6
Sample selection and maximum likelihood estimation

6.1 Estimation framework

The structure of the data, that allows me to observe peaceful transitions of government only in times of peace, and violent transitions only in times of war, suggests the correct structure to analyze the data would be a Roy model. More specifically, to take into account the sample selection issue when estimating q^W and q^P, I should estimate the following model:

$$\begin{cases} t_{it}^P = Y_{it}^P \beta_P + \epsilon_{it}^P & if\ W_{it} = 0 \\ t_{it}^W = Y_{it}^W \beta_W + \epsilon_{it}^W & if\ W_{it} = 1 \end{cases} \tag{1}$$

with the occurrence of wars being driven by:

$$W_{it} = \mathbb{1}\big(-Z_{it}\beta_C + (Y_{it}^W \beta_W - Y_{it}^P \beta_P) Z_{it}\beta_V - (1 - Y_{it}^P \beta_P) Z_{it}\beta_d \leq \delta_{it}\big) \tag{2}$$

where $\mathbb{1}(\cdot)$ is an indicator function. Again, I am assuming for simplicity a linear probability model for t_{it}^P and t_{it}^W and ignoring the heteroskedasticity due to (i) the fact that players infer about q^P and q^W based on more information than I observe and (ii) due to unobserved variables in X_{it} and d_{it}. Assuming that $\delta_{it}, \epsilon_{it}^W, \epsilon_{it}^P \sim i.i.d.N(0, \Sigma)$, I can estimate this empirical model by maximum likelihood. I will denote by ρ_1 the covariance between δ_{it} and ϵ_{it}^W, and by ρ_2 the covariance between δ_{it} and ϵ_{it}^P.

It is worth it to discuss the identification of this model in more detail. The model here is a Roy model with a cross equation restriction of coefficients. Moreover, the fact that I am omitting the variables ω_{it}^P and ω_{it}^W (which are the differences between my predicted probabilities of transition of governments and the probabilities predicted by the actual players in each country with their full informational set) should not be a problem, as long as they are independent of my observable variables Z_{it}, X_{it}^P and X_{it}^W: they will only add to the correlation between δ_{it} and $\epsilon_{it}^W, \epsilon_{it}^P$, which is something being modeled.

6.2 Main model for wars

Table 10.7 presents estimates of the equation of wars estimated jointly with q^W and q^P. The results are qualitatively similar to the results in table 10.6: as I add heterogeneity in terms of c_2, X and d to the model, the average estimated X and d increase quantitatively and in statistical significance.

Again, the model estimates a low cost of war: the average cost of war is negative (though it is not estimated precisely). Again, given the limits of the estimation procedure here, this estimate raises a doubt on whether the occurrence of war should be modeled as an costly event that happens due to limited Coasian bargaining.

Once I add heterogeneity in X_{it}, d_{it} and c_{it}, the average level of commitment raises and becomes close to X_{it}. The point estimates suggest that the country with average observable characteristics faces something close to full commitment. It should be noted, however, that often the model does not reject statistically the hypothesis of zero commitment, since the estimates are imprecise.

As in the previous section, heterogeneity in c_2, X and d seem to add considerable explanatory power to the model: the Wald test on the explanatory variables Z_{it} indicate they are jointly significant in columns (2)-(4). Moreover, in these columns, the Wald test indicates that heterogeneity in X seems to be important. However, in these columns, the model apparently cannot separate very well between heterogeneity in d and heterogeneity in c_2. In the full model of column (5), though the Wald test indicates that the variables of heterogeneity in X, d and c_2 are jointly significant, it is hard to distinguish between heterogeneity in X, in d and in c_2.

The covariances between the error terms from the war equation and from the equations predicting the probabilities q^W and q^P, given by ρ_1 and ρ_2, are not robustly statistically significant. The estimates of ρ_1 range from 0.16 to -0.024, while the estimates of ρ_2 range from 0.042 to 0.09. ρ_1 is only statistically significant in column (2), while ρ_2 is significant in column (3)-(5). Coherently with that, the estimates of q^W and q^P do not change much from the estimates implied by tables 10.2 and 10.3, despite the fact that, now, the equation of wars is also informing on these probabilities.

6.3 Sensibility to different sources of variation of q^P and q^W

Again, there is considerable uncertainty in how I should estimate q^P and q^W. For that, table 10.8 provides estimates of the Roy model in column (5) of table 10.7 with different predictors of q^P and q^W. In columns (1), (2) and (4), the results from table 10.7 do not change: the average commitment level is still quantitatively high (being comparable to the average X), and statistically significant. While one might think that war causes democracy and political competition and that is driving results, when one replaces the measure of current political competition by the average POLTIY IV between 1950-75, the result remains unaltered. Despite the fact that this does not fully correct for the endogeneity of democracy, it rules out the possibility that the result was driven by simultaneous changes over time in a given country in political competition and in occurrence of wars.

In columns (3) and (5), however, the average commitment level is not statistically significant. That happens in spite of the fact that the predictors of q^P and q^W show up as statistically significant. Despite the lack of significance of the point estimate, it is hard to say whether it means lack of commitment or imprecise estimates, since the point estimates in these columns are similar to the point estimate in the other columns.

When it comes to the heterogeneity in X, c_2 and d, the results do not change: the variables of heterogeneity in those three parameters are jointly significant in every column. However, except for the case of column (4), the variables of heterogeneity in X are not jointly significant, and neither are the variables of heterogeneity in d and the ones in c.