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Santiago Campos-Rodríguez[1], John Chung[2]

[1]University of California, Irvine/USA
[2]Auburn University, Auburn/USA

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E-Mail: joerg.peters@rwi-essen.de
RWI – Leibniz Institute for Economic Research
Hohenzollernstraße 1-3
45128 Essen/Germany
www.i4replication.org

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A Comment on "The Relative Efficiency of Skilled Labor across Countries: Measurement and Interpretation" by Rossi (2022)

Santiago Campos-Rodríguez * John Chung †

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Abstract

Rossi (2022) examines the relative efficiency of skilled workers across countries. He finds the elasticity of skill efficiency with respect to GDP per worker is 1.4 and that the relative human capital accounts for only about 9 percent. We reproduce the paper's main findings and test the sensitivity of the results to (1) alternative samples and (2) additional controls for determining wages. We find the results remain robust to these alternative specifications, and the estimated values of the key elasticities remain nearly unchanged.

*Santiago Campos-Rodríguez: University of California-Irvine. E-mail: scampos4@uci.edu
†John Chung: Auburn University. E-mail: chung@auburn.edu.

1 Introduction

Rossi (2022) explores how the relative efficiency of high- and low-skill workers depends on country's level of development. Using individual cross-section data from IPUMS for 12 countries, he finds that "the relative skill efficiency is strongly increasing with GDP per worker." Analysis of migrants suggests that the relative human capital of skilled labor is not the primary explanation for this difference: "the relative human capital of skilled labor accounts for a minor share, from 5 to 18 percent, with a baseline estimate of 9 percent of the cross-country variation in relative skill efficiency."

In the present paper, we evaluate the computational reproducibility and robustness replicability of the main findings. For reproduction, we used the replication package provided by the author through the *American Economic Review* and downloaded additionally required data from IPUMS International. We successfully reproduced the original results after installing an additional Stata package.

The replication codes clearly restrict the sample to working age population when calculating the labor hours, although this restriction is not obvious from the paper's text. Lifting this restriction raises the estimated skill efficiency elasticity from 1.408 to 1.436, strengthening the argument made by the author.

We consider two types of robustness replications. First, we check the sensitivity of the skill efficiency elasticity estimate with respect to sample selection criteria. In computing relative wages, the original paper restricts the sample to workers with high labor market attachment. We examine the impact of relaxing this requirement. This again raises the skill efficiency elasticity estimate from 1.408 to 1.424 without working age restriction or 1.431 with working age restriction.

Second, we consider additional control variables, age and sex, in determining migrant wages to check the sensitivity of human capital elasticity. These controls may help to further isolate the role of migrant's origin-country on human capital acquisition. Ex post, however, the main results are virtually unaffected by the

additional controls. Under the baseline specification, the human capital share of skill efficiency elasticity falls from 0.095 to 0.094, a negligible difference in light of the standard errors.

2 Reproducibility

We were successful in replicating the results in the paper using the replication package[1] provided by the author and through the American Economic Association. The only data not provided in the package were those from IPUMS International. Although the instructions in the package did not explicitly list the required variables, these could be inferred from the included codes.

We also had to make a minor adjustment to fully run the replication package codes. One of the do-files requires the Stata package "*grc1leg2*," but the set-up do-file instead includes the installation command for the package "*grc1leg*." After installing *grc1leg2* package, we were able to run the replication package to completion with results matching the paper's.

We found one minor discrepancy between the paper's description of the methodology and the implemented code. When calculating the total hours worked by all workers within an education level category, the code restricts the sample to workers of age 16–65. In the paper, this is described as one of the criteria for the "high degree of labor market attachment" applied to the log wage regressions, but not necessarily for the labor supply calculations (which are "computed by summing up the hours worked by all workers"). While this is likely an issue of exposition rather than a coding error, we nonetheless examine how the relative labor hour measures change when workers outside of the 16–65 age range are included. A priori, these restrictions may impact the skill efficiency elasticity estimate as the norm retirement age may vary across countries systematically.

Table 1 provides the direct reproduction of Table 1 in the original paper for convenience and for the p-values on the elasticity estimates. Table 2 provides the

[1] Available at Open ICPSR site.

replication of the same table with the working-age restriction lifted for the labor supply calculations. This affects only the Baseline $\frac{\tilde{H}}{\tilde{L}}$ and $\frac{A_H Q_H}{A_L Q_L}$ columns. Values in all other columns, reflecting successful reproduction, are identical to the original paper's. (We maintain the sample restriction for "No Hours" results as in the original paper.)

Including non-working-age workers makes relatively small differences. The point estimate of the relative labor supply elasticity increases from 0.911 in the original specification to 0.925 with the full sample and raises the skill efficiency elasticity from 1.408 to 1.436.

We did not find any other errors during our review of the codes, and the results we obtained from replication were otherwise identical to those reported in the paper. Given the large size of both the codebase and the involved data, however, errors may remain.

3 Robustness

We test the robustness of the main results in two dimensions: sample selection and additional controls.

3.1 Sample selection

The paper measures wage levels based on the sample of workers "with a relatively high degree of labor market attachment." The criteria for the attachment are (1) age between 16 and 65 and (2) working at least 30 hours per week and working at least 30 weeks per year. As discussed in the previous section, criterion (1) is applied also to the sample used for measuring labor supply.

In this section, we consider the sensitivity of the estimation results to the labor market attachment criteria. Table 3 reports the results obtained by relaxing 30 hours per week and 30 weeks per year requirement when measuring the wages. Table 4 reports the results with further relaxing the age requirement. For the labor supply sample, we maintained the working age restriction throughout as in the

original paper. Nonetheless, all estimates except the -Traditional- column values are affected since the wage ratios are used as weight terms in the supply calculations. The estimates from the traditional approach are unaffected since the returns are fixed at 0.10 rather than estimated from the wage ratios.

The main estimate of interest, the skill efficiency elasticity, rises slightly from 1.408 in the original paper to 1.431 and 1.423 with the relaxed labor market attachment conditions. While the associated standard error essentially remains the same at 0.40. The estimated elasticities of the components also remain stable. Overall, the main results are robust to the sample restriction based on the labor market attachment.

3.2 Additional control variables

Section III of Rossi (2022) examines the skill premia of immigrants to examine the contribution of human capital in the skill efficiency differences across countries. This involves measuring the average wage amongst immigrants within each pair of country of origin and education level. In the paper, the wage regression used for determining the average wage also includes a set of controls: cubic polynomial in the number of years since migration and self-reported proficiency in the local official language. These controls, by accounting for factors other than country-of-origin, help to isolate the effect of home-country education.

We conduct a robustness test by including additional set of controls: cubic polynomial in the age and gender. These account for potential variations and demographic compositions amongst immigrants of different origin countries and education levels.

Table 5 provides reproduction of the original paper's Table 3 for convenience and for p-values. Table 6 reports the results of the replication with the additional controls. The results are robust to these additional controls. Under the broad sample specification with US immigrants (row 1) and elasticity of substitution at $\sigma = 1.5$, the human capital share of skill efficiency elasticity falls from 0.095 to

0.094. The estimates remain similarly stable across different specifications. The only specification the additional controls make a noticeable difference is one with the bilateral controls (row 3) using the microdata sample. The additional controls more than doubles the estimated human capital elasticity from 0.095 to 0.212, raising its share from 0.067 to 0.151.

4 Conclusion

In this article, we presented the results of our replication of Rossi (2022). We find the key conclusions of the paper are computationally reproducible and robust to sample selection and additional controls. Although the scope of our checks are relatively limited, given the large array of sensitivity analysis performed in the original paper, we believe the main results are likely to stand with other specifications. Future replication exercises, therefore, could instead examine alternative sources of data or different time periods and countries.

References

Rossi, F.: 2022, The relative efficiency of skilled labor across countries: Measurement and interpretation, *American Economic Review* **112**(1), 235–66.

5 Tables

Table 1: Skill Premium, Supply, and Efficiency across Countries (Original specification)

Country	Baseline			No Hours	All Working Age	Traditional
	$\frac{w_H}{w_L}$	$\frac{\tilde{H}}{\tilde{L}}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$
India	2.230	0.205	0.041	0.050	0.092	0.040
Indonesia	1.957	0.070	0.003	0.004	0.009	0.006
Jamaica	2.969	0.067	0.010	0.011	0.011	0.003
Brazil	3.419	0.158	0.087	0.121	0.115	0.022
Venezuela	2.490	0.257	0.089	0.132	0.152	0.055
Uruguay	2.218	0.363	0.126	0.189	0.225	0.260
Panama	2.262	0.313	0.099	0.123	0.119	0.077
Mexico	2.205	0.227	0.049	0.069	0.070	0.040
Trinidad and Tobago	2.746	0.100	0.018	0.022	0.024	0.009
Israel	1.606	0.596	0.129	0.155	0.109	0.156
Canada	1.508	1.539	0.711	0.825	0.928	1.628
United States	1.802	1.397	1.000	1.000	1.000	1.000
Elasticity wrt GDP p.w.	-0.138	0.911	1.408	1.366	1.117	1.575
	(0.078)	(0.244)	(0.394)	(0.402)	(0.414)	(0.509)
	[0.106]	[0.004]	[0.005]	[0.007]	[0.022]	[0.011]

Notes: The table shows the skill premium, relative skill supply, and efficiency across the countries in the microdata sample. Relative skill efficiency is normalized such that it takes value 1 for the United States. *No hours* refers to estimates obtained when not weighting workers by hours worked; *all working age* refers to estimates obtained when including all working age population irrespective of employment status (and hours worked); *traditional* refers to estimates obtained when using a Mincerian return of 0.10 to impute the skill premium and calibrate the human capital stocks. The last row shows the coefficient of a regression of the log of each variable on log GDP per worker (standard errors in parentheses, p-values in brackets).

Table 2: Skill Premium, Supply, and Efficiency across Countries (No age restriction in baseline labor supply calculations)

Country	Baseline			No Hours	All Working Age	Traditional
	$\frac{w_H}{w_L}$	$\frac{\tilde{H}}{\tilde{L}}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$
India	2.230	0.195	0.041	0.050	0.092	0.040
Indonesia	1.957	0.068	0.003	0.004	0.009	0.006
Jamaica	2.969	0.067	0.010	0.011	0.011	0.003
Brazil	3.419	0.154	0.087	0.121	0.115	0.022
Venezuela	2.490	0.251	0.089	0.132	0.152	0.055
Uruguay	2.218	0.355	0.126	0.189	0.225	0.260
Panama	2.262	0.302	0.099	0.123	0.119	0.077
Mexico	2.205	0.219	0.049	0.069	0.070	0.040
Trinidad and Tobago	2.746	0.101	0.018	0.022	0.024	0.009
Israel	1.606	0.593	0.129	0.155	0.109	0.156
Canada	1.508	1.517	0.711	0.825	0.928	1.628
United States	1.802	1.397	1.000	1.000	1.000	1.000
Elasticity wrt GDP p.w.	-0.138	0.925	1.436	1.366	1.117	1.575
	(0.078)	(0.241)	(0.389)	(0.402)	(0.414)	(0.509)
	[0.106]	[0.003]	[0.004]	[0.007]	[0.022]	[0.011]

Notes: The table shows the skill premium, relative skill supply, and efficiency across the countries in the microdata sample. Relative skill efficiency is normalized such that it takes value 1 for the United States. *No hours* refers to estimates obtained when not weighting workers by hours worked; *all working age* refers to estimates obtained when including all working age population irrespective of employment status (and hours worked); *traditional* refers to estimates obtained when using a Mincerian return of 0.10 to impute the skill premium and calibrate the human capital stocks. The last row shows the coefficient of a regression of the log of each variable on log GDP per worker (standard errors in parentheses, p-values in brackets).

Table 3: Skill Premium, Supply, and Efficiency across Countries (No attachment requirements other than working-age)

Country	Baseline			No Hours	All Working Age	Traditional
	$\frac{w_H}{w_L}$	$\frac{\tilde{H}}{\tilde{L}}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$
India	2.241	0.204	0.040	0.050	0.090	0.040
Indonesia	1.932	0.071	0.003	0.004	0.008	0.006
Jamaica	2.925	0.067	0.010	0.010	0.010	0.003
Brazil	3.348	0.158	0.081	0.112	0.105	0.022
Venezuela	2.470	0.260	0.088	0.128	0.147	0.055
Uruguay	2.285	0.367	0.139	0.206	0.244	0.260
Panama	2.262	0.313	0.098	0.121	0.115	0.077
Mexico	2.160	0.233	0.047	0.066	0.068	0.040
Trinidad and Tobago	2.781	0.099	0.018	0.021	0.023	0.009
Israel	1.571	0.604	0.122	0.146	0.101	0.156
Canada	1.556	1.567	0.797	0.921	1.029	1.628
United States	1.814	1.395	1.000	1.000	1.000	1.000
Elasticity wrt GDP p.w.	-0.132	0.914	1.431	1.390	1.141	1.575
	(0.076)	(0.246)	(0.403)	(0.412)	(0.426)	(0.509)
	[0.113]	[0.004]	[0.005]	[0.007]	[0.023]	[0.011]

Notes: The table shows the skill premium, relative skill supply, and efficiency across the countries in the microdata sample. Relative skill efficiency is normalized such that it takes value 1 for the United States. *No hours* refers to estimates obtained when not weighting workers by hours worked; *all working age* refers to estimates obtained when including all working age population irrespective of employment status (and hours worked); *traditional* refers to estimates obtained when using a Mincerian return of 0.10 to impute the skill premium and calibrate the human capital stocks. The last row shows the coefficient of a regression of the log of each variable on log GDP per worker (standard errors in parentheses, p-values in brackets).

Table 4: Skill Premium, Supply, and Efficiency across Countries (No attachment requirements)

Country	Baseline			No Hours	All Working Age	Traditional
	$\frac{w_H}{w_L}$	$\frac{\tilde{H}}{\tilde{L}}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$	$\frac{A_H Q_H}{A_L Q_L}$
India	2.246	0.207	0.042	0.052	0.093	0.040
Indonesia	1.935	0.072	0.003	0.004	0.009	0.006
Jamaica	2.931	0.067	0.010	0.010	0.010	0.003
Brazil	3.354	0.161	0.084	0.116	0.109	0.022
Venezuela	2.461	0.263	0.089	0.130	0.149	0.055
Uruguay	2.289	0.370	0.141	0.210	0.249	0.260
Panama	2.262	0.317	0.100	0.124	0.118	0.077
Mexico	2.161	0.236	0.048	0.068	0.070	0.040
Trinidad and Tobago	2.803	0.098	0.018	0.022	0.024	0.009
Israel	1.573	0.604	0.122	0.146	0.102	0.156
Canada	1.555	1.583	0.811	0.939	1.051	1.628
United States	1.814	1.395	1.000	1.000	1.000	1.000
Elasticity wrt GDP p.w.	-0.133	0.911	1.423	1.382	1.133	1.575
	(0.076)	(0.247)	(0.404)	(0.413)	(0.427)	(0.509)
	[0.113]	[0.004]	[0.006]	[0.007]	[0.024]	[0.011]

Notes: The table shows the skill premium, relative skill supply, and efficiency across the countries in the microdata sample. Relative skill efficiency is normalized such that it takes value 1 for the United States. *No hours* refers to estimates obtained when not weighting workers by hours worked; *all working age* refers to estimates obtained when including all working age population irrespective of employment status (and hours worked); *traditional* refers to estimates obtained when using a Mincerian return of 0.10 to impute the skill premium and calibrate the human capital stocks. The last row shows the coefficient of a regression of the log of each variable on log GDP per worker (standard errors in parentheses, p-values in brackets).

Table 5: Relative Human Capital Across Countries (Original specification)

	Broad sample				Microdata sample			
		θ_Q/θ_{AQ}				θ_Q/θ_{AQ}		
	θ_Q	$\sigma = 1.5$	$\sigma = 1.3$	$\sigma = 2$	θ_Q	$\sigma = 1.5$	$\sigma = 1.3$	$\sigma = 2$
1. US immigrants	0.105	0.095	0.057	0.189	0.043	0.030	0.018	0.068
	(0.016)				(0.048)			
	[0.000]				[0.397]			
2. All host countries	0.098	0.088	0.053	0.176	0.078	0.055	0.032	0.123
	(0.016)				(0.047)			
	[0.000]				[0.128]			
3. Bilateral controls	0.062	0.056	0.034	0.112	0.095	0.067	0.039	0.149
	(0.026)				(0.087)			
	[0.019]				[0.300]			
4. Selection adjusted	0.039	0.035	0.021	0.070	0.067	0.047	0.027	0.105
	(0.026)				(0.080)			
	[0.140]				[0.427]			
5. 10+ years in US	0.065	0.059	0.035	0.118	0.078	0.055	0.032	0.122
	(0.017)				(0.060)			
	[0.000]				[0.225]			
6. English speakers	0.096	0.087	0.052	0.173	0.039	0.028	0.016	0.061
	(0.015)				(0.041)			
	[0.000]				[0.360]			
7. Skill downgrading	0.072	0.065	0.039	0.130	0.007	0.005	0.003	0.012
	(0.014)				(0.038)			
	[0.000]				[0.848]			
8. Sorting (sectors)	0.094	0.085	0.051	0.170	0.078	0.056	0.032	0.123
	(0.012)				(0.037)			
	[0.000]				[0.059]			
9. Sorting (geographic)	0.101	0.091	0.055	0.182	0.033	0.024	0.014	0.052
	(0.016)				(0.044)			
	[0.000]				[0.467]			

Notes: The table shows the elasticity of relative human capital with respect to GDP per capita θ_Q (standard errors in parentheses, p-values in brackets) and its ratio with respect to the elasticity of relative skill efficiency θ_{AQ}. Each row reports results from a different methodology (as indicated by the row titles) to estimate the relative human capital endowment of high-skill labor.

Table 6: Relative Human Capital Across Countries (Age and gender controls)

	Broad sample				Microdata sample			
		θ_Q/θ_{AQ}				θ_Q/θ_{AQ}		
	θ_Q	$\sigma = 1.5$	$\sigma = 1.3$	$\sigma = 2$	θ_Q	$\sigma = 1.5$	$\sigma = 1.3$	$\sigma = 2$
1. US immigrants	0.105	0.094	0.057	0.189	0.045	0.032	0.018	0.070
	(0.015)				(0.045)			
	[0.000]				[0.342]			
2. All host countries	0.096	0.087	0.052	0.174	0.067	0.048	0.028	0.106
	(0.014)				(0.040)			
	[0.000]				[0.123]			
3. Bilateral controls	0.068	0.061	0.037	0.123	0.212	0.151	0.087	0.334
	(0.033)				(0.123)			
	[0.041]				[0.114]			
4. Selection adjusted	0.039	0.035	0.021	0.070	0.068	0.049	0.028	0.108
	(0.026)				(0.082)			
	[0.140]				[0.422]			
5. 10+ years in US	0.067	0.060	0.036	0.120	0.070	0.050	0.029	0.110
	(0.016)				(0.056)			
	[0.000]				[0.239]			
6. English speakers	0.095	0.086	0.052	0.172	0.043	0.031	0.018	0.068
	(0.013)				(0.037)			
	[0.000]				[0.273]			
7. Skill downgrading	0.071	0.064	0.039	0.129	0.010	0.007	0.004	0.016
	(0.012)				(0.034)			
	[0.000]				[0.771]			
8. Sorting (sectors)	0.097	0.088	0.053	0.176	0.071	0.050	0.029	0.111
	(0.012)				(0.035)			
	[0.000]				[0.073]			
9. Sorting (geographic)	0.101	0.091	0.055	0.182	0.034	0.024	0.014	0.054
	(0.015)				(0.040)			
	[0.000]				[0.409]			

Notes: The table shows the elasticity of relative human capital with respect to GDP per capita θ_Q (standard errors in parentheses, p-values in brackets) and its ratio with respect to the elasticity of relative skill efficiency θ_{AQ}. Each row reports results from a different methodology (as indicated by the row titles) to estimate the relative human capital endowment of high-skill labor.