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Game of Organizing International Cricket: Co-Existence of Country-Line and Club-Line Games

Satya P. Das
Planning Unit, Indian Statistical Institute

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Abstract:

The paper presents an economic model of interaction between cricket boards, players and international club-line games sponsors like ICL or IPL. It attempts to capture the inherent conflict between such games and country-line games traditionally organized by cricket boards. It identifies the nature of various trade offs facing these 'players' in the game and examines the effects of market-size changes on the composition of players, the scale of country-line and club-line games and the welfare of players and cricket boards.

JEL: L13, L23, L83
Keywords: *Sports; cricket; cricket boards*

Correspondence: Satya P. Das, Planning Unit, Indian Statistical Institute; 7 S.J.S. Sansanwal Marg, New Delhi 110016.

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1 Introduction

The theme explored in this paper requires a description of the game of cricket, its evolution and two recent phenomena that are likely to permanently change the organization of the game at the international level.

Cricket is a game played intensively in some of the Commonwealth countries. It has an international governing body, the the International Cricket Council (ICC). Although ICC's membership extends over 120 countries, the game is played competitively and in large scale in a handful of countries, namely, England (where the modern form of the game is believed to have originated from), Australia, Bangladesh, India, Keyna, New Zealand, Pakistan, South Africa, Sri Lanka, "West Indies" (meaning the Caribbean islands as a group) and Zimbabwe. In Australia it is the national game. In the Indian subcontinent (India, Pakistan, Sri Lanka and Bangladesh), it is an immensely popular sport, almost a craze – even at the cost of other sports.

There are three distinguishing features in the manner in which the game of cricket is organized at the international level – which separate this sport from others like soccer, American football, baseball, basketball, etc. First, there is not a single or uniform format of international cricket. At present, it is played in three versions: a 'long' format called "tests," a 'short' format called one-day internationals (ODIs) and finally a 'very short' format named Twenty20.[1] Tests are the most traditional of all three formats of the game. ODIs started in the 1970s, while Twenty20 is very recent, no more than three years old by now. Second, and importantly from the viewpoint of who plays who on a *regular basis*, international competition or matches have been held (until very recently) between national teams *only*. In other words, unlike soccer for instance in which inter-country matches are played in select tournaments and their qualifying rounds (e.g. Euro Cup, Olympics, World Cup etc.), inter-country or *country-line* competition in cricket is an ongoing process. At any given day of the year, there is some country-line game going on somewhere with probability close to one - often times two or more competitions going on at the same time. Third, this game is politically charged, since a notion of 'national prestige' is on the line all the time as the country-line games take place round the year. Performance of the national teams is sometimes discussed in national legislatures.

Each major cricket playing country has a national governing body, e.g., BCCI (Board of Control for Cricket in India), ECB (English and Wales Cricket Board) and CA (Cricket Australia). Sometimes, these bodies are headed by political figures. They conduct domestic competition, select the national teams for different versions of the game and schedule country-line competitions.

In each country, national-level players have contracts with respective boards. Boards pay them retainer fees, and match-fees for being selected in the team for particular matches. In countries such as India and Australia, players' earnings from the respective cricket boards are relatively high, compared to their counterparts in New Zealand, South Africa and West Indies. Average salaries of players across countries are largely a function of how popular the game is in respective countries and the size of the respective domestic 'markets' for watching

[1] A 'test' is a five-day match having 30 to 35 hours of play time. An ODI lasts about eight hours. A Twenty20 game is a three to three-and-half hours affair.

the game.[2]

As for the "business" of cricket, according to the *Director's Report and Financial Statements for the Year Ended 31 December 2005* posted on the Internet, the total value of turnover for the English cricket body (ECB) was around 79 million pounds during the year 2005, which roughly amounts to US$150 million at April 2008 exchange rates. According to Wikipedia, Cricket Australia's revenue from mid-2004 to mid-2005 was AU$72 million, which is roughly US$57 million at April 2008 exchange rates. According to the ePaper of 01 November 2006 edition of *The Hindu*, a local daily newspaper in India, BCCI's revenue for the financial year 2005-06 was Rs. 250 crores, which translates to US$62 million.

These are not particularly high numbers. But in more recent times, the financial position of BCCI particularly has been strong and growing. Currently, it is believed to be the "richest" among all boards. According to a report published in May 02 edition of *Business Today*, an established weekly from India, from 2007 onwards for three years the annual turnover of BCCI would be around Rs. 1,621 crores (over US$400 million at the April 2008 exchange rate). In 2006, *Forbes* magazine provided a valuation of cricket boards, in which BCCI was on the top, worth US$1.5 billion, followed ECB (US$270 million), CA (US$225 million), ICC (US$200 million), Pakistan's PCB (US$100 million), South Africa's UCBSA (US$65 million) and Bangladesh's BCB (US$5 million). Furthermore, among the ten full members of ICC, India contribution in terms of revenue of ICC is over 70% (see Knowledge@Wharton (2007)). Various big-ticket media contracts and sponsorships have been recently negotiated by BCCI.[3]

Against this background, there have emerged two recent phenomena that have seriously challenged the prevalence of the cricket boards' traditional way of organizing international cricket along country-line games.

In as late as 2007, a business body in India, Essel Group, sponsored an international *club-line* Twenty-20 tournament, under the banner of Indian Cricket League (ICL), by drawing prominent players from various countries, forming teams and matches and offering the players 'fantastic' salaries compared to what the respective cricket boards pay. This was similar to the introduction of Kerry Packer's World Series Cricket (WSC) in the 70s that paid a huge sum of money to its players (relative to what they were getting from respective cricket boards at the time) and revolutionized the ODI form of cricket competition.

ICL was immediately opposed by the establishments of cricket, as was WSC in the 70s, except that Packer's WSC was ridiculed as 'pajama cricket,' where ICL has not experienced such verbal insults.[4] Most cricket boards issued a policy that those playing in ICL will be banned from representing the respective countries in country-line games. It essentially meant the end of a cricketer's international career if he participated in the ICL tournament.[5]

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[2] Across individual players, the total earnings vary a whole lot of course, as they earn from various endorsements, advertising, etc.

[3] For instance, the global media rights for games to be held in India were granted to Nimbus Communications over the period 2006 to 2010 for US$612 million (see *The Hindu Business Line: Internet Edition*, February 18, 2006).

[4] This is a testimony of growing understanding by cricket boards of what business competition means.

[5] ICL has about a billion US dollars (in the form of rupees) in corpus funds. The first set of games were held toward the end of 2007. More "editions" are scheduled for 2008. So far, it is fair to say, it has not been very successful in drawing spectators to watch its matches.

The reasons behind such a strong opposition by the cricket boards are not hard to see. Club-line games offer business competition that may threaten the popularity of country-line games, which fill the pockets and well-being of the boards. If such games thrive at the cost of country-lines, these boards – at least, their high visibility – may very well disappear.

It is an interesting coincidence that within days of ICL's announcement (in mid 2007) of names of some well-known cricket stars who signed with them, the BCCI substantially raised its players' salaries and came up with its own version of an international club-line tournament. It created a business 'unit' under it, called Indian Premier League. IPL announced eight franchises (teams) and they were auctioned off to Indian business houses or celebrity individuals. The auction fetched over US$700 million for BCCI. In a high-profile event in early 2008, players from different countries were auctioned off to various franchisees. Some players obtained more than a million US dollars (for participating in IPL tournament scheduled in the heat of the 2008 Indian summer).[6]

BCCI also had its share of trouble with other cricket boards, but of course much less compared to ICL, because (a) it is one of 'them,' (b) among all boards BCCI contributes the most to ICC and (c) matches against the Indian team fetch most revenues to other boards. In any event many differences were ironed out (at least for the time being) and IPL tournament started in April 2008 among a lot of fanfare (and controversies of different kinds such as the costumes of cheer leaders). It ended on June 1, 2008 on a very high note.

The limited 'success' of ICL (so far) and the huge all-gaga account of IPL raise serious issues about the evolution of cricket. Are such 'break-away' trends from traditional country-line games just temporary? ICL seemed to be almost forgotten while IPL games were on, but it can come back, perhaps as strongly as IPL. As soon as the IPL games went underway, Allen Stanford, a billionaire from Texas, expressed his willingness to finance an equivalent of IPL for ECB.

Compared to other sports such as soccer, baseball, etc., which have been organized mostly along club-line games – and as mentioned earlier, country-line games in these sports occur less frequently – the current situation in cricket is quite unique.[7] While country-line games are the 'tradition,' club-line games are 'threatening' to become regular features as well. Against this background, the aim of this paper is to analyze – and theoretically forecast (i.e. speculate) – the implications for behavior of the 'industry' of cricket, if such club-line games are to survive.

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[6]The actual payment is of course determined at a pro-rata basis and a portion of it goes to the Income Tax Department of India. The fascinating details of the auction process and various restrictions imposed on franchisees should be of considerable interest to auction theorists.

[7]In football (soccer) for instance there is an ongoing 'club versus country' dilemma. But it is of a different nature. First of all, no single country as a sponsor of its national team is an organizer of club-line games. There are many independent clubs and these are like different ICLs, with each ICL having one team only. Secondly and most importantly, the extent of country-line games is rather fixed dictated by events like World Cup, Euro Cup etc., whereas in cricket that is "variable" in terms of which country may want to play with which other countries how many times. Therefore, the scope of conflict in football is much less. Many of the conflicts arise in terms of *individual players* signed to different clubs, who are not able to participate in qualifying matches (towards the grand events) for their countries. Furthermore, the number of football playing countries – and clubs is much bigger compared to cricket and thus the strategic dependence of one type of games on the other is much less.

At the moment, the game and the business of cricket are in a state of churning.[8] As IPL games were in progress, over-a-drink speculations were flooding the media as to how far the public, hitherto accustomed to cheering respective national teams, would embrace hybrid club-line teams, how the super-short Twenty20 format of the game in club-line matches can adversely affect the 'art' of playing cricket, whether the cricket boards of other countries would continue to support BCCI sponsored IPL, whether they would ever 'recognize' ICL and above all, all said and done, whether the club-line games would survive and if they do, how it would affect 'traditional cricket' and the cricket boards.

For instance, CA's chief James Sutherland has expressed serious doubts about the financial viability of IPL. According to him, the chances of Australian ODI players taking part in 2009 IPL games are almost nil, given the schedule of the Australian team. But a survey by Australian Cricketers' Association (ACA) indicates that 47% of national players under contract with CA are not hesitant to quit "international" cricket (take early retirement) and join club-line competitions in India (*Sydney Morning Herald*, April 9, 2008). According to Paul Marsh, the ACA's chief executive, the only way to prevent a mass exodus is to accommodate IPL; country-line and club-line tournaments such as IPL or ICL must co-exist.

The analysis of this paper rides on the presumption that international club-line games are going to stay side by side with country-line games organized by cricket boards (just as Paul Marsh says) - despite imperfections of various kinds that have been pointed out on the organization of IPL and ICL games thus far.[9]

To be specific, the paper provides a theoretical analysis of the behavior of the cricket industry in the presence of an international club-line games sponsor. Under which conditions exactly is it rational for cricket boards to release player time to the club-line games? How does it affect the welfare of cricket boards and players? How would changes in preferences or market sizes for these two types of games affect the wage structure, the scale and composition of players in club-line games? What is nature of difference in behavior between when the sponsor of the club-lines games is an 'outsider' and when it is one of the cricket boards?

It is easy to shrug off such a study as 'irrelevant' – or a trivial pursuit at best – since the (equilibrium) nature of the industry is unclear at the present time. But, on the other hand, it cannot be denied that theoretical economists, irrespective of their fields, tend to focus too much of their energy on explaining the *ex post*. While understanding the past is instructive

[8]As of May 23, 2008, on a minor note, the norms of "on-stadium' behavior of IPL franchise owners were not clear – according to Shah Rukh Khan, a famous movie star of India and the owner of Kolkata's *Knight Riders*.

[9]The author's own reasoning is the following.

First, before the IPL matches began in particular, questions were raised about the viewers' club-wise "loyalty" as opposed to respective country-wise loyalty, since until very recently fans were used to cheering for their national team only. The attendance at the IPL matches proves the contrary. It is reported that Ricky Ponting, the captain of Australia's national team and as a member of Kolkata *Knight Riders* was called "Ponting-da," *da* being a term of endearment used by Bengalis. In the first match between *King's XI, Punjab* and *Rajasthan Royals* on April 21, 2008, there was some incident involving the mercurial Indian young pace bowler Sreesanth and Pakistani cricketer Kamran Akmal and the crowd was jeering against the former. Second, cricket is big business, capable of sustaining both country-line and club-line games. Last but not least, players constitute the most critical 'input' to the game and business of cricket. Lucrative offers are bound to lure them and this will put enormous pressure on cricket boards to accommodate the hi-fi international club-line games. To be clear, the issue is that of co-existence of "traditional" cricket and club-line games, *not one or the other*.

and useful, as certain unprecedented phenomena are in progress, it seems natural and quite relevant for social scientists to generate theoretical predictions about the future. Indeed, the present moment seems to be the most opportune time to (theoretically) 'forecast,' by using economic models, the ramifications of the entry of international club-line games into cricket.

Specifically, I consider two scenarios, one in which the sponsor of these games is a completely outside entity (such as ICL) and the other in which it is one of the cricket boards (such as IPL).

Before getting to such a paper-pencil venture, a few words of caution are a must. First, the paper may be a major disappointment for connoisseurs of cricket. Indeed, most of them do not 'like' the Twenty20 format and particularly dislike the commercialization and glitz associated with ICL or IPL tournaments.[10] On the top of that the analysis does not contain any element of the game of cricket per se. The model is a purely economic one.

Second, it makes many simplifying assumptions regarding the timing and objects of decision-making, what are endogenous and what are not, etc. However, this is true for any kind of economic analysis and the idea here is to put together a simple behavioral model that can enable us to think about issues in the game of cricket and has the potential of steadily moving into more complex scenarios.

Third, the reader will discover that many results are obvious. But there are quite a few non-trivial implications too. Both these features combined indicate that the model developed in the paper may be a reasonable abstraction.

Hopefully, the behavioral insights gained will enable us to 'understand' and accept what may be in store for the game of cricket.

2 The Introductory Model

Our analysis will be focused on the tension between (a) the sponsor of the club-line games, (b) the cricket boards (CBs) and (c) the players (cricketers). The aim is to understand some relevant trade-offs and their implications. Assumptions are made accordingly.

To begin with, what are the functions of a CB and what is its objective function? None of the CBs are purely governmental bodies; nor are they private corporations. Legally speaking, BCCI, for example, is a non-profit organization, registered in the state of Tamil Nadu, India. The general aim of a CB is to 'promote' the game. This involves finding best talents, nurturing and selecting them into the national team, paying the players, organizing intra-country and country-line matches, marketing the game, etc.

We abstract from many of these functions and focus on organizing the task of country-line contests or 'series.' A series could involve two teams, three teams (triangular ODI series) or many teams (e.g. World Cup). The size of a national team, a collection of best talents for the game, is fixed and same for all countries or CBs, equal to the interval 0 to $\bar{e}$ (> 0). Our analysis thus does not endogeneize a CB's effort to find talent through search, training

[10] However, according to John Buchanan, the coach of Kolkata's *Knight Riders* and the former coach of the Australian national team, "T20 will improve the skill level of a cricketer. The bowlers will find newer ways of getting wickets, while the batsmen will find newer ways of scoring runs. That will also benefit the cricket-viewing public in general" (*Hindustan Times*, June 3, 2008). The editorial of this daily on the same day describes traditional forms of cricket and its Twenty20 version similar to "Dostoyevsky surviving side-by-side with Jeffrey Archer on the book shelves."

camps, conducting domestic competition etc. The best pool of players for the game are always available to the respective CBs costlessly. The supply of this pool is larger than the size of the team.[11] Each player's talent level is the same (normalized to unity) across all countries. Let n be the number of countries or CB^{i}s.

In this section, there is no 'rival' or 'rebel' sponsors of club-line games. The national players provide their 'input' services to the respective CBs only. The player-input services produce an output: a performance. In turn, the output generates revenues to the CB. Ours is a static model. All contests take place with a unit interval of time (the maximum of a player's time available barring some fixed leisure time). Let μ^i denote the fraction of time that CB^i allows its players to participate in country-line contests.

Our key concept is that of a revenue function for CB^i be defined over the *total play-time* of its all players: $r^i = r^i(\bar{e}\mu^i; a^i)$, where a^i is the income-adjusted or "effective" market size of country i for the purpose of generating revenues.

Of course, revenues generated by a CB would depend on the exptected intensity of contest by the constituent national teams. Furthermore, if there is revenue sharing between CBs, contests with India for example are likely to bring more revenues to a CB than those with other teams; hence, revenues of CB^i may depend on market size of some other country j. However, if all teams play nearly equal times with each other, ceteris paribus, the ranking of earnings will follow the ranking of market sizes. Our specification of the revenue function abstracts from these considerations in order to focus sharply on the differences that would emerge from the presence of aa club-line games sponsor.

Let r_e^i and r_a^i denote respectively the partial of $r^i(\cdot)$ function with respect to the first and the second argument. Both partials are positive, $r_{ee}^i < 0$, $r_{ea}^i > 0$ and $r^i(0, a^i) = 0$.[12]

Clearly, this notion of revenue bypasses many intricate aspects of scheduling and who plays whom etc. It captures in an extreme form the notion that, all else the same, the greater the size of the market, the higher are the total revenues and marginal revenues earned; similarly, given the market size, the more a CB plays its players, the more is the number of international country-line matches organized and the higher are the revenues at a decreasing rate. Diminishing marginal revenues reflect viewers' diminishing marginal willing to pay for seeing matches. The revenues are net of all costs, except payments to players.

The following remarks are in order.

1. Our postulated revenue function is somewhat similar to the production function or revenue function estimated for various sports. There is a sizeable literature on the estimation of production function (in terms of win percentages or points) for American football, basket and baseball (e.g. Zech, 1979; and Zak, 1981). There are also production function estimates for cricket (Schofield, 1988; Bairam et. al. 1990). Borland (2005) contains a useful summary of various approaches to the estimation of production functions in sports and the associated econometric issues. But most (perhaps all) of such existing studies examine production function in the 'strategy' or characteristics space; in cricket, for instance, how the rate of success of a team is related to runs completed per over (reflecting attacking batting), balls bowled per wicket (attacking bowling), runs scored by the opposition team per over (defensive bowling) etc.

[11] Thus, if there is retirement by some players, they can be always be replaced without additional cost.
[12] The function $r^i = a^i(1 - y^i) - (1 - y^i)^2/2$ satisfies these conditions.

2. The output is sometimes measured in terms of revenues from TV broadcast rights or attendance (see Hausman and Leonard, 1997; and Gustafson et. al., 1999). In contrast, in our analysis, the revenue function is defined on the players-space.
3. The scenario depicted is equivalent to a domestic product being sold domestically.

Coming to a CB's objective function, although it is not strictly a profit-maximizing entity, it would, one would suppose, care about its 'profits' (reflected by its accumulation of assets for future use in up-keeping and promoting the game). In addition, it would recognize the value of players as core inputs in its endeavor and take into consideration their welfare or surplus. Our analysis regards a CB as an agent attempting to maximize a weighted average of its surplus and that of its players. Alternatively, this can be seen as an objective function arising out of bargaining between a CB and the respective players' association.

Each player is paid a retainer fee u^i and a match-fee m^i by CB^i for representing the country. The profit and the total compensation to players have the following expressions:

$$\Pi^i \equiv r^i(\bar{e}\mu^i; a^i) - (u^i + m^i\mu^i)\bar{e}; \quad \Omega^i \equiv (u^i + m^i\mu^i)\bar{e}.$$

A CB's objective function is to maximize $U^i \equiv \alpha \ln \Pi^i + (1-\alpha)\Omega^i$, where $1-\alpha \in (0,1)$ denotes the weight assigned to players' payoff from the CB. It may be argued that this weight is likely to be small. All we require is that it is a positive fraction, not zero.[13] The choice variables are u^i, m^i and μ^i.

The optimization problem yields the familiar first-order condition with respect to both u^i and m^i:

$$(1-\alpha)\Omega^i = \alpha\Pi^i. \tag{1}$$

Thus the retainer and match-fees are perfect substitutes. Furthermore, using (1) we obtain that U^i increases monotonically increases with μ^i. Hence the solution is that playing time is fully maximized, i.e., the optimal $\mu^i = 1$.

Intuitively, the situation is akin to maximizing joint utility with respect to μ^i, while the compensation to players is the instrument of internal transfer according to the relative bargaining strengths. As long as the marginal revenues are positive, an increase in μ^i adds to the joint surplus and thus optimal μ^i is equal to unity, its upper bound.

Define $s^i \equiv u^i + m^i$, a player's total earnings from CB^i. Eq. (1) yields:

$$s^i = \frac{(1-\alpha)r^i(\bar{e}; a^i)}{\bar{e}}. \tag{2}$$

Two points may be noted. (a) Players' earnings are independent across countries in that s^i depends entirely on the market size for the game in country i. (b) All else the same (including r^i function being the same for all i), players are rewarded more in a high-market country compared to a low-market country.[14]

[13] The opportunity cost of players is normalized to zero. It is also presumed that α is the same across countries. However, this can be relaxed without any change in results.

[14] It is well-known that attendance in international cricket games are relatively low in New Zealand and West Indies and the average wages of national players in these countries are indeed very low, compared to, say, Australia, England or India. According to Brian Lara, the retired legendary batsman from West Indies, he has seen cricket stadium attendance for an international game in New Zealand consisting of a few people along with their dogs, while a nearby Rugby stadium would be filled to capacity.

In the scenarios to be covered in our analysis, the retainer and the match-fee are always substitutable. Hence, from now on, we normalize u^i to zero. Without loss of generality, we also set $\bar{e} = 1$.

The description of our introductory model is complete. We now consider the advent of international club-line games. Conflicts and interdependencies arise since these games must use players' time from the CBs.

3 An Outsider Club-Line Games Sponsor: The ICL Scenario

Suppose that an outside party sponsors international club-line games lasting for time $t < 1$. We call this sponsor ICL. We assume t to be exogenous irrespective of the size of participation.[15] Assume for now that ICL hires players only from the national squads. Let v denote the wage rate or the instantaneous rate of compensation package offered by ICL to one unit of a player's time. Thus if the players are able to participate for the entire length of club-line games, they get the amount tv from the sponsor. Let y^i denote the total player time released by CB^i for all its players to participate in club-line games.[16]

The (game) sequence is that ICL moves first, declares a total tournament-time salary tv. In stage II, CBs decide m^i and y^i. In stage III playing time is hired by ICL at the pre-announced v. There is perfect foresight. In stage I, ICL effectively knows how much of player time it will be able to hire. Actually hiring in stage III is just a formality.

Decision Making by a CB in Stage II

The profit and the players' total payoff expressions are:

$$\Pi^i \equiv r^i(1 - y^i, a^i) - m^i(1 - y^i); \quad \Omega^i \equiv m^i(1 - y^i) + vy^i.$$

With respect to m^i, we have the same sharing rule, $\alpha\Omega^i = (1 - \alpha)\Pi^i$. Once m^i is chosen optimally, the important point is that dU^i/dy^i is *not* negative necessarily, where, recall that $U^i \equiv \alpha \ln \Pi^i + (1 - \alpha) \ln \Omega^i$. A unit increase in y^i implies a loss of revenue equal to r^i_e and a gain to players equal to v.

The relevant first-order condition is and its implications are:

$$-r^i_e(1 - y^i; a^i) + v = 0 \Rightarrow y^i = y^i(\underset{+}{v}; \underset{-}{a^i}). \tag{3}$$

The y^i equation dictates a CB's supply of players' time to the club-line games sponsor. Our assumptions that $r^i_{ee} < 0$ and $r^i_{ea} > 0$ imply the indicated signs of the partials of the player-time supply function by CB^i to the club-line games.

One important insight emerging here is that how much of players' time should be released for the club-line games does *not* hang on whether the club-line games sponsor pays more to the player than does a CB, i.e., whether $tv > m^i$. The relevant trade-off facing a CB is v vis-a-vis the marginal revenue from using its players' time. As long as the former exceeds

[15] Optimal duration of tournament, dependent on the size of participation, is something left for future research.

[16] Thus y^i is "like" $1 - \mu^i$.

the marginal revenue at full use of players' time ($\mu^i = 1$), a CB should allow a positive participation of its players in the club-line tournament.

If a^i is low enough $y^i = t$ and if it is high enough $y^i = 0$. The model predicts that, all else the same, the low-cricket market countries will have a higher participation in the club-line games. For our marginal analysis we will suppose that the distribution of a^i and the $r^i(\cdot)$ functions are such that there is an 'interior' solution of y^i for all i, i.e. $0 < y^i < t$.

Given that a CB allows participation in the club-line games, the joint surplus (of a CB and its players) is higher, and, thus by suitably adjusting (lowering) m^i, both the CB and the players are better off. A marginal increase in v has the same implications for a CB and its players.

Proposition 1 *(a) Given that $v > r^i_e(1; a^i)$, CB^i would participate in (release some players' time for) the club-line games and lower its compensation to players; compared to no participation, a positive participation in club-lines games implies a higher surplus of both CBs and its players.*
(b) Given positive participation, a higher v implies a higher supply of players' time to club-line games, a lower compensation by a CB to its players but higher surplus of both CBs and its players. Furthermore, the higher the market size for country-line games (a^i), the less is the players' time released by CB^i for club-line games.

Proof: Positive participation condition follows from the first-order condition in (3). The total surplus sharing equation (1) holds in case of zero or positive participation. We have a CB's compensation to players equal to

$$s^i \equiv m^i(1 - y^i) = (1 - \alpha)r^i(\cdot) - \alpha v y^i. \tag{4}$$

Compared to no participation, positive participation is equivalent to an increase in v and y^i from zero to respective positive values. As r^i decreases with y^i it follows that s^i is less under positive participation. The difference in total surplus of both CB and players together under positive participation and under no participation equals $r^i(1 - y^i; a^i) - r^i(1; a^i) + vy^i$. This is positive under the condition $v > r^i_e(1; a^i)$. Since the proportion of Π^i to Ω^i is fixed, the surplus of each party is higher. This proves part (a).

The impacts of an increase in v follow from eq. (3). Its positive effect on the total surplus is seen through the envelope theorem. The negative effect of an increase in a^i on y^i follows from this also. Thus part (b) is proved. ■

For further analysis, we impose an additional restriction on the $y^i(\cdot)$ function, namely,

$$y_{vv} \leq 0. \tag{R1}$$

For instance, if the revenue function is quadratic, i.e., $r^i = a^i(1 - y^i) - (1 - y^i)^2/2$, then the supply function is linear and this condition is met. Alternatively, it is satisfied if the revenue function is such that the supply function is iso-elastic in v with elasticity less than or equal to one. As will be seen, (R1) will be needed for the second-order condition to be met in stage I decision-making.

Finally, we sum up the individual supply functions in (3) and obtain an 'aggregate supply' function of players' time to the club-line games:

$$Y(v; \mathbf{a}) = \sum_i y^i(v; a^i), \tag{5}$$

where $\mathbf{a}$ denotes the vector of a^is.

ICL's Decision Making in Stage I

Let Q denote the total players' time available to ICL and A the market-size parameter for club-line games. Given that its pool consists of players from national sides only, $Q = Y$. Similar to the revenue function facing CBs, we define a revenue function of the sponsor, $\rho(Q; A)$, having the following properties: $\rho_Q > 0 > \rho_{QQ}$, $\rho_A > 0$ and $\rho_{QA} > 0$.[17,18]

The club-line-games sponsor's surplus is: $\Gamma \equiv \rho(Y(v; \mathbf{a}); A) - vY(v; \mathbf{a})$. This is maximized with respect to v. Thus the sponsor is the first-mover or the Stackelberg leader and chooses v, by taking into account the behavioral response of the CBs. The first-order condition is

$$[\rho_Q(Y(v; \mathbf{a}); A) - v]Y_v(v; \mathbf{a}) - Y(v; \mathbf{a}) = 0. \tag{6}$$

Given the conditions imposed on the function $\rho(\cdot)$ and the restriction (R1), the second-order condition is met. The above equation solves v.

It is instructive to loosely interpret (6) as the 'demand curve' for players' time – as it posits a negative relationship between Y and v.[19] Together with (5), which is the aggregate supply curve of players' time, we have a demand-supply equilibrium. This is illustrated in Figure 1.

As a simple comparative statics, suppose that the club-line international games become more popular, i.e., the parameter A increases. Then the demand curve shifts to the right, while the supply curve is unaffected. As a result, both v^* and Y^* rise. As one would expect, the scale of club-line games increases, that of country-line games falls and the club-line sponsor benefits. It may be obvious but important to note that, since v increases, the CBs and their players benefit too.

There is a concern that club-line games may very well lead to a decline in the popularity of traditional country-line games. Suppose the popularity of country-line games falls in some countries, i.e., a^is decrease for some countries. What are the effects? We see that, in general, both supply and demand curves shift. Hence the implications are not clear-cut. But notice that a change in a^i has a 'first-order' positive effect on the supply curve and an ambiguous 'second-order' effect on the demand curve (depending on the sign and magnitude of y^i_{va}s). If

[17] These inequalities are met if $\rho = AQ - Q^2/2$.

[18] We assume that different countries offer their players' time either simultaneously or a little apart from each other so that scheduling club-line games is not affected.

[19] We obtain

$$\frac{dY}{dv} = -\frac{Y_v^2 - YY_{vv}}{Y_v(1 - Y_v\rho_{QQ})} < 0.$$

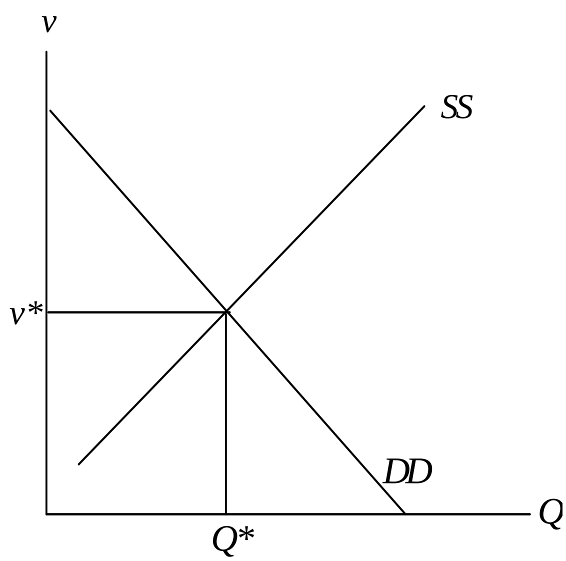

Figure 1: Determination of v^* and Y^*

these second-order effect are small (and these are zero in the linear supply case), the former effect dominates, and, as a result, v^* falls, while Y^* increases.

These implications are quite intuitive. As the popularity of country-line games falls, the marginal revenue for a CB from these games falls and it tends to supply more player time to club-line games. As a result, v^* decreases and the scale of club-line games increases.

Interestingly and in addition, this imposes a negative externality on other CBs and the welfare of players in other countries (through the decline in v). Thus a decrease in some a^is adversely affects *all* CBs and players from all countries. In this sense, the lot or welfare of CBs and players across countries moves together. Such externalities among CBs and players from different countries arise because of the coexistence of club-line games.

Now suppose the popularity of club-line games improves at the cost of country-line games, i.e., A increases while some a^is decrease. The impact on v^* is ambiguous, while the scale of club-line games increases by both pull and push factors.

Fringe Players

Club-line games thus far (organized by both ICL and IPL) have included 'fringe' or 'promising' players, who are yet to represent national teams. Their inclusion facilitates the development of skill and the selection process for the CBs and thus has implicit support from CBs. We now model them and do so by viewing them simply as worthy of playing side-by-side with national-team players in club-line games.

We posit a positively sloped supply function of fringe players, $X = X(w)$, in terms of players' time again, where w is the wage rate offered by the sponsor of the international club-line games and $X_w > 0$. Similar to the supply function of national-team players, we assume $X_{ww} \leq 0$. This is the aggregate supply of fringe players from all countries. Since these players are 'outside' to the decision making facing the CBs, it does not matter whether they are from one country or many.

In the revenue function facing ICL, we now define effective total players' time Q, equal to $Y + \lambda X$, $\lambda \leq 1$. Thus national-team and fringe players are perfect substitutes but may not be necessarily in 1:1 proportion. Even when $\lambda < 1$, one can always redefine X as 1:1 substitutable for Y and modify the supply function accordingly. Thus, without loss of generality, let $\lambda = 1$. Of course, it is arguable that the 'marginal product' of one category of players increases with an increased presence of the other category. This would only strengthen our results, although the algebra will be more complicated.

Note that there is no change in stage II behavior of the CBs. As before, it yields the supply function $Y(v; \mathbf{a})$. In stage I, the sponsor of club-line games maximizes $\Gamma = \rho(X(w) + Y(v; \mathbf{a}); A) - wX(w) - vY(v; \mathbf{a})$. There are two first-order conditions:

$$[\rho_Q(X(w) + Y(v; \mathbf{a}); A) - w]X_w(w) - X(w) = 0 \tag{7}$$

$$[\rho_Q(X(w) + Y(v; \mathbf{a}); A) - v]Y_v(v; \mathbf{a}) - Y(v; \mathbf{a}) = 0.\text{[20]} \tag{8}$$

An important point to note here is that although the two categories of players are perfect substitutes of each other in the sponsor's revenue function, there is a general incentive to hire from *both* categories, not one. It is because of the *increasing* marginal cost of hiring players' time from either category.[21]

Voluntary Retirement (VR)

Current roasters of both ICL and IPL do have retired players. There are already speculations that the high wages offered by club-line sponsors may very well prompt national-team players (in the future) to retire and join these games full time. Keeping this in mind, we now consider voluntary retirement (VR) of players from the national sides. It is assumed that the sponsor of the club-line games does not discriminate between national-team players and those who have retired: both are offered v per instant of time to their services in the club-line games. From now on we shall use the terms 'players' time' and 'players' interchangeably.

Whether a player undertakes VR depends on the relative rewards; tv versus the earnings received from remaining with the CB, σ^i, which has the expression:

$$\sigma^i \equiv s^i + vy^i = (1 - \alpha)\left[r^i(\cdot) + vy^i\right] \equiv \sigma^i(v; a^i). \tag{9}$$

By virtue of (3) the envelope theorem, $\sigma^i_v = (1 - \alpha)y^i \in (0, 1)$ and $\sigma^i_a = (1 - \alpha)r^i_a > 0$. Define $\delta^i(v; a^i) \equiv tv - \sigma^i(v; a^i)$. We have $\delta^i_v = t - (1 - \alpha)y^i > 0$, since $y^i < t$. This is illustrated in Figure 2. If there are no other considerations, a player would retire and participate full time in club-line games if $v > \underline{v}$.

However, a player would very well take into account values from other sources, such as personal pride in representing one's own country, as opposed to more leisure time associated with playing in club-lines games only. Let a common parameter k ($\gtreqless 0$) denote the net extraneous value of representing the national side.

A reasonable decision rule is then: retire or do not retire as $tv \gtreqless \sigma^i + k$. Recall that σ^i is itself dependent on v having the property: $0 < \sigma^i_v < 1$. Let v^i_0 be the (unique) solution

[20] It can be checked that the second-order conditions are met.

[21] The situation is analogous to a multi-plant monopolist with increasing marginal cost associated with each plant.

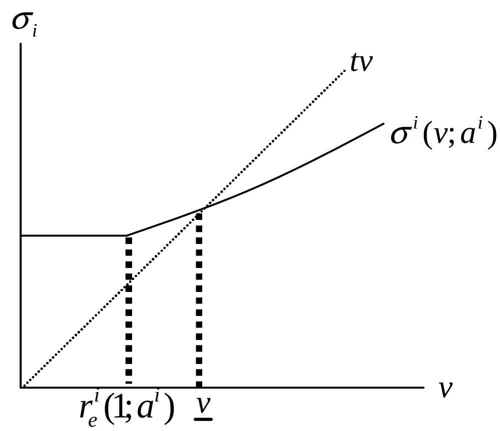

Figure 2: σ^i Function

to the equation $tv = \sigma^i(v; a^i) + k$. A player will retire or remain in the national side as $v \gtrless v_0^i$. Note that this "reservation wage" (from the CB) does *not* depend on the market size of club-line tournament; it depends on a^i.

We now differentiate the arbitrage equation and use (9) to obtain:

$$\frac{dv_0^i}{da^i} = \frac{(1-\alpha)\sigma_a^i}{t-(1-\alpha)y^i} > 0. \tag{10}$$

Quite intuitively, the reservation wage is positively related to the size of the respective market size for country-line games. If we now arrange countries in an ascending order of a^i, then we have a situation as depicted in Figure 3 (provided that the revenue functions are the same). All players in CBs 1 and 2 will retire, while no one from CB numbered 3 and higher will.

This is rather extreme and not very useful, although it highlights the point that low-revenue CBs are likely to experience high retirement rate and turnover, compared to high-revenue CBs.

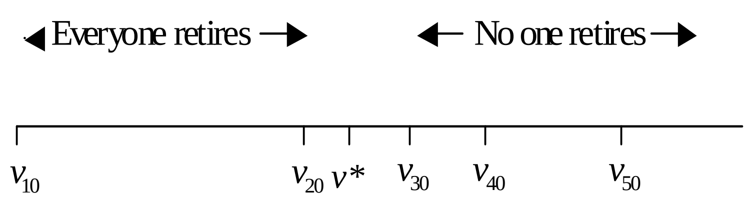

Figure 3: Retirement Decision

One set of factors that prevents such extreme outcome is risk considerations with respect to both choices. Another is price discrimination by the club-line games sponsor. Although, in our model nothing prevents the sponsor from such practice, the plausibility of price discrimination of players across countries seems highly questionable.

In what follows, we bring in a different aspect, namely, player heterogeneity in terms of the preference parameter k. Suppose that the players associated with any CB differ in their valuation of k. Arrange them in a ascending order of k and for player j, let $k_j = \beta + \gamma j$, where β can have any sign but $\gamma > 0$.[22] For simplicity, let this function be the same across countries.

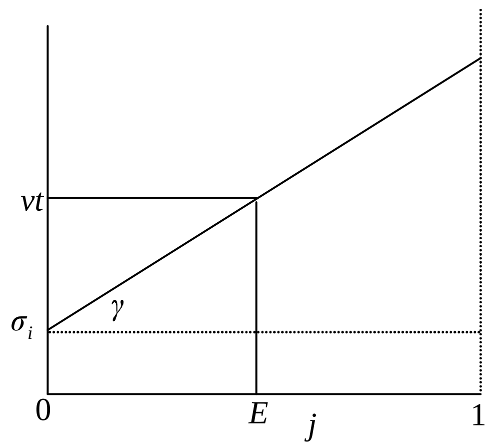

Figure 4: Players' Heterogeneity in Preferences and Retirement Decision

Figure 4 illustrates this in the case of $\beta = 0$. Players in the interval $0E$ retire. We assume that the parameter γ is high enough such that VR is partial in any country. Let the retirement rate in country i be denoted as $\hat{z}^i$, the solution to the equation $tv = \sigma^i + \beta + \gamma \hat{z}^i$. Thus, given v and σ^i, $\hat{z}^i = (tv - \sigma^i - \beta)/\gamma$.

Assume that the market size parameter A is high enough (and γ high enough) such that $\hat{z}^i \in (0, 1)$. Further, let $\beta = 0$ for notational simplicity. Thus, the supply function of retired players' time from country i to the club-line games has the expression:

$$z^i = t\hat{z}^i = t\frac{\delta^i(v; a^i)}{\gamma} \equiv z^i(v; a^i). \tag{11}$$

We have $z^i_a < 0$ (as $\sigma^i_a > 0$), $z^i_v > 0$ (as $\delta^i_v > 0$); particularly, $z^i_{vv} < 0$ since $\sigma^i_{vv} = (1-\alpha)y^i_v > 0$. These are analogous to the properties of the $y^i(\cdot)$ function.[23]

Summing the functions $z^i(\cdot)$, the total supply of retired players' time is given by

$$Z = \sum_i z^i(v; a^i) \equiv Z(v; \mathbf{a}). \tag{12}$$

We assume that CB's are able to costlessly find replacement for the team from the pool of fringe players and the size of the national team is always equal to unity. Thus the supply function of players' time from CBs for the club-line games remains same as (5). We also an entry rate to the pool of fringe players such that the supply function $X(w)$ remains invariant.

One can add to this scenario an exogenously given 'natural rate' of retirement of players from a national team and their availability for club-line games. In that case, as long as we confine ourselves to a steady state in which this rate of entry is equal to an exit rate from these games, our analysis remains static and in tact.

The sequence of decision making is the following:

[22] In principle, k_j could be any monotonically increasing function of j.

[23] Note that these properties would have followed from more general k_j functions, not just linear.

ICL announces v → CBs choose m^i and y^i → Some players take VR and CBs replenish → ICL: hire players' time

From the decision-making behavior by CBs and players, the aggregate supply of players' time to club-line games is now: $Q = X + Y + Z$. In stage I, the club-line games sponsor maximizes $\Gamma \equiv \rho(X(w) + Y(v;\mathbf{a}) + Z(v;\mathbf{a}); A) - wX(w) - v[Y(v;\mathbf{a}) + Z(v;\mathbf{a})]$.

Define $V \equiv Y + Z$, the supply of "veteran players" to the club-line games. The first-order conditions with respect to w and v are given by:

$$[\rho_Q(X(w) + V(v;\mathbf{a}) - w]X_w(w) - X(w) = 0 \tag{13}$$

$$[\rho_Q(X(w) + V(v;\mathbf{a}); A) - v]V_v(v;\mathbf{a}) - V(v;\mathbf{a}) = 0. \tag{14}$$

Under our maintained assumptions, the Hessian matrix

$$\Delta \equiv \begin{bmatrix} (\rho_{QQ}X_w - 2)X_w + (\rho_Q - w)X_{ww} & \rho_{QQ}X_wV_v \\ \rho_{QQ}X_wV_v & (\rho_{QQ}V_v - 2)V_v + (\rho_Q - v)V_{vv} \end{bmatrix}$$

is negative definite and thus the second-order conditions are met. Eqs. (13) and (14) each define a negative schedule in w and v. These are respectively shown as WW and VV in Figure 5. The intersection point marks the solution.

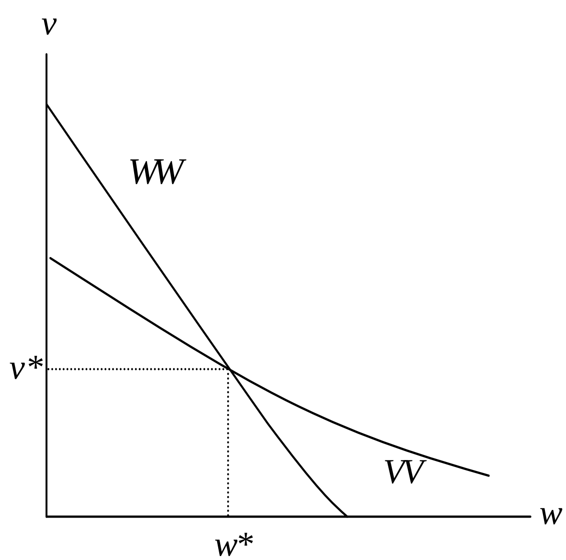

Figure 5: Solutions of w and v

Consider first the comparative statics with respect to an increase in A, the market size for club-line games. The proposition below summarizes the effects.

Proposition 2 *As the market size for club-line games increases,*
(a) ICL increases the wages rates of veteran and fringe players;
(b) there is more participation of national-team, retirees and fringe players in club-line games;
(c) the scale of these games (Q) expands and that of country-line games falls;
(d) all CBs, their players as well as retirees and fringe players benefit.

Proof: Totally differentiating (13) and (14),

$$\frac{dw}{dA} = \frac{\rho_{QA} X_w}{|\Delta|}[2V_v - (\rho_Q - v)V_{vv}] > 0; \quad \frac{dv}{dA} = \frac{\rho_{QA} V_v}{|\Delta|}[2X_w - (\rho_Q - w)X_{ww}] > 0.$$

As w and v increase, so do X, y^i and z^i for all i. An increase in y^i for all i implies less player time available for country-line games by all CBs. Parts (a)-(c) of the above proposition are proved. As w and v increase, retirees and fringe players are better off. In view of Proposition 1, CBs and their players benefit too. ■

Consider next a decline in the market size for country-line games in country i. In general, the impacts are ambiguous because of the presence of the "second-order effects" $y^i_{va} \gtreqless 0$ and $z^i_{va} = -(t/\gamma)(1-\alpha)y^i_a < 0$. If these magnitudes are relatively small, then the implications are clear-cut.[24] Then

Proposition 3 *(I) Suppose that the market size of country-line games falls in country* i. *Assume that the second-order effects are small, i.e.,* $y^i_{va} \simeq 0$ *and* $z^i_{va} \simeq 0$. *Then*
(a) ICL decreases the wage rates of veteran and fringe players;
(b) all CBs and players of all categories are worse off;
(c) participation of fringe players in club-line games declines and that of veterans increases, while the scale of club-line games increases;
(d) the supply of veteran players' time to club-line games from country i *increases;*
(e) that from other countries falls and the scale of participation these countries in country-line games increases;
(II) If the market size for country-line games falls in all countries (while the second-order effects are small), then (a) and (b) hold.

Proof: Suppose the market sizes for country-line games fall in country i. Eqs. (13) and (14) imply

$$\begin{aligned} \frac{dw}{d(-a^i)} &= -\frac{(y^i_a + z^i_a)\rho_{QQ} X_w [V_v - (\rho_Q - v)V_{vv}]}{|\Delta|} < 0 \\ \frac{dv}{d(-a^i)} &= -\frac{(y^i_a + z^i_a)[(2\rho_{QQ} V_v + \rho_{QQ} X_w - 2)X_w - (\rho_{QQ} V_v - 1)(\rho_Q - w)X_{ww}]}{|\Delta|} < 0. \end{aligned} \tag{15}$$

These signs prove I(a); recall that y^i_a and z^i_a are both negative. I(b) is now obvious. Next, rewrite (13) as $\rho_Q(\cdot) = w + X(w)/X_w(w)$. The r.h.s. is increasing in w and hence decreases as w falls. Thus $\rho_Q(\cdot)/d(-a^i) < 0$. Because $\rho_{QQ} < 0$, it follows that Q (the scale of club-line games) increases. Together with X declining, it follows that V must increase. Thus I(c) is proved. The change in total supply of veteran players from country i is given by $dV^i/d(-a^i) = -(y^i_a + z^i_a) + V^i_v dv/d(-a^i)$. It is straightforward to prove that this change in positive, proving I(d). Since v falls, CB^{j}s, $j \neq i$, participate less in the club-line games and more in country-line games. VRs in these countries decline as v falls. I(e) is thus proved. Part II follows directly from part I. ■

Note that the effect on the *composition* of veteran players' time in club-lines games from a country facing a decline in a^i is not clear. There is an intriguing possibility that y^i declines,

[24] If, for example, the function $r^i(\cdot)$ is quadratic, $y^i_{va} = 0$ and if $1-\alpha$ is small enough, $z^i_{va} \simeq 0$.

z^i increases, while the sum of $y^i + z^i$ increases unambiguously. In this case the country may increase its participation in country-line games. If a^i declines for all countries, this possibility applies to all countries.

Overall then, while an increase in the market size of club-line games leads to more supply of each category of players and benefits all CBs and all category of players, a decrease in the market size of country-line games leads to more supply of veteran players' time, less of that of fringe players into the club-line games and it hurts all CBs and all categories of players.

Finally, it is quite possible that club-line games become popular at the *expense* of country-line games. Then the sum of the effects outlined in Propositions 2 and 3 holds.

Proposition 4 *If a^i declines in all countries while A increases,*
(a) the scale of club-line games increases and
(b) there is a higher supply of veteran players' time to these games, while that of fringe players may increase or decrease.

Part (a) of this proposition is of course obvious. But, part (b) is not: the decline in a^is increases the supply of veteran players, which exerts a negative substitution effect on the demand for fringe players that may not outweigh the positive effect of an increase in A.

4 A CB as the Club-Line Games Sponsor: The IPL Scenario

This is the situation where one of the CBs, say CB^1, is the sponsor of club-line games. Presumably, CB^1, has the largest market ($a^1 > a^j$, $\forall j > 1$) and thus the largest cash-flow so as to be able to finance these games, while credit market imperfections do not permit this option to other CBs. This scenario adds a dimension of asymmetry between the club-line-games sponsoring CB and the rest.

In modeling a CB that sponsors club-line games, we treat the entity conducting these games (IPL) as a distinct organ of the CB.[25] We assume that in stage I, behaving as a separate unit, the IPL chooses w and v so as to maximize its 'profits', equal to the difference between $\rho(\cdot)$ and costs of hiring players. In stage II, CB^1 and other CBs choose m^i and y^i. To start with, we assume no retired players.

In stage II, Nash competition is assumed among the CBs in choosing y^i. The best response functions of CBs other than CB^1 are already given by (3). The choice of y^j (for $j > 1$) is independent of other y's. Turning to CB^1, its surplus includes profits from IPL and we have the following expressions of this surplus and that of its players:

$$\Pi^1 \equiv r^1(1 - y^1; a^1) + \Gamma - m^1(1 - y^1); \quad \Omega^1 \equiv m^1(1 - y^1) + vy^1,$$

where $\Gamma \equiv \rho(X + Y; A) - wX(w) - vY$ is the profit of IPL. CB^1 chooses m^1 and y^1, given y^j, $j > 1$. Its objective function is to maximize $U^1 \equiv \alpha \ln \Pi^1 + (1 - \alpha) \ln \Omega^1$.

Like other CBs, the first-order condition with respect to m^1 is: $\alpha\Omega^1 = (1 - \alpha)\pi^1$. Using this, the first-order condition with respect to y^1 reduces to:

$$r^1_e(1 - y^1; a^1) = \rho_Q(X + Y; A). \quad (16)$$

[25]The contract paper sent to players for participating in IPL tournament states IPL as a "unit" of BCCI, which is signed between a player and the BCCI.

Here is the first major behavioral difference between the club-line-games sponsoring CB and others. That is, the former's trade-off guiding the optimal choice of supply of player time to these games does *not* directly involve the rate of payment for participating in club-line games. This is because the payment to its players is an internal transfer. Instead, it involves the two marginal revenues from the two different 'types' of games. As CB^1 is effectively 'selling' in two markets, at the optimum the marginal revenues from the two markets must be equal.

Interestingly, if the total player time for the IPL events increases, the marginal revenue from this 'venture' falls and CB^1 must move some of its own player time from IPL to country-line games. Accordingly, eq. (16) implies a *negative* relationship between y^1 and $X + \tilde{Y}$, where $\tilde{Y} \equiv y^2 + \cdots + y^n$. That is, y^1 is a strategic substitute of players' time supplied by other CBs and fringe players. The interesting implication is that

Proposition 5 *All else the same, a higher v implies more participation in the club-line games by other CBs, but less by the sponsoring CB.*

However, this proposition does not say anything about the equilibrium participation of CBs. Using $\tilde{Y} = \tilde{Y}(v; \cdot)$, eq. (16) implicitly defines

$$y^1 = y^1(\underset{-}{v}, \underset{-}{X}; \underset{+}{A}, \mathbf{a}); \quad Y = Y(\underset{+}{v}, \underset{-}{X}; \underset{+}{A}, \mathbf{a}). \tag{17}$$

Notice that, unlike in the ICL model, the total national-team supply of players' time to IPL is directly dependent on (a) the market size of club-line games and (b) the total supply of fringe players' time. This is because the supply of players' time by the host CB is directly dependent on these two factors.

In stage I, IPL maximizes $\Gamma \equiv \rho(X(w) + Y(v, X(w); \cdot); A) - wX(w) - vY(v, X(w); \cdot)$. The first-order conditions for w and v are:

$$\{\rho_Q(X(w) + Y(v; \cdot); A)[1 + Y_X(v, X; \cdot)] - w\}X_w(w) - X(w) = 0 \tag{18}$$

$$[\rho_Q(X(w) + Y(v, X; \cdot); A) - v]Y_v(v, X; \cdot) - Y(v, X; \cdot) = 0. \tag{19}$$

Host CB 'Bias'

The first question we ask now is whether, all else equal, the sponsoring CB has an incentive to 'field' more or less players for club-line games than any other CB.

Proposition 6 *Let $r^i(\cdot)$ function and a^i be the same for all i. Then $y^1 > y^j$.*

Proof: In view of (3), (16) and (19), we have $r_e(1 - y^1; a) = \rho_Q(\cdot) > v = r_e(1 - y_j; a)$ for $j > 1$. Given that the $r_{ee} < 0$, the inequality, $r_e(1 - y^1; a) > r_e(1 - y^j; a)$ implies $y^1 > y^j$, for $j > 1$. ■

Thus there is an in-built bias for higher participation in the club-line games by the host CB. Increasing marginal cost of hiring players implies that the marginal benefit of y^1 to the host CB (equal to ρ_Q) exceeds v, which is marginal benefit of y^j to its CB. This difference in marginal benefits implies $y^1 > y^j$.

However, differing market sizes for country-line games, a^1 vis-a-vis all other a^js, matter too. That $a^1 > a^j$ for all $j > 1$ tends to imply $y^1 < y^j$. Hence, in general, $y^1 \gtreqless y^j$.

Retirement Decisions

We now introduce these decisions. For players in other CBs the rule is the same as in the ICL case. But, for the players affiliated with the host CB, it is somewhat different, because the joint surplus of the host CB includes profits from the club-line games and this is partly shared by affiliated players.

Analogous to $\tilde{Y}$, let $\tilde{Z}$ denote the players' time of retirees of other countries. The joint surplus of the host CB has the expression:

$$\begin{aligned}\bar{S}^1 &= \underset{y^1}{\text{argmax}} \, \{r^1(1-y^1;a^1) + \rho[y^1 + X(w) + \tilde{Y}(v) + z^1 + \tilde{Z}(v);A] \\ &\quad - wX(w) - v[\tilde{Y}(v) + z^1 + \tilde{Z}(v)]\} \\ &\equiv \bar{S}^1(v; \underset{+}{A}, \underset{+}{a^1}).\end{aligned}$$

Thus, the return to staying in the national team of the host CB equals $\sigma^1 = (1-\alpha)\bar{S}^1$.

In view of (11), the rate of retirement from CB[1] is equal to $z^1 = t(tv - \sigma^1)/\gamma$. Hence, at given v, it depends on $\bar{S}^1$ (as a fixed proportion of it is obtained by the players). But $\bar{S}^1$, in turn, depends on z^1. Simultaneous solving yields

$$z^1 = z^1(v; \underset{-}{A}, \underset{-}{a_1}).^{26} \tag{20}$$

At given v, a higher market size for club-line games or for traditional country-line games implies a higher return from staying with CB[1] and hence less retirement. With respect to a change in v,

$$z^1_v = \frac{1-(1-\alpha)\bar{S}^1_v}{\gamma/t + (1-\alpha)\bar{S}^1_z} = \frac{1-(1-\alpha)\bar{S}^1_v}{\gamma/t + (1-\alpha)(\rho_Q - v)}.$$

From the optimization of the IPL in Stage I it would follow that $\rho_Q(\cdot) > v$; thus the denominator of the above expression is positive. We have $\bar{S}^1_v = (\rho_Q(\cdot) - v)(\tilde{Y}_v + \tilde{Z}_v) - (\tilde{Y} + \tilde{Z}) \gtreqless 0$. We however assume that $1-\alpha$, the bargaining power of players, is not high enough, such that the numerator is positive (even when $\bar{S}^1_v > 0$).[27] This implies that $z^1_v > 0$, i.e. the VR rate from host CB increases with v. If $1-\alpha$ is small enough, it also follows that $|z^1_{vv}|$ is relatively small.

In view of (11) and (20), we now write the aggregate supply function of retirees: $Z(v; A, \mathbf{a}) \equiv z^1(v; A, \mathbf{a}) + \tilde{Z}(v; \mathbf{a})$.

Foreign Quota

As before, we define $V = Y + Z$, the total supply of veteran players' time. In stage I, IPL's objective is to maximize $\Gamma = \rho(X(w) + V(v, X(w); \cdot); A) - wX(w) - vV(v, X(w); \cdot)$. The first-order conditions are the analogs of (18) and (19). Proposition 6 remains in tact.

Instead of further characterizing this scenario, we now introduce a major feature of IPL, which is likely to be retained by any potential CB sponsoring club-line games. That is, the

[26]By virtue of (18), the marginal impact of w on $\bar{S}$ and z^1 is zero.
[27]Note that $\bar{S}^1_v$ is independent of α.

current IPL system contains a quota on the number of foreign players. For the 2008 "summer IPL games," any particular franchisee could not hire more than eight foreign players and field more than four in any particular game. The reason behind such a cap is to encourage domestic talent. It is similar to the practice of English County Cricket (ECC) for its county games. Earlier, there was no quota imposed by ECC and were complaints that it was harming local players. It is indeed believed that this is a big reason for the relative decline in standards of England's national team in recent times.[28] In what follows, we explore the implications of a CB-sponsored club-line games in the presence of such a quota.

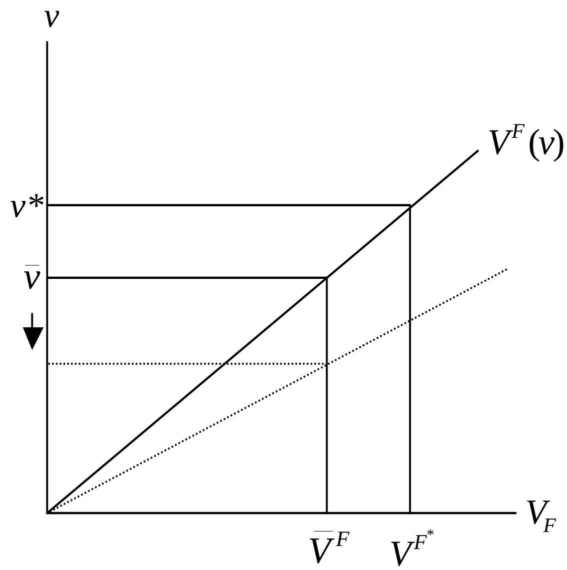

Figure 6: Foreign Quota and Supply of Foreign Players

For simplicity, we shall further assume that all fringe players to be hired for these games are from the host country; let it be denoted by the function $x(v)$. All players from abroad in the club-line games are then of the veteran category, earning the wage rate v from IPL.

Figure 6 depicts the supply of foreign players, indicated by the line, $V^F = V^F(v)$. (Ignore for now the dotted lines and the downward arrow.) To understand the implications of player quota from abroad, suppose that initially there is no quota. Let V^{F^*} denote the total unconstrained amount of foreign players' time hired by the host CB at the equilibrium wage rate v^*. Interpreting this as the original situation, now a quota at $\bar{V}^F < V^{F^*}$ comes to effect.[29,30]

The first question to be addressed is: How would IPL now price the veteran players?

Proposition 7 *Let v_0 denote the optimal v in the quota system. Then $v_0 \geq \bar{v} \equiv V^{F^{-1}}(\bar{V}^F)$. If $|\bar{V}^F - V^{F^*}|$ is small enough, $v_0 = \bar{v}$.*

[28] I am grateful to Arunava Sen for illuminating me on these aspects of quota.

[29] It is easy to see that, if IPL is unconstrained, it is never optimal to voluntarily ration any category players. Because at any $v \leq v^*$, reducing the number of players hired, would reduce the total profits since $\rho_Q > v^*$.

[30] This can be seen as analogous to 'non-economic objective' in the theory of international trade.

Proof: With respect to decision making by IPL in stage I, define

$$\bar{\Gamma} \equiv \underset{w}{\operatorname{argmax}}\, \rho(y^1(v;\cdot) + z^1(v;\cdot) + x(w) + \bar{V}^F) - wx(w) - v(y^1(v;\cdot) + z^1(v;\cdot) + \bar{V}^F).$$

If $v_0 < \bar{v}$, it is equivalent to the unconstrained regime. We know that in this regime $\bar{\Gamma}_v > 0$ as long as $v \le v^*$. Thus $\bar{\Gamma}(\bar{v}) > \bar{\Gamma}(v_0)$ and therefore v_0 cannot be less than $\bar{v}$. Next, by applying the envelope theorem,

$$\begin{aligned}
\bar{\Gamma}_v &= [\rho_Q(\cdot) - v](y^1_v + z^1_v) - (y^1 + z^1 + \bar{V}^F), \text{ implying} \\
\bar{\Gamma}_v\Big|_{v=v^*} &= [\rho_Q(y^{1^*} + z^{1^*} + x(w^*) + \bar{V}^F) - v^*](y^{1^*}_v + z^{1^*}_v) - (y^{1^*} + z^{1^*} + \bar{V}^F) \\
&= [\rho_Q(y^{1^*} + z^{1^*} + x(w^*) + \bar{V}^F) - \rho_Q(y^{1^*} + z^{1^*} + x(w^*) + V^{F^*})](y^{1^*}_v + z^{1^*}_v) \\
&\quad + V^{F^*} - \bar{V}^F - [\rho_Q(y^{1^*} + z^{1^*} + x(w^*) + V^{F^*}) - v^*]V^{F^*}_v \\
&\gtrless 0.
\end{aligned}$$

The quota on foreign players may lead to substitution by domestic players. Thus, it may be optimal to attract domestic players at a higher rate higher than v^*. However, if $V^{F^*} - \bar{V}^F$ is small enough, then $v^* - \bar{v}$ is small enough, and,

$$\begin{aligned}
\bar{\Gamma}_v\Big|_{v=\bar{v}} &= [\rho_Q(\cdot) - \bar{v}](y^1_v + z^1_v) - (y^1 + z^1 + \bar{V}^F) \\
&\simeq [\rho_Q(y^{1^*} + z^{1^*} + x(w^*) + V^{F^*}) - v^*](y^{1^*}_v + z^{1^*}_v) - (y^{1^*} + z^{1^*} + V^{F^*}) \\
&= -[\rho_Q(y^{1^*} + z^{1^*} + x(w^*) + V^{F^*}) - v^*]V^{F^*}_v \\
&< 0.
\end{aligned}$$

Hence there is no incentive choose $v_0 > \bar{v}$ and thus $v_0 = \bar{v}$. ■

In what follows we consider the scenario where $|\bar{V}^F - V^{F^*}|$ is small enough, such that $v_0 = \bar{v}$.

The following is the decision rule for y^1, an analog of (16).

$$r^1_e(1 - y^1; a^1) = \rho_Q(x(w) + y^1 + z^1(\bar{v}) + \bar{V}^F; A). \tag{21}$$

It yields $y^1 = y^1(z^1(\bar{v}), x(w); A, a^1, \bar{V}^F)$ and $V^1 = V^1(z^1(\bar{v}), x(w); A, a^1, \bar{V}^F)$, where $V^1 \equiv y^1 + z^1$ denotes the supply of veteran players' time from the host country. These functions have the following properties:

$$\begin{aligned}
&y^1_z = y^1_x = y^1_F \in (-1, 0);\ y^1_A > 0 > y^1_a; \\
&V^1_z \in (0, 1);\ V^1_x = V^1_F \in (-1, 0);\ V^1_A > 0 > V^1_a.
\end{aligned}$$

Back in stage I, the first-order condition for setting w is:

$$[\rho_Q(\cdot)(1 + V^1_x) - w]x_w(w) - x(w) = 0. \tag{22}$$

In terms of Figure 5, the equilibrium/optimal w is a point on the WW curve below the intersection point.

For comparative statics, our simple model is, unfortunately, too complicated. For tractability, let us further assume that V^1_x is independent of $\bar{v}$, x, A, a^1 or $\bar{V}_F$. (Indeed, this holds if the revenue functions are quadratic: $r^i = a^i(1 - y^i) - (1 - y^i)^2/2$ and $\rho = AQ - Q^2/2$.)

The following proposition lists the effects of an increase in A, a decrease in a^j, $j > 1$ and a decrease in a^1.

Proposition 8 *(I) An increase in A leads to (a) less retiree participation from the host country in the club-line games; (b) more participation by its national-team and fringe players; and (c) a higher scale of club-line games, unless $|z_A^1|$ is very large.*
(II) Any combination of decline in a^js ($j > 1$) implies (a) a decrease in $\bar{v}$ and hence a decrease in retirees' participation in club-line games; (b) an increase in w and hence an increase in the inclusion of fringe players; (c) an increase in the host's national-team players; and yet (d) a decrease in the scale of club-line games.
(III) If a^1 falls, (a) there is more retirement from the host CB; (b) w falls and thus there is less participation of fringe players in club-line games; (c) the participation of the host's national-team players in these games may increase or decrease; and (d) the scale of these games increases however.

Proof of Part I: Recall that $z_A^1 < 0$, while z^1 is not affected by a change in w. Thus z^1 falls, proving I(a). An increase in A and a decline in z^1 implies a higher $\rho_Q(\cdot)$ at given x. From (22) it follows that w and $X(w)$ increase. In turn, this implies, from (22) again, that $\rho_Q(\cdot)$ is higher (taking to account the change in x). Eq. (21) then implies that y^1 is greater. Thus I(b) is proved. Unless $|z_A^1|$ is large enough, the decline in z^1 cannot outweigh the increases in y^1 and x and thus the scale of club-line games increases. ■

Thus a quota leads to more participation by domestic national-team and fringe players.

Note that an increase in A tends to increase the surplus of the host CB and thereby discourages retirement (z^1). If $1 - \alpha$, the relative weight of national-team players' payoff in the joint surplus, is small enough, the magnitude of this negative effect will be small.

Proof of Part II: Any combination of declines in a^js shifts the foreign player supply function to the right, as shown by the dotted line in Figure 6. Given that the quota is fixed, IPL is able to bid down $\bar{v}$. As a result, z^1 declines. From (22), a decline in z^1 implies an increase in w and x. From this equation again, it follows that ρ_Q increases, implying (i) a smaller scale of Q, and (ii) a higher y^1 via eq. (21). ■

Proof of Part (III): III(a) follows immediately. From eq. (22), w and x fall. This equation again implies that $\rho_Q(\cdot)$ falls. This means an increase in Q, the club-line games. In eq. (21), at given y^1 both the l.h.s. and the r.h.s. fall; hence the impact on y^1 is ambiguous. ■

Overall, notice that various market size shifts have assymetric effects on the composition of players from the host CB. Interestingly, even though the supply of foreign players is fixed, a change in the market size of country-line games in other countries affects the players' composition in club-line games and their scale. This occurs through a change in the supply curve $V^F(v)$ and thus a change in $\bar{v}$. A 'surprising' implication is the *negative* impact of decreases in a^js on the scale of club-line games (II(d)), which results from the decline in the rate of retirement from the host CB as $\bar{v}$ falls.

Finally, we consider a marginal relaxation of foreign quota itself, i.e., an increase in $\bar{V}^F$.

Proposition 9 *If the foreign quota becomes less stringent, there is (a) an increase in $\bar{v}$ and a greater participation by foreign players; (b) more retirement from the host CB; (c) a decline in w and less inclusion of fringe players; (d) less participation from the national-team players of the host CB; and (e) an increase in the scale of club-line games.*

These are expected outcomes and the proof is similar to that of Proposition 8. We can 'reverse' this proposition and infer that, compared to no quota, a quota on foreign players has a negative effect on the rate of retirement in the host country and a positive effect on the inclusion of domestic fringe and national-team players in the club-line games. The very last implication means that the foreign-player quota system adds to the bias towards the participation of national-team and fringe players from the host country in these games.

5 Concluding Remarks

This paper is meant to be a first cut at speculating how the industry of cricket may behave when country-line and club-line games coexist. The objective was to articulate a simple model capturing interdependencies between cricket boards and a club-line-games sponsor, which is either an outside entity or one of the boards. The focus was on pricing and hiring decisions by the sponsor with respect to players of different categories and decision making by the boards regarding their extent of participation in club-line games.

Our model seems to offer a few insights, which I list below.

First and foremost, the coexistence of country-line and club-line games implies a linkage between total earnings of players across countries, as the cricket boards share their player-inputs with club-line games. One implication is that the earnings of players from one country depend on the market size for traditional country-line games of some other cricket-playing country.

Second, contrary to one's first instinct, whether or how much of players' time a cricket board should release for club-line games depends on the wage rate offered by the club-line games sponsor relative to the marginal revenue earned from players' time in the country-line games, *not* relative to what it offers to its players.

Third, given that the wage rate offered by the club-line sponsor exceeds the marginal revenue from full-time country-line games, players and cricket boards benefit from participating in the club-line games.

Fourth, even though national-team, retired and fringe players are perfect substitutes in the revenue function of the club-line games sponsor, the sponsor has a general incentive to hire players from all three categories. This is because of increasing marginal cost of hiring players' time from each category.

Fifth, if one of the cricket boards is the club-line games sponsor (e.g. BCCI organizing IPL games), the degree of participation by the host cricket board in the club-line games does *not* depend on the wage rate offered to its players from club-line games. It depends on the marginal revenues earned by it from the two competing forms of the game (similar to the decision-making rule for a price-discriminating monopolist).

Sixth, in the last scenario, there is a built-in bias of the host cricket board to use more of its own players than players from other countries. This is accentuated by the quota on foreign player participation in IPL-like games.

Seventh, in the presence of a quota on foreign players, a decrease in the market size of traditional country-line games in other countries leads, surprisingly, to a decline in the scale of club-line games. As the supply schedule of foreign players for club-line games shifts to the right due to the decline in demand for country-line games, higher competition among them for the same quota level of players in club-line games enables the host CB, the sponsor of these games, to lower the wage it offers. In turn, this discourages voluntary retirement from the host CB and implies less participation of retirees in club-line games. The host CB partly compensates for this by attracting more fringe players and releasing more time of its national-team players for these games. This is why and how the scale of these games declines.

There are many ways of extending and enriching the analysis. Our assumption of identical players from each category is a glaring abstraction. A lot of media attention has been given to very high salaries offered to some players relatively to others in the IPL tournament. In the course of this tournament, there were computations of player ranking in terms of "value per money." Subsequent analysis must model heterogeneity among players in terms of their skills.

Our analysis has assumed one club-line-games sponsor only, so as to highlight the conflict between the sponsor and the cricket boards. At this point of time, there are already two such sponsors, IPL and ICL, who have already organized international club-line games. It is reported that Allen Stanford has already signed a multi-million-pounds deal with ECB for staging in November 2008 a winner-take-it-all five-match series of Twenty20 games between English players and "Stanford's Super Stars", with the latter presumably consisting players from West Indies. Thus, competition among sponsors is already a reality, and, this must be modeled too.

Our model assumes 'non-cooperative' participation by CBs in the club-line games whether or not these games are officially recognized by ICC. In the future, these games may very well feature regularly in the ICC calendar, as an outcome of 'cooperative' decision making among the CBs (and the sponsors if they happen to be outside entrepreneurs). The analysis must be modified accordingly.

It is hoped that the economic analysis of the business of cricket, which entertains over a billion of people in the Indian subcontinent, Australia, England, Caribbeans, African continent and elsewhere, proceeds with the evolution of the organization of the game itself.

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