Bain-Modigliani Limit Pricing

Deceiving Strategy & Incredible Threat of Entry

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How did these beliefs and practices now appear to him?
Not more rational than had then appeared.
Not less rational than other beliefs and practices now appeared.
Joyce *Ulysses*

Aide Memoire for Management

There are circumstances and challenges faced by you on attaining your value proposition. You need to articulate a clear long-term vision. We will work with you to assemble exactly the strategy you want and to work on a long term vision, strategic direction and credible metrics against which you can assess performance. On an assessment of opponent's types and their likely commitment to the game we adjudge that it may be rational to enter the market-as-a-game and sustain a competitive advantage. On appointment we will work with your strategic team to convert the game theoretic advice into a playbook that delivers value and meets KPIs.

The management team is seeking advice on entry to a new market. Entry to a new market creates a value proposition for management. The incumbents are likely to react. The advice depends on the belief formation process of both players, the timing of entry and commitment from the incumbent. In order to assess the value proposition for a client-entrant we describe the main battlefield – we open a pre-entry playbook for the entrant based on belief formation and commitment, then we open a post-entry playbook with the entrant 'thinking as an incumbent' and assess the risk-on of the strategy sets.

Introduction: is it rational for a company to enter a game?

The objective of the strategic reasoning in this note is to provide a robust playbook for an entrant. The timing of entry can be assessed in terms of the threat of entry, an optimal entry plan, pre-entry price signaling, and belief formation. They are key elements in an economic evaluation of the value proposition from a game theoretic perspective

Post-entry 'what-if' scenarios are evaluated in order to provide an entrant with a menu of choices. Player A is a potential entrant to a game of ∑ incumbents. Fig 6.1 in *Decoding Strategy* illustrates[1] the microeconomics of the game dimension in the limiting pricing game. The market price Pm is known to all players. Player B is a representative incumbent. Neither player believes that each have reserve capacity. The price G is a break-even price for the entrant and Pc is the break-even price for the incumbent. The entrant's entry function is guided by [Pm – G] > 0 and a limit price L is defined as

[1] Patrick McNutt (2014): *Decoding Strategy*.

the price that converts a positive pre-entry function into a negative post-entry function. The entrant must decide to enter or not. If entry is a play then they have to either enter aggressively or not.

Playbook Pre-Entry

1. Reputational type and credible threat

Incumbent builds a reputation in (t – 1) games so that when they signal ΔP = L < G there is a hard commitment to reduce price post-entry. If the entrant believes that the post-entry price will be L < G then the entrant will not enter. The player abandons[2] the game.

This is Nash equilibrium strategy play in the game with no entry and incumbent price signaling. However we examine this further by addressing a player's commitment and players' belief formation.

Note: An incredible threat of entry is an error[3] in the game. It coincides with an incumbent's prior belief that an entrant would never play 'enter' that 'enter' was not in the entrant's strategy set but the entrant plays 'enter'. The choice to enter is rational if it is optimal for some belief that an entrant holds about the incumbent's choice.

2. CL type[4], reserve capacity and camouflage

Alternatively the reputational type plays ΔP but the entrant is a camouflaged CL type with reserve capacity. This can be illustrated in Figure 6.1 if we switch the entrant's cost function with that of the incumbent. On entering, price falls to Pc, a new break-even for a CL entrant but at a loss for the incumbent.

3. Coogan's bluff[5]: Fighting ship type with NE

Likewise if the entrant is a cross-subsidized fighting ship they will enter at the pre-entry announced price ΔP = L and compete in a sequence of price disciplining moves with the incumbent until the prices converge to a zero price equilibrium. The entrant has in effect 'called the bluff' of the incumbent. This is a classic price war.

4. Lemmings Strategy (Dysan's bluff[6])

If the entrant has a (t - 1) history of entering a game as a fighting ship they reveal a lemmings strategy in believing the worst outcome (post-entry lower prices) that could happen so they pro-actively indulge[7] the incumbent's threat of L until pre-entry prices fall to a new lower bound set by

[2] We call this the Luzhin move after the chess master in Vladimin Nabokov's novel *The Defence* wherein Luzhin abandons the chess game by jumping out a window.
[3] *Vide* the discussion pp178-180 *Decoding Strategy*
[4] Define CL in Chapter 5 *Decoding Strategy* as 'cost leader' with capacity discipline to the level of reserve capacity in the game threatening to reduce price to zero.
[5] Named after the character Marshall Walt Coogan played by Clint Eastwood in the classic 1968 genre movie *Coogan's Bluff.*
[6] Refer to the PC RPG game *Dysan Shapeshifter* where players have an opportunity to *shape-shift* or look like the enemy. Also in the 2014 fantasy comedy drama *The Cobbler* the character Max Simkin impersonates many characters by wearing their shoes.
[7] Lemmings imagine the worst and feel like it is happening now. They are aggressive.

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the incumbent[8]. In a sequence of moves reminiscent of Selten's chain store paradox the entrant observes prices falling and in the belief that there is no sustainable competitive advantage on entering at a predatory price below L they wait until prices increase post-entry.

5. Folk theorem Co-ordination

In the belief that a Nash equilibrium outcome will not obtain (for example, no price war) an entrant simulates in a feedback loop all the potential prices likely to arise from the Playbook moves 1 to 4. The entrant player then, assesses the risk profiles in Table 1 to create a price hierarchy from Pm to G to Pc to zero. The prices are the focal points[9] in a price signaling entry game.

Table 1: Risk Evaluation & Feedback Loop

Entrant Payoffs	Incumbent Payoffs
Pre-entry: $\pi = [Pm - G] > 0$	Pre-entry: $\pi = [Pm - Pc] > 0$
1. Post-entry: $\pi \leq 0$	1. Post-entry: $\pi > 0$ **Limit pricing strategy**
2. Post-entry: $\pi > 0$ **Camouflage strategy**	2. Post-entry: $\pi \geq 0$
3. Post-entry: $\pi \leq 0$ **Fighting ship strategy**	3. Post-entry: $\pi < 0$
4. Post-entry: $\pi > 0$ **CL strategy**	4. Post-entry: $\pi \leq 0$
5. Post-entry: $\pi > 0$ **Folk Theorem strategy**	5. Post-entry: $\pi \geq 0$

Belief Structure

The entrant has a simple belief structure such that the player believes that the incumbent is correct about the entrants' beliefs. The incumbent believes that the entrant will not enter. And the incumbent believes that the entrant believes that the incumbent will price at L. So the incumbent type ascribes one type only for the entrant for which 'no entry' is optimal. The entrant's belief structure must be generated by belief about the choices of the $\sum$ of competitors. The entrant believes that the incumbent believes that the entrant believes that the incumbent believes that the entrant will not enter.

True State Feedback Loop

When the limit price L = Pc the market is contestable. In contestable markets the threat of entry at 2, 3 and 4 in Table 1 disciplines the pricing behavior of the incumbents. Prices are set at a lower rate with a credible threat of entry into a market-as-a-game. Consumers do benefit from the lower price. In a separating equilibrium the price signal is dependent on type: so, the Baumol type in a Bertrand

[8] The incumbent's price behavior is driven by what he believes the entrant believes about his intentions as regards lowering prices – the paradox of lowering prices. Ultimately the representative incumbent is blamed by the $\sum$ incumbents for lowering prices.

[9] In this folk theorem price co-ordination the entrant could enter as 'an accidental tourist' or as CL type setting the lowering price bound of the price hierarchy.

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game will signal a (lower) price move and a CL type with reserve capacity will play camouflage. With reserve capacity they set a lower price but not lower than the limit price, L. In a pooling equilibrium the price signal is independent of type so a high cost and a low cost CL type incumbent both equally likely set the same high price or the same low price.

An entrant player filters the information from Table 1 into the 'true state' strategy set in Table 2. In other words the strategy set in Table 2 represents the choices of a player who thinks as an opponent. In the limit pricing game with incredible entry the entrants, thinking as incumbents, believe that they will be accommodated on entry in order to avoid the Nash trap. The incumbents intent on deterring entry behave as if the Nash equilibrium is a credible threat and that the Nash equilibrium *per se* is a threat strategy in the game.

Table 2: Dark Strategy

Entrant thinking as an Incumbent type	Incomplete Information[10]	Imperfect	Information
		Separating equilibrium Signal = *f*(type)	Pooling equilibrium Signal ≠ *f*(type)
Strategy S1	Entry	Entry	No entry
Strategy S2	No Entry Limit price	Entry but π Higher in Strategy S1	No entry
Strategy S3	No Entry Limit price	Entry but π Higher than in Strategy S2 and Lower than S1	Entry but π Lower than in Strategy S2

Playbook Post-Entry

Based on the information in Table 2 the *entrant thinking as an incumbent* enters the game to the surprise of the ∑ incumbents presenting them with an incredible threat of entry.

What if Strategy S1: The representative incumbent demonstrates a commitment to Player A to pricing at L if it is costly to revoke if A enters with post-entry $\pi > 0$. The incumbent believes that the entrant is a camouflaged CL and that negotiation is an optimal choice.

What if Strategy S2: The ∑ of competitors signal a commitment to a post-entry limit price L, so that $\pi < 0$ and there is a Nash trap at (0, 0). The entrant enters the game with a fighting ship.

What if Strategy S3: A silent incumbent, D, does not accept L if $L < P_D$ so this assuages A's fear of a post-entry $\pi < 0$. However A may be deterred from entering if A believes that D will morph into a commitment type mimicing the ∑ behavior. The entrant believes that coordinated pricing[11] will evolve in time.

[10] Adapting Harsanyi's definition so that incomplete information is about player type and imperfect information is about how the game is played.

[11] Not dissimilar to a *folk theorem* coordinated pricing or an observed 'accidental sameness in prices' described in McNutt (2005): *Law, Economics and Antitrust*.

Core Ideas

The Nash Trap

The likely moves in an entrant's post-entry playbook will have been computed from the feedback loop 3 (fighting ship) or feedback loop 4 (CL with reserve capacity). If the high cost incumbent plays limit pricing under the pooling equilibrium in Strategy S1 the entrant will enter; in Strategy S2 with a fighting ship setting prices below L the entrant will engage with the ∑ of competitors and, if the reputational type mimics the behavior of ∑ in Strategy S2 by matching entrant prices then the prices in Strategy S3 will be lower with CL type entry than the matching prices in Strategy S2 with a probability of a zero price equilibrium.

In the extensive decision tree outlined in the Masterclass http://www.patrickmcnutt.com/wp-content/uploads/DecisionTree2012.pdf the branches of the tree outline the likely sequence of moves. In the overlap between limit pricing games and games of commitment[12] there are small learning effects from a correlation between player type and commitment. A rational representative incumbent would rather accommodate than fight a camouflaged entrant.

Two Nash equilibrium strategies are defined: (i) Table 3: in terms of aggressive entry with an incumbent retreat, and (ii) Table 4: in terms of no entry and incumbent price signaling. A new decision tree will be worked through as an exercise in the Masterclass. In the interim, here are payoff matrices for consideration.

The entrant believes that the representative incumbent will not reduce price so the entrant receives a payoff of 2 or 0, and it is rational for entrant to enter and attack aggressively.

Payoff: Incumbent, CL Entrant.

Table 3 What if Strategy S1

	CL Enter	No entry
Limit pricing	-1 -2	0 0
No pre-entry price decrease	-2 2	0 0

Consequently an entrant 'thinking as an incumbent' believes that the incumbents prefer prices converging to Pm and away from the Nash trap. If the incumbent's commitment reflects this belief the entrant will have successfully deceived the incumbent players in the entry deterrent game. The deceit is credible when a post-entry sequence of moves include (i) entering, notwithstanding the credible threat of L, and (ii) entering with a profitable entry plan. Whether or not a deceiving strategy delivers a sustainable competitive advantage for an entrant depends on the ability of any player in the game to make threats that are credible.

[12] Thomas Schelling (2006): *Strategies of Commitment and Other Essays*.

Game Loders

The Incumbent's Perspective

In this note the *entrant thinking as an incumbent* enters the game to the surprise of the ∑ incumbents presenting them with an incredible threat of entry. Regardless of what the entrant does the representative incumbent believes that limit pricing is at least as good as not reducing pre-entry prices. So the incumbent plays a limit price strategy and believes that the entrant will not enter. This is the classic Bain-Modigliani entry deterrent strategy.

Payoff: Incumbent, FS Entrant.

Table 4 What if Strategy S2

	FS Enter	No entry
Limit pricing	0 -2	0 0
No pre-entry price decrease	-2 -2	0 0

In this case Pm remains. In other words there are circumstances in the limit pricing game with belief formation where it is rational for both players to accommodate each other. At that point of balance in the game when both players believe that neither can improve unilaterally on the payoff the possibility of a cooperative signaling game presents itself as a stable outcome.

Payoff: Reputational Incumbent, CL Entrant.

Table 5 What if Strategy S3

	Cooperate	Compete
Cooperate	2 2	0 3
Compete	3 0	1 1

However, there is a classic Prisoners' dilemma outlined in Table 5. Only if both players trust each other not to deviate from the co-operating play will both will gain 2. However, it is rational to betray trust. There are two readings related to our discussion here entitled *Thief of Nature* and *Second Win* and both documents can be downloaded from http://www.patrickmcnutt.com/news/masterclass/. In Table 5 there is a Nash equilibrium at (1, 1), a price war. The entrant thinking as an incumbent will punish the betrayal and commit to the (1, 1) outcome for a period of time. A price war can be costly for both players, independent of commitment to type – they require deep pockets.

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