Sport Participation and Migration

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Abstract: We extend an economic model of human capital investment to participation in sport – in the form of training, conditioning and physical development – and explore the implications of this form of human capital investment. The model predicts that the level of sport specific training undertaken will fall short of the socially optimum level, under certain conditions, providing an economic rationale for government subsidies of sport. Introducing the possibility of migration into the model, motivated by the potential for individuals who have invested in sports specific training to migrate from developing or transitional economies to developed economies, produces a similar effect as subsidies. We illustrate the applicability of the model with a discussion of participation in youth ice hockey in the Czech Republic under two different migration regimes.

Keywords: Migration; sport participation; human capital investment; social welfare; sport subsidies.

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1 Introduction

A considerable amount of anecdotal evidence suggests an important link between sports participation and migration. In North America, most professional sports leagues contain a large and increasing number of foreign-born players. Jaromir Jagr, and many other players from Central and Eastern Europe play in the National Hockey League, many European players – as well as Chinese center Yao Ming – play in the National Basketball Association, and Major League Baseball team rosters contain numerous players who were born and raised in Central America, the Caribbean, Asia, and Australia. In Europe, professional football sides often contain players from sub-Saharan Africa and South America. These elite players were born, raised, and learned to play their respective sports in developing or transitional economies; they represent the most talented members of the pool of athletes in their home countries and their international success exerts considerable influence on the decision to participate in sports in their home countries.

Both partial and general equilibrium models of migration stress the role of relative wages in migration decisions. Mobile workers with portable skills tend to move from countries with low relative real earnings to countries with high relative real earnings. This concept can be readily extended to athletes, sports participation, and migration. Poor children in the slums of Rio or Buenos Aires learn to play football in hopes of one day realizing the earnings and fame of Pele or Maradona; teens in the Czech Republic hone their ice hockey skills in order to play in the National Hockey League in the future and earn as much money as Jagr or Hašek; youths in the Dominican Republic play baseball from sunup to sundown so that they can be the next Pedro Martinez or Manny Ramirez. In all cases, the earnings of professional athletes playing in sports leagues in north America or western Europe exceeds by far the earnings of professional athletes in developing or transitional economies, and the decision to migrate in order to play sports professionally is analogous to the decision of any other worker to migrate to a country with higher wages.

In this paper, we examine the relationship between participation in sports and migration. Our basic approach treats participation in sport as a specialized form of human capital. Learning to play a sport – a process we call *sport specific training* – requires both mental and physical skills that take time, effort, instruction, repetition and experience to acquire. When not actively used, sport specific training depreciates.

In this way, sport specific training is similar to human capital in terms of the participation or acquisition decision and the effect on migration.

Treating participation in athletics as a form of human capital makes the decision to participate in sports an economic decision; it also provides a link between this research and the large literature on the "brain drain" – the migration of skilled workers from developing and transitional economies to developed economies – and provides a broader economic setting for examining the role of sports participation in the economy. A great deal of debate in the brain drain literature has focused on the economic effects of the migration of highly skilled workers on the home country. If the possibility of future migration leads to increased human capital investment in a developing or transitional economy, then the net effect of the brain drain could be positive because some of the educated workers do not migrate; if the possibility of migration leads only to an exodus of skilled workers and no additional human capital investment, then the net effect of the brain drain is negative in the home country.

A similar story applies to sport specific training in this paper. We treat sport specific training like human capital, in that we assume that sport specific training, like human capital, enhances the ability of an economy to produce real output. Support for this assumption can be found in the economics literature. Carroll and Humphreys (2000) point out that the economic justification for Title IX of the Educational Amendments of 1972 is based on the idea that the lack of access to participation in athletics lead to economic harm to females in the United States. Willis (2000) describes a link between youth sports programs and economic development in developing countries in Sub-Saharan Africa. In addition, participation in sports has been linked to improved health and well being that contribute to the productivity of workers and thus to the ability of an economy to produce real output. Thus the relationship between the possibility of migration and participation in sports in developing and transitional economies can also be linked to the long run growth and standard of living in an economy.

2 Sport Specific Training

Participating in sport provides opportunities for individuals to invest in a specific form of human capital – referred to here as sport specific training – in order to realize higher earnings, have access to other pecuniary benefits through a future career in sports, and enjoy other non-pecuniary benefits like improved health and well being. In this sense, sport specific training exhibits many properties similar to the common notion of *human capital*. Standard models of human capital accumulation, as in Mincer (1958) and Becker (1962), investigate the determinants and implications of the stock of human capital and the underlying investment flow into human capital. Here, we build on models of human capital accumulation in the presence of a work-related migration option to enhance our understanding of the economics of sports, the process of human capital investment, and the relationship between sport participation and other economic behavior. We extend the model of human capital investment with a work related migration option developed by Stark and Wang (2002) to to the case of investment in sport specific training.

The acquisition of sport specific training is costly. The costs of acquiring sport specific training include both direct costs and opportunity costs arising from the time required to invest in sport specific training. Participation in any sport requires physical conditioning that takes time and may also be physically demanding. All sports require coaching, and coaches typically charge fees. In order to improve, athletes often must seek out better and better coaches and these coaches may charge more for their services. Many sports require specialized equipment and facilities that also must be paid for by the athlete. Finally, many athletes must travel, sometimes internationally, in order to compete at the highest level. Travel costs, including transportation, room and board is also costly.

Sport specific training, like human capital, also depreciates. Sport specific training can depreciate because the athlete reduces her physical conditioning, because she spends less time practicing the fundamentals of the sport, or because she does not participate in enough contests. In all cases, the ability of the athlete will deteriorate due to the depreciation of sport specific training. An athlete's stock of sport specific training can also depreciate due to age and injury.

Finally, note that sport specific training can be distinguished from other types of human capital like education and on-the-job training. Education is primarily a mental activity, and although physical education is part of the curriculum at many schools, this is a basic level of physical conditioning and not geared toward specialization in any specific sport. On-the-job training is a specialized form of human capital that is focused on the production of some specific good or service and directly related to some business firm.

3 A Model Of Investment In Training

Consider an economy with no possibility of migration. This economy produces a single commodity and the price of this commodity is normalized to one; the production of this single commodity requires only labour inputs. The economy has N identical workers who have the option of investing in human capital, and their stock of human capital is represented by (θ_h). Workers in this economy also have the opportunity to participate in some sport. In order to participate, individuals must first acquire some stock of sport specific training, represented by (θ_s).

Like human capital, the acquisition of sport specific training is costly. From the standpoint of individual participants the costs involve direct costs from fees and equipment and opportunity costs of time. We initially assume a linear specification for the cost of acquiring both human capital and sport specific training. What distinguished sports specific training from human capital acquisition is that sport specific training likely provides positive utility while education does not. The cost functions for acquiring human capital and sport specific training are

$$c_h(\theta_h) = k_h\theta_h \tag{1}$$

$$c_s(\theta_s) = k_s\theta_s \tag{2}$$

where θ_h is human capital and θ_s is sport specific training. These functions are twice differentiable and linear with cost parameters k_h and k_s.

The aggregate production function for the single commodity produced in this economy is

$$Q = Nf(\theta_h, \theta_s) \tag{3}$$

and associated with this aggregate production function is a per-worker production function for the single commodity

$$\begin{aligned} f(\theta_h, \theta_s) &= \alpha_h ln(\theta_h + 1) + \eta_h ln(\overline{\theta}_h + 1) \\ &+\alpha_s ln(\theta_s + 1) + \eta_s ln(\overline{\theta}_s + 1) \end{aligned} \tag{4}$$

where $\alpha_h > k_h$, $\alpha_s > k_s$, $\eta_h > 0$ and $\eta_s > 0$ are constants. $\overline{\theta}_h$ is the economy-wide average level of human capital and $\overline{\theta}_s$ is the average level of sport specific training among all sports participants in the economy.

Sport specific training differs in several important ways from intellectual human capital. Human capital models usually assume that entire population undertakes some amount of human capital investment. Here, only a subset of the population undertakes investment in sport specific training. Initially, we assume that the proportion of population investing in sport specific training is exogenously given and fixed. In later research we plan to drop this strict assumption and make the proportion depend on country specific conditions (summarized by a production function) like physical dispositions for certain sports, differences in preferences, or historically given factors.

In equation (4), η_h represents the positive impact of externalities accruing to society from aggregate human capital investment. These externalities arise because human capital accumulation makes both individual workers and their colleagues more productive. η_s represents the externalities accruing to society from aggregate sport specific training. These sport-related externalities can be motivated in two ways. These might arise because sport specific training enhances the ability of individuals to work together in groups. If the mental and physical skills and ability to work effectively with others toward a common goal acquired as part of participation in sport can be applied to the production of the single commodity in this economy, then these externalities can be thought of a capturing such effects. Alternatively, the single commodity produced by the economy could be interpreted as “sport,” in which case human capital could be ignored without any loss of generality, as sport specific training would effectively fill the same role as human capital in this model. In either case, the presence of aggregate sport specific training in the economy makes both individual workers and their colleagues more productive.

Initially we consider only the amount of sport specific training acquired by individuals who have already decided to invest in sport specific training and human capital. By assumption, both human capital and sport specific training are supplied to the labour market inelastically. Workers acquire human capital and sport specific training instantaneously at the beginning of the single period of life and finance the acquisition of these stocks by borrowing at a zero rate of interest. In this way, we abstract from the decision of when and how quickly individuals acquire human capital and sport specific training. The decision to invest in sport specific training will be addressed in future research. Here we examine only the second step in the optimizing behavior of individuals who have already chosen an optimal amount of sport specific training $\theta_s > 0$. We also abstract from the decision to invest in human capital and focus only on sport specific training.

With only one input to production the gross wage is equal to output per worker. Gross earnings of sports participants, ignoring the effect of human capital, are given as

$$f(\theta_s) = \alpha_s \ln(\theta_s + 1) + \eta_s \ln(\overline{\theta}_s + 1) \tag{5}$$

where, again, θ_s is the total amount of efficiency units of sport specific training possessed by individual participants and $\overline{\theta_s}$ stands for average amount of θ_s among all sports participants in the country. In future research we intend to extend this model to include a positive *scale spillover* effect. There is no discounting and no uncertainty in equation (5). Individuals in this economy seek to maximize net earnings, defined as gross earnings minus the costs of acquiring sport specific training. Net earnings per worker can be expressed as

$$W(\theta_s) = \alpha_s \ln(\theta_s + 1) + \eta_s \ln(\overline{\theta}_s + 1) - k_s\theta_s. \tag{6}$$

Individuals will acquire sport specific training – measured in efficiency units – until the marginal benefit of the last efficiency unit is equal to the marginal cost of acquiring that unit of sport specific training. The first order condition for equation (6) is

$$\frac{\partial W(\theta_s)}{\partial \theta_s} = \frac{\alpha_s}{\theta_s + 1} - k = 0 \tag{7}$$

Define the optimal quantity of sport specific training that individuals will choose as θ_s^*. The optimal amount of sport specific training can be found by manipulating equation (7) to show

$$\theta_s^* = \frac{\alpha_s}{k_s} - 1.$$

The intuition for this equation is that individuals will acquire more sport specific training as the marginal private benefit of this stock (α_s) increases and acquire less sport specific training as the cost of acquiring this training (k_s) increases, other things equal. The optimal amount of sport specific training will be greater than zero so long as the individual return to sport specific training exceeds the cost of acquiring sport specific training. For individuals who acquire sport specific training, net earnings are

$$W(\theta_s^*) = (\alpha_s + \eta_s)\ln\frac{\alpha_s}{\eta_s} - \alpha_s - k_s.$$

Stark and Wang (2001) prove that $W(\theta_s^*) > 0$. Under these conditions, the total amount of sport specific training acquired by the N identical individuals in this economy is less than the socially optimal level. To see this, consider the objective function of a social planner in this economy. The social welfare function maximized by a social planner can be expressed

$$W(\theta_s) = \alpha_s \ln(\theta_s + 1) + \eta_s \ln(\theta_s + 1) - k_s\theta_s. \quad (8)$$

The social welfare function takes the externalities associated with sport specific training into account. The social planner chooses a level of sport specific training to maximize θ_s. The first order condition for the social planner's problem is

$$\frac{\partial W(\theta_s)}{\partial \theta_s} = \frac{\alpha_s + \eta_s}{\theta_s + 1} - k = 0$$

and from this expression, the socially optimal amount of sport specific training is

$$\theta_s^{**} = \frac{\alpha_s + \eta_s}{k_s} - 1.$$

Since $\eta_s > 0$, it follows that $\theta_s^{**} > \theta_s^*$. Individual workers choose a less than socially optimal amount of sport specific training, because individuals do not see society's external benefit from this type of human capital. This result provides a justification for government subsidization of training in sport, through physical education programs and other channels. These subsidies encourage individuals to acquire additional sport specific training, moving the economy toward the socially optimal quantity of sport specific training and increasing social welfare.

4 Introducing Migration

The possibility of athletes migrating to a country with larger markets, better technology, and higher wages could potentially motivate individuals to acquire more sport specific training, even in the absence of subsidies to encourage this behavior. In other words, the possibility of migration can increase social welfare in the home country by inducing individuals to invest in additional sport specific human capital, increasing the amount of output produced. The possibility of migration can mitigate the need for subsidies to encourage investment in sport specific training. This possibility is especially important in transition and developing economies where the government lacks funds to subsidize participation in sport.

In order to introduce migration into the model, we assume that sport specific training is perfectly portable across countries. Sport specific training is identical in all countries; it does not depreciate or appreciate as an individual migrates. We also assume that individuals have the opportunity to migrate from a home country, denoted by a subscript d, where there is either no possibility to play sports professionally for pay, or alternatively, where the pay for playing sports is relatively low, to another country, denoted by a subscript O, containing relatively high paying professional sports leagues. The difference between these two countries is that the private return to sport specific human capital is higher in country O and lower in country d.

Gross earnings of athletes in the home country, ignoring the effects of human capital on earnings, are

$$f_d(\theta_s) = \alpha_s \ln(\theta_s + 1) + \eta_s \ln(\overline{\theta}_s + 1). \tag{9}$$

Again, the subscript d stands for the domestic sport market when the participant has no option to play sports for pay in country O. Gross earnings in the other country, where the return to sport specific training is higher, is

$$f_O(\theta_s) = \beta \ln(\theta_s + 1). \tag{10}$$

We assume that the marginal return to a percentage change in θ_s in country O exceeds the marginal returns in country d, so that $\beta > \alpha_s$ for all positive levels of sport specific training. Note that by using this set-up we differentiate our model from the model in Stark and Wang (2001), who assume $f^H(\theta) = \beta \ln(\theta + 1) + C$, where $C > 0$ captures earnings enhancing factors in H other than a worker's own human capital. In this case we must impose the restriction that $f^H(\theta = 0) = 0$; Stark and Wang's model does not allow for this assumption.

To capture the option to migrate, we introduce a probability p that option O will be realized by an individual athlete. In the human capital model of Stark and Wang (2001), the probability p is either given by economic conditions in the other country (availability of jobs, distance from the home country, etc.) or by administrative limits imposed by government in country d and/or O on migration. The case of sports is slightly different, because the amount of θ_s may be positively related to p. We initially assume that p is exogenously given. In future research, we will relax this assumption and model p as a function of θ_s.

An individual's objective function – net any expected earnings in the absence of human capital – in the presence of a migration option, can be written as

$$W(\theta_s) = pf_O(\theta_s) + (1-p)f_d(\theta_s) - k_s\theta_s. \tag{11}$$

Since θ_s is the only choice variable in (11), the optimum amount of sports training θ_s^* is given by

$$\frac{\partial W(\theta_s)}{\partial \theta_s} \equiv pf_O^{'}(\theta_s^*) + (1-p)f_d^{'}(\theta_s^*) - k_s = 0 \tag{12}$$

Substituting from 9 and 10 into 12 and neglecting the impact through $\overline{\theta_s}$, optimal θ_s is defined

$$\theta_{sm}^* = \frac{p(\beta - \alpha_s) + \alpha_s}{k_s} - 1. \tag{13}$$

Note, that

$$\frac{\partial[\alpha_s \ln(\overline{\theta_s} + 1)]}{\partial \theta_s} = \frac{\alpha_s}{n(\theta_s + 1)} \ll \frac{\alpha_s}{\theta_s + 1}$$

for high enough n, the number of individuals for which mean $\overline{\theta_s}$ is computed. Similarly, in the case of a scale spillover effect

$$\frac{\partial[\eta \ln(\overline{\theta_s} + 1)]}{\partial \theta_s} = \frac{\eta}{n\theta_s + 1} \ll \frac{\alpha_s}{\theta_s + 1}.$$

Therefore, η and α_s are not present in (13) because the positive externality is not taken into account by agents maximizing only private gains.

We consider individual's decisions about the optimum level of sport specific training under two alternative regimes. An initial regime for which $k_s = k_0$ and $p_0 = 0$, corresponding to an economy with closed borders and no possibility of migration, like during communism in the transition economies in central and Eastern Europe. Under this regime, the optimum stock of sport specific training is

$$\theta^*_{sm0} = \frac{\alpha_s}{k_0} - 1$$

as shown in the previous section. Under the alternative regime, investment in sport specific training is more costly but the option to migrate exists for individuals with this training. Under the second regime, sport specific training costs are $k_s = k_1 > k_0$ and $p_1 > p_0 = 0$. Higher costs in the second regime reflect much lower public subsidies for sports and increasing opportunity costs of sport participation as many new leisure activities appear. From (13) The optimum stock of sport specific training under the second regime is

$$\theta^*_{sm1} = \frac{p(\beta - \alpha_s) + \alpha_s}{k_1} - 1.$$

Consider the conditions under which the regime change leads to higher investment in sports training. First, define

$$\Delta_{10} = \theta^*_{sm1} - \theta^*_{sm0} > 0. \tag{14}$$

To identify the range of p and $\Delta k = k_1 - k_0$ for which (14) holds, substitute the expressions for optimal θ_{sm} into (14) and rearrange to get

$$p\left(\frac{\beta}{\alpha_s} - 1\right) > \frac{k_1}{k_0} - 1 \tag{15}$$

Given that $\beta > \alpha_s$ and $k_1 > k_0$, (15) shows that more investment in sport specific training occurs under the new migration regime if and only if the expected percentage increase in marginal returns is high enough to compensate for the increase in marginal costs k_s. If this inequality holds, agents in country d will increase their investment in sport specific training even though the cost of acquiring sport specific training has risen in the second regime. Note that the expected increase in marginal returns may or may not exceed the increase in marginal costs. For example, playing and training for football is relatively cheap, requiring only a ball and a flat piece of ground, so the marginal cost of this participation might not increase by much; playing ice hockey, or golf, is relatively expensive because of the equipment costs – and most of this equipment would have to be imported – as well as costs associated with the specialized facilities associated with these sports, so the marginal cost of participating in ice hockey of golf could increase significantly. Still, introducing the possibility of migration in a country with a higher private rate of return on sport specific training works like a subsidy in the absence of a migration option.

4.1 Example: Ice Hockey in the Czech Republic

The history of ice hockey participation in the Czech Republic (prior to 1992 Czechoslovakia) illustrates the key predictions of the model about sport participation and migration. Ice hockey is a very popular spectator and participant sport in the Czech Republic. Czechoslovakia first fielded a team in the world hockey championships in 1920. Professional or club ice hockey leagues existed in Czechoslovakia since 1932. During the period of communist control, migration was strictly controlled and Czech ice hockey players were unable to play in professional leagues in western Europe or North America. After the fall of communism, Czech ice hockey players could freely move to professional hockey leagues throughout the world, and many Czech players migrated.

The fall of communism in the Czech Republic also led to changes in the cost of acquiring ice hockey specific human capital. Government subsidies for youth ice hockey programs fell, the real wage rose leading to increases in the opportunity cots of acquiring sport training, and the cost of equipment and ice time rose. These changes resemble the two alternative migration regimes described above.

Equation (15) provides a prediction of the relationship between the costs of acquiring sport specific training, the private benefit from participation, and the probability of migration. This equation can be rewritten as

$$p\left(\frac{\beta - \alpha_s}{\alpha_s}\right) > \frac{k_1 - k_0}{k_0} \tag{16}$$

where the fraction on the right hand side is the increase in the cost of acquiring sport specific training from regime 0 to regime 1. In this case, the cost of acquiring sport specific training increases because the state supported ice hockey training programs were closed following the fall of communism in Czechoslovakia forcing participants in ice hockey to pay more in training costs for coaching, equipment and ice time. The fraction on the left hand side of (16) is the increase in the private return to sport specific training for a Czech athlete with enough ability to migrate to a western European or north American to play professional hockey after the fall of communism.

In this context, p is the probability of a Czech hockey player migrating to play professional hockey in western Europe or north America. The fall of communism in led to changes in the migration regime facing ice hockey players. Under communism, only a few older professional ice hockey players were allowed to play in the west but after the fall of communism migration was easier, implying an increase in p. Following the fall of communism, the state supported ice hockey training programs closed, increasing the cost of acquiring hockey skills on the right hand side of (16). Given this increase in costs, the inequality can be maintained either because of the increase in p or the combination of an increase in p and an increase in the private return to sport specific training because β increases by more than α_s.

5 Migration and Training

In standard human capital migration models, the probability of an individual migrating is ambiguously related to the amount of human capital acquired by the individual. In the case of sport specific training, the amount of sport specific training undertaken should be related to the probability of migration, as individuals with more sport specific training will perform better in sport and be more likely to attract the attention of foreign sports scouts.

Carrington and Detragiache (1998) show that individuals with little or no education are unlikely to migrate, and that the probability of international migration increases with the level of education. Anecdotal evidence suggests that the only exceptional athletes are able to migrate as well. We assume that a similar relationship holds for sport specific training: θ_s is assumed to be an increasing function of the probability of migration, p. The simplest form of this relationship is a linear function

$$p = f(\theta_s) = \pi_s \theta_s \tag{17}$$

where $\pi_s > 0$ is a scaling factor that captures the constant marginal increase in the probability of migration associated with acquiring an additional efficiency unit of sport specific training. With this function for the probability of migration, net earnings from sport specific training becomes

$$W(\theta_s) = p(\theta_s) f_O(\theta_s) + [1 - p(\theta_s)] f_d(\theta_s) - k_s \theta_s. \tag{18}$$

The first order condition from the maximization problem for agents in the home country is

$$\begin{aligned}\tfrac{\partial W(\theta_s)}{\partial \theta_s} &= p'(\theta_s)f_O(\theta_s) + p(\theta_s)f_O'(\theta_s) + f_d'(\theta_s)\\ &-[p'(\theta_s)f_d(\theta_s) + p(\theta_s)f_d'(\theta_s)] - k_s = 0.\end{aligned} \tag{19}$$

Some tedious algebra leads to the following expression for the optimum stock of sport specific training, given that the probability of migration depends on the amount of sport specific training acquired

$$\theta_{sm}^{**} = \frac{\alpha_s - k_s + \pi_s(\Delta_E + \beta)}{k_s + \pi_s\alpha_s - \pi_s(\Delta_E + \beta)} \tag{20}$$

where $\Delta_E = f_O(\theta_s) - f_d(\theta_s)$ is the difference in the gross return to sport specific capital between country d and country O. The intuition behind this expression is clear. When athletes can migrate, and the probability of migration depends on the amount of sport specific capital acquired, increases in the cost of acquiring sport specific training (k_s) decrease the numerator and increase the denominator in (20), unambiguously decreasing investment in sport specific training. An increase in the private return on sport specific capital in the home country (α_s) increases both the numerator and the denominator, but the effect on the denominator is weighted by the marginal effect on the probability of migration of each additional efficiency unit of sport specific training (π_s), so this unambiguously increases investment in sport specific training.

$(\Delta_E + \beta)$ is the marginal difference in earnings gained by athletes who migrate, and $\pi_s(\Delta_E + \beta)$ is the expected marginal difference; this term is the expected benefit from successfully migrating. As this expected benefit increases, the numerator increases and the denominator decreases, so the effect on the optimal stock of sport specific training is positive.

Equation (20) also can provide insight into the effect of the change in the probability of migration on the level of sport specific training that individuals undertake. The optimal level of sport specific training when the probability of migration is exogenous, equation (13), can be rearranged as

$$\theta_{sm}^{*} = \frac{\alpha_s - k_s + p(\beta - \alpha_s)}{k_s} \tag{21}$$

and can be compared to the optimum stock of sport specific training when the probability of migration depends on the amount of sport specific training, shown in equation (19). The comparison

$$\frac{\alpha_s - k_s + p(\beta - \alpha_s)}{k_s} \lessgtr \frac{\alpha_s - k_s + \pi_s(\Delta_E + \beta)}{k_s + \pi_s\alpha_s - \pi_s(\Delta_E + \beta)}$$

shows the effect on θ_s^* of making p endogenous. Comparing the numerators, the $-\alpha_s$ term on the left side is contained in Δ_E. p is the exogenously given probability of migration while π_s is the marginal effect on the probability of migration associated with each additional efficiency unit of sport specific training. This marginal probability should be smaller than the overall, or average, probability, suggesting that the numerator of the fraction on the left should be larger. Comparing the denominators, recall that, by assumption $\beta > \alpha_s$, so $\pi_s(\alpha_s - \beta) < 0$. This implies that the denominator of the fraction on the left hand side is smaller. The numerator of the fraction on the left is larger, and the denominator smaller. Thus making the probability of migration depend on the stock of sport specific training leads to a decrease in the amount of sport specific training undertaken by individuals, and thus to the total stock of sport specific training in country d. However, it is still clear that

$$\frac{\alpha_s - k_s + \pi_s(\Delta_E + \beta)}{k_s + \pi_s\alpha_s - \pi_s(\Delta_E + \beta)} > \frac{\alpha_s - k_s}{k_s} = \theta_s^*$$

so the possibility of migration still increases the optimal stock of sport specific human capital above the optimum stock when there is no possibility of migration. Events like the fall of communism in central Europe, and the ensuing change in the ability of athletes to migrate to western professional sports leagues with their higher salaries does not necessarily produce a drain of athletes from these countries. Instead, there may be more investment in the skills required for sports in the post-communist era.

6 Summary and Conclusions

Individual's decisions to participate in sports depend on many factors. Participation in sports provides individuals with consumption benefits, improved health and well being, and extends the life span. In this paper, we extend an economic model of human capital investment to participation. This extension is based on the idea that the training and skills required to participate in sport is a specialized form of human capital. In this framework, the skills and training that must be acquired in order to participate in sport, like human capital, increase the ability of the participants to produce output, and thus increase the earnings of the individuals who choose to acquire sport specific training and participate in sport and the productive capacity of the economy. The latter effect also increases social welfare in these economies.

In the context of the migration decision faced by individuals living in developing or transitional economies, acquiring sport specific training has additional benefits. The acquisition of sport specific training makes it possible for athletes to migrate from a developing or transitional economy, where the private benefit to participation in sport is low, to a developed economy where the presence of large markets and well developed professional sports leagues makes the private return to sport specific training much higher. In this way, the decision of highly skilled athletes to migrate from developing or transitional economies to developed economies in order to play in professional sports leagues is similar to the brain drain phenomena where highly educated individuals migrate from developing economies to developed economies.

In order to explore the relationship between sport participation and migration, we extend the model of human capital acquisition and migration developed by Stark and Wang (2001) to include sport specific training. Our model predicts that the stock of sport specific training acquired by individuals varies directly with the economic benefits and inversely with the cost of acquisition. Furthermore, without subsidies or the possibility of migration, the overall stock of sport specific training acquired by individuals in a country is less than the socially optimal level because individuals are not compensated for the overall effect of the aggregate stock of sport specific training on the productivity capacity of the economy. This prediction provides an economic basis for the subsidization of sport undertaken by governments around the world.

When the possibility of migration is introduced to the model, individuals increase their acquisition of sport specific training in response to the expanded possibility of migrating to a country where the private return on sport specific training is higher. This predication suggests that relaxing migration restrictions need not lead to am "athletic drain" in transitional or developing economies, even if the relaxation of migration rules is accompanied by a decrease in subsidies for sports training. Instead, the globalization of sports markets can lead to greater domestic sport participation.

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