



# Organizational structure of a global supply chain in the presence of a gray market: Information asymmetry and valuation difference



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## ABSTRACT

We consider a global supply chain of a multinational firm (MNF) with domestic and foreign markets in the presence of a gray marketer. In particular, we investigate the organizational structure of the MNF for pricing (centralization vs decentralization) when the foreign division of the MNF competes with the gray marketer. The foreign division has a private information on the market potential and customers have a valuation difference between the products sold by the foreign division and the gray marketer. In this situation, while centralized pricing may control the gray marketer's activities, decentralized pricing may take advantage of a local manager's private information, especially when a significant valuation difference of customers exists due to product or service differentiation. We analyze the trade-offs in the choice of organizational structure for pricing and the impact of information asymmetry and valuation difference on this choice. Also, we show that decentralization can be further improved by an incentive adjustment of profits between divisions, which has a potential to increase all divisions' and MNF's total profits over centralization.

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## 1. Introduction

Gray market activity represents the third-party (gray marketer)'s parallel import of a manufacturer's brand product from a low-price region to a high-price region (Autrey et al., 2015). The gray market activity arises in a wide range of product categories such as clothes, electronic equipment, books, and automobiles where the prices vary across different regions. Antia et al. (2004) reported that the size of the gray market reaches 7.4 billion euros in the European Union (EU). Also, in the information technology (IT) sector, the size of the gray market exceeds 40 billion dollars and the total losses of IT firms due to gray market activity are about 5 billion dollars (KPMG LLP, 2003). Thus, for a multinational firms (MNFs) who operate businesses in different regions through its local divisions cannot ignore the impact of the gray market activity on its pricing decisions.

While the gray market activity has the potential to create a new demand for the product (see, for example, Mukherjee and Zhao (2012), and Raff and Schmitt (2007)), usually the gray market activity leads to a decrease in the price discrimination across regions by the MNF. Then, the demand of the brand product sold by the local branch of MNF and also the profit of MNFs may reduce

due to the gray market activity. In this case, MNFs actively devise means to tackle gray market activity.

Among many strategies the MNF can devise, MNFs tend to focus mainly on product pricing to counter gray market activity (Irvani et al., 2013). In fact, most papers on product pricing in the presence of a gray market consider centralized pricing where the headquarters (HQ) of a MNF controls each division's regional pricing (e.g., Ahmadi and Yang, 2000; Mukherjee and Zhao, 2012). Empirical studies including Myers (1999) and Myers and Griffith (1999) show that implementing centralized pricing reduces the gray market.

While centralized pricing is regarded as conventional wisdom in the gray market literature, in practice many MNFs still adopt decentralized decision-making. According to Robinson and Stocken (2013), MNFs recently have tended to delegate decision rights to the local division. They reported that 77% of the firms in the wholesale trade industry employ a decentralized authority. Autrey et al. (2014) also mentioned that the textbook publisher John Wiley & Sons utilizes decentralized control even though the gray market's threat in the textbook market is evident. Then, why does the decentralized organizational structure prevail in an industry where the gray market is active?

One possible reason for decentralization is information asymmetry among the divisions in a MNF. Information asymmetry easily arises in a MNF whose organizational structure is complex, as not all information is perfectly shared. For example, in a semiconductor manufacturer, each production division may observe a

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state of local demand that is not observable to the HQ (Karabuk and Wu, 2005). To utilize local information that is only available to the local division, it has been suggested that decentralization is a suitable organizational structure (Arora et al., 2013). However, to the best of our knowledge, information asymmetry has not been considered in the organizational structure decision literature under the gray market. While Autrey et al. (2014) considered an organizational structure with a gray market, they focused only on the competition between a MNF and another rival firm. However, Assmus and Wiese (1995) mentioned that, while centralized pricing may control gray market activity, a local manager's private information may make decentralization more beneficial than centralization in the presence of a gray market. Thus, when decentralization is implemented, local information is utilized to increase divisional profit although the gray market quantity may not be minimized.

Another factor that may affect the choice of the organization structure for pricing is the valuation difference between a brand product and a parallel import. In a MNF's pricing decision in the presence of a gray market, Ahmadi and Yang (2000) suggested that the MNF should consider the consumer's valuation difference between the brand product and the parallel import to counter gray market activity. Evidently, the gray marketer's parallel import may not provide the same warranty or service as the brand product does. Also, consumers take a risk of counterfeit (Ahmadi et al., 2015) when buying parallel imports, which makes the parallel import an inferior good compared to the brand product to customers (Huang et al., 2004). Since the degree of valuation difference affects the competition between a gray marketer and the local division of MNF (and, in turn, the size of gray market), we incorporate the customer's *relative valuation* of a parallel import compared to the brand product in our analysis of the organizational structure for pricing in a MNF.

In this paper, we investigate the optimal organization structure – either centralization or decentralization – of a global supply chain in a MNF for pricing in the presence of a gray market. In particular, we compare the expected total profit of the MNF in the two organizational structures under information asymmetry reflected by a variability of an uncertain market potential and the customer's perceived valuation difference between parallel import and brand profit reflected by the relative valuation of a parallel import compared to the brand product.

The trade-off between two organizational structures motivates us to find a method to enjoy the benefits of two organizations at the same time. As a result, we consider incentive adjustment among local divisions of a MNF in decentralization such that each division concerns the other division's profit up to a certain proportion. Our numerical analysis shows incentive adjustment may be a viable option to both HQ and the local division of a MNF.

The next section, Section 2, reviews the related literature to position our paper. In Section 3, we introduce our model. Section 4 analyzes a MNF's optimal pricing decision in centralization and decentralization while Section 5 considers incentive adjustment in decentralization. Section 6 summarizes managerial insights. Finally, Section 7 provides conclusions.

## 2. Literature review

A large body of the literature on a firm's strategy in the presence of a gray market discusses the strategies to curb gray market activity to improve the profit of the firm. Among various strategies, the pricing strategy of MNF to its divisions is popular in the literature. For example, Assmus and Wiese (1995) and Myers and Griffith (1999) insisted that price coordination among sales divisions in different markets can hinder gray market trade and

increase the total profit of the firm. Myers (1999) empirically confirmed that centralized decision making is helpful to reduce gray market volume in his survey on MNFs. Similar to our paper, Autrey et al. (2014) discussed organizational structure in pricing when a MNF competes with its rival firm in the high price region with a gray marketer. They showed that decentralized pricing is optimal when a competing rival firm exists and the competition intensity is relatively high. While Autrey et al. (2014) focused on a firm's external factors like competition with the rival firm, in this paper, we raise the question whether internal factors exist that affect the choice of organizational structure by considering two possible factors: (1) information asymmetry and (2) valuation difference in the presence of a gray market.

The choice of organizational structure in the presence of information asymmetry has been studied extensively in the economics literature. The closest paper to ours is Alonso et al. (2008b). They considered organizational structure choice (i.e., centralization vs. decentralization) in a MNF when a local division has private information that its HQ cannot observe and when a coordination benefit exists from centralization. Since each division's decision is interrelated as in our paper, a tension between centralization and decentralization exists. Similarly, Alonso et al. (2008a) considered MNFs that sell products to two different markets when the local division knows the level of the exact demand potential. Dessein et al. (2010) analyzed the organizational structure choice when two divisions create negative externalities for each other. In the management literature, Arora et al. (2013) analyzed the same issue in the context of technology licensing. While a local division observes a licensing opportunity better than its HQ, it may not fully utilize this opportunity since licensing may create competition in the local market, which hurts the local division's profit. However, to the best of our knowledge, none of the previous papers deals with the organizational structure choice of a MNF under information asymmetry in the presence of a gray market.

Information asymmetry has been popularly studied in the supply chain management literature. However, most papers assume that centralized decision is a benchmark without information asymmetry, which makes the total profit in centralization higher than that in decentralization. For example, Lee et al. (2000) examined the impact of information sharing in a two-level supply chain. Ha and Tong (2008) investigated contract and information sharing in two competing supply chains. Özer and Wei (2006) addressed the issue of information credibility in information sharing when the supplier should determine the capacity in advance. Kim and Netessine (2013) studied the collaborative cost reduction between a manufacturer and supplier when information regarding a supplier's production cost is revealed to a manufacturer as they collaborate. While our paper is related to this research stream that considers information asymmetry in a supply chain, the focus of this stream is on conflict and cooperation, not on the choice of organizational structure.

In analyzing the pricing decision of MNFs in the presence of the gray market, Ahmadi and Yang (2000) considered relative valuation on a parallel import compared to the brand product. Due to the counterfeit concern (Ahmadi et al., 2015) and to product or service differentiation between regions, consumers perceive a parallel import as an inferior good compared to the brand name product (Huang et al., 2004). Shavandi et al. (2015) studied the pricing strategy of a centralized MNF when it competes with a rival firm and a gray marketer. While they did not consider the organizational structure decision, they incorporated relative valuation in their analysis of an equilibrium pricing strategy between a MNF and a rival firm. We also observe that relative valuation is reflected in Ahmadi et al. (2015), Irvani et al. (2013), and Xiao et al. (2011) in their analytic model considering the gray market. We thus incorporate relative valuation in our analysis of organizational structure for pricing decisions in the presence of a gray market.

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