration, relative population is also assumed to be exogenous in this type of models. Hence, is it possible to make a good approximation of political interest based on distance and relative population only? Or do individual characteristics outweights distance and relative population as predictors of political interest?

III. An alternative definition of $\mathbf{W}$ with empirical evidence

III.A. Data

In a questionnaire send to 6,000 households in two Swedish urban regions, Gothenburg and Umeå, in 2010 respondents were asked to rank to what extend they put interest in local politics in their neighboring jurisdictions. The different alternatives were no interest, low, good and high. Each respondent were asked the same question for each and every jurisdiction within the region where he/she lived.[4] The questionnaire also consisted of a set of other questions such as age, income, gender, and education. In total, the questionnaire provided 1,013 usable answers from the Umeå region and 1,735 from the Gothenburg region.[5] As the respondents in the Umeå and Gothenburg region were asked about their political interest in each individual municipality within the Umeå and Gothenburg region respectively the total number of observations on which the estimations presented in this paper is based on increases to 25,885.

4. In the empirical model the covariance matrix is corrected for the fact that the answers from the same respondent could not be treated as independent from each other. The estimation is also weighted by the proportion of answers from each municipality in relation to the population in the municipality.

5. The Umeå region consist of six municipalities including Umeå and the Gothenburg region consist of 13 municipalities including Gothenburg. The Gothenburg area is the second largest metropolitan area in Sweden with about 1.2 million inhabitants (about 500.000 in Gothenburg). The Umeå region represents a typical middle-sized Swedish region containing about 145.000 inhabitants (about 115.000 in Umeå). Nearly 90-percent of the Swedish population lives within either of these two types of areas, and about 35-percent in a major city region such as Gothenburg.

What factors could be important determinants of interest in political issues in neighboring jurisdictions (y_{ij})? It is often argued that education and political interest is positively correlated. It is also reasonable to assume income, gender, and age to be important determinants of political interest. Moreover, according to Tobler's first law of geography, political interest is likely to decrease with the physical distance between jurisdictions. Finally, it is reasonable to assume that individuals living in a small jurisdiction (in population terms) will put higher interest in political issues in a larger neighboring jurisdiction than vice versa. That is, political interest is likely to be correlated with relative population. Here, y_{ij} is assumed to depend on the geographical distance between municipalities ($distance_{ij}$), the relative population between the two municipalities ($relative\ population_{ij}$=$population_i/population_j$), $gender_i$ (which takes the value 1 for women, otherwise 0), $income_i$ (here measured as the total income within the household), age_i and $education_i$. Education is measured as a dummy variable taking the value 1 if the individual has a university degree, otherwise 0. Descriptives of political interest (y_{ij}) and covariates are given in Table 1 below.

Table 1: Descriptive statistics

Variable	Mean	Standard dev.	Minimum	Maximum
Political interest, y_{ij}	0.682	0.817	0	3
- no interest (y_{ij}= 0)	0.513	0.500	0	1
- low interest (y_{ij}= 1)	0.322	0.467	0	1
- good interest (y_{ij}= 2)	0.135	0.342	0	1
- high interest (y_{ij}= 3)	0.030	0.171	0	1
Gender, $gender_i$	0.454 (0.50)	0.498	0	1
Education, $education_i$	0.286 (0.22)	0.452	0	1
Age, age_i	48.885 (47.30)	17.194	17	87
Income, $income_i$	4.394 (tSEK)	2.120	5.000	7.500
Geographical distance, $distance_{ij}$	3.411	1.885	0.142	54.711
Relative population, $relative\ pop_{ij}$	9.850	11.760	0.022	45.63

Note: National averages in 2008 within parenthesis

As mentioned above, each respondent were asked to rank his or her political interest in neighboring jurisdictions as either no interest, low, good or high. In Table 1, these alternatives are coded as 0, 1, 2 and 3 respectively. From Table 1 it is evident that most of the respondents ranked their interest as either no interest or low (51-percent as no and 32-percent as low). Compared with the national average in year 2008 our data is fairly representive even though the share of women in the data set is slightly lower while the educational level is higher.

III.B. Estimation procedure

Denote by y_{ij}^* the unmeasured latent variable who's values determine the observed ordinal variable y_{ij} which reflect interest of local politics in jurisdiction j of an individual living in jurisdiction i. For every $y_{ij}^* \leq \alpha_0$, $y_{ij} = 0$ and no interest, for $\alpha_0 < y_{ij}^* \leq \alpha_1$, $y_{ij} = 1$ and interest increases to low, for $\alpha_1 < y_{ij}^* \leq \alpha_2$, $y_{ij} = 2$ and interest increases to good, and for $\alpha_2 < y_{ij}^*$, $y_{ij} = 3$ and interest increases to high. The continuous latent variable y_{ij}^* is assumed equal to

$$y_{ij}^* = \sum_{k=1}^{4} \left(\beta_k' \mathbf{x}\right) + u_{ij} = Z_i + u_{ij} = y_{ij} + u_{ij} \tag{4}$$

where $\mathbf{x}$ does not include an intercept and u_{ij} is the logistic distributed random error term. When the cutoff terms $(\alpha_k; k = 0, 1, 2)$ are estimated the probability that y_{ij} will take on a particular value could be calculated as

$$\begin{aligned}
\Pr\left(y_{ij} = 0\right) &= \frac{1}{1 + \exp\left(Z_i - \alpha_0\right)} \\
\Pr\left(y_{ij} = 1\right) &= \frac{1}{1 + \exp\left(Z_i - \alpha_1\right)} - \frac{1}{1 + \exp\left(Z_i - \alpha_0\right)} \\
\Pr\left(y_{ij} = 2\right) &= \frac{1}{1 + \exp\left(Z_i - \alpha_2\right)} - \frac{1}{1 + \exp\left(Z_i - \alpha_1\right)} - \frac{1}{1 + \exp\left(Z_i - \alpha_0\right)} \\
\Pr\left(y_{ij} = 3\right) &= 1 - \frac{1}{1 + \exp\left(Z_i - \alpha_2\right)}
\end{aligned} \tag{5}$$

and marginal effects are given by

$$\frac{\partial \Pr\left[y_{ij} = k\right]}{\partial \mathbf{x}_i} = \left\{F'\left(\alpha_k - \mathbf{x}_i'\beta\right) - F'\left(\alpha_{k-1} - \mathbf{x}_i'\beta\right)\right\}\beta \tag{6}$$

The main hypothesis is that y_{ij} will be negatively correlated with distance and relative population. To capture potential nonlinearity, *geographical distance, relative population, income*, and *age* also enters equation (4) in squares. It is assumed that y_{ij} is positively correlated with $income_i$, age_i and $education_i$. Moreover, recognizing the skewed distribution of y_{ij} displayed in Table 1, equation (4) is also estimated by binomial logit were $y_{ij} = 0$ for no interest or low, and $y_{ij} = 1$ if interest is good to high.

III.C. Empirical results

Parameter estimates of four different versions of equation (4) by ordered- and binomial logit are presented in Table 2 below. To keep the model as simple as possible, the non-significant parameters in Model 1 are excluded in Model 2, and in Model 3 only distance and relative population are used to predict y_{ij}. In Model 4, y_{ij} depend on relative population only.[6]

Table 2: Parameter estimates of equation (4)

	Ordered logit			
Variable	Model 1	Model 2	Model 3	Model 4
Distance (β_D)	-0.064 (-2.09)	-0.094 (-7.40)	-0.052 (-1.76)	-
Distance^2 (β_{D^2})	-0.003 (-0.98)	-	-0.003 (-1.10)	-
Income (β_I)	0.091 (1.08)	-	-	-
Income^2 (β_{I^2})	-0.012 (-1.30)	-	-	-
Relative pop (β_R)	-0.044 (-7.26)	-0.045 (-7.26)	-0.050 (-8.18)	-0.038 (-5.95)
Relative pop^2 (β_{R^2})	0.001 (7.87)	0.001 (7.85)	0.001 (8.68)	-0.001 (5.88)
Gender (β_G)	0.091 (1.24)	-	-	-
Education (β_E)	0.117 (1.42)	-	-	-
Age (β_A)	0.067 (5.09)	0.070 (5.69)	-	-
Age^2 (β_{A^2})	-0.000 (-3.42)	-0.000 (-3.95)	-	-
α_0	1.600 (4.90)	1.412 (4.64)	-0.677 (-8.59)	-0.340 (-6.08)
α_1	3.326 (10.00)	3.136 (10.09)	0.989 (12.63)	1.315 (23.61)
α_2	5.210 (15.39)	5.020 (15.84)	2.853 (28.78)	3.170 (37.51)

	Binomial logit			
	Model 1	Model 2	Model 3	Model 4
Distance (β_D)	-0.186 (-8.21)	-0.172 (-8.47)	-0.179 (-7.98)	-
Distance^2 (β_{D^2})	0.002 (1.61)	-	0.002 (1.39)	-
Income (β_I)	-0.013 (-0.12)	-	-	-
Income^2 (β_{I^2})	0.002 (0.21)	-	-	-
Relative pop (β_R)	-0.079 (-9.20)	-0.079 (-9.19)	-0.084 (-9.84)	-0.062 (-7.03)
Relative pop^2 (β_{R^2})	0.002 (9.57)	0.002 (9.51)	0.002 (10.14)	0.001 (6.71)
Gender (β_G)	0.102 (1.14)	-	-	-
Education (β_E)	0.042 (0.41)	-	-	-
Age (β_A)	0.045 (2.75)	0.046 (2.99)	-	-
Age^2 (β_{A^2})	-0.000 (-1.57)	-0.000 (-1.79)	-	-
α_0	2.096 (5.02)	2.100 (5.28)	0.472 (6.32)	1.241 (20.95)

Note: t-values in parenthesis.

From the results presented in Table 2 above it is interesting to note that income, gender and education do not have any significant impact on political interest. This is a rather surprising result

6. We have also estimated an logarithmic version of equation (4) which gave basically the same results as those presented in the paper.

as education is often believed to have a positive effect on the individual's involvement and interest in the public debate. However, the results presented in Table 2 do not support this belief.

It is also interesting to note that *distance* and *distance*^{2} are both insignificant in the ordered logit regression of Model 3 which suggests that distance is not as powerful predictor of political interest as relative population. However, the significance of *distance* and *distance*^{2} depend to some extend on the definition of y_{ij} (ordered logit or binomial logit) and it is maybe even more interesting to note that the parameter estimates indicate an increasing negative effect of distance on political interest in the ordered logit regressions. This result give support to definitions of w_{ij} based on geographic distance in combination with cut-off values, that is, jurisdictions are only defined as neighbors within a specific distance from each other. However, this does not hold true for the binomial logit regressions. Moreover, the ordered probit and the binomial logit produce the same sign on the significant parameter estimates which indicates that the sign of the significant parameter estimates are fairly robust for different estimation procedures and definitions of y_{ij}.

Even though the parameter estimates presented in Table 2 are of interest, it is also of importance to discuss and compare the predictive power of these models. Table 3 shows sample means and predicted probabilities based on equation (4).

Table 3: Sample and predicted probabilities

	Ordered logit				
	y_{ij} (sample)	Model 1	Model 2	Model 3	Model 4
	Mean	Mean	Mean	Mean	Mean
Interest = 0	0.513	0.456	0.455	0.456	0.470
Interest = 1	0.322	0.357	0.357	0.357	0.351
Interest = 2	0.135	0.152	0.153	0.153	0.150
Interest = 3	0.030	0.035	0.035	0.035	0.033

	Binomial logit				
	y_{ij} (sample)	Model 1	Model 2	Model 3	Model 4
	Mean	Mean	Mean	Mean	Mean
Interest = 0	0.835	0.810	0.810	0.810	0.827
Interest = 1	0.165	0.190	0.190	0.190	0.173

From Table 3 it is evident that the different models estimated by both ordered probit and binomial probit are relatively accurate in predicting the probabilities of y_{ij} as the average of the predicted probabilities are close to the observed frequencies of each outcome. Interesting to note is that Model 4 outperforms the other specifications suggesting that a very simple model with relative population only gives the best approximation of y_{ij}. As data on relative population is quite easy to collect and to keep things as simple as possible, we argue at this stage in favor of Model 4 in Table 3.

Based on the predicted probabilities it is now possible to define w_{ij} either as a continuous variable[7]

$$w_{ij} = \Pr(y_{ij} = 1) \times 1 + \Pr(y_{ij} = 2) \times 2 + \Pr(y_{ij} = 3) \times 3 \tag{7}$$

or as the most probable outcome where

$$\begin{aligned} w_{ij} &= 0 \text{ if } \Pr(y_{ij} = 0) > \Pr(y_{ij} = 1), \Pr(y_{ij} = 2), \Pr(y_{ij} = 3) \\ w_{ij} &= 1 \text{ if } \Pr(y_{ij} = 1) > \Pr(y_{ij} = 0), \Pr(y_{ij} = 2), \Pr(y_{ij} = 3) \\ w_{ij} &= 2 \text{ if } \Pr(y_{ij} = 2) > \Pr(y_{ij} = 0), \Pr(y_{ij} = 1), \Pr(y_{ij} = 3) \\ w_{ij} &= 3 \text{ if } \Pr(y_{ij} = 3) > \Pr(y_{ij} = 0), \Pr(y_{ij} = 1), \Pr(y_{ij} = 2) \end{aligned} \tag{8}$$

But how accurate are the proposed methods? Let us first look at the average predicted values of y_{ij} based on (7) and compare this with the sample mean, $\overline{y}_{ij}$. For the binomial logit, the sample and predicted probabilities based on equation (7) are the same as presented in the lower part of Table 3. From Table 3 it is evident that the predicted probabilities based on Model 4 (0.173) are closest to the sample mean (0.165) which suggests that Model 4 outperform the other specifications. The figures based on the ordered probit estimates are presented in Table 4 below.

Table 4: Sample and predicted probabilities based on equation (7).

		Ordered logit			
	Sample	Model 1	Model 2	Model 3	Model 4
Mean	0.683	0.766	0.769	0.768	0.742

As displayed in Table 4, Model 4 again provides predicted probabilities closest to the sample mean. Moreover, the predicted probabilities based on the parameter estimates of Model 4 only differs from the sample probability by 0.059 which is fairly close. Based on this we once more argue in favor of Model 4.

Turning to the accuracy when calculating the most probable outcome. For the binomial model, the predicted probability that $y_{ij} = 0$ is always higher than the probability that $y_{ij} = 1$ which means that the binomial regressions will on average, using (7) correctly predict $y_{ij} = 0$ or $y_{ij} = 1$ in 83.5-percent of the cases. This is displayed in Table 3, so Table 5 contains results based on ordered probit estimates only.

7. This is based on the estimated probabilities from the ordered probit models. For the binominal models the calculations are of course $w_{ij} = \Pr(y_{ij} = 1)$, and $w_{ij} = 0$ if $\Pr(y_{ij} = 0) > \Pr(y_{ij} = 1)$ while $w_{ij} = 1$ if $\Pr(y_{ij} = 1) > \Pr(y_{ij} = 0)$.

Table 5: How correct does equation (8) predict the true y_{it}?

	Ordered logit			
	Model 1	Model 2	Model 3	Model 4
Interest = 0	0.560	0.561	0.523	0.513
Interest = 1	0.562	0.558	0.601	0.678
Interest = 2	0.865	0.865	0.865	0.865
Interest = 3	0.970	0.970	0.970	0.970

	Overall accurate predictions			
	Model 1	Model 2	Model 3	Model 4
	0.739	0.738	0.741	0.741

The results presented in Table 5 suggest that the probability that the different models correctly predict $y_{ij} = 0$ is only just a little better than flipping a coin while the models are quite accurate in predicting $y_{ij} = 1$, 2 or 3. However, if we instead look at the overall precision of the different models, that is how well does the models correctly predict $y_{ij} = 0$, $y_{ij} = 1$, $y_{ij} = 2$ or $y_{ij} = 3$ using (8), the figures are more encouraging. These probabilities are presented in the lower part of Table 5. On average, the 4 different models tend to correctly predict the true value of y_{ij} in about 74-percent of the cases. And again, Model 4 is performing just as well or even better than the other specifications.

IV. Concluding remarks

The basic intuition behind the theory of yardstick competition is that inhabitants only have imperfect information regarding the honesty and/or competence among the local decision makers (local politicians). Therefore, inhabitants in one jurisdiction will use information on local public expenditures and tax rates in other jurisdictions as a yardstick to evaluate the quality and/or efficiency of their own local decision makers. In order to test for the existence of yardstick competition, it is desirable to have information on how well informed or interested individuals are in local politics in other jurisdictions. However, such information is seldom available to the researcher as it is difficult and/or costly to collect. We have in this paper presented a very simple and intuitive way of defining the elements in the spatial weights matrix when testing or controlling for yardstick competition which reflect inhabitant's political interest in other (neighboring) jurisdictions. In particular, we have shown that political interest in other jurisdictions, which is most often unknown for the researcher, could be approximated by a simple function of relative population between two jurisdictions, information which is often known or at least relatively easy for the researcher to collect. This definition has two nice properties; 1) it reflects political interest, and 2) it provides exogenous elements of the spatial weights matrix $\mathbf{W}$.

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