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Final replication Project

Women and Economic Statecraft:

The Negative Impact International Economic Sanctions Visit on Women

**1. Introduction**

Most economic sanction research focuses on the effectiveness of international sanctions on target countries but rarely studies the disproportional impact on vulnerable groups within a country. Yet, A. Cooper Drury and Dursun Peksen address the consequences of sanctions on women’s well-being. They find that economic sanctions are likely to worsen women's economic, social, and political status, and especially women in poor countries are hit hardest.

They develop two main hypotheses.

* Hypothesis 1: Economic sanctions will reduce the level of respect for women's economic rights, but this effect is mitigated by the wealth of the target's economy (Drury and Peksen, 2014: 468).
* Hypothesis 2: Economic sanctions will reduce the level of respect for women's social and political rights, but this effect is lessened by the wealth of the target's economy (Drury and Peksen, 2014: 470).

They employ﻿ ordered logit model and time-series and cross-nation analysis to analyze the economic, political, and social consequences of economic coercion on women’s status in 146 countries from 1971 to 2005. But I will only focus on ordered logit in my replication analysis.

They also address four methodological issues. First, they correct the autocorrelation between variables by creating binary variables for each of the four variables of women's rights. Second, they fix unit root problems in time-series analysis by first-differencing female labor participation (Yt – Yt-1). Third, they use HuberWhite to correct robust standard errors to control heteroskedasticity in the models. Last, they use a one-year lag (t − 1) of the time-variant variables to mitigate simultaneity issues between the dependent and independent variables (Drury and Peksen, 2014: 474-75).

**2. Data and Measurement**

In the first note, they clarify that they refer to “women’s status as the extent to which women are able to exercise and enjoy the objectives of economic, political, and social rights” in terms of international human rights law (Drury and Peksen, 2014: 484). Therefore, Drury and Peksen draw on ﻿the Cingranelli–Richards (CIRI) Human Rights Database (﻿Cingranelli and Richards, 2006) and the World Development indicators database of the World Bank (2009) to measure women’s status with four dependent variables (DVs). But this measurement might be problematic because these rights might not be sensitive to the effects of economic sanctions. They also use Hufbauer et al.’s economic sanction data (Hufbauer et al., 2007), Armed Conflict Database (Strand et al., 2005), Polity IV dataset’s Polity 2 index, and World Bank datasets to measure IVs and control variables.

There are three ordinal variables and one continuous dependent variable (DVs). They use (1) CIRI women's economic rights (ordinal) and (2) female labor participation rate (continuous) to measure women’s economic status, and use (3) CIRI women's political rights (ordinal) and (4) CIRI social rights (ordinal) to measure political and social status respectively. It is worthy of mention that women's economic, political, and social rights are four-category ordinal variables ranging from 0 (extreme violations of women's rights and toleration of societal discrimination against women) to 3 (no major violation of women's rights and none or almost no toleration of societal discrimination against women) (Drury and Peksen, 2014: 470-72). Put it simply, higher scores mean greater respect for women's rights and less government toleration for societal discrimination against women.

As Figure 1 “Distribution of DVs” shows, women’s economic and social rights are mostly in the first category and political rights in the second. From Figure 2 “Distribution of IVs,” we know that the sanction is a dummy variable, and most countries have not experienced sanctions in the research period. Polity is a multinomial variable, and most countries’ polity scores range from -10 to -5 and from 5 to 10. As Table (1) shows, there are many over two thousand missing values. The different ways of dealing with NAs will likely lead to very different results produced from the same models.

Admittedly, they have considered main DVs to measure women's status. But in my opinion, they should also include the unemployment rate to better measure economic situation because this indicator is generally more sensitive to economic interruptions. Therefore, the measurement would be more comprehensive to add the fifth DV: unemployment rate. However, my focus is to examine the ordered logit model and categorical variables, so I will not explore the female labor participation rate and unemployment rate in this replication analysis.

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Figure 1. Distribution of DVs

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Table (1) Summary of DVs

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Figure 2. Distribution of Some IVs

Moreover, they have two main independent variables (IVs): (1) economic sanctions, which takes the value of 1 if a country is under any type of economic sanction in a given year and 0 otherwise, and (2) sanction costs, which measures the average cost of sanctions on the target economy as a percentage of gross national product over the entire sanction episode. To dig out more nuanced impact, they also include other three sanction-related variables: (1) ﻿sanction duration, which is a counter-variable that accounts for how long a sanction has been imposed in a given year; (2) multilateral sanction, a dummy variable, which takes the value of 1 for sanctions imposed under the auspices of the UN and other international organizations and 0 otherwise; (3) humanitarian sanction, a dummy variable, in the model, which controls for imposed sanctions with the goal of preventing humanitarian crises such as genocides, civil wars, extra-judicial killings, and political repression (Drury and Peksen, 2014: 472-73). According to Figure 2., the economic sanction is a dummy variable. Countries have not received sanctions from 1970 to 2004. Sanction cost is continuous. Most costs are below ten percent of GNP, but one outlier above 50 percent, indicating the cost for a country in a specific year is over 50 percent of GNP.

﻿Last, they control variables include (1) ﻿natural log of GDP Per Capita income is included to control for the effect of economic developmental differences across countries; (2)﻿ democracy variable, ranging from −10 (most autocratic) to 10 (most democratic), controls for the impact of regime type on women's status in a country; (3) level of economic openness, which takes the natural log of total trade flows as a percentage of GDP; (4) civil war and interstate war dummy variables, which take the value of 1 if there is a civil or interstate war (respectively) in a country and 0 otherwise; (5)﻿ the number of peace years counts the number of years since the end of the most recent internal or interstate militarized conflict in a country (Drury and Peksen, 473-474) ; (6) the region-specific effect, which is constructed by five regional dummy variables:

Asia and Pacific, Latin America/Caribbean, Middle East/North Africa, sub-Saharan Africa, and North America/Europe (reference category) and (7) lagged women’s rights (women’s right 1, 2, 3; 0 is reference category) which is to correct robust standard errors.

**3. Methodology Discussion and Replication Results**

Drury and Peksen employ two types of models, but I will only focus on the ordered logit model. They develop two logit models with different independent variables. And they use these models to see the effects on each of the women’s rights. Their variables are carefully selected. Four variables: female labor participation rate, and economic, political, and social rights, are used to measure women’s well-being.

These should be sufficient proxies regarding their definitions of women’s status, which is the extent to which women are able to exercise and enjoy the objectives of economic, political, and social rights. But CIRI measurement of these rights may emphasize changes of laws and regulations instead of rights violations in practice. It is possible that these proxies are not sensitive enough to capture the negative consequences of economic sanctions on women’s well-being.

They also mention that the different facets of women’s status are conceptually correlated. But they find the average correlation is only 0.4, which means they are still different. However, they forget to take account of the unemployment rate to see the effects of economic disruptions.

Their primary model is the ordered logit model. Ordered logit should be a good model considering the nature and distribution of three categorical variables. But we can also try the probit and Gumbel model. Although they do not specify their models in this paper, I explicitly make the following models according to their regression tables.

* Logit Model 1

Women’s well-being it = α + β1 \* economic sanctions i(t-1) + β2 \* sanction\*GDP i(t-1) +

β3 \* GDP per capita i(t-1) + β4 \* sanction costs i(t-1) + β5 \* democracy i(t-1) + β6 \* economic openness i(t-1) + β7 \* war i(t-1) + β8 \* civil war i(t-1) + β9 \* peace years i(t-1) + β10 \* Asia/Pacific i + β11 \* Latin America/Caribbean i + β12 \* Sub-Saharan Africa i + β13 \* Middle East/North Africa + women’s rights 1 i(t-1)  + women’s rights 2 i(t-1)  + women’s rights 3 i(t-1)

* Logit Model 2

Women’s well-being it = α + β1 \* GDP per capita i(t-1) + β2 \* sanction duration i(t-1) + β3 \* sanction duration\*GDP i(t-1) + β4 \* sanction costs i(t-1) + β5 \* multilateral sanction i(t-1) +

β6 \* humanitarian sanction i(t-1) + β7 \* democracy i(t-1) + β8 \* economic openness i(t-1) +

β9 \* war i(t-1) + β10 \* civil war i(t-1) + β11 \* peace years + β12 \* Asia/Pacific i + β13 \* Latin America/Caribbean i + β14 \* Sub-Saharan Africa i + β15 \* Middle East/North Africa i + women’s rights 1 i(t-1)  + women’s rights 2 i(t-1)  + women’s rights 3 i(t-1)

The difference between Logit Model 1 and Model 2 is that Model 2 does not include “economic sanctions” and “sanction\*GDP” but adds “sanction duration,” “sanction duration\*GDP,” “multilateral sanction,” and “humanitarian sanction.” The “it” means a specific country in a particular year, and “t-1” means this variable’s values all lagged one year.

I use “stargazer” to generate two tables, in which the logit model’s results are the same as the original results, but linear model has different results. It is also weird that the linear model does show coefficients of areas even though I add the region variables in the regression. The difference is due to that we use different functions in R and Stata respectively. The authors use “texreg” for linear regression in Stata, but I don’t find the exact same function, so I can only use “plm” in R. Table 1 is the effect of sanctions on women’s economic conditions, and Table 2 is the effect of sanctions on women’s social and political conditions. In the tables, the sanction has a significantly negative impact, and GDP and their interaction term have a significant and positive effect on women’s economic and political rights but not very significant on women’s social rights. The newly added multilateral sanction has no significant effect on women’s rights. The humanitarian sanction only has a significant and positive effect on women’s economic rights.

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It is worthy of mention that the dataset is not complete. First, two variables: "d.wdifemlabor" and "lsanction\_hse\_dur" are absent in the dataset that the authors provided. However, I think that "d.wdifemlabor" is a first-differenced female labor participation variable for solving non-stationarity issues and "lsanction\_hse\_dur" is a lagged sanction duration variable for solving simultaneity in time-series analysis. So, I create these variables. Second, it is problematic to convert some ordinal and nominal variables in this dataset. I reorder "wecon", "wosoc", and "wopol" (0-3) and convert "lsanction\_hse", "lagwar", "lagcwar", "asia", "lamerica", "ssafrica", and "nafrme" (0, 1) from integers to characters. But reordering "wecon," "wosoc," and "wopol" respectively make my results different from the authors’ results.

**3. Problems, Solutions, and Model Comparison**

No research is perfect, but we can always improve it conceptually and methodologically. Drury and Peksen’s research has three problems. Firstly, their ordinal logit models violate the proportional odds assumption (PRA). Secondly, they omit some variables with statistical significance. To solve these issues, I use the vector generalized linear model to replace the ordered logit to ensure no violation of PRA and then extend the existing dataset by adding new variables from the World Bank database. Third, they should use other proxies to measure women’s status because CIRI’s women’s rights cannot support their hypotheses. When I use the generalized linear model (VGLM), my results contradict the authors’ findings of economic sanction and country wealth. Sanction is positively rather than negatively related to women's rights, and GDP (country’s wealth) is negatively instead of positively related to women's rights.

First, I conduct model diagnostics for the ordered logit models. I use “brant” to run the PRA test for six models. Many IVs in their models violate the PRA, in particular, main IVs, including lsanction\_hse (economic sanction), lagsanctiongdp (GDP), and their interaction term. I take the test result tables of two economic rights models as examples. To solve the PRA violation problems, I adopt vector generalized linear model (VGLM), which can ensure non-violations of these variables.

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Then, I extend datasets because Drury and Pekson may ignore some women’s socioeconomic factors in addition to state and international influence on women. To find possible omitted variables, I review the existing literature about the determinants of economic sanction effectiveness. Education, fertility rate, employment, public spending are commonly used variables (Buck and Nossal 1998, Drury and Peksen 2014, Taheri and Lisaniler 2018). I find the relevant data from the World Bank database and add them into the models. They are female fertility rate, female literacy rate, female secondary education, tertiary education, female vulnerable employment rate, rate of females in industry, rate of females in service, rate of females in agriculture, and public spending on education.

To be more specific, education has four proxies: female literacy rate, female secondary education, tertiary education, and public spending on education. And different types of employment are female vulnerable employment rate, rate of female in industry, rate of female in service, and rate of female in agriculture. Drury and Peksen lag all IVs for one year to alleviate simultaneity issues between the DV and the IVs. Therefore, I also lag new IVs.

However, only the fertility rate and the share of vulnerable employment statistically affect women’s economic, political, and social rights. Vulnerable employment refers to the sum of contributing family workers and own-account workers (DataBank of The World Bank, 2021). The vulnerable workers are less likely to be covered by social security and other protection. But vulnerable employment is conceptually related to women’s economic rights because this right is measured by ﻿job security, for example, unemployment benefits and no arbitrary firing or layoffs. The concepts are similar. However, their correlation is only -0.36. It is not a strong correlation. I may need to keep it.

Therefore, these two variables should be included in the control variables. I add them to my models.

* New VGLM Model 1

Women’s well-being it = α + β1 \* economic sanctions i(t-1) + β2 \* sanction\*GDP i(t-1) +

β3 \* GDP per capita i(t-1) + β4 \* sanction costs i(t-1) + β5 \* democracy i(t-1) + β6 \* economic openness i(t-1) + β7 \* war i(t-1) + β8 \* civil war i(t-1) + β9 \* peace years i(t-1) + β10 \* Asia/Pacific i + β11 \* Latin America/Caribbean i + β12 \* Sub-Saharan Africa i + β13 \* Middle East/North Africa + β14 \* fertility i(t-1) + β15 \* vulnerable employment i(t-1) + women’s rights 1 i(t-1)  + women’s rights 2 i(t-1)  + women’s rights 3 i(t-1)

* New VGLM Model 2

Women’s well-being it = α + β1 \* GDP per capita i(t-1) + β2 \* sanction duration i(t-1) + β3 \* sanction duration\*GDP i(t-1) + β4 \* sanction costs i(t-1) + β5 \* multilateral sanction i(t-1) +

β6 \* humanitarian sanction i(t-1) + β7 \* democracy i(t-1) + β8 \* economic openness i(t-1) +

β9 \* war i(t-1) + β10 \* civil war i(t-1) + β11 \* peace years + β12 \* Asia/Pacific i + β13 \* Latin America/Caribbean i + β14 \* Sub-Saharan Africa i + β15 \* Middle East/North Africa i + β16 \* fertility i(t-1) + β17 \* vulnerable employment i(t-1) + women’s rights 1 i(t-1)  + women’s rights 2 i(t-1)  + women’s rights 3 i(t-1)

I also conduct the likelihood ratio test for my VGLM models and old VGLM models and compare their AICs and BICs. As for the likelihood ratio test, I cannot directly compare the ordered logit and VGLM, so I instead use original IVs and DV to run vglm and compare it with my VGLMs with the new IVS. I run three tests for three types of women’s rights. The results show that new models have significant differences from the old models. In other words, the added variables should be included in building more accurate models. And my models all have smaller AICs and BICs. I put the results in Table 3, Table 4, and Table 5. Regarding this, my models are better than the old ones.

A big finding is that VGLM models produce opposite results from ordered logit models. Sanction is positively rather than negatively related to women's rights, and GDP (the wealth of the country) is negatively instead of positively related to women's rights. The authors' hypotheses may not be incorrect. But it is problematic to use CIRI human rights to measure women's well-being/status since the results do not make sense. So, we have to come up with a more precise measurement of women’s status.

I also take into account the dataset problems. I may miss some critical data or delete too many NAs, so that's why I got different results. To solve the possible data issues, I apply the authors’ original dataset, the merged dataset, and the selected data of the merging dataset to the same VGLM model for economic rights. I get pretty similar results shown in Table 6, which are all opposite to the authors’ findings. Therefore, it is sufficient to believe that Cooper and Peksen may not have a good selection of models and measurements.

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4. Model Diagnostics

I conduct model diagnostics for my models. But the problem is that I cannot use regular ways to plot VGLM residuals as I did for linear models and generalized linear models. Though I calculate working, Pearson, and response residuals for each model, I am unsure how to produce residual plots to check the good fitness of the models. But I apply Thomas Yee’s plotvglm to plot Pearson residuals versus the linear predictors and to plot the Pearson residuals versus the hat values. There should be no obvious pattern in the plots. However, the plots all show some patterns. So, it might be problematic to have such VGLM models or some variables. I have to improve the models. I only show six plots for economic rights VGLM model 1 in this paper. The other plots can be seen in my RMD file.

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**5. Conclusion**

Drury and Peksen’s research is thought-provoking, but their methodology is problematic. There are three serious problems. First, the ordered logit model is not suitable for their data. The main IVs, such as economic sanctions and GDP per Capita, violate PRA in several models. This deficit makes their arguments meaningless. Second, they omit several important variables. The fertility rate and female vulnerable employment rate yield statistically significant effects on women’s status. They should have included socioeconomic and demographic variables in their controlling variables. Third, the measurement of women’s well-being is questionable. In my new models, the results cannot support Drury and Peksen’s hypotheses. To be more specific, economic sanctions do not negatively affect women’s economic, social, and political rights, and the wealth of the target country cannot alleviate the negative consequences of sanctions on women. The findings are statistically right but conceptually wrong. How could sanctions yield positive effects on the target? We should have more precise indicators to measure women’s status.

To solve the above methodological problems, I first replace the ordered logit models with vector generalized linear models (VGLMs) and add new variables into the model. All the test results confirm that my models are better than the ordered logit models. Firstly, all the variables in my VGLMs do not violate parallel assumptions. Secondly, the likelihood ratio test tells me that the new models which have fertility rate and female vulnerable employment are significantly different than the old models. It is sufficient to believe that these variables should not be omitted. Thirdly, my models have smaller AICs and BICs than the old models. However, I have to admit that my models are neither perfect. Residual plots of my models do not show the goodness of fit since the residuals of my main variables have specific patterns. My models need to be further improved.

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