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SOCIETY OF ACTUARIES Entrepreneurial Actuaries Section

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ENTREPRENEURIAL ACTUARIES SECTION

A New Model for Determining Salaries for NHL Players

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Executive Summary

As an actuary hired by the National Hockey League (NHL), a mandate to propose a new method helping teams in allocating their salary budget between players on their roster has been received. This paper explains how a new model based on determining an economic value for each athlete could help replace the existing method based principally on salary comparison between players with similar statistics. The economic value is based on the value added brought by each player to the franchise according to nine identified components. These economic values will help team executives in determining players' salaries in light of their financial impacts.

Business Problem

Historically, due mainly to player agents and lack of viable financial tools, determining how much an organization should pay one of its players has often been based on irrational factors like "similar" players comparison. The problem with this kind of emotional behaviour is that these other players also have been evaluated based on comparisons. With this chain of comparisons, one erroneous link will lead to an important derailment of the evaluation process. Such a comparison process could be severely impaired by an owner willing to buy a championship or a general manager overestimating a player.

Given that since the 2005 labour dispute the NHL operates under a salary cap and floor concept, it is clear that every team could beneficiate from a tool that would help them allocating salaries based on the real economic value of each player. Salaries represent nearly 60 percent of total operating costs and complex parameters like North American economy and currency value for Canadian teams would make such a tool more than welcome.

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Contract negotiations have become increasingly difficult with agents that were able in the past to play the comparison game in such a way that teams now need to respond with rational arguments to make sure that the negotiation process would be a fair one.

Business Impact

The fact that almost 60 percent of operating costs are freely managed by people who have no concrete data regarding the financial benefits coming from a player is obviously risky. The cost of a given salary is clear but what about the benefits? Any organization operating in such a way that it cannot explain how one of the two components in a cost/benefit analysis is determined is not managing its business properly. Many teams already operate at loss which should give us a hint that more sophisticated tools may be needed. To continue spending most of the budget in such a guessing way could lead the NHL into major trouble since teams in financial distress create problems like bankruptcy, relocation and lack of parity. These are the kind of problems that could even put the league in jeopardy on a long term basis.

Solution: The Economic Value Concept

Our method is based on two parts: the value components and the parameters that will individually influence the components. It actualizes values based on a given set of industry assumptions and contingencies regarding the player.

1.0 Value components

Nine components are considered while trying to determine the economic value. The model is flexible so any other component could be integrated. The method consists of actualizing components over time. The time period would be the contract duration. Many of the parameters described in section 2.0 would have to be taken into account in determining the assumptions.

1.1 Direct additional ticket sales revenues (S)

These revenues would be additional revenues provided by an increase in ticket sales due to the inclusion of the player in the roster. If the team is in a "sold out" situation, the following question must be answered: "By how much could we increase the price of our tickets without losing our "sold out" situation with this player on our team compared to without?" If the team is not in a "sold out" situation, the question becomes: "How many more tickets could we sell by including this player on our roster?"

1.2 Ancillary revenues from additional ticket sales (A)

These revenues would come from additional revenues for each new customer. This includes parking fees, food and beverages. Statistics regarding how much each fan spends on average for these, say $X per event or Y percent of the ticket revenues would be used. Our model allows increasing the value of X or Y if adding the player would improve significantly team's performance and past experience shows that values of X and Y then increase.

1.3 Marketing revenues (M)

These revenues would come from additional derivative products sales made following the player arrival. Included in this component is additional sponsorship with the player on the team.

1.4 Additional local television revenues (T)

This is calculated by actualizing the difference in TV broadcasting revenues with or without the player presence on the roster. Similar national TV contract differential would not be taken into account here but within the component described in section 1.9.

1.5 Additional local radio revenues (R)

Similar to 1.4 except that it applies to radio instead of TV.

1.6 Performance value (P)

Basically, this component is the additional postseason revenues that the team would be able to collect because the player is now part of the team. This is highly subjective and management judgment plays a crucial role for this. Our model needs to use parameters such as player relative calibre (including talent, leadership, attitude, injury proneness and experience), complementarity, chemistry, player position and total revenues brought by additional postseason games.

1.7 Franchise value (F)

Hiring a player could generate an increase in franchise value. This increase could come from two sources: firstly if the salary paid is lower than the economic value; secondly if adding the player produces an impact on the competitiveness of the team improving rankings and/or profitability.

1.8 Player market value (D)

When a player is hired, he has a market value. This market value has to be translated in terms of dollars. If the contract is signed over a period of years, we have to

estimate the market value of the player at the end of this period if then the player is not a free agent. Difference (positive or negative) between the two values should be used in determining the economic value. This is like an amortization cost.

1.9 League value (L)

This value would be given only as an exception to outstanding athletes generating an increase in total league revenues. This component should be supported by every team in the league. Additional revenues over the league should be considered. The league would determine the percentage of this value that would be returned to the player.

2.0 Parameters

For each component, we have to determine assumptions to be used in the actuarial formulas. These assumptions and the ensuing computations will be influenced by the following parameters.

- Age should be considered when evaluating contingencies risks like mortality, disability and injuries. It would have a significant impact on most of the nine components.
- Charisma, if applicable, could influence principally component 1.3 and to a lesser degree other components.
- Complementarity could influence principally component 1.6 and to a lesser degree other components.
- Player behaviour outside the rink
- Energy and resilience
- Reliability would influence the same way complementarity would.
- Leadership
- Experience
- Performance would be the most significant parameter affecting all components.
- Injury proneness will influence the disability assumptions.

3.0 Salary Calculation

This would be done according to the following steps.

3.1 Determine contract length

This must be fulfilled before any salary calculation. If the team wants to test multiple durations, the model allows it by replicating the calculation using multiple durations.

3.2 Determine the economic value percentage

A decision has to be made regarding the percentage of the total value that the team wants to pay the athlete. This percentage could be over 100 percent due to market considerations, but at least management would then be aware of it in its payroll management.

3.3 Calculate the economic value

This is where the model comes into play. Team management determines the assumptions and the model calculates the economic value as the sum of the first eight components (see spreadsheet joined). The league value component, if necessary, would be calculated separately since being divided between teams.

3.4 Salary calculation

This final step will be done according to values determined in the first three steps, making sure to take into account other factors like minimum salary and any cap constraints.

Formulas regarding economic value and salary calculation are included in appendix.

A practical example is included as a separate spreadsheet for player X with no League value.

Appendix (Formulas)

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Appendix

Formulas

Economic value (EV) = S + A + M + T + R + P + F + D

EV = F + W where W = S + A + M + T + R + P + D

If y is the percentage of EV that we want to credit the player

And

F = F1 + F2

Where

F1 = (1-y) x EV
F2 is the value of the increase in franchise value due to the player addition

Then

F = ((1-y) x EV) + F2

EV = W + F2 + ((1-y) x EV)

EV = (W + F2) / y

EV should be calculated over the entire period of the contract to be signed

Annual salary AS = Z + (((y x EV) + (k x L)) / ä)

Or AS = Z + ((W + F2 + (k x L)) / ä)

Where

Z is the minimum salary prescribed by the players convention*
k is the percentage of the league value component to be credited
ä is an actuarial discounted value over the period of the contract taking into account all contingencies like mortality, cost of capital, short term disability and long term disability. This factor could take the form of an annuity for fixed values or be calculated on a cash flow seriatim basis for varying values.

* Z could be ignored but for fairness reasons is included in our model.

Formulas for S, A, M, T, R, P, F2, D and L are actualizations of the benefits based on assumptions determined by team management (league management for L) and actuarial contingencies such as interest, mortality and disability

$S = (N_p - N_b) \times TP_b \times \ddot{a}$ if not in a sold out situation
$S = (TP_p - TP_b) \times C \times \ddot{a}$ if in a sold out situation

$A = X_p \times (N_p - N_b) \times \ddot{a}$ if not in a sold out situation and data available is X $ per fan
$A = Y_p \times TP_b \times (N_p - N_b) \times \ddot{a}$ if not in a sold out situation and data available is Y % of TP
$A = (X_p - X_b) \times C \times \ddot{a}$ if in a sold out situation and data available is X $ per fan
$A = (Y_p - Y_b) \times TP_p \times C \times \ddot{a}$ if in a sold out situation and data available is Y % of TP

$M = (M_p - M_b) \times \ddot{a}$

$T = (T_p - T_b) \times \ddot{a}$

$R = (R_p - R_b) \times \ddot{a}$

$P = G \times TP_p \times AD \times C \times \ddot{a}$

$F2 = (FV_n - FV_o) \times {}_nP_x^{(T)} \times v^n$

$D = (MV_n - MV_o) \times {}_nP_x^{(T)} \times v^n$

$L = \sum_{t=2}^{z} (S_t + S_t' + A_t + M_t + T_t + R_t + F2_t)$ for the other (z-1) teams

Where

N_p is the number of tickets sold per local game with the player now in the roster
N_b was the number of tickets sold per local game before the player was added
TP_p is the average ticket price for a game now that the player is with the team
TP_b was the average ticket price before the player was added
C is the maximum capacity of the arena
X_p is the average amount of dollars a fan spends per game for ancillary purposes with the new player on the team
X_b was the average amount of dollars a fan spent per game for ancillary purposes before the player joined the team
Y_p is the percentage of the ticket price a fan spends per game for ancillary purposes with the new player on the team
Y_b was the percentage of the ticket price a fan spent per game for ancillary purposes before the player joined the team

M_p is the value of derivative products sold per game with the addition of the player
M_b was the value of derivative products sold per game before the addition of the player
T_p is the value of the television contract per game with the player added
T_b was the value of the television contract per game before adding the player
R_p is the value of the radio broadcasting contract per game with the player added
R_b was the value of the radio broadcasting contract per game before adding the player
G is the number of additional playoff games to be played due to an improved team with the new player
AD is the ratio of average ticket price during playoff games compared to regular games
FV_n is the estimated franchise value of the team at the end of the player contract (n years)
FV_o is the franchise value at the time of the player signature
MV_o is the market value of the player if sold to another team at time of signature
MV_n is the estimated market value of the player at the end of his contract
S' is the value of S (regular games) but for playoff games for all other teams

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