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雙佔廠商的最適互補品策略
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一、中文摘要

本研究旨在分析不完全競爭之雙佔廠商的最適產品組合策略，以及廠商產品組合策略與廠商間價格競爭強度之互動關係。且本研究試圖回答出廠商何時應推出可提升其鎖定目標消費者區隔能力之替代品，抑或選擇推出能增加主力產品(primary good)競爭優勢之互補品的條件。考慮消費者理想點均勻分配於[0,1]、雙佔廠商分別位於兩端點的 Hotelling 模型，且僅有高端廠商具備生產加值型產品(premium product)的能力，因而互補品搭配加值型產品時，可讓消費者產生較互補品搭配基本型產品(basic product)時更高的額外效用。本研究探討兩類消費者族群：高端消費者較偏好加值型產品，而低端消費者對兩類主力產品感到無差異。從而獲致以下之研究結論：(i)當低端廠商獨家生產互補品時，高端廠商偏好同時生產加值型產品與基本型產品，而非選擇僅生產加值型產品。(ii)當高端廠商同時生產加值型產品與基本型產品時，獨家推出互補品之低端廠商在某些條件下可能偏好將互補品只銷售給高端廠商（即對手廠商）的顧客。(iii)反之若此一低端廠商偏好將互補品銷售給所有顧客，則隨著加值型產品相較於基本型產品的競爭優勢越小，低端廠商提供互補品的獲利及誘因就越高。

關鍵字：互補品、產品組合、競爭策略。

二、英文摘要

This study analyzes the optimal product mix strategies of two imperfectly competitive firms which currently produce primary products and consider whether to introduce a complementary good. In particular, this paper attempts to examine the interactions between manufacturers' product mix strategies and the intensity of their price competition in the market of the primary good. When should a firm add another primary product in order to better screen its consumer segments and let its rival exclusively supply the complementary good? When should a firm add a complementary good to increase the competitive advantage of its primary product, and target the latter to a mass market? To address the above issues, we assume a Hotelling model where consumers' ideal points are uniformly distributed over [0,1] and the two firms are

positioned at the two ends of [0,1]. Furthermore, only the high-end firm is capable of producing a premium primary product and the complementary good creates higher extra utility to consumers when consumed with the premium product than with the basic product. We consider two consumer segments: consumers in the high-end segment prefer the premium product to the basic product while those in the low-end segment feel indifferent between the two products produced by the same firm. We obtain the following results:

(i)When the low-end firm exclusively produces the complementary good, the high-end firm will prefer producing both the premium product and the basic product to producing the premium product only.

(ii) When the high-end firm produces both the premium product and the basic product, the low-end firm that chooses to offer the complementary good exclusively under some conditions may prefer selling it only to its rival's customers.

(iii)If instead the low-end firm prefers selling its exclusive complementary good to all consumers, the smaller the competitive advantage of the premium product from the complementary good relative to the basic product, the more likely that the low-end firm finds it profitable to offer the complementary good exclusively in addition to its primary product.

Keyword：Complementary goods, Product mix, Competitive Strategies.

三、緒論

在高度競爭的市場環境中，廠商開始思考如何透過與其他廠商的合作來擴充市場需求，而不僅僅侷限於將其他廠商視為競爭對手的傳統思維。Brandenburger 與 Nalebuff (1995)就曾指出廠商有時應徹底改變遊戲的規則，而不只是在既定的規則中尋找策略性的手段。Brandenburger 與 Nalebuff 所提出最獨特且重要的論點，是提醒廠商不應忽視產品的供給商以及製造與其產品互補之產品的廠商（在該文中以「互補品廠商(complementor)」稱之）。該研究中搜羅相當豐富的實例，證實出基本品供應商與互補品廠商常改變廠商間的互動關係，從而影響均衡時的利潤。

不論是學界或實務界皆體認到廠商必須與上下游等其他廠商合作，才能透過為顧客創造和傳遞較優越的價值來建立競爭優勢(Kotler, 2003)。當兩家廠商推出與對方互補的新產品時，彼此間的競爭本質已經產生變化，特別是當大部分的廠商都擁有不只一條的產品線時，了解產品組合策略對於其與競爭廠商間競爭關係的影響將是至關重要，因為廠商可能利用產品組合策略來與原本為競爭關係的廠商進行合作，從而提升產品組合策略的效能。

因此，廠商為有效規劃其產品組合，必須先了解在推出能夠互補自己與其他廠商基本品的產品時，將對兩家廠商基本品市場的競爭造成何種影響？而當廠商推出的是能替代(而非互補)自己與其他廠商基本品的產品時，對基本品市場的競爭所產生的影響又有何不同？接下來，我們將藉由整理過去文獻，歸納出互補品在獨佔廠商和雙佔廠商等不同觀點中所扮演的角色。

獨佔廠商的觀點

對於獨佔廠商來說，互補品的存在會誘使廠商考量產品對其他產品的外溢效

果，因此，相較於分別銷售兩種產品的獨立廠商，多產品廠商的產品訂價會較低，這是因為獨佔廠商會將降低單一產品售價可同時提升多種產品銷售量的正面效果納入分析。此意味著獨佔廠商有可能將互補品訂價訂得低於邊際成本，以便達到提升其他產品銷售量的推廣效果。

雙佔廠商的觀點

Matutes 與 Regibeau(1988)考慮當消費者可自行搭配不同成份產品(例如硬體與軟體)以組成一系統時，兩家同時生產所有成份產品(components)之雙佔廠商是否應生產與其競爭廠商產品相容的成份產品，結果發現當廠商推出與競爭廠商相容的成份產品時，有助於減緩廠商間的價格競爭。此乃起因於當廠商選擇將其成份產品與競爭者相容時，消費者可自行搭配來自不同廠商之成份產品以組成一混合系統(hybrid system)；此時單一廠商若將其某一成份產品降價，將會同時提升以該成份產品與競爭廠商另一成份產品所搭配之混合系統之需求，圖利其競爭者，因而降低廠商降價的誘因。因此，兩家廠商有較強的誘因來提供具相容性的互補品。而 Economides(1989)的研究也顯示出此結果在多廠商和需求定義較一般化的情況依舊成立。

Matutes 與 Regibeau(1992)將其過去所做之研究加以延伸，將混合型組合產品(mixed bundling)策略（即廠商對由其成份產品搭配而成之組合產品在訂價上給予折扣）納入分析範疇。該研究顯示混合型組合產品策略會導致該子賽局產生囚犯困境般的均衡，從而降低廠商選擇與競爭者產品相容的誘因。這是因為選擇混合型組合產品策略的廠商促銷的是其獨家的組合產品，而非單一的成份產品，進而縮減了未提供組合產品之廠商所能服務的市場需求，且當未提供產品組合之廠商因可服務的殘存市場縮小而被迫降低單一產品的價格時，提供組合產品的廠商就可因競爭廠商自訂的低價而由混合系統產生搭便車的好處。然而，由於在這兩篇研究中，Matutes 與 Regibeau 都假設兩家廠商都生產所有的成份產品，這項限制使得該研究結果無法提供有關廠商最適產品組合策略的行銷意涵。

Cabral 與 Villas-Boas(2005)分析多產品廠商自身產品間之互動關係對於均衡利潤的影響。特別值得注意的是，該研究發現當多產品廠商其自身產品間的需求互補關係較強時，儘管會產生正面的直接效果（即給定競爭廠商的策略不變時一廠商改變策略所能產生的效果），但同時也會強化廠商間的競爭，從而降低均衡時的利潤。然而，如同作者所言，此研究結果與作者假設各廠商具對稱性有關。如下所述，當廠商擁有不同的市場定位而非對稱廠商時，需求互補性對廠商產品策略與均衡利潤將產生截然不同的影響。事實上，Ma(2004)的實證研究就顯示出，競爭廠商在體認其各自產品線之需求互補性時可獲得較佳的利潤。

周善瑜、陳其美與蔡和霖(2005)分析在基本品市場為競爭關係的兩家非對稱雙佔廠商，所應採行的最適互補品策略。該研究假設兩廠商基本品的品質有所差異，且消費者對基本品理想點的心理偏好為一均勻分配。此外，該研究假設互補品可為兩家廠商基本品所生產的附加價值(互補效用增額)有所差異，但不因消費者而有不同。在這種前提假設下，該研究發現，兩廠商的均衡策略端視高、低階廠商基本品間的品質差距以及兩家廠商各自產品線互補程度的差異，兩項重要的研究結果包括：第一，當在互補品搭配基本品所產生的效用增額差異不大時，會有單一

廠商獨家推出互補品，且將互補品訂定低價服務整個市場，且基本品利潤亦隨互補品推出而上升。第二，當互補品搭配高階基本品效用夠高時，低階基本品製造商最終將放棄自己的基本品，而專心經營互補品市場，在此情況下，兩家廠商分別在兩種產品市場中成為獨佔廠商且彼此轉為合作關係。該研究也顯示著非對稱廠商的分析以及內生決定的最適產品策略可啟發出更豐富的行銷意涵，然而，周善瑜等人(2005)的研究並未考慮廠商可以推出替代品而非互補品的可能性，且模型假定每一個廠商皆一次推出其產品組合(互為互補品或替代品)，因而無法探討廠商最適的動態產品組合策略。其次，雖然周善瑜等人(2005)的研究顯示互補品對兩廠商基本品所產生附加效用之差異會影響廠商獨家推出互補品的誘因，但該研究假設互補品對兩廠商基本品所產生之附加效用為外生給定，並未將廠商可經由 R&D 影響該互補品與其基本品搭配之競爭優勢納入分析。

有鑒於過往互補品相關文獻分析之缺漏，本研究旨在分析不完全競爭之雙佔廠商的最適產品組合策略，以及廠商產品組合策略與廠商間價格競爭強度之互動關係。且本研究特別試圖回答出廠商何時應推出可提升其鎖定目標消費者區隔能力之替代品，抑或選擇推出能增加主力產品競爭優勢之互補品的條件。

本研究假設此雙佔廠商分別位於消費者理想點為均勻分配之 Hotelling 模型的兩端點，且僅有高端廠商具備生產加值型產品(premium product)的能力，因而互補品搭配加值型產品時，可讓消費者產生較互補品搭配基本型產品(basic product)時更高的額外效用。本研究探討兩類消費者族群：高端消費者較偏好加值型產品，而低端消費者對兩類主力產品感到無差異。

從而本研究獲致以下之結論：

(i) 當低端廠商獨家生產互補品時，高端廠商偏好同時生產加值型產品與基本型產品，而非選擇僅生產加值型產品。

(ii) 當高端廠商同時生產加值型產品與基本型產品時，獨家推出互補品之低端廠商偏好將互補品銷售給高端廠商（即對手廠商）的顧客。

(iii) 反之若此一低端廠商偏好將互補品銷售給所有顧客，則隨著加值型產品相較於基本型產品的競爭優勢越小，低端廠商提供互補品的獲利及誘因就越高。

四、文獻探討

回顧文獻可知，有一派學者在探討生產基本品的獨佔廠商（如微軟）在面臨網路外部性時的最適互補品定價策略(Economides and Viard, 2004; Lee, 2000)。Economides 與 Viard(2004)探討的是一獨佔基本品製造商面臨是否要自行推出互補品的決策。作者認為考量自行推出一互補品或贊助其他廠商推出互補品時，基本品獨佔廠商較偏好前者，因為自行推出互補品的利潤提升將大於贊助其他廠商推出所能獲得的利潤。而即使花費的成本相同，基本品的獨佔廠商較偏好「增加」互補品數量而非「提升」互補品品質，以期刺激基本品的銷售。當考量應贊助許多廠商推出多種互補品或贊助廠商提升互補品品質時，即使贊助總額相同，該基本品獨佔廠商將較偏好贊助廠商推出更多的互補品種類。在訂價上，即使互補品搭配基本品的效用提升，廠商將傾向拉高互補品價格而不願提高基本品價格。該研究以微軟的 Windows 與 Office

為例，前者為作業系統，代表基本品；後者為應用軟體，代表互補品，即使微軟在兩產品的市佔率皆超過九成，然而實務上 Windows 的售價會比 Office 的售價低上許多，原因即為部分消費者可能選擇購買 Windows 搭配其他非 Office 的應用軟體，保持基本品較低訂價將可吸引此群消費者仍願購買基本品，因此出現互補品訂高價、基本品訂低價的情況。然而，本研究目的在於了解當網路外部性不存在時，製造商的互補品決策對於基本品市場競爭造成的影響，因此將排除網路外部性的影響。

而另外一派的文獻則著重在分析互補品雙佔廠商的價格競爭(Economides, 1989; Matutes and Regibeau, 1988; Matutes and Regibeau, 1992)，關注的焦點是兩家同時生產基本品和互補品的廠商，所推出的互補品是否應和競爭廠商的基本品相容。Matutes 與 Regibeau(1988)發現，垂直整合的廠商有更大的誘因去生產與競爭廠商產品相容的產品。而由 Matutes 與 Regibeau(1992)分析雙佔廠商的產品策略得知，是否與競爭廠商產品具相容性會影響廠商最適的定價決策。當兩家廠商生產相容性的產品時，單一產品(pure component)策略會凌駕於單純組合(pure bundling)策略。但當兩家廠商產品不具相容性時，所有產品策略獲利相同。但是，由於這派文獻假設各家廠商的產品組合為外生給定，因此將互補品的策略效果納入考量後，這派學者便難以決定出最適的產品組合。

類似的研究還包括 Cabral 和 Villas-Boas(2005)進行的互補性產品線廠商間之競爭分析，該研究發現若只有單一廠商推出互補品，則可提升該廠商之利潤，但當所有廠商都推出互補品時，互補品的存在會強化兩家廠商間的價格競爭並導致利潤的下降。且 Cabral 和 Villas-Boas(2005)的研究中假設製造商的產品策略是外生給定，因此廠商無法透過調整產品組合來減緩價格競爭。然而，Ma(2004)的實證研究顯示當廠商追求的是極大化不同產品類別產生的加總利潤時的獲利較佳。Telser(1979)探討獨佔廠商在互補產品的搭售策略(tie-in sales)與特價誘客商品(loss leader)。文中指出若廠商能在互補性產品（打卡紙）處於獨佔地位，該廠商將會在基本品（製表設備）上訂定低於邊際成本的價格，再將互補性產品訂高價以達價格歧視，例如，IBM 在製表設備訂低價而要求用戶所需要的打卡紙必須全部向 IBM 購買，酒吧裏酒保提供免費點心以吸引酒客消費更多酒類飲品。Lal & Matutes(1989)考慮雙佔市場之競爭，當廠商彼此提供多種相同產品時，會傾向於各自選擇其中一產品訂低價吸引消費者上門，而亦出現類似特價誘客商品的現象，模型假設市場部分消費者購物時有交通成本而儘可能同地購足所需產品，當此類消費者比例上升則上述現象越可能出現，此時將有效緩和彼此間的競爭程度。可惜的是，Cabral 和 Villas-Boas(2005)的研究中還是假設製造商的產品策略是外生給定，因此廠商依舊無法透過調整產品組合來減緩價格競爭。

基本品與互補品之間的互動關係，也是不少學者持續關心的焦點。Sengupta(1998)的實證研究指出，互補品確實可提升基本品的銷售量，儘管互補品的售價未必很高，但廠商卻可從基本品的銷售量增額獲得更多的利潤。基本品與互補品的關係甚至可以應用到財務與行銷跨領域的研究，由於生產耐久財的廠商可經由租賃耐久財來表明不會生產過剩，或是可透過自行銷售產品來擔保產量不會有不足的現象，因此 Bhaskaran 與

Gilbert(2005)發現，生產耐久財的廠商選擇自行出售或租賃耐久財的決策，會受到由另外一家廠商獨立生產之互補品的影響。隨著互補品市場相對於耐久財基本品市場之重要性的逐漸增加，廠商的最適策略會從單純的租賃策略轉移到租賃搭配銷售的策略組合，最後當互補品市場重要性較高時，最適策略演變為單純的銷售策略。類似地，當耐久財基本品和互補品的互補程度逐漸提升時，廠商的最適策略也會產生與上述相同的轉變。Shockers、Bayus 與 Kim(2004)依靜態動態觀點將互補品分類：靜態上可分為使用互補與特殊互補，前者如電腦與軟體，後者如公事包大小與內容物；動態上可分新推出產品影響既有產品銷售，如遊戲軟體的推出增加遊戲主機的銷售，反之則為既有產品影響新推出產品銷售，如電子郵件容量影響消費者購買數位相機的意願，由此可知不同的互補品種類，基本品與互補品間的影響關係也有所差異。

雙佔市場中各廠商之基本品與互補品的差異化程度，也是影響廠商內部產品與定價決策和廠商間競合關係的關鍵，其影響範圍包括廠商的產品、價格、通路和推廣策略。

- 在產品部分，Economides(1999)發現，相較於基本品獨佔廠商與互補品獨佔廠商整合的情況，兩廠商獨立時的產品品質較低且價格較高。Lee(2001)的研究發現，當基本軟體（基本品）是由一獨佔廠商生產時，若該基本品廠商與另外一家廠商都同時推出應用軟體（互補品），則該互補品應採用差異化策略較佳，即不該生產標準化的互補品。Chernev(2005)指出，消費者的產品選購決策會受到各產品差異化屬性之互補性的影響。當造成產品差異化的屬性為互補性的屬性時，將提升消費者進行決策的困難度，因此會較面臨非互補性的差異化屬性時更常延後決策時點，且當選擇集合擴充時，消費者針對具互補性的產品選擇也較分歧。因此，當廠商考慮進行產品線延伸時，應在非互補性的屬性上進行差異化，方可避免降低消費者選擇意願的風險。
- 在價格方面，Gabszewicz、Sonnac 與 Wauthy(2000)的研究結果顯示，雙佔市場中兩家廠商產品之互補程度會影響產品的訂價。當互補性很低時，只存在著不對稱的獨佔型均衡；而互補性很強時，唯一的均衡為對稱的互補型均衡；當互補性中等時，上述兩種均衡都會出現。
- 在通路方面，Economides(2005)探討兩家生產基本品和兩家生產互補品的四家廠商，會依據基本品與互補品之互補程度來決定是否進行基本品廠商與互補品廠商的垂直整合。當互補品互補程度高時，會同時提升兩組廠商的整合意願，反之則傾向於四家廠商獨立經營，但在互補品程度中等時，生產互補品的廠商只有在另一組廠商整合時才會進行整合，因此，兩組廠商同時進行整合或四家廠商獨立經營都是均衡策略。
- 在推廣方面，Sinitsyn(2003)分析雙佔廠商的產品促銷時機策略，並用實證的方法驗證產品互補程度與促銷時機之間的關係。模型假設雙佔廠商生產相同的互補產品組合(如蛋糕與糖霜)，且廠商間的產品彼此替代性極高。作者發現當產品組合互補性越高時，一產品價格下降所影響另一產品購買意願的程度就越大，因此，製造

商為了避免產生搭便車問題(free-rider problem)而愈傾向同時促銷兩項產品。

最後，周善瑜等人(2005)的研究分析了雙佔廠商的互補品策略，而本研究與該研究有三項重大的差異。首先，周善瑜等人(2005)的研究並未考慮廠商可以推出替代品而非互補品的可能性，因而無法探討內生決定的最適產品組合策略。其次，周善瑜等人(2005)的研究由於研究焦點僅在互補品，因而僅考慮單一市場區隔，未將廠商利用多個替代產品項目以區隔多個市場的可能性納入分析，因而不能探討互補品與不同替代產品項目之互補強度差異如何影響廠商的產品組合策略。

五、模型設定

本研究探討對象為，主力產品彼此競爭之不對稱雙佔廠商正考慮是否應再多推出互補品。在主力產品方面，高端廠商可選擇推出因高品質而消費者保留價格較高的加值型產品、品質較低之基本型產品、或兩者皆生產，但低端廠商卻僅具備生產基本型產品之能力。而常態化為 1 之消費者市場又可細分為高端消費者(比例為β）與低端消費者（比例為$1-\beta$）兩類，其中高端消費者對加值型產品與基本型產品之保留價格分別為V與v，但低端消費者對兩種產品的保留價格皆為v。而兩製造商－高端廠商 A 與低端廠商 B 之基本型產品分別位於消費者理想點為[0, 1]間均勻分配之 Hotelling 模型的兩端點。位於x的消費者當購買 A 廠商或 B 廠商基本型產品時將會分別產生x或$(1-x)$的負效用。此外，j 廠商生產之基本型產品（標示為j_1，$j\in\{A,B\}$），而 A 廠商生產之加值型產品（標示為A_2）。且兩類產品為垂直差異化之產品，故位於廠商 A 所在位置之消費者對A_2的願付價格為V，而位於座標 1 的消費者只願意付v來購買B_1，且$V\geq v$。兩廠商都考慮是否投資一固定的研發成本（標示為$k_i, i=A,B$）來推出互補品。並假設兩廠商都透過公司自營店面直接向消費者銷售產品。

在互補品（標示為C）方面，此產品必須搭配主力產品方可使用，且搭配加值型產品與搭配基本型產品時會分別產生δ_2與δ_1的額外效用（假設$\delta_2\geq\delta_1$）。雖然δ_2與δ_1可能取決於k_A與k_B，但為簡化起見，本研究假設δ_2與δ_1均為外生給定，故δ_2與δ_1的值不受生產互補品者為廠商 A 或廠商 B 的影響。而當δ_2與δ_1差距較大時，代表本研究欲捕捉主力產品與互補品決策間之互動關係，從而探索競爭之雙佔廠商均衡時之產品組合策略。因此本研究通篇以$\delta_2-\delta_1$來表示互補品搭配兩類主力產品所能產生之額外效用的差異，當$\delta_2-\delta_1$越大時，代表高端消費者在同時消費主力產品與互補品時，加值型產品相較於基本型產品越具吸引力。

給定雙佔廠商決定產品策略並選定價格後，消費者決定向哪家廠商購買何種產品以極大化消費者剩餘。

本研究通篇以(a,b)來表示雙佔廠商的產品策略，其中廠商 A 選擇 a 而廠商 B 選擇 b。賽局順序如下：首先，兩廠商同時決定主力產品的種類並決定是否投資研發成本來生產互補品。而當產品策略選定後，兩廠商同時決定產品定價。最後，消費者決定向哪家廠商購買何種產品以極大化消費者剩餘。本研究運用後向歸納法(backward induction)並從產品策略(a,b)給定之最後階段開始著手進行推導。

且本研究假設一家廠商最多僅能生產兩項產品。因此，無法生產加值型產品之低端廠商－廠商 B 有B_1與B_1+C兩種選

擇方案，而高端廠商－廠商 A 則有 A_2、A_1、A_2+A_1、A_2+C 與 A_1+C 等五種選擇方案，故可構成十個子賽局。故本研究以如下四個涉及加值型產品之子賽局所對應的均衡為起點進行分析：(A_2+A_1, B_1+C)、(A_2+A_1, B_1)、(A_2, B_1+C)與(A_2+C, B_1)。

六、子賽局之均衡結果

■ 子賽局(A_2+A_1, B_1+C)

命題一：當廠商 A 同時生產加值型產品與基本型產品而廠商 B 同時生產基本型產品與互補品時，在某些條件下，B 會選擇 $\delta_1 < P_c \le \delta_2$ 並僅將互補品賣給購買 A 廠商加值型產品之消費者，此時均衡價格為：

$$P_{A_2} = \frac{u+1}{3},$$
$$P_{A_1} = 1+\frac{2\beta}{3(1-\beta)},$$
$$P_{B_1} = \frac{3+\beta}{3(1-\beta)},$$
$$P_c = \frac{4+(1-\beta)u}{3(1-\beta)}.$$

$$(u \equiv V - v + \delta_2)$$

對應之均衡利潤如下：

$$\Pi_A^{(i)}(A_1+A_2, B_1+C) = \frac{\beta}{2}P_{A_2}{}^2 + \frac{1-\beta}{2}P_{A_1}{}^2$$
$$= \frac{\beta}{2}(\frac{u+1}{3})^2 + \frac{1-\beta}{2}(\frac{3-\beta}{3(1-\beta)})^2$$
$$\Pi_B^{(i)}(A_1+A_2, B_1+C) = \frac{\beta}{2}P_c{}^2 - \beta P_c P_{B_1} + \frac{1}{2}P_{B_1}{}^2$$
$$= \frac{\beta}{2}(\frac{4+(1-\beta)u}{3(1-\beta)})^2 - \beta(\frac{4+(1-\beta)u}{3(1-\beta)})\frac{3+\beta}{3(1-\beta)}$$
$$+\frac{1}{2}(\frac{3+\beta}{3(1-\beta)})^2.$$

命題二：當廠商 A 同時生產加值型產品與基本型產品而廠商 B 同時生產基本型產品與互補品時，在某些條件下，均衡時廠商 B 會選擇 $P_c \le \delta_1$ 並將互補品賣給所有購買主力產品之消費者，此時均衡價格為：

$$P_{A_2} = 1+\frac{(3-\beta)\Delta}{6},$$
$$P_{A_1} = 1-\frac{\beta\Delta}{6},$$
$$P_{B_1} = \frac{3-\beta\Delta}{3},$$
$$P_C = \delta_1.$$

$$(\Delta \equiv V - v + \delta_2 - \delta_1)$$

對應之均衡利潤如下：

$$\Pi_A^{(ii)}(A_1+A_2, B_1+C) = \frac{\beta}{2}P_{A_2}{}^2 + \frac{1-\beta}{2}P_{A_1}{}^2$$
$$= \frac{\beta}{2}(1+\frac{(3-\beta)\Delta}{6})^2 + \frac{1-\beta}{2}(1-\frac{\beta\Delta}{6})^2$$
$$= \frac{1}{2}(1-\frac{\beta\Delta}{6})^2 + \frac{\beta}{2}\Delta(1-\frac{\beta\Delta}{6}+\frac{\Delta}{4})$$
$$\Pi_B^{(ii)}(A_1+A_2, B_1+C) = P_c + \frac{1}{2}P_{B_1}{}^2 = \delta_1 + \frac{(3-\beta\Delta)^2}{18}.$$

■ 子賽局(A_2+A_1, B_1)

命題三：當廠商 A 同時生產加值型產品與基本型產品而廠商 B 僅生產基本型產品時，在某些正規條件下[1]，均衡價格為：

$$P_{A_2} = \frac{6+(3-\beta)(V-v)}{3},$$
$$P_{A_1} = \frac{6-\beta(V-v)}{6},$$
$$P_{B_1} = \frac{3-\beta(V-v)}{3}.$$

對應之均衡利潤如下：

$$\Pi_A^{(ii)}(A_1+A_2, B_1) = \frac{\beta}{2}P_{A_2}{}^2 + \frac{1-\beta}{2}P_{A_1}{}^2$$
$$= \frac{\beta}{2}(\frac{6+(3-\beta)(V-v)}{6})^2 + \frac{1-\beta}{2}(\frac{6-\beta(V-v)}{6})^2$$
$$\Pi_B^{(ii)}(A_1+A_2, B_1) = \frac{1}{2}P_{B_1}{}^2 = \frac{(3-\beta(V-v))^2}{18}.$$

■ 子賽局(A_2, B_1+C)

[1] 這些正規條件確保最適價格的內解存在。

命題五：當廠商 A 僅生產加值型產品而廠商 B 同時生產基本型產品與互補品時，在某些正規條件下，均衡時廠商 B 會選擇 $\delta_1 < P_c \le \delta_2$ 並僅將互補品賣給購買 A 廠商加值型產品之消費者，此時均衡價格為：

$$P_{A_2} = \frac{\beta u + 3}{3},$$
$$P_{B_1} = 1 + \frac{\beta}{1-\beta} + \frac{\beta u}{6},$$
$$P_c = \frac{1}{1-\beta} + \frac{V - v + \delta_2}{2}.$$

對應之均衡利潤如下：

$$\Pi_A^{(i)}(A_2, B_1 + C) = \frac{1}{2} P_{A_2}{}^2 = \frac{1}{2}(\frac{\beta u + 3}{3})^2,$$
$$\Pi_B^{(i)}(A_2, B_1 + C) = \frac{\beta}{2} P_c{}^2 - \beta P_c P_{B_1} + \frac{1}{2} P_{B_1}{}^2$$
$$= \frac{\beta}{2}(\frac{2 + (1-\beta)(V - v + \delta_2)}{2(1-\beta)})^2$$
$$- \beta(\frac{2 + (1-\beta)(V - v + \delta_2)}{2(1-\beta)})(\frac{6 + (1-\beta)\beta u}{6(1-\beta)})$$
$$+ \frac{1}{2}(\frac{6 + (1-\beta)\beta u}{6(1-\beta)})^2.$$

命題六：當廠商 A 僅生產加值型產品而廠商 B 同時生產基本型產品與互補品時，在某些正規條件下，此時均衡價格為：

$$P_{A_2} = \frac{\beta\Delta + 3}{3},$$
$$P_{B_1} = \frac{3 - \beta\Delta}{3},$$
$$P_c = \delta_1.$$

對應之均衡利潤如下：

$$\Pi_A^{(ii)}(A_2, B_1 + C) = \frac{1}{2} P_{A_2}{}^2 = \frac{1}{2}(\frac{3 + \beta\Delta}{3})^2$$
$$\Pi_B^{(ii)}(A_2, B_1 + C) = \delta_1 + \frac{1}{2} P_{B_1}{}^2 = \delta_1 + \frac{1}{2}(\frac{3 - \beta\Delta}{3})^2.$$

■ **子賽局**$(A_2 + C, B_1)$

命題七：當廠商 A 同時生產加值型產品與互補品而廠商 B 僅生產基本型產品時，在某些一般性條件下，均衡時廠商 A 會選擇 $\delta_1 < P_c \le \delta_2$ 並僅將互補品賣給購買自己加值型產品之消費者，此時均衡價格為：

$$P_{A_2} = 1 - \frac{\beta u}{6},$$
$$P_{B_1} = 1 - \frac{\beta u}{3},$$
$$P_c = \frac{V - v + \delta_2}{2}.$$

對應之均衡利潤如下：

$$\Pi_A^{(i)}(A_2 + C, B_1) = \frac{\beta}{2}(\frac{u}{2})^2 - \beta(\frac{u}{2})P_C(1 - \frac{\beta u}{6}) + \frac{1}{2}(1 - \frac{\beta u}{6})^2$$
$$\Pi_B^{(i)}(A_2 + C, B_1) = \frac{1}{2} P_{B_1}{}^2 = \frac{1}{2}(1 - \frac{\beta u}{3})^2.$$

命題八：當廠商 A 同時生產加值型產品與互補品而廠商 B 僅生產基本型產品時，在某些條件下，均衡時廠商 A 會選擇 $P_c \le \delta_1$ 並將互補品賣給所有購買主力產品之消費者，此時均衡價格為：

$$P_{A_2} = \frac{\beta\Delta + 3}{3},$$
$$P_{B_1} = \frac{3 - \beta\Delta}{3},$$
$$P_c = \delta_1.$$

對應之均衡利潤如下：

$$\Pi_A^{(ii)}(A_2 + C, B_1) = \delta_1 + \frac{1}{2} P_{A_2}{}^2 = \delta_1 + \frac{1}{2}(\frac{\beta\Delta + 3}{3})^2,$$
$$\Pi_B^{(ii)}(A_2 + C, B_1) = \frac{1}{2} P_{B_1}{}^2 = \frac{1}{2}(\frac{3 - \beta\Delta}{3})^2.$$

七、結果與討論

根據上述各子賽局對應之均衡利潤，可歸納出以下之結論。

結果一：當低端廠商獨家生產互補品而高端廠商同時生產加值型產品與基本型產品時，高端消費者對於加值型產品相較於基本型產品的偏好程度越高，則低端廠商越可能偏好訂定較高之互補品價格，僅銷售給購買對手廠商主力產品的

顧客。

值得注意的是，低端廠商在兩種不同定價策略下之利潤 $\pi_B^{(i)}(A_2+A_1,B_1+C)$ 與 $\pi_B^{(ii)}(A_2+A_1,B_1+C)$ 分別為：

$$\pi_B^{(i)}(A_2+A_1,B_1+C)=\frac{\beta}{8}(u+1-P_{A_2})^2+\frac{1-\beta}{8}(1+P_{A_1})^2 + \frac{\beta}{2}(1+P_{A_1})+\frac{\beta^2}{2(1-\beta)},$$

$$\pi_B^{(ii)}(A_2+A_1,B_1+C)=\frac{1}{8}[\beta(1+P_{A_2}-\Delta)+(1-\beta)(1+P_{A_1})]^2.$$

故當高端消費者對於加值型產品相較於基本型產品的偏好程度越高（無論是起因與主力產品本身或是來自與互補品之高互補性）時，相較於將互補品銷售給所有消費者的策略，低端廠商將互補品市場鎖定在對手廠商所擁有的高端消費者族群上時獲利較豐。

結果二：當高端廠商僅生產加值型產品而低端廠商獨家生產互補品並將其銷售給所有消費者時，隨著高端消費者人口比例越大或高端消費者對加值型產品相較於基本型產品的偏好越高，低端廠商的利潤越低。

值得注意的是，低端廠商的利潤 $\pi_B^{(ii)}(A_2,B_1+C)$ 為 $\delta_1+(1/2)[1-(\beta\Delta/3)]^2$，故當高端消費者人口比例越大時，低端廠商在 (A_2,B_1+C) 之產品策略下在吸引高端消費者時越不具競爭優勢，從而降低了低端廠商的獲利。

結果三：當高端廠商同時生產加值型產品與基本型產品時，互補品搭配加值型產品相較於互補品搭配基本型產品的互補性越高，則低端廠商越不傾向於獨家生產互補品。

結果四：當低端廠商同時生產基本型產品與互補品時，高端廠商偏好同時生產加值型產品與基本型產品，而非選擇僅生產加值型產品。

八、計畫成果自評

本研究已完成專案計畫書中所設定之目標。本研究旨在分析不完全競爭之雙佔廠商的最適產品組合策略，以及廠商產品組合策略與廠商間價格競爭強度之互動關係。而本研究透過模型建構與推導所獲致之數項重要結論，且特別試圖針對廠商何時應推出可提升其鎖定目標消費者區隔能力之替代品，抑或選擇推出能增加主力產品競爭優勢之互補品等相關議題深入剖析並提出具體看法。儘管本研究尚未羅列所有子賽局之均衡結果，但關鍵性較高之子賽局皆已分析完畢，故整體而言，本研究仍完成預期達成之研究目標並產生相當貢獻。

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出席國際學術會議心得報告

計畫編號	95-2416-H-002-020-
計畫名稱	雙佔廠商的最適互補品策略
出國人員姓名 服務機關及職稱	周善瑜(國立臺灣大學工商管理學系教授)
會議時間地點	2006/06/28~2006/06/30 於新加坡
會議名稱	(中文) 2007 INFORMS 行銷科學年會 (英文) 2007 INFORMS Marketing Science Conference
發表論文題目	(中文) 雙佔廠商之最適產品別廣告與品牌廣告策略 (英文) The Optimal Generic Advertising and Brand Advertising Strategies for Duopolistic Firms

一、參加會議經過

在 2007 INFORMS Marketing Science Conference 中，我除了負責在六月二十九日口頭報告「The Optimal Generic Advertising and Brand Advertising Strategies for Duopolistic Firms」一文，也聆聽多場精采的論文發表，此行收穫非常豐碩。

二、與會心得

本次行銷科學年會雖然可能因為舉辦地點首次選在亞洲(之新加坡)，因而較少美國學者參與，但也正因為論文報告人數較少，使得每篇報告論文的作者得以有更充裕的時間與機會與其他學者交流互動，並可增加討論的深度。

此次與本人研究興趣相關的議題場次包括忠誠度方案、網路行銷與行銷組合要素上的競爭策略，許多論文都給與我未來研究方向上莫大啟發。首先，Praveen Kopalle 教授等學者合作之「A Dynamic Structural Model of the Impact of Loyalty Programs on Customer Behavior」，將忠誠度方案根據「frequency reward」與「customer tier」區分成兩類，再以此探討忠誠度方案如何影響消費者行為，提供獨到見解。此次研討會也出現較以往為數更多的博士生參與，且其中不少博士生也提出很卓越的見解。例如，Je-Sheng Huang 博士生的「Modeling Concentration Degree on the Most Valuable Customers for E-Commerce Sites」一文，涉及非常有趣的議題並加入「網路搜尋行為」此一新構面以辨別最具價值的顧客，然而部份結論仍需進一步的推敲與分析。最後，Elie Ofek 教授與 Zsolt Katona 博士生合作之「Quality and Advertising in a Vertically Differentiated Market」，探討的是競爭廠商從先決定產品定位(即決定產品品質)從而進行廣告決策的序貫賽局中制定出最適行銷策略，是考量多項行銷決策變數的學術好文，也帶給本人許多研究的靈感。

整體而言，參與此次會議收穫甚豐，感謝行政院國家科學委員會的大力支持與補助，使得本篇論文能因此次報告而能更加精進。

The Optimal Generic Advertising and Brand Advertising Strategies for Duopolistic Firms.

Shan-Yu Chou, Chyi-Mei Chen and Young-Sheng Ku[1]

ABSTRACT:

This paper analyzes the optimal advertising and pricing strategies for duopolistic firms. We consider a market consists of consumers who are loyal to the two firms and switchers whose ideal points are uniformly distributed between the positions of the two firms'. In the firs stage, the two firms choose among three strategies: generic advertising, brand advertising, and no advertising. Generic advertising allows a firm to expand the market, while brand advertising enables a firm to convert part of switchers into loyal customers though the effect of brand advertising will be mitigated in the presence of competition advertising. After their advertising decisions, the two firms compete in prices. Assuming the stronger firm (the one having a larger loyal base) has a higher capability in converting switchers into loyal customers than the weaker firm, we find the following results: (i) When the advertising cost is low, the weaker firm has higher incentives to conduct generic advertising than the stronger firm.(ii) If the size of new users created by generic advertising is large enough and the advertising cost is high, it may happen that only the stronger firm chooses generic advertising when expecting its rival chooses brand advertising. (iii) Though the effect that the weaker firm's brand advertising on expanding its loyal base is lower (than its rival) and is reduced by its rival's brand advertising, if the advertising cost is low and the power of the weaker brand is high enough, the weaker firm may prefer brand advertising to generic advertising when expecting brand advertising by its rival.

KEYWORDS: Brand Advertising, Generic Advertising, Advertising Strategy, Game Theory

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1. Introduction

More than a billion dollars is spent annually on generic advertisements that promote the consumption of commodity goods (Armbruster and Nichols, 2001; Chakravarti and Janiszewski, 2004). Generic advertising increases primary demand while brand advertising increases selective demand (Friedman and Friedman, 1976; Chakravarti and Janiszewski, 2004; Krishnamurthy, 2000). Facing the increasing complexity of advertising decisions, firms have to understand the effects of the two kinds of advertising on competition in order to make effective advertising decisions.

Friedman and Friedman (1976) suggest generic advertising allows firms to increase per capita consumption as well as the total number of customers for the generic product. They point out that many firms resort to competitive (brand) advertising prematurely, i.e. before the market for the product has reached its peak, thus shortening the life cycle of the product category. Even for products in the saturation stage of their life cycle, they suggest firms could use generic advertising to promote new uses and extend their life cycle.

Chakravarti and Janiszewski (2004) suggest that generic advertising may increase consumers' price sensitivity and thus systematically changes their brand preferences. They argue that these effects of generic advertising occurs in that generic advertising tends to change the relative importance of attributes consumers use to evaluate brands. In this paper, following Bass et al. (2005), we define generic advertising as promoting the product category while downplaying or oftentimes not mentioning the sponsoring brand. Unlike Chakravarti and Janiszewski (2004) where generic advertising influences consumers' attitudes and thus their brand preferences, we consider the effects of generic advertising on price competition and thus on firms' profits.

The objectives of the paper are two-fold. First, we analyze how firms' advertising strategies influence the competitive structure of consumer segments and thus the intensity of price competition. Second, we characterize firms' equilibrium advertising strategies after taking into account the interactions between advertising strategy and pricing strategy. In particular, we attempts to analyze how the relative power of brands influence firms' incentives to conduct generic advertising and brand advertising.

To achieve the above goals, we develop a game-theoretic model and consider two asymmetric firms which differ in the size of their loyal base and in the power of converting switchers into their loyals. The ideal points of switchers are assumed to distributed uniformly between the positions of the two firms' products. Brand advertising enables a firm to expand its loyal base though the effectiveness of brand advertising also depends on whether there exists competitive ad interference. Generic advertising allows a firm to attract new users (probably from other product categories), which are all switchers and make their purchase decisions on price alone. The two firms first choose their advertising strategy simultaneously and then compete in price.

Based on the above assumptions, we derive the following results:

(i) When the advertising cost is low, the weaker firm has higher incentives to conduct generic advertising than the stronger firm.

(ii) If the size of new users created by generic advertising is large enough and the advertising cost is high, it may happen that only the stronger firm chooses generic advertising when expecting its rival chooses brand advertising.

(iii) Though the effect that the weaker firm's brand advertising on expanding its loyal base is lower (than its rival) and is reduced by its rival's brand advertising, if the advertising cost is low and the power of the weaker brand is high enough, the weaker firm may prefer brand advertising to generic advertising when expecting brand advertising by its rival.

The remainder of this article is organized as follows. Section 2 lays out the model and characterizes the equilibria. Section 3 gives concluding remarks.

2. Model

We assume that there are two firms competing in a mature market. There are three types of consumers in the market, Firm A's loyal consumer, Firm B's loyal consumer, and switchers. We normalize the size of the total market to 1. Firm A's loyal base, firm B's loyal base and switchers account for proportion α', β', and $1-\alpha'-\beta'$ of the whole market, where $1>\alpha'\geq\beta'>0$, $1>1-\alpha'-\beta'>0$. Firm A's loyal consumer values Firm A's product at 1 and values Firm B's product at 0, Firm B's loyal consumer values Firm A's product at 0 and values Firm B's product at 0.

All switchers have 1 utility for both Firm A's and Firm B's product, but each switcher has different preference for these two products. The ideal point x of all switchers are uniformly distributed in a 0 to 1 line, Firm A sets at 0 and Firm B sets at 1. The distance between x and the points that Firm A and Firm B will bring an extra cost t for that switcher, If a switcher at x, he will have an extra cost tx for buying Firm A's product, $t(1-x)$ for buying Firm B's product, $t>0$.

Before setting the product price, each firm could choose different advertising strategies. There are three kinds of advertising strategies: Brand advertising, Generic advertising, and No advertising. It cost C to conduct Brand advertising or Generic advertising, firm could only choose one type of the advertising strategies.

When Firm A conducts Brand advertising and Firm B chooses Generic advertising or No advertising, Firm A's advertising strategy converts $K_A(1-\alpha'-\beta')$ switchers into Firm A's loyal consumers. We call K_A as the Brand advertising power of Firm A. When Firm B conducts Brand advertising and Firm A chooses Generic advertising or No advertising, Firm B's advertising strategy converts $K_B(1-\alpha'-\beta')$ switchers into Firm A's loyal consumers. We call K_B as the Brand advertising power of Firm B, here we assume that Firm A's Brand advertising power is greater than B's, $1\geq K_A>K_B\geq 0$. When both firms conduct Brand advertising, the Brand

advertising power of both firms might decrease because the messages in the different Brand advertisings confuse the consumer. We define λ as a Brand clarified index, when both firms conduct Brand advertising, $\lambda \times K_A(1-\alpha'-\beta')$ switchers become Firm A's loyal consumer, $\lambda \times K_B(1-\alpha'-\beta')$ switchers become Firm B's loyal consumer, $1 \geq \lambda \times (K_A + K_B) > 0$, $1 \geq \lambda > 0$. In order to simplify the variable, we assume that $K_A(1-\alpha-\beta) = \gamma_A$, $K_B(1-\alpha-\beta) = \gamma_B$。

No matter one or two firms conduct Generic advertising, one group of new switchers will be in the market. The distribution and property of new switchers are the same as the existing switchers. We assume that new switchers will not be affected by Brand advertising, so the number of transferred switchers is the same of the firm conducting Brand advertising.

Finally, we assume that before two firms choose advertising strategies, Firm A has more loyal consumer and stronger Brand advertising power than Firm B. We call Firm A as stronger brand, Firm B as second brand. We make these assumptions in order to see the different choices between different firms.

In the firs stage, the two firms choose among three advertising strategies. In the second stage, after their advertising decisions, they compete in prices. Each firm has three strategies at first stage, so there will be nine possible scenarios in the second stage. In this article we use 【x, y】 to represent the strategies choices of two firms, x is Firm A's strategy and y is Firm B's strategy. For example [B, G] means Firm A conducts Brand advertising and Firm B conducts Generic advertising. Now we will use backward induction to solve the SPNE in this model.

3.1 Equilibrium Analysis

Suppose the two firms have made their advertising decisions and the new composition of consumer segments is as follows. The loyal base of firm A, the loyal base of firm B, and switchers account for proportion α, β and δ of the whole market, respectively, where δ≥1-α-β. To derive the profit functions of the two firms, first note that a switcher located at z_0, where $z_0 \in$ (0,1), feels indifferent between the two brands if the following condition holds:

$1 - P_A - tz_0 = 1 - P_B - t(1 - z_0)$.

That is $z_0 = \frac{P_B - P_A + t}{2t}$ ……(equation 1)

In order to highlight the competition between the two firms in competing for switchers, we shall first assume the parameters satisfy some regularity conditions so that $0<z_0<1$; furthermore, $1 - tz_0 - P_A \geq 0$ so that all consumers will be served in equilibrium.

Therefore, the profit function of firm A is as follows:

$\pi_A = P_A \times (\alpha + \frac{P_B - P_A + t}{2t})$ ……(equation 2)

Taking derivative of the above function with respect to P_A gives us A's reaction function:

$P_A = \frac{P_B + t}{2} + \frac{t[\alpha + \delta]}{\delta}$

Substituting the above price into π_A gives firm A's profit as a function of P_B:

$$\pi_A(P_B)=\frac{\delta}{2t}\left(\frac{P_B+t}{2}+\frac{t\alpha}{\delta}\right)^2$$

Alternatively, firm A can serve its loyal customers only by setting the price at 1 and obtaining a sure profit α. Thus firm A's reaction function can be described as follows:

$$P_A=\frac{P_B+t}{2}+\frac{t[\alpha+\delta]}{\delta},\ \ if\ \pi_A(P_B)\geq\alpha;;$$

$$P_A=\alpha,\ \ otherwise.$$

Similarly, we can derive firm B's profit function as follows:

$$P_B=\frac{P_A+t}{2}+\frac{t[\beta+\delta]}{\delta},\ \ if\ \ \pi_B(P_A)=\frac{\delta}{2t}\left(\frac{P_A+t}{2}+\frac{t\beta}{\delta}\right)^2\geq\beta$$

$$P_B=\beta,\ \ otherwise.$$

We shall focus on the situations where both firms will not give up switchers. Therefore, suppose the equilibrium prices $(P_A{*},P_B{*})$ satisfy the following four conditions,

$$0<z_0^*<1 \text{.....(5-1)}$$

$$1-tz_0^*-P_A^*\geq 0 \text{.....(5-2)}$$

$$\pi_A(P_B^*)=\frac{\delta}{2t}\left(\frac{P_B^*+t}{2}+\frac{t\alpha}{\delta}\right)^2\geq\alpha \text{.....(5-3)}$$

$$\pi_B(P_A^*)=\frac{\delta}{2t}\left(\frac{P_A^*+t}{2}+\frac{t\beta}{\delta}\right)^2\geq\beta \text{.....(5-4)}.$$

Then we can derive $(P_A{*},P_B{*})$ as follows:

$$P_A^*=t[3\delta+4\alpha+2\beta]/(3\delta),$$

$$P_B^*=t[3\delta+2\alpha+4\beta]/(3\delta).$$

The corresponding profits and z_0^* are as follows:

$$\pi_A^*=\frac{t[3\delta+4\alpha+2\beta]^2}{18\delta},$$

$$\pi_B^*=\frac{t[3\delta+2\alpha+4\beta]^2}{18\delta},$$

$$z_0^*=\frac{1}{2}-\frac{\alpha-\beta}{3\delta}.$$

Substituting the equilibrium prices and z_0^* into (5-1)-(5-4), we derive the following R1~R4：

（R1） $1>\frac{1}{2}-\frac{\alpha-\beta}{3\delta}>0$

（R2） $t\leq\frac{2\delta}{3\delta+2\alpha+2\beta}$

（R3） $\pi_A^*\geq\alpha$

（R4） $\pi_B^*\geq\beta$

Note that there is no subgame perfect Nash equilibrium where both firms choose generic advertising in the first period to expand the market. Therefore, there are only eight advertising strategy profiles. Note that the firms' advertising decisions change the composition of consumer segments. Denote generic advertising, brand advertising and no advertising by g, b and n, respectively. Denote the size of the three segments by α(x,y), β(x,y) and δ(x,y), where x and y represent the advertising choices by the two firms and $x,\ y\in\{g,b,n\}$. Table 1 lists the profits for the eight advertising subgames. All corresponding regularity conditions are put in Appendix C.

Table 1：The Equilibrium profits and prices of various advertising subgames

$\pi_A^*=t[3\delta(x,y)+4\alpha(x,y)+2\beta(x,y)]^2/(18\delta),$
$\pi_B^*=t[3\delta(x,y)+2\alpha(x,y)+4\beta(x,y)]^2/(18\delta)$

$P_A^* = t\left[3\delta(x,y)+4\alpha(x,y)+2\beta(x,y)\right]/(3\delta),$ $P_B^* = t\left[3\delta(x,y)+2\alpha(x,y)+4\beta(x,y)\right]/(3\delta).$	
(b, b)	$\alpha=\alpha'+\lambda\gamma_A, \beta=\beta'+\lambda\gamma_B,$ $\delta=1-\alpha-\beta.$
(b, g)	$\alpha=\alpha'+\gamma_A,\ \beta=\beta',$ $\delta=1-\alpha-\beta+\gamma.$
(g, b)	$\alpha=\alpha',\ \beta=\beta'+\gamma_B,$ $\delta=1-\alpha-\beta+\gamma.$
(b, n)	$\alpha=\alpha'+\gamma_A, \beta=\beta',$ $\delta=1-\alpha-\beta.$
(n, b)	$\alpha=\alpha', \beta=\beta'+\gamma_B,$ $\delta=1-\alpha-\beta.$
(g, n)	$\alpha=\alpha', \beta=\beta',$ $\delta=1-\alpha-\beta+\gamma.$
(n, g)	$\alpha=\alpha', \beta=\beta',\ \delta=1-\alpha-\beta+\gamma.$
(n, n)	$\alpha=\alpha', \beta=\beta',\ \delta=1-\alpha-\beta.$

Before deriving the Nash equilibrium for advertising strategy, I shall conduct some comparative statics and report the results in the following table:

	π_A^*	π_B^*
α	$\frac{\partial\pi_A^*}{\partial\alpha} = P_A^*(1-z_0^*+\frac{1+\beta+\gamma}{3\delta})$	$\frac{\partial\pi_B^*}{\partial\alpha} = P_B^*\frac{1+\alpha+3\beta+\gamma}{6\delta}$
β	$\frac{\partial\pi_A^*}{\partial\beta} = P_A^*\frac{1+3\alpha+\beta+\gamma}{6\delta}$	$\frac{\partial\pi_B^*}{\partial\beta} = P_B^*(z_0^*+\frac{1+\alpha+\gamma}{3\delta})$
δ	$\frac{\partial\pi_A^*}{\partial\delta} = P_A^*\left(\frac{3\delta-2\beta-4\alpha}{6\delta}\right)$	$\frac{\partial\pi_B^*}{\partial\delta} = P_B^*\left(\frac{3\delta-4\beta-2\alpha}{6\delta}\right)$

Lemma 1：Suppose all regularity conditions hold. Other things being equal, after firms' advertising decisions, the larger a firm's loyal base, the higher the equilibrium prices and profits of both firms. The equilibrium profits of firm A and firm B decrease with the size of switchers if and only if

$\delta \le \frac{2}{3}(2\alpha+\beta)$, **and**

$\delta \le \frac{2}{3}(\alpha+2\beta)$ **, respectively.**

The proofs of lemma 1 are put in Appendix D. Note that the increase in new users who are not loyal to either firm, may result in the lower profits for both firms. It happens because it intensifies the competition between the two firms. Therefore, the effect of generic advertising on firms' profits will depend on the current size of switchers relative to that of loyal base. As for whether the stronger firm or the weaker firm has higher incentive to conduct generic advertising, we have the following lemma.

Lemma 2: If $\delta \ge \frac{2}{3}(2\alpha'+\beta')$, then generic advertising by either firm will increase the profits of both firms (without considering the advertising cost); furthermore, the increase in firm B's

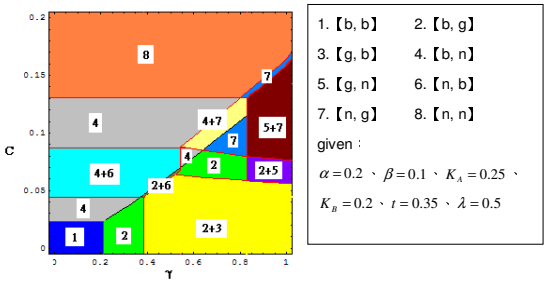
profit will be higher than that in firm B's profit.

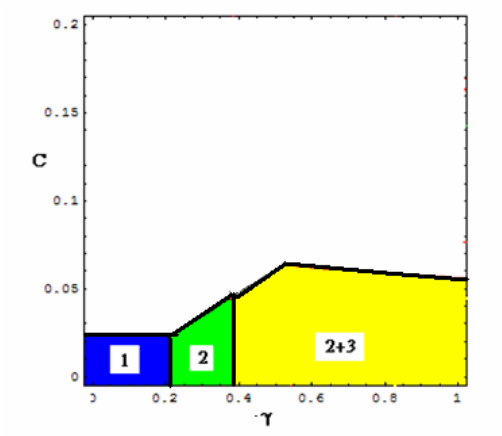
After knowing the effects of advertising on firms' profit, we report the equilibrium conditions for firms' advertising strategies in Proposition 1.

Proposition 1: The corresponding conditions for each subgame perfect Nash equilibrium in advertising strategy are listed in the following table. All conditions are in Appendix.

	A		B	
1.(b, b)	(A-1)	(A-2)	(B-1)	(B-2)
2. (b, g)	(A-3)		(B-1')	(B-3)
3. (g, b)	(A-1')	(A-4)	(B-4)	
4. (b, n)	(A-5)	(A-6)	(B-2')	(B-3')
5. (g, n)	(A-5')	(A-7)	(B-4')	
6. (n, b)	(A-2')	(A-4')	(B-5)	(B-6)
7. (n, g)	(A-3')		(B-5')	(B-7)
8. (n, n)	(A-6')	(A-7')	(B-6')	(B-7')

In the following, we shall examine how the advertising cost and the size of switchers to be created by generic advertising influence the firms' equilibrium advertising strategies. Furthermore, we shall analyze how the two firms with different brand power differ in their preferences towards different advertising strategies.



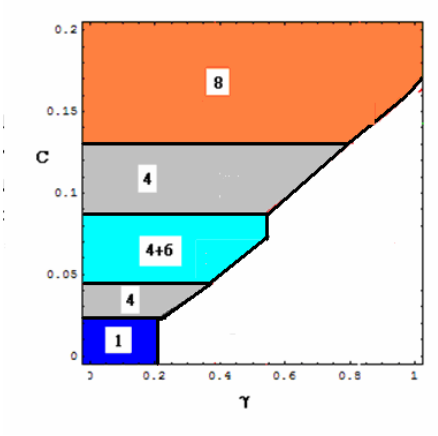


In figure 1, given other parameter values, we see the regions for the eight possible advertising equilibria listed in Proposition 1 to occur. In figure 2, we further fix the advertising cost at a low level, e.g., at 0.01, to see how the equilibria vary with the size of new potential switchers to be attracted by generic advertising.

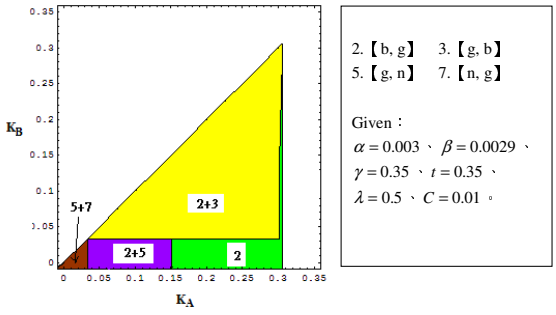
As shown in figure 2, when the size of new switchers γ to be attracted by generic advertising is small, both firms will conduct brand advertising in equilibrium despite the advertising effect is weakened by their rival's brand advertising (assuming $\lambda=0.5$). With the increase in the size of potential switchers, the weaker firm will conduct generic advertising when expecting its rival to choose brand advertising. When γ increases further, even the stronger firm will conduct generic advertising as well when expecting its rival to choose brand advertising. In doing so, the stronger firm avoid direct competition in brand advertising though allowing its rival to free ride its generic advertising.

The effect of adverting cost on advertising strategies is shown in figure 3 where γ is fixed at a t such a low level (0.01) that no generic advertising occurs in

equilibrium. It is interesting to note that the equilibrium where only the weaker firm conducts brand advertising occurs only when the advertising cost is moderate. It happens because when the advertising cost is too high, neither firm will advertise. When the advertising cost is too low, then choosing brand advertising is a dominant strategy for the stronger firm.

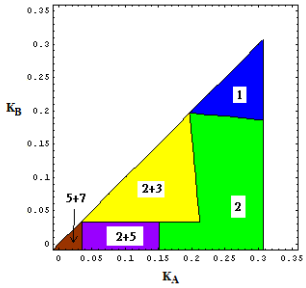


In figure 4-6, we examine how the advertising equilibria change with brand advertising power (K_A, K_B), advertising cost and the adverse effect of competitive advertising (i.e., 1- λ).



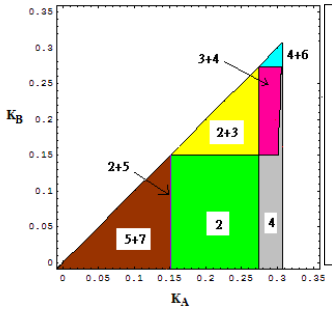
2.【b, g】 3.【g, b】
5.【g, n】 7.【n, g】

Given：
$\alpha = 0.003$、$\beta = 0.0029$、
$\gamma = 0.35$、$t = 0.35$、
$\lambda = 0.5$、$C = 0.01$。



1.【b, b】 2.【b, g】
3.【g, b】 5.【b, n】
7.【n, g】

Given：
$\alpha = 0.003$、$\beta = 0.0029$、
$\gamma = 0.35$、$t = 0.35$、
$\lambda = 0.7$、$C = 0.01$。



2.【b, g】 3.【g, b】
4.【b, n】 5.【g, n】
6.【n, b】 7.【n, g】

Given：
$\alpha = 0.003$、$\beta = 0.0029$、
$\gamma = 0.35$、$t = 0.35$、
$\lambda = 0.5$、$C = 0.05$。

First, the above figures show that competitive brand advertising occurs only when the adverse effect of competitive advertising is not too large and the advertising cost is not too high. In this situation, as long as each brand advertising power is high enough, firms will choose to compete directly in brand advertising, as shown in figure 4, the equilibrium 1.

When the adverse effect of competitive advertising increases, given the high brand power (high K_A and K_B), each firm will conduct generic advertising when expecting his rival conducts brand advertising, as shown in figure 5, equilibria 2 and 3. With the decrease in each brand power, only one firm will advertise through generic advertising.

Finally, from figure 6 it is interesting to note that when advertising cost increases, (from 0.01 to 0.05), if brand A is powerful (large K_A), then there always exist one equilibrium where firm B will not spend on

advertising and firm A will choose brand advertising, i.e., equilibrium 4. With the increase in the power of brand B, there also exists another equilibrium where firm A conducts generic advertising while firm B conducts brand advertising. Furthermore, given A's brand advertising, it shows that firm B will choose generic advertising when brand A is less powerful, as shown in figure 6, region 2+3.

The above equilibrium graphs and discussions show that brand advertising by either firm can soften the price competition with its rival. Generic advertising allows a firm to expand the whole market though benefiting its rival as well. A high advertising cost or a high power of the competing brand, will discourage the weaker firm to conduct generic advertising when expecting its rival to conduct brand advertising.

In the next section, we shall discuss our equilibrium results and compare them with existing literature and some assumptions made in this paper.

3. Discussion

We shall first compare our results with literature and then discuss the effects of some assumptions on our results.

Theoretical Implications

In this paper, we assume generic advertising and brand advertising differ in their effects on the composition of consumer segments. Unlike extent literature (Friedman and Friedman, 1976; Krishnamurthy, 2000; Bass et al., 2005), our results show that both the leading (stronger) firm and the weaker firm may conduct generic advertising. Similar to Friedman and Friedman (1976), Bass et al. (2005) suggest that the stronger firm should tolerate free-riding of generic advertising more than the weaker firm. However, in our paper, the weaker firm, having fewer loyal customers, can compete for switchers created by generic advertising more aggressively. Therefore, if advertising cost is not too high, the weaker firm has higher incentives to conduct generic advertising. In contrast, Bass et al. (2005) and Krishnamurthy (2000) do not explicitly consider the interaction between advertising and pricing decisions and thus cannot characterize advertising strategy that reflects the differential advantages of the two firms in price competition.

Similar to Krishnamurthy (2000), our results show that brand advertising expenditure by the rival firm will discourage a firm from conducting generic advertising. However, as long as the power of the rival brand in converting switchers to loyals is not too strong and the advertising cost is not too high, the firm may still optimally choose generic advertising when expecting its rival to conduct brand advertising. To highlight the trade-off between generic advertising and brand advertising, we assume firms can spend only on one type of advertising. As a result, unlike Krishnamurthy (2000) where the expenditures of the dominant firm on generic and brand advertising are positively related, our model is not able to accommodate the possibility of positive correlation between the two types of advertising.

Assuming brand advertising allows a firm to convert some switchers into its loyal customers, we find that brand advertising by either firm will soften the price competition with its rival. Shaffer and Zettelmeyer (2004) challenge the conventional wisdom that advertising message that differentiates competitive products increase firms' profits. They argue that when only some consumers are exposed to the advertising messages, manufacturers may be worse off after conducting advertising reducing cross-price elasticity. In this paper, we assume brand advertising will not influence the preferences of new users while generic advertising will not influence preferences of loyal customers. It is equivalent to assume firms are able to target different advertising messages to different segments, which is not only feasible but also profitable with the advancement of information technology. Therefore, when firms improve their capability of targeting advertising messages, it is more likely that firms can employ brand advertising to reduce price competition and thus increase their profits.

Examination of Assumptions

As mentioned above, we assume new users created by generic advertising will not be influenced by brand advertising. We have the following justifications. First, due to selective attention, new users, who are not familiar with this product category or with the new use, may not pay attention to brand advertising messages. Second, current customers and potential new users may differ in their characteristics and thus firms will choose different advertising media to reach them, respectively. Finally, brand advertising is more likely to be effective when audience have use experiences. As a result, it is hard to influence new users through brand advertising.

However, if new users can be influenced by brand advertising, then a firm will have stronger incentives to conduct brand advertising when expecting its rival chooses generic advertising. On the other hand, given the new switchers created by one firm's generic advertising can be persuaded by the other firm's brand advertising, the former is less likely to choose generic advertising to benefit its rival.

As shown before, under some parameter values, there may exist two equilibria, where one firm (either the stronger firm or the weaker firm) conducts generic advertising while the other firm conducts brand advertising. If one firm can choose its advertising strategy before its rival, it means the leader can influence the follower's advertising decision and choose its best advertising strategy based on the reaction function of its rival. In this case, the leader tends either to save the advertising cost or to conduct brand advertising to induce the follower to spend on generic advertising. As a result, it is more likely to have the equilibrium where it is the follower (i.e., the one moving first) rather than the leader that conducts generic advertising.

4. Concluding Remarks

In this paper, we incorporate the interaction between advertising strategy and pricing strategy. Our results show that firms' equilibrium advertising strategies depend on

the composition of consumer segments, the potential new users, advertising cost and the negative of competitive advertising. Unlike previous literature, we show that generic advertising may be chosen by the weaker firm to expand the market of switchers, given its competitive advantage in aggressive pricing over the stronger firm. Furthermore, the positive effect of a firm's generic advertising on its profit will be weakened by its rival's brand advertising. As a consequence, when the advertising cost is not too low, for the equilibrium where one firm conducts generic advertising and the other firm conducts brand advertising to occur, the brand power of the firm that chooses brand advertising cannot be too high.

Managerial Implications

Based on our equilibrium results, we can obtain the following managerial implications：

1. The weaker brand may benefit more from market expansion than the stronger brand

This paper explicitly incorporates the interaction between advertising and pricing strategies. We show that despite the weaker brand has a smaller loyal base than the rival brand, given its advantage in price competition, it may pay for the weaker firm to conduct generic advertising, rather than compete directly with its rival in brand advertising. As suggested by Friedman and Friedman (1976), the effect of competitive brand advertising on a firm's profit may be short-lived. After understanding the interaction between advertising and pricing strategies, the weaker firm may well leverage its competitive advantage in pricing when choosing its advertising strategies.

2. Generic advertising and price competition
Given generic advertising may intensify the subsequent price competition, the leading firm (the stronger firm) has to trade-off the benefit of increasing the pie and the cost of more intensive price competition. In particular, the more the stronger brand is at disadvantage in price competition, it is more difficult for it to increase the share of the pie via generic advertising.

3. The Advertising Strategy over the product life cycle

We have analyzed how the firms' equilibrium advertising strategies depend on the size of firms' loyal base and the size of potential new users. In the earlier stages of the product life cycle, depending on the size of its loyal base relative to its rival's and other factors, it is not always true that the market leader should expand the total market via generic advertising. Whether generic advertising can be successfully conducted also depends on how many new users it can create. As pointed out by Friedman and Friedman (1976), tea manufacturers may find their real competition is coffee industry. In the latter stage of the product life cycle, marketers should broaden their advertising outlooks and consider the possibility of inducing category substitution via generic advertising. To maximize its effectiveness, marketers can consider targeted advertising so that the advertising message can be tailored to a specific segment.

Future Research

In this paper, we focus on firms' choices between generic advertising and brand advertising and thus do not consider the possibility of conducting both types of advertising. Incorporating the possibilities of multiple advertisements and/or joint generic advertising will produce richer implications.

Also, we only consider one-stage game and therefore the model cannot capture some long-term effects of advertising on profits. For one thing, if we have a two-stage game, the stronger firm may find it optimal to sacrifice some short-term profit by conducting generic advertising, hoping to accumulate more loyal customers in the next stage via brand advertising. Furthermore, the segments of loyals and switchers are assumed to be exogenously given. In order to have better understanding of the interactions between advertising and pricing strategies, a complete model that incorporates the formation of loyal segments via advertising is suggested for future research.

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Appendix A

（A-1） Under this condition, given B's brand advertising, A prefers brand advertising to generic advertising

$$\frac{t[3(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)+4[\alpha+\lambda\times K_A\times(1-\alpha-\beta)]+2[\beta+\lambda\times K_B\times(1-\alpha-\beta)]]^2}{18(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)}$$
$$-\frac{t[3[(1-K_B)(1-\alpha-\beta)+\gamma]+4\alpha+2[\beta+K_B(1-\alpha-\beta)]]^2}{18[(1-K_B)(1-\alpha-\beta)+\gamma]}\geq 0$$

（A-2） Under this condition, given B's brand advertising, firm A prefer brand advertising to no advertising.

$$\frac{t[3(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)+4[\alpha+\lambda\times K_A\times(1-\alpha-\beta)]+2[\beta+\lambda\times K_B\times(1-\alpha-\beta)]]^2}{18(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)}$$
$$-C-\frac{t[3(1-K_B)(1-\alpha-\beta)+4\alpha+2[\beta+K_B(1-\alpha-\beta)]]^2}{18(1-K_B)(1-\alpha-\beta)}\geq 0$$

（A-3） Under this condition, given B's generic advertising, firm A prefers branding advertising to no advertising:

$$\frac{t[3[(1-K_A)(1-\alpha-\beta)+\gamma]+4[\alpha+K_A(1-\alpha-\beta)]+2\beta]^2}{18[(1-K_A)(1-\alpha-\beta)+\gamma]}-C$$
$$-\frac{t[3(1-\alpha-\beta+\gamma)+4\alpha+2\beta]^2}{18(1-\alpha-\beta+\gamma)}\geq 0$$

（A-4） Under this condition, given B's brand advertising, A prefers generic advertising to no advertising:

$$\frac{t[3[(1-K_B)(1-\alpha-\beta)+\gamma]+4\alpha+2[\beta+K_B(1-\alpha-\beta)]]^2}{18[(1-K_B)(1-\alpha-\beta)+\gamma]}-C$$
$$-\frac{t[3(1-K_B)(1-\alpha-\beta)+4\alpha+2[\beta+K_B(1-\alpha-\beta)]]^2}{18(1-K_B)(1-\alpha-\beta)}\geq 0$$

（A-5） Under this condition, given no advertising by firm B, A prefers brand advertising to no advertising:

$$\frac{t[3(1-K_A)(1-\alpha-\beta)+4[\alpha+K_A\times(1-\alpha-\beta)]+2\beta]^2}{18(1-K_A)(1-\alpha-\beta)}$$
$$-\frac{t[3(1-\alpha-\beta+\gamma)+4\alpha+2\beta]^2}{18(1-\alpha-\beta+\gamma)}\geq 0$$

（A-6） Under this condition, given B's no advertising, A prefers brand advertising to no advertising:

$$\frac{t[3(1-K_A)(1-\alpha-\beta)+4[\alpha+K_A\times(1-\alpha-\beta)]+2\beta]^2}{18(1-K_A)(1-\alpha-\beta)}-C$$
$$-\frac{t[3(1-\alpha-\beta)+4\alpha+2\beta]^2}{18(1-\alpha-\beta)}\geq 0$$

（A-7） Under this condition, given B's no advertising, A prefers generic advertising to no advertising:

$$\frac{t[3(1-\alpha-\beta+\gamma)+4\alpha+2\beta]^2}{18(1-\alpha-\beta+\gamma)}-C-\frac{t[3(1-\alpha-\beta)+4\alpha+2\beta]^2}{18(1-\alpha-\beta)}\geq 0$$

Appendix B

（B-1） Under this condition, given A's brand advertising, B prefers brand advertising to generic advertising:

$$\frac{t[3(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)+2[\alpha+\lambda\times K_A\times(1-\alpha-\beta)]+4[\beta+\lambda\times K_B\times(1-\alpha-\beta)]]^2}{18(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)}$$
$$-\frac{t[3[(1-K_A)(1-\alpha-\beta)+\gamma]+2[\alpha+K_A(1-\alpha-\beta)]+4\beta]^2}{18[(1-K_A)(1-\alpha-\beta)+\gamma]}\geq 0$$

（B-2） Under this condition, given A's brand advertising, firm B prefer brand advertising to no advertising:

$$\frac{t[3(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)+2[\alpha+\lambda\times K_A\times(1-\alpha-\beta)]+4[\beta+\lambda\times K_B\times(1-\alpha-\beta)]]^2}{18(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)}$$
$$-C-\frac{t[3(1-K_A)(1-\alpha-\beta)+2[\alpha+K_A(1-\alpha-\beta)]+4\beta]^2}{18(1-K_A)(1-\alpha-\beta)}\geq 0$$

（B-3） Under this condition, given A's brand advertising, B prefers generic advertising to no advertising:

$$\frac{t[3[(1-K_A)(1-\alpha-\beta)+\gamma]+2[\alpha+K_A(1-\alpha-\beta)]+4\beta]^2}{18[(1-K_A)(1-\alpha-\beta)+\gamma]}-C$$
$$-\frac{t[3(1-K_A)(1-\alpha-\beta)+2[\alpha+K_A(1-\alpha-\beta)]+4\beta]^2}{18(1-K_A)(1-\alpha-\beta)}\geq 0$$

（B-4） Under this condition, given A's generic advertising, B prefers brand advertising to no advertising:

$$\frac{t[3[(1-K_B)(1-\alpha-\beta)+\gamma]+2\alpha+4[\beta+K_B(1-\alpha-\beta)]]^2}{18[(1-K_B)(1-\alpha-\beta)+\gamma]}-C$$
$$-\frac{t[3(1-\alpha-\beta+\gamma)+2\alpha+4\beta]^2}{18(1-\alpha-\beta+\gamma)}\geq 0$$

（B-5） Under this condition, given A's no advertising, B prefers brand advertising to generic advertising:

$$\frac{t[3(1-K_B)(1-\alpha-\beta)+2\alpha+4[\beta+K_B(1-\alpha-\beta)]]^2}{18(1-K_B)(1-\alpha-\beta)}$$
$$-\frac{t[3(1-\alpha-\beta+\gamma)+2\alpha+4\beta]^2}{18(1-\alpha-\beta+\gamma)}\geq 0$$

（B-6） Under this condition, given A's no advertising, B prefers brand advertising to no advertising:

$$\frac{t[3(1-K_B)(1-\alpha-\beta)+2\alpha+4[\beta+K_B(1-\alpha-\beta)]]^2}{18(1-K_B)(1-\alpha-\beta)}-C$$
$$-\frac{t[3(1-\alpha-\beta)+2\alpha+4\beta]^2}{18(1-\alpha-\beta)}\geq 0$$

（B-7） Under this condition, given A's no advertising, B prefers generic advertising to no advertising:

$$\frac{t[3(1-\alpha-\beta+\gamma)+2\alpha+4\beta]^2}{18(1-\alpha-\beta+\gamma)}-C-\frac{t[3(1-\alpha-\beta)+2\alpha+4\beta]^2}{18(1-\alpha-\beta)}\geq 0$$

Appendix C- Regularity Conditions

In order to ensure interior solutions for various advertising subgames, as illustrated in section 2 for the subgame (b,g), we impose conditions R1-R4. For the other seven adverting subgames, we require twenty-eight additional conditions, denoted by R5-R32. We shall list them as follows.

1. A：No ad，B：No ad（R5-R8）

$$1>\frac{1}{2}-\frac{\alpha}{3(1-\alpha-\beta)}+\frac{\beta}{3(1-\alpha-\beta)}>0$$
$$t<\frac{2(1-\alpha-\beta)}{3(1-\alpha-\beta)+2\alpha+2\beta}$$
$$\frac{t[3(1-\alpha-\beta)+4\alpha+2\beta]^2}{18(1-\alpha-\beta)}-\alpha>0$$
$$\frac{t[3(1-\alpha-\beta)+2\alpha+4\beta]^2}{18(1-\alpha-\beta)}-\beta>0$$

2. A：Generic ad，B：No ad（R9-R12）

$$1>\frac{1}{2}-\frac{\alpha}{3(1-\alpha-\beta+\gamma)}+\frac{\beta}{3(1-\alpha-\beta+\gamma)}>0$$
$$t<\frac{2(1-\alpha-\beta+\gamma)}{3(1-\alpha-\beta+\gamma)+2\alpha+2\beta}$$
$$\frac{t[3(1-\alpha-\beta+\gamma)+4\alpha+2\beta]^2}{18(1-\alpha-\beta+\gamma)}-\alpha>0$$
$$\frac{t[3(1-\alpha-\beta+\gamma)+2\alpha+4\beta]^2}{18(1-\alpha-\beta+\gamma)}-\beta>0$$

3. A：No ad, B：Generic Ad（R13-R16）

$$1>\frac{1}{2}-\frac{\alpha}{3(1-\alpha-\beta+\gamma)}+\frac{\beta}{3(1-\alpha-\beta+\gamma)}>0$$
$$t<\frac{2(1-\alpha-\beta+\gamma)}{3(1-\alpha-\beta+\gamma)+2\alpha+2\beta}$$
$$\frac{t[3(1-\alpha-\beta+\gamma)+4\alpha+2\beta]^2}{18(1-\alpha-\beta+\gamma)}-\alpha>0$$
$$\frac{t[3(1-\alpha-\beta+\gamma)+2\alpha+4\beta]^2}{18(1-\alpha-\beta+\gamma)}-\beta>0$$

4. A：Brand ad，B：No ad（R17-R20）

$$1>\frac{1}{2}-\frac{\alpha+K_A(1-\alpha-\beta)}{3(1-K_A)(1-\alpha-\beta)}+\frac{\beta}{3(1-K_A)(1-\alpha-\beta)}>0$$
$$t<\frac{2(1-K_A)(1-\alpha-\beta)}{3(1-K_A)(1-\alpha-\beta)+2[\alpha+K_A(1-\alpha-\beta)]+2\beta}$$
$$\frac{t[3(1-K_A)(1-\alpha-\beta)+4[\alpha+K_A(1-\alpha-\beta)]+2\beta]^2}{18(1-K_A)(1-\alpha-\beta)}$$
$$-\alpha-K_A(1-\alpha-\beta)>0$$
$$\frac{t[3(1-K_A)(1-\alpha-\beta)+2[\alpha+K_A(1-\alpha-\beta)]+4\beta]^2}{18(1-K_A)(1-\alpha-\beta)}-\beta>0$$

5. A：No ad，B：Brand ad（R21-R24）

$$1>\frac{1}{2}-\frac{\alpha}{3(1-K_B)(1-\alpha-\beta)}+\frac{\beta+K_B(1-\alpha-\beta)}{3(1-K_B)(1-\alpha-\beta)}>0$$
$$t<\frac{2(1-K_B)(1-\alpha-\beta)}{3(1-K_B)(1-\alpha-\beta)+2\alpha+2[\beta+K_B(1-\alpha-\beta)]}$$
$$\frac{t[3(1-K_B)(1-\alpha-\beta)+4\alpha+2[\beta+K_B(1-\alpha-\beta)]]^2}{18(1-K_B)(1-\alpha-\beta)}-\alpha>0$$
$$\frac{t[3(1-K_B)(1-\alpha-\beta)+2\alpha+4[\beta+K_B(1-\alpha-\beta)]]^2}{18(1-K_B)(1-\alpha-\beta)}$$
$$-\beta-K_B(1-\alpha-\beta)>0$$

6. A：Brand ad，B：Brand ad（R25-R28）

$$t\leq\frac{2(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)}{3(1-\alpha-\beta-\lambda(\gamma_A+\gamma_B))+2[\alpha+\lambda\gamma_A]+2[\beta+\lambda\gamma_B]}$$
$$1>\frac{1}{2}-\frac{[\alpha+\lambda\gamma_A]-[\beta+\lambda\gamma_B]}{3(1-\lambda\times K_A-\lambda\times K_B)(1-\alpha-\beta)}>0$$
$$\frac{t[3(1-\alpha-\beta-\gamma_A-\gamma_B)+4[\alpha+\lambda\gamma_A]+2[\beta+\lambda\gamma_B]]^2}{18(1-\alpha-\beta-\gamma_A-\gamma_B)}$$
$$-[\alpha+\lambda\gamma_A]\geq 0$$

$$\frac{t[3(1-\alpha-\beta-\gamma_A-\gamma_B)+4[\alpha+\lambda\gamma_A]+2[\beta+\lambda\gamma_B]]^2}{18(1-\alpha-\beta-\gamma_A-\gamma_B)}$$
$$-[\beta+\lambda\gamma_B]\geq 0$$

7. A：Generic ad，B：Brand ad（R29-R32）

$$1>\frac{1}{2}-\frac{\alpha-\beta-\gamma_B}{3[1-\alpha-\beta+\gamma-\gamma_B]}>0$$

$$t<\frac{2[1-\alpha-\beta+\gamma-\gamma_B]}{3[1-\alpha-\beta+\gamma-\gamma_B]+2\alpha+2[\beta+\gamma_B]}$$

$$\frac{t[3[1-\alpha-\beta+\gamma-\gamma_B]+4\alpha+2[\beta+\gamma_B]]^2}{18[1-\alpha-\beta+\gamma-\gamma_B]}-\alpha>0$$

$$\frac{t[3[1-\alpha-\beta+\gamma-\gamma_B]+2\alpha+4[\beta+\gamma_B]]^2}{18[1-\alpha-\beta+\gamma-\gamma_B]}-\beta-\gamma_B>0$$

Appendix D

In this appendix, we shall prove lemma 1.

1. $\frac{\partial\pi_A}{\partial\alpha}>0$,

$$\therefore\frac{\partial\pi_A^*}{\partial\alpha}=P_A^*\times\left(\frac{\partial D_A}{\partial\alpha}+\frac{\partial D_A}{\partial P_B}\times\frac{\partial P_B^*}{\partial\alpha}\right),\ (where\ D_A=\alpha+z_0^*\delta)$$
$$=P_A^*\times\left(1-z_0^*+\delta\frac{\partial z_0^*}{\partial P_B}\times\frac{\partial P_B^*}{\partial\alpha}\right)$$
$$=P_A^*\times\left(1-z_0^*+\delta\frac{1}{2t}\frac{t(2+2\gamma+2\beta)}{3\delta^2}\right)$$
$$=P_A^*\times\left(1-z_0^*+\frac{(1+\gamma+\beta)}{3\delta}\right)>0$$

The above derivation shows that the increase in A's loyal base will increase A's profit. It happens because increasing A's loyal base will not only increase the number of its customers (keeping prices unchanged) but also induce firm B to charge a higher price, thus allowing firm A to attract a higher share of switchers.

2. $\frac{\partial\pi_A}{\partial\beta}>0$,

$$\therefore\frac{\partial\pi_A^*}{\partial\beta}=P_A^*\times\left(\frac{\partial D_A}{\partial\beta}+\frac{\partial D_A}{\partial P_B^*}\times\frac{\partial P_B^*}{\partial\beta}\right)$$
$$=P_A^*\times\left(-\frac{P_B^*-P_A^*+t}{2t}+\frac{1-\alpha-\beta+\gamma}{2t}\times\left(\frac{2t(2-\alpha+2\gamma)}{3(1-\alpha-\beta+\gamma)^2}\right)\right)$$
$$=P_A^*\times\left(-\frac{1}{2}+\frac{\alpha-\beta}{3(1-\alpha-\beta+\gamma)}+\left(\frac{2-\alpha+2\gamma}{3(1-\alpha-\beta+\gamma)}\right)\right)$$
$$=P_A^*\times\left(\frac{-3+3\alpha+3\beta-3\gamma+2\alpha-2\beta+4-2\alpha+4\gamma}{6(1-\alpha-\beta+\gamma)}\right)$$
$$=P_A^*\times\left(\frac{1+3\alpha+\beta+\gamma}{6(1-\alpha-\beta+\gamma)}\right)>0$$

Thus the effect of the increase in α on firm B's profit include the direct effect and the strategic effect:

(i) The direct effect of β on the firm A's demand:

This direct effect $\frac{\partial D_A}{\partial\beta}=-\frac{P_B^*-P_A^*+t}{2t}$ is negative in that it decreases the size of switchers.

(ii) The strategic effect of β on firm A's demand:

This strategic effect

$$\frac{\partial D_A}{\partial P_B^*}\times\frac{\partial P_B^*}{\partial\beta}=\frac{1-\alpha-\beta+\gamma}{2t}\times\left(\frac{2t(2-\alpha+2\gamma)}{3(1-\alpha-\beta+\gamma)^2}\right)$$

is positive because the increase in firm B's loyal base makes firm B charge a higher price, thus increasing the demand faced by firm A. It turns out that this strategic effect of β dominates its direct effect and thus increases firm A's profit.

3. $\frac{\partial\pi_A}{\partial\gamma}>0$ and can be shown as follows：

$$\because \left.\frac{\partial \pi_A^*}{\partial P_A}\right|_{P_A^*} = 0 \quad \therefore \frac{\partial \pi_A^*}{\partial \gamma} = P_A^* \times \left(\frac{\partial D_A}{\partial \gamma} + \frac{\partial D_A}{\partial P_B^*} \times \frac{\partial P_B^*}{\partial \gamma} \right)$$

$$= P_A^* \times \left(\frac{P_B^* - P_A^* + t}{2t} + \frac{1-\alpha-\beta+\gamma}{2t} \times \left(\frac{-2t(\alpha+2\beta)}{3(1-\alpha-\beta+\gamma)^2} \right) \right)$$

$$= P_A^* \times \left(\frac{1}{2} - \frac{\alpha-\beta}{3(1-\alpha-\beta+\gamma)} - \left(\frac{(\alpha+2\beta)}{3(1-\alpha-\beta+\gamma)} \right) \right)$$

$$= P_A^* \times \left(\frac{3-3\alpha-3\beta+3\gamma-2\alpha+2\beta-2\alpha-4\beta}{6(1-\alpha-\beta+\gamma)} \right)$$

$$= P_A^* \times \left(\frac{3+3\gamma-7\alpha-5\beta}{6(1-\alpha-\beta+\gamma)} \right)$$

Similarly, the effect of γ can be separated into the direct effect and the strategic effect.

(i) The direct effect of γ on firm A's demand

$\left(\frac{\partial D_A}{\partial \gamma} \right) = \frac{P_B^* - P_A^* + t}{2t}$ is positive.

(ii) The strategic effect of γ on firm A's demand：

The strategic effect of γ equals $\left(\frac{\partial D_A}{\partial P_B^*} \times \frac{\partial P_B^*}{\partial \gamma} \right) = \frac{1-\alpha-\beta+\gamma}{2t} \times \left(\frac{-2t(\alpha+2\beta)}{3(1-\alpha-\beta+\gamma)^2} \right)$, which is negative.

That is, the increase of new users will induce firm B to cut its price in competing for switchers, which in turn reduce firm A's share of switchers.

Combing the two effects, we have：

If $3+3\gamma-7\alpha-5\beta>0 \Rightarrow \frac{\partial \pi_A}{\partial \gamma}>0$ ，

If $0>3+3\gamma-7\alpha-5\beta \Rightarrow \frac{\partial \pi_A}{\partial \gamma}<0$ ；

By symmetry, we can obtain the effects of these parameters on firm B's profit. W summarize the results in the following table.

		P_A	P_B	π_A	π_B
α	↑	↑	↑	↑	↑
β	↑	↑	↑	↑	↑
γ	↑	↓	↓		

Appendix E

In this Appendix, we shall show the conditions under which when one firm conducts brand advertising and the other firm conducts generic advertising, the equilibrium prices of both firms increase. First note that under (b, g), A's loyal base increases but the size of switchers is decreased by A's brand advertising and increased by B's generic advertising. It can be easily shown A's equilibrium price increases iff

$\frac{\gamma}{K_A} < \frac{(2-\beta)(1-\alpha-\beta)}{2\alpha+\beta}$.

Similarly, firm B's price increases iff

$\frac{\gamma}{K_A} < \frac{(1+\beta)(1-\alpha-\beta)}{\alpha+2\beta}$.

Since $\frac{K_A(2-\beta)(1-\alpha-\beta)}{2\alpha+\beta} > \frac{K_A(1+\beta)(1-\alpha-\beta)}{\alpha+2\beta}$ ，

(i). If $\frac{\gamma}{K_A} > \frac{(2-\beta)(1-\alpha-\beta)}{2\alpha+\beta}$ ，both prices decrease after their advertising decisions.

(ii).If $\frac{(2-\beta)(1-\alpha-\beta)}{2\alpha+\beta} > \frac{\gamma}{K_A} > \frac{(1+\beta)(1-\alpha-\beta)}{\alpha+2\beta}$ ，A's price increases while B's price decreases.

(iii).If $\frac{(1+\beta)(1-\alpha-\beta)}{\alpha+2\beta} > \frac{\gamma}{K_A}$ ，both prices increase.

For the subgame (g, b), firm B's loyal base is increased by its brand advertising. Suppose after firm B's advertising decision, firm B has a larger loyal base than firm A.

$\because \frac{K_B(2-\alpha)\times(1-\alpha-\beta)}{\alpha+2\beta} > \frac{K_B(1+\alpha)\times(1-\alpha-\beta)}{2\alpha+\beta}$

Then we have the following

(i) If $\frac{\gamma}{K_B} > \frac{(2-\alpha)\times(1-\alpha-\beta)}{\alpha+2\beta}$ ，both prices decrease

(ii)If $\frac{(2-\alpha)\times(1-\alpha-\beta)}{\alpha+2\beta} > \frac{\gamma}{K_B} > \frac{(1+\alpha)\times(1-\alpha-\beta)}{2\alpha+\beta}$

，B's price increase while A's price decrease.

(iii) If $\frac{(1+\alpha)(1-\alpha-\beta)}{2\alpha+\beta} > \frac{\gamma}{K_B}$ ，both prices increase.