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CONTEMPORARY WELFARE STATES
AND
STUDENT ACHIEVEMENTS

Abstract. Our paper estimates the effect of social welfare on student achievements that are measured by the Programme for International Student Assessment (PISA) scores which test students across countries for skills in mathematics, problem-solving, and a few other subjects. Higher student achievements mean that secondary school pupils of one country are doing better in these tests than pupils from other countries.

We employ the extent of destruction of European economies during the Second World War (WWII) as an instrument for assessing the scope of the social welfare state. WWII caused a large numbers of orphans, widows, and people in need. The resulting atmosphere of solidarity caused unanimous agreements on expanding the welfare state.

The authors' contribution to the development of the problem consists of using new instruments and measures of the social welfare state in European countries. We use econometric modelling that involves instrument variable approach and multiple regressions to establish the determinants of the contemporary welfare state.

Our results demonstrate that a country badly struck by the war yielded a higher level of the acceptance and solidarity with the victims. Our identification strategy exploits the resulting correlation between the extent of the social welfare state and the destruction during the WWII and finds significantly positive effects of the extent of the welfare state on student achievements.

Keywords: welfare state; student achievements; WWII; instrument variables; multiple regression; econometric modeling.

JEL Classification: C01, I39, P26

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СОВРЕМЕННЫЕ ГОСУДАРСТВА ВСЕОБЩЕГО БЛАГОСОСТОЯНИЯ И СТУДЕНЧЕСКИЕ ДОСТИЖЕНИЯ
Аннотация. В статье оценивается характер и масштабы взаимосвязи между государством социального благополучия и студенческими достижениями, определяемыми по результатам тестов в рамках Программы международной оценки студентов (PISA). На основе тестирования проверяются их навыки в математике, решении проблем и др.
В своем исследовании авторы рассматривают степень разрушения европейских экономик во время Второй мировой войны в качестве отправной точки для оценки сферы действия государства всеобщего благосостояния. Вторая мировая война привела к появлению большого числа сирот, вдов и нуждающихся людей. В результате атмосфера солидарности в послевоенной Европе вызвала к жизни единодушное соглашение о расширении социальной роли государства.
Вклад авторов в развитие данной проблемы заключается в использовании новых инструментов для оценки эффективности мер государственной социальной помощи в европейских странах. Подобная оценка осуществляется на основе эконометрического моделирования, которое включает в себя инструментальные переменные и множественные регрессии для установления факторов, определяющих современный концепт государства всеобщего благосостояния.
Представленные результаты исследования показывают, что страны, которые пострадали в результате военных конфликтов, демонстрируют более высокий уровень солидарности с потерпевшими гражданами. Авторская стратегия идентификации позволила выявить корреляцию между степенью общественного благосостояния и разрушениями во время Второй мировой войны, а также обнаружить взаимосвязь между уровнем развития социального государства и студенческими достижениями.
Ключевые слова: государство всеобщего благосостояния; студенческие достижения; Вторая мировая война; переменные инструменты; множественные регрессии; эконометрическое моделирование.

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СУЧАСНІ ДЕРЖАВИ ЗАГАЛЬНОГО ДОБРОБУТУ ТА СТУДЕНТСЬКІ ДОСЯГНЕННЯ

Анотація. У статті оцінюється характер та масштаби взаємозв'язку між державою соціального добробуту і студентсь-кими досягненнями, що визначаються за результатами тестів у рамках Програми міжнародної оцінки студентів (PISA). На основі тестування перевіряються їхні навички в математиці, вирішенні проблем та ін.

У своєму дослідженні автори розглядають ступінь руйнування європейських економік під час Другої світової війни як відправну точку для оцінки сфери дії держави загального добробуту. Друга світова війна призвела до появи великої кількості сиріт, удів і нужденних людей. У результаті атмосфера солідарності в післявоєнній Європі викликала появу одностайної угоди про розширення соціальної ролі держави.

Внесок авторів у розвиток зазначеної проблеми полягає у використанні нових інструментів для оцінки ефективності заходів державної соціальної допомоги в європейських країнах. Подібна оцінка здійснюється на основі економетрич-ного моделювання, що містить у собі інструментальні змінні та множинні регресії для встановлення факторів, які виз-начають сучасний концепт держави загального добробуту.

Представлені результати дослідження показують, що країни, які постраждали внаслідок військових конфліктів, де-монструють більш високий рівень солідарності із нужденними громадянами. Авторська стратегія ідентифікації дозво-лила виявити кореляцію між ступенем суспільного добробуту та руйнуваннями під час Другої світової війни, а також виявити взаємозв'язок між рівнем розвитку соціальної держави і студентськими досягненнями.

Ключові слова: держава загального добробуту; студентські досягнення; Друга світова війна; змінні інструменти; мно-жинні регресії; економетричне моделювання.

Introduction

Success in education highly effect earnings and employ-ment chances. This gives children and their parents incentives to care about school results. A strong welfare state narrows the gap between the different outcomes in the labor market. It removes parts of the negative consequences for students that do not very well at school and, subsequently, later in the labor market (see [1]). Even if children were too young to fully under-stand the implications of the welfare state, it is likely that parents would. Parents' effort to make their children succeed in educa-tion should therefore decline since it comes with costs. As a result an expansion of the social welfare state should have a negative effect on student achievement.

One of the new and interesting ways how to measure the effect of social welfare on student achievements can be done using the student scores from the Programme for International Student Assessment (PISA). The Programme for International Student Assessment (PISA) is a worldwide study by the Organization for Economic Co-operation and Development (OECD) in its member and non-member countries. It is typical-ly done with the 15-year-old school pupils and is intended to measure their scholastic performance on mathematics, sci-ence, and reading. It was first conducted in 2000 and is repeat-ed every three years. It is done with a view to improving educa-tion policies and outcomes in OECD member states.

Our paper is structured as follows: Section 2 provides a brief literature review. Section 3 explains the purpose and the methodology of our study. Section 4 presents the data obtained for our analysis. Section 5 discusses the results from our econometric model that employs our new approach to the prob-lem of measuring the links between the students' achievements and the welfare state and using instrumental variables and mul-tiple regression techniques. Section 5 provides overall conclu-sions and closes our elaboration.

Brief Literature Review

There are several works on welfare state and school perfor-mance of children. For instance, Lindbeck and Nyberg [2] demonstrate one possible mechanism of how an increase in the extent of the welfare state weakens parents' incentives to make their children work hard at school. In their model, parents are altruistic and children know it. This gives the children an incen-tive to reduce their work effort at school. As adults, they would then live of their parents' altruism. Parents try to avoid that by instilling strong work ethics in their children that make them work hard at school and during their work life. Introducing a wel-fare state in the model weakens this incentive for parents. Then the welfare state would pay instead of the parents if a child fails

in the labor market (see [3]). Parents, then, don't want to bear the costs of instilling strong work ethics. Following this mecha-nism, an increase in the extent of the social welfare state low-ers student achievement.

The welfare state as we know it today developed after the World War II. The extent of the welfare state is often subject to controversial discussions. Critics often argue that the benefits people receive from the government prevent them from taking actions on their own (e.g. [4]). It would then be unfair and ineffi-cient to ask wealthier people to pay for the poor. After WWII this sort of argument was weaker. There were widows, orphans and wounded veterans. Most of them were threatened by poverty. It wasn't easy to argue that they were to blame themselves for their misery. This sentiment increased the acceptance of redis-tribution via the welfare state above party lines. This effect was stronger if a country was struck harder by war, since the suffer-ing of the victims was more obvious and visible. Therefore, countries with more destruction tended to have bigger welfare states. Countries that introduced a strong welfare state in the 1950s and 1960s tend to have a relatively strong welfare state until today. Therefore, the level of destruction during WWII serves as a relevant instrument for the extent of contemporary welfare states.

Falch and Fischer [5] and Matsaganis [6] estimate the effect of government involvement in the economy on student achieve-ment. They run different specifications where they use govern-ment consumption, progressivity of taxation and social expendi-tures as approximation for government involvement. For their identification strategy, they use data from international achieve-ment tests in math and science to create an unbalanced panel data set. This enables them to run fixed effect models to remove heterogeneity between different countries. They find negative effects of government involvement in the economy on student achievement (e.g. [7] or [8]).

Our instrument variable approach is a different solution to the same problem. In contradiction to [5], we find a significant positive effect of the welfare state. This also contradicts [2], as well as our initial assumption about the relationship between the social welfare state and student achievement.

Purpose and methodology

We employ an instrument variable approach to estimate the effect of social welfare on student achievement. In order to achieve that, we regress student achievement on the casualties during WWII in percent of population size of a country and dif-ferent control variables:

$$S_c = \emptyset + \theta Vict_c + \varphi \Omega_c + \gamma \Gamma_i + \epsilon_c, \tag{1}$$

where S is the extend of the social welfare state in percent of GDP, $\emptyset$ is the constant, $Vict_c$ are the WWII casualties in percent of the population size of each country, Ωc represents several country level control variables and Γ_i represents student level control variables, and θ, φ, γ, and ϵ_i are the coefficients (similar to βs in OLS regression).

In the second stage, we run the regression of the proxy for student achievements Ti on the fitted values from the first stage and all the control variables from the first stage (2):

$$\mathrm{T_i} = \alpha + \beta Instrument_c + \gamma\Omega_c + \delta T_i + \epsilon_i ,\qquad(2)$$

where $\mathrm{T_i}$ are the fitted values from the first stage, *Instrument_c* represents the control variables from the first stage, Ωc represents several country level control variables, and α, β, γ, and ϵ_i are the coefficients.

Complementary, we run a simple OLS model that can be summarized as follows:

$$T_c = \alpha + \beta S_c + \gamma\Omega_c + \delta T_i + \epsilon_c ,\qquad(3)$$

where β is the coefficient of the effect of the social welfare state on student achievements (this means that the regression is a cross-country regression at heart and therefore vulnerable to unobserved heterogeneity between the different countries), where S is the extend of the social welfare state in percent of GDP, Ωc represents several country level control variables, T_i are the fitted values from the first stage, θ, φ, γ, α, β, γ, and ϵ_i are the coefficients.

The data

In order to estimate the effect of social welfare on student achievements, we use the 2009 PISA data. Specifically, we use the math scores as the measure for student achievement. Additionally, we use several different student level characteristics as control variables.

The extent of the social welfare state is a country level variable. Therefore, we add several control variables on the country level. We also add data about unemployment, GDP per capita and expenditure per student from the OECD data base. On the country level, our sample is restricted to the OECD countries. While this increases the data quality, there is also a disadvantage. Hence, we cluster the students along countries. Due to the relatively small number of OECD countries, the number of clusters is relatively small. This decreases the statistical power strongly.

We run the IV model with four different sets of data. We run it with country level variables from 1995, when the participants of the 2009 Pisa study were just born and with data from 2007, two years before the actual test. The idea behind this is that it is not clear if economic conditions at birth or economic conditions relatively close to the test should have more of an impact on the test results. We run both regressions with two different sets of data. First, we run it for the whole sample. After that, we run it again for a subset. The subset includes only students who rank in the lowest percentile of the Index of economic, social and cultural status. Very roughly speaking, this subset includes only the «less privileged» students (Table). This leaves us with four different IV estimates.

Our instrument for all the IV regressions is the percentage of the population that died in each country during WWII. There is a positive correlation between these WWII victims and the social welfare state both in 1995 (Graph 1) and 2007 (Graph 2). In both cases, there is a cluster of countries where there were no deaths during WWII since the countries were at peace. Dropping these countries would result in even lower numbers of clusters which would shatter the statistical significance. Despite the difficult situation with the number of clusters, we find reasonable F-Statistics in a number of the specifications.

The estimation of social welfare state impact would be biased if there are differences between countries that are

ESCS	1995 control variables					2007 control variables				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
OLS for all students with PISA math scores as dependent Variable										
Social Expend in % of GDP	1.714** (.677)	1.158* (.631)	1.392** (.611)	1.604* (.809)	.918 (.853)	1.903* (.695)	.873 (.74)	.849 (.79)	.69 (.951)	.661 (.939)
Expenditure per Student	-	.004* (.002)	.0 (.002)	.0 (.002)	.001 (.002)	-	.004** (.002)	.004 (.003)	.004 (.004)	.005 (004)
GDP per Capita	-	-	.001** (.0)	.001* (.0)	.001** (.0)	-	-	.0 (.001)	.0 (.001)	.0 (.0)
Unemployment Rate	-	-	-	-.528 (.87)	.372** (.97)	-	-	-	.25 (1.994)	-.132 (1.901)
communist	-	-	-	-	29.07 (10.895)	-	-	-	-	10.594 (8.237)
Observations (students)	282967	210343	210343	210343	210343	298454	293485	293485	271173	271173
Clustering Units (countries)	31	21	21	21	21	34	33	33	29	29
R-squared	0.2323	0.2466	0.2503	0.2506	0.2544	0.2313	0.2403	0.2403	0.2409	0.2416
OLS for bottom percentile with respect to ESCS with PISA math scores as dependent Variable										
Social Expend in % of GDP	1.484*** (.255)	.801** (.801)	.784* (.402)	.554 (1.071)	.886 (1.246)	1.752*** (.204)	.534 (.665)	.192 (.792)	-1.103 (1.076)	-.647 (1.097)
Expenditure per Student	-	.004*** (.001)	.005* (.002)	.005** (.002)	.004 (.002)		.004* (.002)	.008 (.004)	.011** (.004)	.01** (.004)
GDP per Capita	-	-	.0 (.001)	.0 (.001)	.0 (.001)			-.001 (.001)	-.002* (.001)	-.001 (.001)
Unemployment Rate	-	-	-	.391 (1.335)	.088 (1.459)				2.932** (1.388)	2.772** (1.298)
communist	-	-	-	-	-18.312 (23.376)					23.822* 12.681
Observations (students)	28968	24312	24312	24312	24312	29465	29204	29204	27613	27613
Clustering Units (countries)	31	21	21	21	21	34	33	33	29	29
R-squared	0.0882	0.0998	0.0998	0.1000	0.1005	0.0914	0.0965	0.0974	0.1004	0.1020

Table: **OLS Regressions, Index of economic, cultural and social status (ESCS)**

Instrumental Variable Approach. 1st stage dependent variable: Social Expenditure in Percent of GDP. 2nd Stage Dependent variable: PISA Math score. The variable «WW2Victims» is the share of the population of a country that died during WW2. Student level control variables in all regressions: Home Mother, Home Father, Sex, Grade, PARED, Language at Home, number of Books at home, country of birth, family structure.

Source: Own results
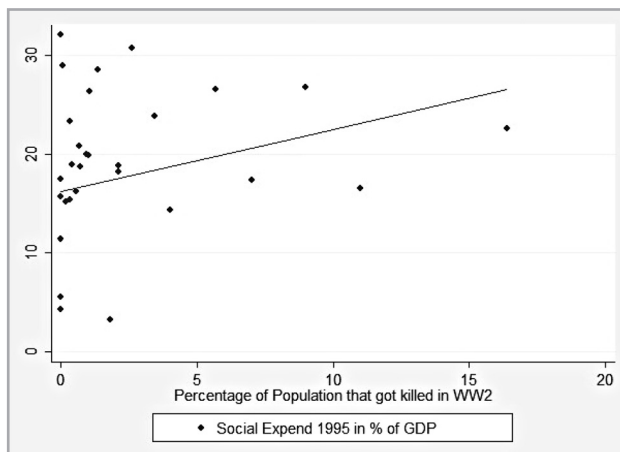
**Graph 1: Correlation between this WWII victims
and the social welfare (1995)**
Source: Own results
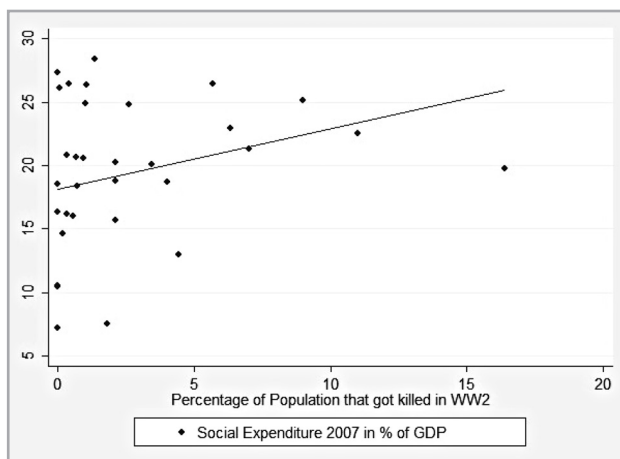
**Graph 2: Correlation between this WWII victims
and the social welfare (2007)**
Source: Own results

linked to the WWII victims and at the same time to student achievement.

The data shows that eastern European countries had a relatively high share of their population killed during WWII. Most of these countries later became part of the Soviet Union. It is reasonable to assume that being part of the Soviet Union had an effect on the schooling system. Likely that effects student achievement in 2009. Therefore, we add a Communist dummy to my specifications that is 1 for former soviet countries. While the dummy has a non-significant effect in almost all of our specifications, this could be due to the small cluster size.

Discussion of results

The most remarkable result is that the coefficient for the impact of the social welfare state on student achievement is positive for all specification in the IV and the OLS approach. This stands in contrast to the findings of Falch and Fischer (2008) and the theory of Lindbeck and Nyberg [2]. This is not only the case for the full data set, but also in Table 1 for the «less privileged» Our results point out at smaller than average effects for «less privileged» students.

Table shows that using 1995 control variables and the social expenditure in 1995 yield more significant coefficients then the data from 2007. This would mean that economic conditions during early childhood are more important than very recent conditions. This of course is very intuitive, since education is a long process where skills are formed over many years.

The magnitude of the effect is roughly between 2 and 4 standard deviations for all reasonable specifications. The F-sta-

tistics, especially in the cases with 1995 data, are reasonably high, suggesting that we used in our analysis relevant instrument which can be applied for estimating the model specified above.

The OLS approach yields similar results. Our results demonstrate that all the estimates come through as positive, although with a smaller magnitude than in the IV case.

Overall, there is a lot of significance in the specifications with the 1995 data. In the specifications with the 2007 data, we do not see much significance and, therefore, cannot clearly conclude for the magnitude and the scope or results.

Conclusions

It is difficult to interpret the effects as causal. If a bigger welfare state helps student achievement, «less privileged» children should benefit more, since they are the ones that actually receive more help. In contrast, the results show smaller than average effects for those children. This makes not much sense, especially since it stands in contrast to the findings of Falch and Fischer [5] and the theory of Lindbeck and Nyberg [2], as well as a couple of similar studies (e.g. [9] or [10]).

Additionally, the number of clusters is too low to allow for much more country level control variables without a drop in statistical significance. On top, the cross-country regression approach is vulnerable to biases through unobserved heterogeneity.

For future, research the results could be strengthened by adding more countries to our analysis. This would not only allow for more country control variables but also increase the statistical significance of the existing specifications. Another possibility would be to run the regressions for more different sub-samples with respect to socio-economic variables.

If the coefficients remain positive, it would be interesting to develop a theory that shows a mechanism through which the extent of the welfare state has a positive effect on student achievement.

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