Work and Play

International Evidence of Gender Equality in Employment and Sports

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This article demonstrates a link between an economic and social feature of countries, the relative labor force participation rate of women, and a high-profile characteristic, the performance of women in international sports competitions. The relative labor force participation rate of women was a significant determinant of the number and type of medals won by a country's women in the 2000 Sydney Summer Olympics as well as the likelihood of qualifying for the 1999 Women's Soccer World Cup and performance in that competition. Thus, societies in which women have greater economic opportunities are ones that enable athletically talented women to reach their full potential.

Keywords: *gender equality; sports; labor force participation; Olympics*

What can a country's performances in international sporting events like the Olympics or the World Cup teach us about its society? When all else is equal, world-class competitors are more likely to come from more populous countries because these nations represent larger pools of potential talent. A higher percentage of a country's population has the opportunity to develop their athletic talent in richer countries where people are healthier, the young are less likely to be engaged in work, and more resources are devoted to leisure activities including sports. A number of studies have shown that in fact population and per capita income are significant determinants of Olympic success.[1]

The analysis in this article demonstrates that another key characteristic of a country, one not studied in any previous research on this topic, is related to the achievements of its citizens in international athletic competitions. The performance of a country's women in international sporting events is related to the economic

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opportunities afforded them as measured by the ratio of the labor force participation rate of women to the labor force participation rate of men. This result is consistently obtained in regressions in which we control for population and per capita income as well as for the athletic success of a country's men, a variable that can capture a range of unobservable factors that reflect a country's commitment to sports. Furthermore, this result is not merely reflecting the effect of the role of women in a country's government or fertility rate as it relates to success in international athletic competition, even though each explains to some extent the success of women in international athletic competitions. Also, estimates of the effect of relative labor force participation on success in international athletic competitions are not much changed when we instrument for relative labor force participation rates using the generalized least squares method discussed by Newey (1987). Thus, these results suggest that the participation of women in a country's labor force is an important reflection of their opportunities in other areas of society as well.

These results are based on evidence from the Sydney Summer Olympics in 2000 and the Women's Soccer World Cup in 1999.[2] We conduct a variety of tests, including ones on the number and type of Olympic medals earned, the likelihood of qualifying for the World Cup, and the number of points earned in World Cup competition. These competitions are well suited for our analysis because they include a much wider pool of countries than other international sporting events, like Wimbledon or the Winter Olympics, in which competitors are typically drawn from a narrow set of industrial countries.

The relationship between the ratio of labor force participation rates and the number of Olympic medals won can be sizeable. For example, our estimates suggest that women from a country at the 75th percentile of this variable won over two medals more than their sisters who hail from a country at the 25th percentile, controlling for the factors discussed above. To illustrate this, we note that Canadian women won seven medals in Sydney whereas Spanish women won four. The main difference between these countries is not income, population, or the number of medals won by men from the respective countries, but the fact that Canada is at the 75th percentile of the ratio of labor force participation rates of women relative to men, whereas Spain is at the 25th percentile.

In the next section of this article, we describe both our main measure of women's relative integration in the labor force, the ratio of labor force participation rates, and our cross-country indicators of women's international athletic performance. We also provide some statistics on both of these variables and their relationship in this section. We then present a more complete analysis of the relationship between the performance of a country's women in the 2000 Sydney Summer Olympics and its ratio of labor force participation rates. This is followed by a similar analysis using data from the 1999 Women's World Cup. The last section offers some concluding comments.

LABOR FORCE PARTICIPATION AND ATHLETIC PERFORMANCE: A FIRST LOOK

The central idea of this article is that cross-country evidence of women's performance in international athletic competition reflects differences among countries in women's economic opportunities as manifested by their relative rates of participation in a nation's labor market.[3] In this section, we describe the main sets of variables used to test this hypothesis and present some initial statistics on the relationship between women's presence in the labor market and their performance in international athletic competition.

Labor Market Participation

In a survey article on women's labor force participation and economic development, Kristin Mammen and Christina Paxson (2000) write, "Women's labor force status relative to that of men is an important benchmark of their status in society" (p. 141). *World Bank Development Indicators 2001* echoes this idea with the text accompanying the table presenting the ratio of labor force participation rates of women relative to that of men, which reads, "Girls in many developing countries are allowed less education than boys are—a disparity reflected in lower female primary enrollment and higher female illiteracy. As a result, women have fewer employment opportunities, especially in the formal sector" (p. 23).

In this article, we use the 1999 value of the ratio of labor force participation rates (which we call *LaborRatio*) as an indicator of women's economic opportunities in a country in that year. This ratio represents the rate of economically active women relative to the rate of economically active men.[4] The distribution of this variable is depicted in the histogram in Figure 1. This histogram reflects the fact that 52 countries, representing about one third of the sample, had a value of LaborRatio between 0.22 and 0.62. Another 60% of the sample, representing 85 countries, had a value of LaborRatio between 0.62 and 0.91; and the remaining 9 countries, with a value of LaborRatio greater than 0.91, were all countries with levels of income per capita of less than $800 in 1999. We note that *World Development Indicators 2001* (International Bank for Reconstruction and Development, 2001) includes the remark that a value of unity of LaborRatio indicates gender equality. But only 2 of the 146 countries in this sample, Cambodia and Ghana, have values of LaborRatio equal to or greater than 1.[5]

Although the 10 countries with the highest values of the ratio of labor force participation rates all had low levels of income per capita, the 26 countries in the sample with a value of LaborRatio below 0.52 (the value for Ireland) all had levels of income per capita below $8,100, and 20 of these countries had a level of income per capita below $2,800. Mammen and Paxson (2000) show that among countries there

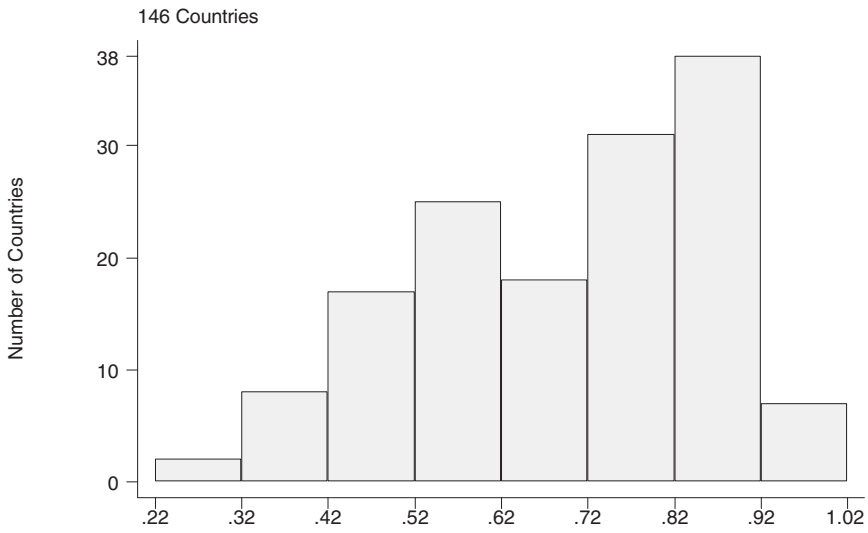

Figure 1: Distribution of Relative Labor Ratio

is a U-shaped relationship between the rate of women participating in the labor force and the logarithm of income per capita. A similar relationship holds for LaborRatio and the logarithm of income per capita in our sample of 146 countries, a fact that we use in our instrumental variable estimation.[6]

Performance in International Athletic Events

One criterion in the choice of indicators used in this article to measure national athletic performance is to select variables that allow for the widest possible set of countries in our data set. Therefore, we use the results of the Summer Olympics and the Women's World Cup. We use two variables reflecting the outcomes of the 2000 Sydney Olympics and two variables indicating performance in the 1999 Women's World Cup. The two Olympic variables are *Medals*, which is the number of Olympic medals won by women; and *MedalPoints*, a point-weighted measure of the number of Olympic medals won by women by which a gold medal counts as 3 points, a silver medal as 2 points, and a bronze medal as 1 point.[7] The two measures reflecting the outcome of the 1999 Women's World Cup competition are *Cup99*, a dummy variable that takes the value of 1 if a country qualified for the 1999 Women's World Cup and otherwise equals 0; and *Cup99Points*, a variable that adds

TABLE 1: Labor Ratio Quartiles and Women's Athletic Performance Measures: Measures of Athletic Success by Quartiles of LaborRatio

2000 Sydney Summer Olympics			*1999 Women's World Cup*		
Quartile (n = 149)	*Medals*	*MedalPoints*	*Quartile (n = 54)*	*Cup99*	*Cup99Points*
I (0.22 < LaborRatio ≤ 0.56)	14	21	I (0.38 < LaborRatio ≤ 0.54)	2	15
II (0.56 < LaborRatio ≤ 0.73)	100	190	II (0.54 < LaborRatio ≤ 0.67)	2	13
III (0.73 < LaborRatio ≤ 0.84)	138	273	III (0.67 < LaborRatio ≤ 0.82)	5	39
IV (0.84 < LaborRatio ≤ 1.01)	108	230	IV (0.82 < LaborRatio ≤ 1.01)	7	57

to the values of Cup99 (for the 16 countries that qualified for the Women's World Cup) the number of points earned in competition, by which a win is worth 3 points, a draw is worth 1 point, and a loss is worth 0 points.[8]

Some initial statistics showing the relationship between LaborRatio and each of the four measures of international athletic performance are presented in Table 1. Each row of this table represents the sum of the values of Medals, MedalPoints, Cup99, and Cup99Points for the set of countries in one of the quartiles of LaborRatio. Note that the values of LaborRatio that define the quartiles differ somewhat between the 146 countries that competed in the Sydney Summer Olympics for which we have complete data and the 54 countries that were involved in the 1999 Women's World Cup competition for which we have complete data.[9]

Medals were awarded to women from 59 different countries at the 2000 Summer Olympics in Sydney. We have data on labor force participation rates and other regressors used in our subsequent analysis for 55 of these countries, as well as for 91 other countries whose women participated in Sydney but did not win any medals.[10] Table 1 shows that the countries that had values of LaborRatio in the lowest quartile (that is, between 0.22 and 0.56) won about one seventh the number of medals of the countries in the next highest quartile (which had values of LaborRatio between 0.56 and 0.73), about one tenth the number of medals won by countries in the third quartile (which had values of LaborRatio between 0.73 and 0.84), and about one eighth the number of medals won by countries in the highest quartile (which had values of LaborRatio between 0.84 and 1.01). The disparity among quartiles in the sum of the values of MedalPoints is even more pronounced, especially when comparing the lowest quartile to the two highest quartiles. One reflection of this is that women from countries in the lowest quartile won 2 gold medals whereas women from countries in the third quartile won 48 gold medals and women from countries in the highest quartile won 41 gold medals.

The relative shortfall in performance among countries in the lowest quartile of LaborRatio is also apparent in the two variables related to the 1999 Women's World Cup. Only two countries in the lowest quartile of this set of 54 countries (Brazil, the country at the 25th percentile in terms of the value of LaborRatio, and Mexico) and

two countries in the second quartile (Nigeria and Italy) qualified for the competition in 1999, with the other 12 teams that qualified coming from countries with values of LaborRatio above the median value of 0.67. Teams from countries in the highest quartile collectively earned the most points. This reflects the fact that more teams came from this quartile than from any of the lower ones as well as the fact that the average number of points earned by a team from this quartile was larger than the average number of points earned by a team from any of the lower quartiles.

The U-shaped relationship between LaborRatio and income per capita suggests that the set of countries in the quartile with the highest values of LaborRatio is drawn from both the richest and the poorest countries in the sample. The patterns presented in Table 1 are all the more striking because they do not control for per capita income, a variable that has been shown to be an important determinant of the success of a country's athletes in the Summer Olympics in previous research. In the next section, we investigate the effect of LaborRatio on the success of a country's women in the Summer Olympics, controlling for income per capita as well as other factors.

LABOR FORCE PARTICIPATION AND OLYMPIC SUCCESS

The Summer Olympics draws participants from more countries than any other single athletic event. The athletes at the 2000 Sydney Summer Olympics represented 199 countries and territories. Women represented 38% of the 10,651 athletes at the Sydney Games. Out of the 290 events at the 2000 Summer Olympics, 118 (41%) were exclusively for women.

The success of a country's women at the Summer Olympics can be explained by a number of factors. The focus of this article is on whether this success reflects the relative economic opportunities of women in a country's labor market as indicated by its value of LaborRatio, and our empirical specifications include this variable. We also include as a regressor the number of medals won by a country's men in the Olympics. This variable helps to control for a range of unobserved factors that reflect the overall commitment of a country to Olympic sports.

Two other variables that have been shown in the research cited above to be important determinants of the overall success of a country's athletes at the Summer Olympics are also included in the regressions; the logarithm of a country's population between the ages of 15 and 64 in 1999 (*lnPop*), which reflects the size of the initial pool of talent from which elite athletes are drawn; and the logarithm of a country's income per capita in 1999 (*lnGDPcap*), which is likely associated with the overall physical well-being of the country's population as well as the resources devoted to athletic pursuits.[11]

We also include two other variables in the regression to address the possible concern that our measure of the integration of women in the work force, LaborRatio, is serving as a proxy for other features of a country. Those countries that have a higher

proportion of women in the labor force may also have a greater presence of women in the government. In this case, it may be that a higher representation of women in government is associated with greater support of women's athletics and this, in turn, contributes to the performance of a country's women in the Summer Olympics. Therefore, we include in the regressions a variable representing the percentage of women in all levels of a country's government, *WomenGov*.[12] In addition, we may suspect that a higher relative labor force participation rate reflects a lower fertility rate, which means that more young women have the opportunity to participate in sports rather than raise children, and this could also contribute to the success of a country's women at the Olympics. Therefore, we also include in the regressions the fertility rate of women in a country, *Fertility*.[13]

Each regression presented in Table 2 also includes three dummy variables. One dummy variable is for the host nation, Australia, to discern whether there is a "home-country advantage" over and above the effect of any of the other regressors. Two other dummy variables, one denoting countries that were members of the former Soviet Union and the other denoting other countries in Eastern Europe, were introduced to explore whether these sets of countries earned more medals or medal points than would be expected given the value of the other relevant explanatory variables.[14]

Table 2 includes four sets of estimates. Each set consists of a standard Tobit regression (in an odd-numbered column) followed by a Tobit regression in which LaborRatio is treated as an endogenous explanatory variable (in the succeeding even-numbered column). All regressions include the same set of regressors but for the variable representing men's Olympic success. The regressions in which the regressand is the number of medals won by women (in columns 1, 2, 5, 6, 7, and 8) include, as a regressor, the number of medals won by men in the respective countries (*MedalsMen*); whereas the regressions in columns 3 and 4, in which the regressand is the number of points earned by women in the Olympics (MedalPoints, which is defined above), include the regressor of the number of points won by men from the respective countries (*MedalPtsMen*). Each regression is run on the same set of 146 countries for which we have complete data on all the regressors.

The Tobit regression in column 1 shows that LaborRatio is a significant (at better than the 98% level of confidence) determinant of the number of medals won by women in the 2000 Sydney Summer Olympics. The point estimate of 8.32 suggests that women from a country at the 75th percentile of LaborRatio earned 2.33 more medals than their sisters from a country at the 25th percentile solely by virtue of the difference in the relative labor force participation rates (because $2.33 = 8.32 \times [0.84–0.56]$). This is a notable amount because there were 19 countries whose women won only 1 medal and another 25 countries whose women won between 2 and 10 medals. This is also comparable to the ceteris paribus effects of population and fertility rates, two other variables whose coefficients are estimated with precision in the regression reported in column 1. The differences between the estimated

TABLE 2: Women's Olympic Performance

	Number of Medals on by Women				*Medal Points Earned by Women*				*Number of Medals Won by Women in Individual Events*				*Number of Medals Won by Women in Team Events*			
Regression No.	*1*		*2: IV*		*3*		*4:IV*		*5*		*6:IV*		*7*		*8:IV*	
Variable	β	*s.e.*	β	*s.e.*	β	*s.e.*	β	*s.e.*	β	*s.e.*	β	*s.e.*	β	*s.e.*	β	*s.e.*
LaborRatio	**8.33**	3.46	**8.48**	3.55	**15.51**	7.53	**15.91**	7.74	**6.40**	2.63	**6.38**	2.70	*5.34*	3.22	*5.61*	3.31
lnGDPcap	0.09	0.51	0.09	0.51	–0.26	1.12	–0.24	1.12	0.05	0.39	0.05	0.39	0.48	0.41	0.47	0.42
lnPop	**1.80**	0.41	**1.78**	0.41	**3.46**	0.90	**3.41**	0.89	**1.34**	0.31	**1.32**	0.31	**0.79**	0.32	**0.79**	0.32
MedalsMen	**0.57**	0.06	**0.57**	0.06					**0.39**	0.05	**0.39**	0.05	**0.19**	0.04	**0.18**	0.04
MedalPtsMen					**0.61**	0.07	**0.61**	0.07								
WomenGov	0.08	0.07	0.08	0.07	0.17	0.16	0.16	0.16	0.04	0.06	0.04	0.06	0.04	0.05	0.03	0.06
Fertility	**–1.67**	0.63	**–1.64**	0.64	**–3.73**	1.36	**–3.68**	1.39	**–1.30**	0.47	**–1.27**	0.48	–1.15	0.77	–1.13	0.79
Australia	–0.52	4.35	–0.55	4.34	–0.40	9.45	–0.47	9.43	–3.45	3.35	–3.48	3.33	3.39	2.50	3.39	2.51
Former USSR	–2.48	1.98	–2.48	1.97	–4.57	4.26	–4.59	4.25	–1.85	1.51	–1.84	1.50	–2.20	1.43	–0.26	1.45
E. Europe	–1.01	1.80	–1.03	1.80	–1.88	3.92	–1.96	3.92	–0.79	1.38	–0.79	1.38	–0.11	1.29	–0.18	1.31
Pseudo R^2	0.34				0.28				0.34				0.41			

NOTE: All estimates include 146 observations. IV follows Newey (1987) with instruments LaborRatio79 and lnGDPcap.[2] Bold = significant at 95% level; italic = significant at 90% level.

numbers of medals won by women from a country at the 75th percentile and a country at the 25th percentile for these two variables are 3.33 for population and –4.84 for fertility.

There may be some concern that LaborRatio is measured with error or, to the extent that it serves as a proxy for broader social and economic forces, it is an imperfect measure of these forces. Therefore, we also include *instrumental variables* Tobit estimates that use the *generalized least squares* approach suggested by Newey (1987).[15] These estimates treat LaborRatio as an endogenous variable by using the 1979 value of relative labor force participation rates, *LaborRatio79*, and the squared value of the logarithm of income per capita, $lnGDPcap^2$, as instruments. These are attractive instruments because both are likely correlated with LaborRatio, the correlation between LaborRatio and LaborRatio79 in our sample is 0.94, and the work of Mammen and Paxson (2000) suggests the importance of a quadratic as well as a linear term in a regression of the logarithm of per capita gross domestic product (GDP) on female labor force participation rates (see also notes 6 and 13). Also, this higher order term for the logarithm of GDP may reasonably be expected not to matter for performance in the Olympics (there is no reason to expect a nonmonotonic relationship between income per capita and Olympic performance), and LaborRatio79 is unlikely to be correlated with the error term of a regression of Olympic success that already includes LaborRatio as a regressor.

The IV Tobit estimate presented in column 2, which takes the same specification as the standard Tobit estimate presented in column 1, offers a result that is found throughout Table 2; the coefficients on LaborRatio and their associated *p* values in the standard Tobit estimates are very close to the respective coefficients and *p* values in the corresponding IV Tobit estimates. The coefficient on LaborRatio in the IV Tobit estimate in column 2 is larger than the coefficient on LaborRatio in the standard Tobit in column 1, but only by about 2%. Also, the *p* value of 0.017 for the coefficient on LaborRatio in column 2 is the same as the *p* value for the coefficient on LaborRatio in the standard Tobit of column 1.

Columns 3 and 4 of Table 2 present estimates that demonstrate the effect of LaborRatio on the medal points earned by women. The estimated coefficient on LaborRatio of 15.51 in the Tobit regression reported in column 3 has a *p* value of 0.041, whereas the coefficient in the IV Tobit regression reported in column 4, which is about 2.5% larger than the coefficient reported in column 3, has a *p* value of 0.040. The standard Tobit estimates suggest that women from a country that has a value of LaborRatio at the 75th percentile value will earn about 4.3 more medal points than women from a country at the 25th percentile value when these two countries are otherwise identical along the dimensions captured by the variables in the regression.[16]

Finally, we investigated whether the effect of LaborRatio on the number of medals won by women differs among team and individual events. There were 260 medals awarded for individual events to women from the 146 countries included in our data set, and 100 medals were awarded to teams that included women. The last four

columns of Table 2 present standard Tobit and IV Tobit regressions in which the dependent variable is either the number of medals won by women in individual events (in columns 5 and 6) or the number of medals won by teams that included women (in columns 7 and 8). These results suggest that there is a larger effect of LaborRatio on the number of medals won by women in individual events than on the number of medals won by women in team events and that this effect is more statistically significant in individual events than in team events. The coefficient on LaborRatio in the regression on the number of medals won by women in individual events reported in column 5 has a p value of 0.017, whereas the coefficient on LaborRatio in the regression on the number of medals won by women in team events reported in column 7 has a p value of 0.099. The p values for the coefficients on LaborRatio in the associated IV Tobit regressions are very close to these values, 0.018 and 0.090, respectively.

We next turn to an analysis of relative labor force participation rates on the outcome of an event that includes only team competition, the Women's Soccer World Cup.

LABOR FORCE PARTICIPATION AND THE WOMEN'S WORLD CUP

As with many other team sports, recent years have seen an increase in women's participation in soccer. One reflection of this was the institution of the Women's World Cup in 1992. In the run-up to the third Women's World Cup, which was held in the United States in 1999, national teams from 59 countries and territories competed for the 15 available slots in the competition.[17]

In this section, we demonstrate that the relative labor force participation rate is a significant determinant of both the likelihood of a women's national soccer team qualifying for one of the available slots in the Women's World Cup competition in 1999 and the performance of those 16 teams that participated in the World Cup. This effect holds while controlling for factors similar to those that determine the success of a country's women in the Olympics, including population and income per capita. In addition, we may think that some countries are more devoted to soccer than others, so we also include as a regressor a dummy variable indicating whether a country's men's soccer team qualified for the 1998 World Cup (*Cup98Men*). We also include WomenGov and Fertility as regressors for reasons discussed above. Finally, in the Tobit regressions, we include a dummy variable for the host country, the United States, to test for a home-country advantage.[18]

The first two columns of Table 3 present probit estimates of the likelihood of a country's team qualifying for the 1999 Women's World Cup. The countries included in the analysis include those that competed for a slot in the World Cup and for which we have complete data. The United States, which automatically qualified for a slot, is not included in the estimates in columns 1 and 2. The estimates also do not include North Korea, a country that did qualify for the 1999 Women's World

TABLE 3: Women's World Cup

	Probability of Qualifying for the World Cup (USA Excluded): Probit Analysis				*Points Earned in World Cup: Tobit Analysis*			
Regression No.	*1*		*2: IV*		*3*		*4: IV*	
Variable	β	*s.e.*	β	*s.e.*	β	*s.e.*	β	*s.e.*
LaborRatio	**6.70**	2.55	**7.50**	2.98	**51.63**	14.28	**55.61**	16.67
lnGDPcap	0.37	0.36	0.32	0.43	–1.08	2.14	–1.40	2.21
lnPop	**0.91**	0.28	**0.93**	0.32	**6.26**	1.66	**6.49**	1.74
Cup98Men	0.88	0.66	1.15	0.95	**12.51**	4.71	**13.64**	5.28
WomenGov	*0.06*	0.03	0.07	0.05	**0.76**	0.26	**0.80**	0.28
Fertility	0.41	0.45	0.39	0.53	–0.69	2.69	–0.87	2.69
USA					–11.41	10.74	–13.28	11.54
Pseudo R^2	0.43		0.44		0.27			
No. of obs.	51		51		52		52	

NOTE: IV follows Newey (1987) and instruments include LaborRatio79 and lnGDPcap.^{2} Bold = significant at 95% level; italic = significant at 90% level.

Cup, because there are no available data on its income per capita or on the proportion of women in its government.[19]

The regression result presented in column 1 shows that LaborRatio is a significant determinant of the likelihood of a country's team qualifying for the Women's World Cup Competition in 1999, with a *p* value of 0.009. In addition, the *p* values of the coefficients on lnPop and WomenGov are 0.001 and 0.066, respectively; none of the other *p* values are less than 0.10. Column 2 presents the results of an Instrumental Variables probit regression, again using the technique suggested by Newey (1987) and the variables lnGDPcap^2 and LaborRatio79 as instruments. The coefficient on LaborRatio is actually larger in this equation than in the standard probit result in column 1, and its *p* value is slightly larger (0.012). The pattern of significance of the coefficients on the other variables also matches that of the results in column 1 except for the lack of significance of WomenGov.[20]

Columns 3 and 4 of Table 3 present Tobit estimates in which the dependent variable is Cup99Points (which represents 1 + the number of points earned in World Cup Competition, as discussed above).[21] LaborRatio is a significant determinant of this variable. The *p* value of the coefficient on LaborRatio is 0.001 in both the standard Tobit and the Instrumental Variables Tobit estimates.

To illustrate the effect of LaborRatio on the number of points earned in World Cup competition by the 16 teams involved in that competition, we regress the number of points won by a team that participated in the World Cup (i.e., *CP* = Cup99Points–1) against LaborRatio, Cup98Men, lnPop, and Fertility, dropping

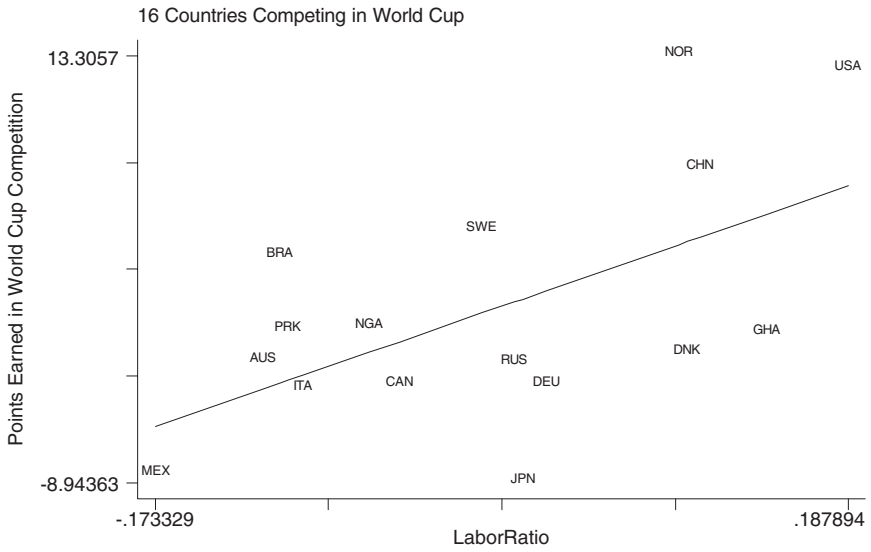

Figure 2: LaborRatio and Points in 1999 Women's World Cup

lnGDPcap and WomenGov as regressors because data on these variables are not available for North Korea. The estimated relationship is

$$CP = \mathbf{-81.95}\ (23.49) + \mathbf{34.82}\ (14.81)\ \text{LaborRatio} + 7.60\ (4.43)\ \text{Cup98Men} + \mathbf{3.35}\ (1.16)\ \text{lnPop} + 0.03\ (1.22)\ \text{Fertility}$$

where robust standard errors appear in parentheses to the right of the coefficient values, and coefficients printed in bold are significant at better than the 95% level of confidence. The R^2 of this regression is 0.50. Figure 2 presents a visual depiction of the ceteris paribus effect of LaborRatio on the number of points earned in the 1999 Women's World Cup with a partial regression leverage plot of this relationship.[22]

The pattern of significance of the other variables included in the Tobit regressions in Table 3 bears mention. There is a significant effect of Cup98Men in the Tobit regressions, with p values of 0.011 and 0.010 for the coefficients reported in columns 3 and 4, respectively. The significance of this variable is less pronounced in the probit regressions. Population is a significant in all specifications reported in Table 3, with a p value of 0.004 or less in all cases. The coefficient on WomenGov is significant at the 93% level of confidence in the probit regression reported in Column 1 and at better than the 99% level of confidence in the regressions reported in

columns 3 and 4. None of the estimates in Table 3 includes a significant effect of Fertility. Interestingly, the estimates in columns 7 and 8 in Table 2, in which the regressand is the number of medals won in team events, are the only ones in that table in which Fertility is not significant. Perhaps this is linked to the fact that the average age of women in individual sports, like swimming or gymnastics, is lower than the average age of women in team sports.

CONCLUSION

This article demonstrates a link between an economic and social feature of countries, the relative labor force participation rate of women, and a high-profile characteristic, the performance of women in international sports competitions. Countries in which women participate more fully in the labor force tend to be ones whose women performed better in the Sydney Summer Olympics in 2000 and whose women's teams were more likely to qualify for the 1999 Women's World Cup and performed better in this event. This effect holds when controlling for factors shown, in other research, to determine national Olympic success, like income per capita and population. In addition to these variables, we also control for the athletic success of a country's men, the rate of participation of women in government, and the fertility rate.

These demonstrated statistical relationships between relative labor force participation and athletic success are silent as to causes. It is reasonable to conjecture, however, that societies in which women have greater economic opportunities are ones that enable athletically talented women to reach their full potential. In these societies, women are more likely to be able to succeed in both work and play.

APPENDIX

Definitions of Variables

LaborRatio: Female labor force activity rate (measured as % of female population ages 15-64) divided by male labor force activity rate (measured as % of male population ages 15-64), 1999 value

lnGDPcap: Per capita gross domestic product (GDP) in 1999, at PPP rates, in 1999 U.S. dollars

lnPop: Population aged 15-64 in 1999

WomenGov: Percentage of women in government at all levels, including elected heads of state and governors of central banks, in 1996

Fertility: Fertility rate

MedalsMen: Number of medals won by men from a country

MedalPtsMen: Number of medal points (gold = 3, silver = 2, and bronze = 1) won by men from a country

Cup99: 1 if country's team qualified for 1999 Women's Soccer World Cup, else 0
Cup99Pts: Cup99 + number of points won in 1999 Women's Soccer World Cup games, with win = 3 points, draw = 1 point, and loss = 0 points

Sources of Variables

Olympic medals: CBS SportsLine.com. See http://www.cbs.sportsline.com/u/olympics/2000/medaltracker/medalcount.htm and
http://www.slam.ca/2000GamesMedals/home.html
World Cup performance: Women's Soccer World Online. See www.womensoccer.com/wwcup99/wwcresults/wwcscores.html
Fertility rates: From *World Development Indicators 2001* CD-ROM*
GDP per capita: 1999 values, at PPP rates, in 1999 U.S. dollar values, from *World Development Indicators 2001* CD-ROM*
Population aged 15-64: In 1999, from *World Development Indicators 2001* CD-ROM
LaborRatio: 1999 values, female labor force activity rate (measured as % of female population ages 15-64) divided by male labor force activity rate (measured as % of male population ages 15-64), from *World Development Indicators 2001* CD-ROM.* Values for 1979, 1989, and 1994, mentioned in note 5, are also obtained from this source.
Women in government: Percentage of women in government at all levels, including elected heads of state and governors of central banks, 1996 value, from *Human Development Report 1999*** CD-ROM

* International Bank for Reconstruction and Development (2001).
** United Nations Development Programme (1999).

NOTES

1. Studies of the determinants of the success of a country's athletes at the Summer Olympics include the analyses of the 1964 games by Ball (1972), the 1972 games by Levine (1974) and by Grimes, Kelly, and Rubin (1974), a panel of 24 Summer Olympiads over the period 1896 to 2000 by Kuper and Sterken (2001a), a panel of the post–World War II Summer Olympic Games by Johnson and Ali (2000, 2002), and a panel of the Summer Olympic Games from 1960 to 1996 by Bernard and Busse (2000).

2. To my knowledge, there are no other studies of the economic and demographic determinants of the success of countries in either the Women's or Men's Soccer World Cup competition comparable to the ones on the determinants of success in Olympic competition.

3. It would be desirable to use in this analysis, in addition to the ratio of labor force participation rates, a variable that reflects the ratio of women's wages to men's wages, controlling for differences in human capital among the sexes, but there is no series like this available for a wide cross-section of countries.

4. The International Labor Organization defines the economically active population as all those who supply labor for the production of goods and services during a specified period, including both the employed and the unemployed.

5. The correlations between LaborRatio, which is calculated using 1999 values of the labor force participation rates, and the same ratios calculated with data for 1994, 1989, and 1979 are 0.997, 0.991, and 0.941, respectively, for the 146 countries used in the analysis of the Olympics. Results using LaborRatio are virtually identical to those obtained by replacing it with an average of the labor force participation rates in 1979, 1989, and 1999. As discussed below, some of the estimates we present use the 1979 value of LaborRatio, along with other variables, as an instrument for its 1999 value.

6. A regression of LaborRatio on the natural logarithm of income per capita, lnGDPcap, and its square, lnGDPcap2, for the 146 countries in our sample gives the result LaborRatio = 2.11–0.36

lnGDPcap + 0.02 lnGDPcap^2. The coefficients on both income and income squared are significant at better than the 99% level of confidence, and the R^2 of this regression is 0.13.

7. Grimes, Kelley, and Rubin (1974); Levine (1974); and Bernard and Busse (2000) do not distinguish among types of medals, whereas Ball (1972) also used weights of 3, 2, and 1 for gold, silver, and bronze. Johnson and Ali (2000) used an ordered probit model, and Kuper and Sterken (2001a) ran separate regressions for each type of medal. Although counting medals in most cases is straightforward, some clarification is worth noting. A team medal counts as one medal for a country. A medal in mixed-doubles badminton counts as a medal for a woman (there is no mixed doubles in Olympic tennis). In several events (especially judo), there were ties, and each medal was counted—for example, two bronze medals were awarded in women's extra lightweight class in judo, one to a Belgian woman and one to a German woman, and this was recorded as a bronze medal for each country.

8. This 3-1-0 point system is the one used in the World Cup to determine standings within each of the four groups in the initial round of play.

9. The 54 countries used in the analysis of the World Cup represent 53 countries that attempted to qualify for World Cup plus the United States that, by virtue of being the host country, was automatically awarded one of the 16 qualifying slots. As discussed below, six other countries that competed in the World Cup qualifying rounds (but not the World Cup itself) could not be included in our analysis because of missing data.

10. The four countries whose women won medals but for which we do not have complete data are Cuba (seven medals), North Korea (two medals), Taiwan (four medals), and Yugoslavia (one medal).

11. See the appendix for a discussion of the variables used in the analysis.

12. The results reported below concerning the effect of LaborRatio on athletic success are virtually identical to those obtained when we use either of two alternatives to WomenGov: the percentage of women in ministerial-level positions or the percentage of women in subministerial positions.

13. Augmenting the regression on LaborRatio presented in note 6 with WomenGov and Fertility, we get LaborRatio = 2.87–0.50 lnGDPcap + 0.03 lnGDPcap^2 + 0.004 WomenGov–0.04 Fertility. All the coefficients in this equation are significant at better than the 95% level of confidence, and the R^2 is 0.22.

14. Grimes, Kelly, and Rubin (1974); Bernard and Busse (2000); Johnson and Ali (2000); and Kuper and Sterken (2001a) control for membership in the former Soviet bloc and whether a country is hosting the games. The Eastern European countries in the data set include Albania, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Slovak Republic, and Slovenia. The countries that were members of the former Soviet Union include Belarus, Estonia, Georgia, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Russian Federation, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

15. This technique can be used for a range of limited dependent variable estimators, including Tobit and probit. Generalized least squares is applied to estimates of reduced form coefficients that are obtained by using reduced form residuals as additional explanatory variables. Newey (1987) shows that this yields more efficient estimators than a two-stage procedure in which least squares estimators are used to generate instrumental variables.

16. The comparable estimates for the differences between the estimated numbers of medal points won by women from a country at the 75th percentile and a country at the 25th percentile of population and fertility rates, two other variables whose coefficients are estimated precisely, are 6.4 and 10.8, respectively.

17. The United States, as host country, was automatically awarded one slot.

18. We do not include a dummy variable for the four former Soviet Union countries that competed for a slot in the World Cup. No former Warsaw Pact Eastern European Countries were among the 60 countries that competed in the World Cup. In a regression similar to that in column 1 of Table 3 but that also included a dummy variable for countries that were in the former Soviet Union, the coefficient on this dummy variable is insignificant, and the pattern of significance of the other variables is the same as the regression reported in column 1.

19. Six other countries and territories that competed in tournaments to qualify could not be included because of a lack of data on population. These include Guam, Taiwan, Martinique, Puerto Rico, Tonga,

and Western Samoa. Hong Kong does not have data on the percentage of women in government, so it is not included in the regressions either.

20. A regression that does not include the variables WomenGov and lnGDPcap will admit two additional observations, that of North Korea and Hong Kong. In this case, the coefficient on LaborRatio is 5.80, with a *p* value of 0.002.

21. Adding 1 to the number of points earned in World Cup competition enables us to distinguish between Mexico and Denmark, two countries whose teams qualified for the World Cup but lost all their games, and other countries whose teams did not qualify for the World Cup.

22. These countries (and their three-letter codes used in Figure 3) included Australia (AUS), Brazil (BRA), Canada (CAN), China (CHN), Denmark (DNK), Germany (DEU), Ghana (GHA), Italy (ITA), Japan (JPN), North Korea (PRK), Mexico (MEX), Nigeria (NGA), Norway (NOR), the Russian Federation (RUS), Sweden (SWE), and the United States (USA).

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