An Exploratory Analysis of Counterfeiting Strategies: Towards Counterfeit-Resilient Supply Chains

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Abstract

Purpose: To identify strategies employed by product counterfeiters in their exploitation of legitimate supply chains; to develop a theoretical understanding of counterfeiting and its impact on competitive resources; and, to propose counter-measures for increasing the resilience of supply chains to the counterfeiting threat.

Design/methodology/approach: An inductive, qualitative analysis of secondary case data obtained from three sources.

Findings: Initial searching and coding identified four sets of strategies: extraction strategies, for obtaining products or materials from the legitimate economy; production strategies, for manufacturing counterfeit goods; distribution strategies; and, infiltration strategies, for introducing counterfeits into the legitimate economy. Secondary, focused coding revealed that much of what the counterfeiting strategies set out to achieve involves the generation, suppression or exploitation of signals. A theoretical account of counterfeiting and its impact on competitive resources (quality, reputation and trademark) is then developed based on signaling theory and the resource-based view.

Research implications: A set of counter-measures for dealing with the counterfeiting threat are proposed. There is scope for much further work on counterfeit-resilience, including on establishing the effectiveness of these counter-measures.

Practical implications: Counterfeiting is an increasingly significant supply chain problem. It provides a direct economic challenge to legitimate producers, undermines the value of trademarks, and threatens consumer welfare. It affects many industries, including automotives, aerospace and pharmaceuticals, where counterfeits have sometimes proven fatal. The paper adds to our understanding of how this phenomenon takes place and how it might be tackled.

Originality/value: Although many OM studies refer to the risks of patent and copyright infringements that arise in supply chains, the problem of product counterfeiting has received only limited attention, leaving a clear gap in our understanding.

Keywords: *Supply chain; Counterfeiting; Resilience; Secondary data; Signaling theory.*
Paper Type: *Research Paper*

1. Introduction

1.1 The Counterfeiting Threat

Counterfeiting is a significant problem evident in a wide range of industries and supply chain echelons. This includes in pharmaceuticals, automotives, electronics, and aerospace, where there is high reliance on Research & Development (R&D) and innovation. Counterfeit activity is increasingly widespread and sophisticated. As described in the many trade publications (e.g. Whitehead, 2003; Wald & Holleran, 2007; Sangani, 2010), counterfeiters may construct complex supply chains and, using cutting-edge technology, bypass years of investment by reverse-engineering a new product before mass producing it to profiteer on the back of a brand name or marketing campaign. On occasions, counterfeiters have used the same technologies and suppliers, and even employed from the same labour pool as Original Equipment Manufacturers (OEMs) to access tacit knowledge (e.g. Haley, 2003; Trott & Hoecht, 2007).

The economic and social impact of counterfeiting is considerable. While the size of the problem is difficult to gauge, because much counterfeit activity goes undetected or unreported, the Counterfeit Intelligence Bureau (CIB) has estimated that counterfeiting represents 5-7% of world trade (CIB, 2011). Counterfeiting increases law enforcement costs, reduces tax revenues, funds organised crime and terrorism, undermines reputations, and damages customer-confidence. It even kills: the International Anti-Counterfeiting Coalition reported that substandard counterfeit shear bolts and sleeves were implicated in an air disaster involving a Norwegian plane which killed 55 people (IACC, 2005; see also Luedeman, 1997). Furthermore, media reports suggest that approximately 15% of pharmaceuticals imported into the U.S. are counterfeits containing unapproved substances (Lister, 2006). Meanwhile, in developing countries, thousands of patients are thought to have died from counterfeit medicine in recent years (Lister, 2006).

Despite interest from practitioners and the popular press, counterfeiting has received only limited attention in the academic Operations Management (OM) literature (e.g. Marucheck *et al.*, 2011b). OM researchers have been concerned with Intellectual Property (IP) risks and the appropriation – usually by suppliers – of expert knowledge (e.g. Choi *et al.*, 2004; Chopra & Sodhi, 2004), but this typically relates to patent and copyright infringement not trademark infringement and passing-off goods as those of another producer, which is the defining aspect of counterfeiting. Even in the wider business and management literature, research into supply-side counterfeit issues – including how counterfeiters exploit legitimate supply chains – is lacking

compared with work on the consumption of counterfeits (Staake *et al.*, 2009). A paper in the risk field (Busby & Stevenson, 2011) and Staake *et al.*'s own recent work (Staake *et al.,* 2012) are exceptions.

In this paper, we present a qualitative, exploratory analysis of secondary data to identify the strategies adopted by counterfeiters to exploit legitimate supply chains. We use this as a basis for developing a theoretical understanding of counterfeiting and its impact on competitive resources. We then propose counter-measures for improving the counterfeit-resilience of supply chains to the strategies employed by counterfeiters. We suggest that it is just as important to develop resilience to counterfeiting as it is to develop resilience to natural disasters, terrorist attacks and other fundamental threats to supply chains (e.g. Christopher & Peck, 2004; Sheffi, 2007; Ponomarov & Holcomb, 2009; Bakshi & Kleindorfer, 2009). We therefore extend the notion of resilience in the OM literature – from the ability to cope, recover or maintain continuity when faced with vulnerabilities or disruptions to operations (e.g. Christopher & Peck, 2004; Sheffi, 2007) – to include threats posed by counterfeiting.

The remainder of this paper is organised as follows. Section 2 briefly reviews several selected streams of OM literature to which the counterfeiting threat could be an important consideration. We show how this literature deals extensively with the appropriation of expertise and both patent and copyright infringement but not with the appropriation of reputation. Section 3 outlines the research method adopted before the results of our secondary data analysis are presented in Section 4. Here, we categorise the counterfeiting strategies that could be identified from our data set, and we show how central to such strategies is the concept of signaling and its impact on reputational resources. Section 5 develops a theoretical view of counterfeiting based on a combination of signaling theory and the resource-based view. Section 6 proposes counter-measures to the identified counterfeiting strategies, particularly in the light of the relevance of signaling, before the paper concludes with Section 7. Before reviewing the literature, we first offer a definition of counterfeiting and explain its fundamental connection with supply chains as a form of organisation.

1.2 Counterfeiting, Trademark and Supply Chains

We distinguish counterfeiting from other intellectual property rights violations, such as patent and copyright infringement, where a concept or design is copied but not necessarily with the intention to pass it off as the originator's. Thus, our definition is:

Counterfeiting is the infringement of trademark and the act of passing a product off as though it were another's.

The World Trade Organisation (WTO, 2014) similarly defined counterfeiting as the "unauthorized representation of a registered trademark carried on goods identical to or similar to goods for which the trademark is registered, with a view to deceiving the purchaser into believing that he/she is buying the original goods". But in some circumstances, counterfeits are procured knowingly so our definition is intended to be slightly wider than the WTO's. Our definition also differs in minor respects from others in the literature (e.g. Yang *et al.*, 2004; Staake *et al*., 2009), but all are based on the central idea that counterfeiting is a deception that some product comes from another, more reputable source.

The concept of counterfeiting as an infringement of trademark is important to the operation of supply chains. A trademark is a device, protected in law, that helps remedy a market failure (Ramello, 2006) arising from the problem that a buyer typically knows far less about a product's quality than the supplier. This asymmetry leads to buyer uncertainty, adds to buyer search costs, creates incentives for suppliers to mislead buyers, and results in an overall fall in product quality and market size (Akerlof, 1970). Trademarks help overcome such uncertainties by intimately associating a good with a reputable producer. They provide the 'glue' that avoids opportunistic behaviour on the part of one firm supplying another. Not only can customers choose suppliers with reputable trademarks, but suppliers also have a strong incentive to maintain their trademark's reputation through the strict management of quality (Ramello, 2006). Trademarks thus become an important prerequisite for supply chains – for having confidence in the division of labour across multiple firms and regions. Counterfeiting is a threat to legitimate supply chains not only by creating unfair economic competition but by undermining the reputational messages that a supply chain may depend upon.

2. Literature Review

In this section we briefly and selectively review the OM literature to support our argument that, while it has been concerned with certain problems of IP management in supply chains, this almost exclusively concerns the appropriation of expertise via patent and copyright infringement rather than the appropriation of reputation – the central aspect of counterfeiting. We then formulate our research question.

2.1 Overview of Selected OM Literature

The threat of product counterfeiting should be an important consideration when choosing suppliers. But while the supplier selection literature considers criterion like trustworthiness (Ireland & Webb, 2007) and the risks of suppliers either exploiting production knowledge to compete with their former customers (Quinn & Hilmer, 1994; Neiger *et al.,* 2009) or 'disintermediate' in the aftermarket for replacement parts (Rossetti & Choi, 2008), it does not explicitly consider, for example, the risk of suppliers passing-off goods under the OEM's trademark. There is a similar emphasis on knowledge appropriation in the supplier integration literature. For example, it is noted that integrating suppliers in new product development can lead to undesirable knowledge transfers if governance mechanisms fail (Das *et al.*, 2006) and a blurring of IP ownership boundaries (e.g. Handfield *et al.*, 1999; Petersen *et al.*, 2005; Parker *et al.*, 2008). Research has also attempted to identify the appropriate degree of supplier involvement in product development (e.g. Wynstra & ten Pierick, 2000; Parker *et al.*, 2008) and strategies for ensuring no external stakeholder has a complete picture of a producer's product or process (e.g. van Hoek & Weken, 1998; Jacobs *et al.*, 2007). But this work says little about how supplier integration might facilitate counterfeiting, or how this risk could be managed.

Work on product traceability, and the technologies that can achieve it, have an obvious relevance to counterfeiting. For example, the use of RFID has been advocated as a way of protecting pharmaceutical supply chains from counterfeiting (Visich *et al.*, 2009, citing the Food and Drug Administration: FDA, 2004; Marucheck *et al.,* 2011b). Meanwhile, there are two important End-Of-Life (EOL) issues connected to counterfeiting. First, when a specific product is disposed of, it may be recovered by counterfeiters, remanufactured and passed off 'as-new', with or without restoration. Closed-loop supply chain management – whereby products are recovered by OEMs or third parties for remanufacture or disposal (e.g. Kleindorfer *et al.*, 2005; French & LaForge, 2006) – provides one potential way of avoiding this. But most research in this area is motivated by waste reduction and environmental concerns, not the threat of counterfeiting. Second, at the end of a product type's life, when a manufacturer discontinues production, demand for replacements may continue, and counterfeiters may step in and fulfil demand with imitations or remanufactured EOL products. But literature in this area does not appear to consider the opportunities created for counterfeiters by product discontinuation.

Off-shore outsourcing and captive offshoring also have a clear connection with the counterfeiting threat. Both introduce physical distance that reduces observability, making the supply chain ripe for opportunistic behaviour (Ellram *et al.*, 2008) – including IP theft (Chopra & Sodhi, 2004; Manuj & Mentzer, 2008). In the case of offshore outsourcing, the literature acknowledges that opportunistic behaviour is a particular danger to innovation-oriented firms, which are at risk of technology appropriation (Rossetti & Choi, 2008) and transfer to 'pirate' suppliers (Spekman *et al.,* 2002) who sell to companies that then compete against the legitimate producer (Wathne & Heide, 2000). Potential remedies include 'out-tasking' (Fine, 1998; Takeishi, 2001), whereby a firm outsources a task but does not transfer knowledge of the process. Captive off-shoring, like outsourcing, has been linked to knowledge transfer and IP concerns. Klassen & Whybark (1994), for example, highlighted the importance of patent protection as an integrated international manufacturing network emerges and as employees and skills become increasingly transient. One suggestion for reducing risk is to disperse IP-producing activity across locations, so the value of IP in any one location is not clear until combined with complementary knowledge held in other locations (Zhao, 2006). But in the literature, the primary concern is with the leakage of knowledge and expertise. Counterfeiting – and the appropriation of reputation – is a quite different, if sometimes related, threat. It is not at all clear that strategies conferring resilience to the former – like the dispersal of R&D and the out-tasking of operations – would necessarily confer resilience to the latter.

There has been some recent work, and in particular a special issue of the *Journal of Operations Management* (Marucheck *et al.*, 2011a), on product safety and security in global supply chains. Two of the five special issue papers made no reference to counterfeiting (de Koster *et al.*, 2011; Hora *et al.*, 2011), and two on supply chain security made only passing reference (Gray *et al.*, 2011; Speier *et al.*, 2011). But Marucheck *et al.* (2011b), focussing on five specific industries, identified counterfeiting as a particular threat for pharmaceuticals and medical devices. They identified a number of contributory factors, including the Internet, outsourcing and the trade in generics, and suggested various remedies (including the use of RFID). Nonetheless, their coverage of counterfeiting phenomena specifically was constrained and, since their focus was not on counterfeiting exclusively, their theoretical development of it was necessarily limited. Our claim is therefore that there remains a need for a systematic study of how counterfeiting exploits and threatens legitimate supply chains. In Table I, we synthesise our observations on the literature, listing the expertise appropriation threats that *have* been identified

with examples of related reputation appropriation threats that have *not* been studied but which are evident from recent counterfeiting cases. This gap prompts important normative and practical questions, e.g. about how best to detect, deter, or prevent counterfeiting. But we first need to understand the nature of counterfeiting itself: the strategies that counterfeiters employ, and how such strategies are incentivised and facilitated. Only then does it make sense to work out how to make supply chains resilient to counterfeiting. Our research question (RQ) is therefore:

RQ: What strategies can be identified that are employed by product counterfeiters to exploit legitimate supply chains? And how can supply chains become more resilient to the counterfeiting threat?

[Take in Table I]

3. Research Method

3.1 Research Design

The research design has three main elements. First, it is qualitative and grounded, suiting the nascent state of theory surrounding the phenomenon (Edmondson & McManus, 2007). The aim is theory building, not theory confirmation. Second, it uses a case study method, which is appropriate for early, exploratory investigation of a phenomenon that is not well understood, with variables that are still unknown (Benbasat *et al.*, 1987; Voss, 2009). The case study method is also appropriate when the interest is in the dynamics present within specific settings (Eisenhardt, 1989) and there is no opportunity for experimental control or manipulation (Benbasat *et al*., 1987). Third, the design uses secondary case data. This reflects the difficulties of studying a clandestine, criminal activity at first-hand. OM researchers have recently been encouraged to make greater use of archival and secondary data (e.g. Calantone & Vickery, 2010), while grounded theory development based on existing case data has been advocated by Lewis (1998).

3.2 Data Collection

Three sources of secondary case data have been used: (i) cases published by the Counterfeit Intelligence Bureau (CIB), a division of the International Chamber of Commerce (ICC); (ii) press releases on counterfeiting cases from the U.S. Federal Bureau of Investigation (FBI); and, (iii) news articles on counterfeiting in broadsheet newspapers, indexed by Nexis (NEX). These sources provide sufficient data in many cases to identify counterfeiters' strategies in context. But

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each has specific limitations and biases. First, CIB reports are vulnerable to industry bias, presenting counterfeiting in a way that suits the CIB's commercial interests and lobbying concerns. Second, FBI reports are vulnerable to enforcement bias, presenting counterfeiting in a way that conforms to agency policy and is constrained by legal concerns. Third, news articles are vulnerable to journalistic bias, presenting counterfeiting in a sensationalised way that reflects the need to sell newspapers. By pooling data from the three sources, industry, enforcement and journalistic viewpoints are all represented and we aim to avoid an overall analysis that is unduly biased. Moreover, the sources are only used to analyse the nature of counterfeiting activity, not to make quantitative inferences about the frequency of its occurrence. This is consistent with the basic notion that the data, in grounded analysis, are there to stimulate qualitative insight rather than measure specific variables, and that qualitative methods are about coming 'to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world' (van Maanen, 1983). Of course an important general limitation of the data is that it is inherently confined to cases of counterfeiting that have been both detected and reported. This introduces an obvious bias, in that those strategies that are most successful at defying detection, or at causing embarrassment to corporations or the authorities, will be the ones least well represented in our sample. The remainder of the article needs to be read with this in mind.

The CIB database contains a large number of reports of which only a proportion describe specific cases of counterfeiting. A search within "all industries and countries" was conducted to retrieve the latest 50 reports for each of 10 categories of impact (e.g. fatalities, loss of employment, poor product quality, etc). This was undertaken on two dates (three months apart) to determine the stability of the dataset. This returned 527 reports (27 from the first date were not retrieved on the second), reduced to 362 non-duplicates and – after close inspection – to 71 that referred at least in part to a specific case. The FBI dataset was queried using "counterfeit" as the search term, producing 525 reports which were reduced to just 30 that referred at least in part to a specific case. The same approach was adopted with the Nexis database; searching for "counterfeit" returned 230 articles, reduced to 26 usable cases. Table II summarises the sampling process resulting in 127 useable cases and Table III indicates which industries are represented.

[Take in Tables II & III]

3.3 Analysis Procedure

Analysis of the case reports followed the principles of grounded theory (Glaser & Strauss, 1967;

Kaufmann & Denk, 2011) rather than content analysis (Weber, 1990). This reflected our exploratory rather than confirmatory objective, and allowed important nuances and qualitative distinctions in counterfeiting strategies to emerge. This involved two stages, as is typical of qualitative analysis: an initial searching and coding stage followed by secondary 'focused' coding (Glaser, 1978; Charmaz, 1983).

3.3.1 Stage 1 – Initial Searching and Coding

Each case in the final sample was read by one researcher to identify counterfeiters' strategies and the goals to which they were directed. A 'strategy' was defined as a pattern of activity that was: (i) chosen, not automatic or forced; (ii) coherent, systematic and apparently goal-directed; (iii) having some generality, i.e. not specific to a narrow product type; and, (iv) concrete, i.e. a particular way of doing something rather than a broad policy. An attempt was made to paraphrase the strategies and characterise the goals that the strategies served, e.g. minimising detection or prosecution risk. Inferring goals in this way recognised that counterfeiters are goal-directed actors, and also reflected the notion that the researcher's core problem is to grasp or understand the meanings that actions and events have for those engaged in them (Emerson, 1983).

The strategies and goals were then organised into a category system constructed from a reading of the data by the process of 'constant comparison' (Glaser & Strauss, 1967). A second researcher read the cases, strategies, goals and categorisations of the first researcher and any unclear or problematic analysis was resolved by discussion. As Glaser (1964) argued, the procedure is not designed to guarantee that two analysts working independently with the same data will achieve the same results, but 'to allow, with discipline, for some of the vagueness and flexibility that aid creative generation of theory'. We present the initial categories with explanations and examples in Section 4.1.

3.3.2 Stage 2 –Secondary Focused Coding

The second stage of the analysis sought to find a coding for the data that expressed a deeper and more abstract understanding. In Section 4.2, we will argue that signaling is an important aspect to the cases that cuts across the initial coding and forms the basis of a further coding scheme, and of our theory building in Section 5. This process is inevitably subjective but, as Weber (1990) explained, it is a mistake to believe naively that texts of any kind speak for themselves. The important step is to make any inferences evident through clear description and explication. Thus,

our approach is to present categories and basic distinctions, and then explicate these with the data. Staake *et al.* (2012) demonstrated how data about counterfeiter's strategies can be analysed using more objective methods – in their case, cluster analysis. The primary advantage of a more subjective analysis is that we can find underlying connections that are not present in the data at a literal level. Our data do not refer to signaling, either directly or by synonyms, but in our interpretation they nonetheless describe signaling phenomena – a claim we attempt to justify in Section 4.2.

4. Results and Findings

4.1 Initial Searching and Coding

Initial searching and coding produced four main categories: *extraction* strategies, i.e. strategies by which counterfeiters obtained products or materials from the legitimate economy; *production* strategies, for manufacturing counterfeit goods; *distribution* strategies; and, *infiltration* strategies, for infiltrating counterfeits into the legitimate economy. These categories were obtained by induction – they represented a natural grouping of the identified strategies during the reading of the data – but also provided a logical partition according to the chronology of counterfeit production. They are clearly not mutually exclusive. Figure 1 summarises the strategies while the remainder of Section 4.1 discusses each category in turn.

[Take in Figure 1]

4.1.1 Extraction Strategies

Of those counterfeiters that extracted genuine parts or products from legitimate supply chains, three strategies were evident in the data, as summarised in Table IV. First, there was extraction by retrieving disposed-of products. In one case, a legitimate drug was recovered after its expiry date, re-packaged, and re-injected into the market for sale to unsuspecting consumers. In another case, used PCs were recovered, again from disposals, overhauled and remarked to pass them off as new, and sold online with counterfeit software. Second, there was extraction by stealing genuine parts or products from the supply chain or aftermarket. This included the theft of aircraft parts by workers from within a repair operation which were, again, passed off as new. Third, there was extraction by obtaining items through legitimate channels, e.g. procuring components from unsuspecting upstream supply chain members. For example, some pharmaceutical counterfeiters incorporated active ingredients sourced from legitimate suppliers.

The various ways in which counterfeiters procure materials from the legitimate economy illustrates how counterfeit-resilience should not be exclusively concerned with tackling the infiltration of counterfeit products into the legitimate supply chain. It must also deal with the inadvertent supply of genuine materials into counterfeiting operations. Counterfeits that are not intended to be functional – for example, counterfeit pharmaceuticals intended to have no therapeutic effect – require no particular extraction strategy. But counterfeits intended to be functional, so that counterfeiters can get repeat sales and avoid detection, do generally need materials, components and products of some sophistication from the legitimate economy.

[Take in Table IV]

4.1.2 Production Strategies

Some of the production strategies identified (see Table V) were essentially about timing. One, for example, involved early market entry that was nearly simultaneous with, or even ahead of, the genuine product. Counterfeiters were known to have attended tradeshows and launch events to get early information and samples. Another timing-related strategy was to postpone final assembly of a product with its counterfeited trademark until close to the final sale, thereby avoiding detection and action by the authorities.

Most of the production strategies in our analysis involved members of legitimate supply chains. For example, some cases consisted of production over-runs by a subcontractor to the genuine manufacturer. The ordered quantity was supplied to the genuine manufacturer but, without authorisation, the subcontractor produced and sold extra output under the manufacturer's trademark. In other cases, subcontractors produced cheaper, near-copies of the original, which they passed off as the genuine article. Sometimes, otherwise legitimate suppliers even counterfeited their own outputs. In one instance, an aircraft parts producer illicitly subcontracted to a cheaper unauthorised producer, before using false paperwork to pass the items off as its own. Counterfeit production in other cases involved downstream supply chain members diluting a genuine product. This included pharmacists and other intermediaries diluting doses of chemotherapy drugs and anti-malarial vaccines.

These strategies indicate that resilience must involve attention to actors both within and outside the supply chain. Counterfeiting as an internal phenomenon is especially problematic insofar as supply chain members have privileged access to production technology and distribution channels, but it is potentially more controllable with suitable governance

arrangements. As an external phenomenon, counterfeiting is more unlikely to produce exact replicas, but it is harder to gain knowledge of, and control over.

[Take in Table V]

4.1.3 Distribution Strategies

Most distribution strategies that could be identified (see Table VI) were intended to reduce risks to counterfeiters. In some cases, counterfeits were shipped via multiple (often free-trade) ports to several addresses in target countries in low volumes to limit traceability and the size of a seizure if intercepted. Risk was also minimised by being mobile. For example, one operation was described as a 'moving target', shifting periodically around Asia and South America to remain out of reach of prosecutors. In some cases, risk was reduced by obscuring the false trademark during transportation – for example, by placing a sticker over the mark which was removed once through customs. Another strategy for coping with seizures was simply to over-produce. The counterfeiting business model, unlike the legitimate one, is tolerant of high attrition rates. The margins on cheap counterfeits are generally so high that counterfeiters accept that many items will be seized, knowing enough will slip through to make the activity profitable.

Only two of the identified strategies were not particularly directed to managing seizure or prosecution risk. The first involved 'bundling' counterfeit products with genuine items. In one case, genuine Nintendo consoles were sold with fake accessories for export from the Far East into Europe. Similarly, a genuine medication was bundled with counterfeit inhalers and dosage counters. This had more to do with minimising detection by consumers than the authorities, and appeared to be mainly intended to facilitate market acceptance of the counterfeits. The second strategy, aimed at similar ends, involved using a legitimate service provider or respected location. This included shipping products via the U.S. mail, using trusted online services such as Paypal, and shipping counterfeits produced in the Far East intended for North America via London simply to obtain a plausible postmark.

[Take in Table VI]

4.1.4 Infiltration Strategies

The first strategy in Table VII involved infiltrating parallel markets to gain or maintain anonymity. Pharmaceuticals, for example, are heavily traded in parallel markets, where cheaper foreign sales are re-imported and re-packaged with local language instructions. This often

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involves many dealers and multiple transactions, creating a substantial degree of anonymity. Anonymity was also obtained in some cases by infiltrating informal, loosely regulated channels such as flea markets. But the most obvious way of gaining anonymity is via Internet trading, and this was widely evident in the data. For example, counterfeit aerospace parts (e.g. radar parts, valves and gauges) – produced in China and the U.S. – were sold through business-to-business and business-to-consumer auction sites.

Some infiltration strategies involved suborning members of a legitimate supply chain, e.g. recruiting otherwise legitimate retailers to sell counterfeits alongside genuine goods. Other strategies focused on infiltrating the aftermarket, which typically has fewer procurement controls due to its size, dispersed nature and often informal institutions. For example, some cases involved independent counterfeiters selling into the automotive aftermarket, often to unlicensed mechanics who were presumably much less likely to report counterfeits to the authorities. Other cases involved the disintermediation of an OEM. For example, a subcontract spare parts supplier to Toyota supplied products branded with the Toyota logo directly to its aftermarket distributors without permission. This multiplicity of possibilities for infiltration suggests that resilience to counterfeiting needs to have a matching complexity if it is to be successful.

[Take in Table VII]

4.2 Secondary Focused Coding

In this deeper, secondary coding, the fundamental step was 'discovering a core category which organises the other categories by continually resolving the main concern' (Glaser, 2002). Our core category was *signaling*: the idea that a common aspect to many of the counterfeiting strategies was the use, suppression or exploitation of signals between actors. This extended across all categories identified during the initial searching and coding. For example:

- Extraction strategies, such as recovering end-of-life products, could broadly be attributed to cost minimisation goals. But they also served signaling goals. For instance, by using obsolete products, counterfeiters avoided signaling their presence in raw material markets and, because these products were once genuine, their appearance naturally signalled authenticity to customers.

- Some production strategies involved counterfeiting by manufacturers of legitimate products, e.g. over-runs by licensed subcontractors in the garment trade, and the passing-off of branded pharmaceuticals by generics manufacturers. This exploited existing facilities to produce

counterfeits cheaply, but the lawful activities also falsely signalled to the authorities that the physical presence and consumption of materials was legitimate.

- Distribution strategies were most obviously risk-reducing, but again commonly involved signaling. For example, small consignments not only reduced the size of seizures but also sent weaker signals to the authorities that consignments were suspicious. Postponing the attachment of trademarks to generic products similarly avoided sending suspicious signals to the authorities who would be alert to, and could prosecute, only goods falsely carrying trademarks. Bundling counterfeit with genuine products also helped to signal authenticity.

- Infiltration strategies similarly had important functions in relation to signaling. For example, using anonymous trading channels, e.g. the Internet, meant counterfeiters avoided signals of illegitimacy and transience (like small, unsigned business premises) that would be obvious if they had to trade face-to-face. Meanwhile, suborning legitimate supply chain members helped signal, misleadingly, to consumers that counterfeits were legitimate.

Hence, although most strategies had a substantive element, they also had a signaling function. Viewing them in terms of signals gives additional insight into why counterfeiters use them and what significance other actors give to them. This echoes much of what has been seen in the signaling literature for over 30 years (since Spence, 1973), which has increasingly seen the signaling value of actions that have hitherto been interpreted only in terms of their substantive effects (e.g. Certo, 2003; Cohen & Dean, 2005). The next stage was, therefore, to identify the signaling elements of the strategies found in the data, and to produce a further set of categories for these elements which reflected two basic dimensions:

1. Actions: What the counterfeiters were doing with respect to a signal, e.g. transmitting a false signal or obscuring a true signal.
2. Objects: What kind of entity or characteristic the signal concerned, e.g. signals about counterfeiters' identities or a product's quality.

The remainder of this section describes and tabulates these categories.

4.2.1 Actions: What Counterfeiters were doing with Respect to Signals

Table VIII lists five types of signaling action implied in the counterfeiting strategies. The simplest involved *transmitting* signals, typically false signals that suggested authenticity, and *obscuring* signals, typically true signals that would have identified products as counterfeit and

allowed the counterfeiters to be traced. False signals extended beyond copying a trademark to copying other accompanying indicators of quality, e.g. certificates and marks of third-party institutions such as the American Petroleum Institute (API).

[Take in Table VIII]

Some strategies involved *acting on* certain signals, e.g. that there was likely to be strong demand for a product that could be counterfeited. Sometimes these were direct market signals, e.g. high prices or evidence that a discontinued product was still needed. Other times, they were market-relevant signals, e.g. health authority recommendations that citizens procure anti-viral medication in anticipation of a pandemic. Heavy demand, to the point of 'panic buying', suggested not only that legitimate producers might be unable to fulfil short-term demand but that consumers might be less attentive to cues that would otherwise identify a product as counterfeit. Signals of this kind are loosely defined: they do not involve any particular actor producing a signal intended for another – only some situation or institution being in a condition that another actor (e.g. a counterfeiter) interprets as a signal. They illustrate how legitimate supply chain members need to be conscious not only of the signals they knowingly or unknowingly send themselves, but of how counterfeiters can be signalled by situations more generally.

Occasionally, the counterfeiters' strategies involved *exploiting* signals exchanged between other actors, or exploiting the absence of such signals. One case described how non-functional counterfeit automotive parts had been implicated in accidents, but how the absence of official accident investigations meant consumers had not received appropriate warnings. Counterfeiters could exploit this absence of a signal by continuing to sell non-functional counterfeits in the market. Another case referred to auction websites publicising controls against counterfeits, thus suggesting safety to potential consumers. Such controls provide useful signals to consumers, but when they were not enforced – as suggested by some of the data – counterfeiters could not only use the website but also benefit from the false, misleading safety signal between website and consumer.

Finally, some strategies straightforwardly involved *ignoring* signals intended for the counterfeiter. Such signals were being created deliberately by actors to deal with counterfeiting, but were often ineffective. For example, when the counterfeiting 'business model' was to trade at such a high margin that customs interceptions had no great consequence, counterfeiters could afford to ignore the signals that authorities were supposedly sending by making seizures. Signals

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of this kind have to be designed with care: they should not just be perceived as being costly to generate but as being costly to ignore.

4.2.2 Objects: What the Signals Concerned

The objects of signaling fell into the eleven categories shown in Table IX. *Authenticity* was probably the most important. Counterfeiters attempted to signal that their products were authentic not only by reproducing the trademark and packaging but by producing fake accompanying documentation and warrants, by bundling counterfeit with genuine products, and by using legitimate distributors. Authenticity signals were aimed not only at consumers but at genuine producers and the authorities. As well as protecting the counterfeiters directly, they also protected complicit buyers who were able to plead ignorance if the counterfeiters had made extensive efforts to signal authenticity. *Quality* signals were often similar to authenticity signals, but they were not the same. The example given in Table IX shows those counterfeiters who wanted repeat sales had to imitate not just the trademark but also the functionality of a product. For example, they had to incorporate the correct active ingredient in a counterfeit pharmaceutical. In theory, at least, some consumers may knowingly consume counterfeits for which authenticity signals are lacking but quality signals are strong.

[Take in Table IX]

Traceability as an object of signaling was also important, and some counterfeiters' strategies were aimed at suppressing signals that would have allowed their locations and identities to become known. For example, Internet trading and dispersing operations over multiple jurisdictions helped suppress traceability signals. This was related to *organisation* as an object of signaling. For example, counterfeiters' production facilities were used for legitimate activity like manufacturing own-brand products and generics, so they did not have to hide evidence of an organised operation like a factory, supply contracts or shipping movements from the authorities. When counterfeiters were extracting materials from legitimate supply chains, *destination* also became a relevant object of signaling. Counterfeiters had to either avoid indicating the actual destination of materials to the supplier, or falsely suggest a legitimate destination.

Counterfeiters' strategies also involved responding to signals about a market's *accessibility* (e.g. the increased accessibility of military equipment markets, where buyers are often now prepared to procure commercial off-the-shelf products), as well as signals about the presence of

demand (e.g. in markets for obsolescent yet vital components). Correspondingly, counterfeiters generated signals about the *availability* of their own products in such markets. They also responded to signals about *recourse* – about how consumers would behave if and when they discovered products were counterfeit. For example, counterfeiters could anticipate that dissatisfied buyers of non-functional products for potentially embarrassing conditions, like erectile dysfunction, would be unlikely to complain. This indicates that legitimate actors are vulnerable to exploitation. Finally, *jurisdictions* and *penalties* were obvious objects for the signals that legitimate groups tried to send to counterfeiters. As with any enforcement activity, the signaling that came from acting against counterfeiters was at least as important as the substantive outcomes of removing counterfeits from the market. Such signals were not only intended to deter counterfeiting but sustain consumers' trust in the trademark as a reliable signal of product quality. Unfortunately, as indicated by the examples in the table, some counterfeiters also responded to signals that jurisdictions were incoherent and penalties were weak or unenforced.

The clear implication of these findings is that most, if not all, of the strategies exhibited by counterfeiters involved signaling in some way. This in turn suggests that achieving counterfeit resilience must also involve dealing with signals: discovering and revealing true signals obscured by counterfeiters, counteracting and undermining the false signals generated by counterfeiters, and recognising the exploitability of signals exchanged in networks of legitimate actors.

5. Theory Development

The above observations point to the potential of developing a more theoretical understanding of counterfeiting in terms of signaling theory, and this will be briefly discussed in Section 5.1. However, they also point to the way legitimate producers and counterfeiters are struggling over reputation, and how reputation is a valuable resource for them: a resource that the legitimate producer wants to preserve and maintain exclusive access to; but also a resource that the counterfeiter wants to get access to without completely destroying in the process. Therefore, in Section 5.2, we combine signaling theory and the Resource-Based View (RBV) of the firm. We do this in a purely qualitative way.

5.1 Counterfeiting as a Signaling Phenomenon

Signaling is fundamentally a process for dealing with information asymmetries, such as in labour markets, where there is uncertainty about quality (Spence, 1973) and liability of newness in some form (Certo, 2003). It also explains the need for trademarks, where consumers know less about a product's quality than the producer, especially if the product (but not the producer) is new. The possibility of copying a trademark, however, allows counterfeiters to exploit this information asymmetry with false signals of provenance. Our findings in Section 4 showed that information asymmetry is important not only in relation to attributes like quality and provenance but also to the integrity of supply chain members, the capacities of producers to act against counterfeiters, and the nature, location and origins of counterfeiters.

Connelly *et al*. (2011) presented a review of signaling theory in which they tabulated its key constructs, including three that are particularly relevant to counterfeiting. First, the *observability* of signals refers to the fact that any signal has a certain strength (Connelly *et al.,* 2011). For example, in the context of counterfeiting, the use of a respected third-party certification may send stronger signals to potential customers, but only up to the point at which the certification is itself found to be counterfeited. Once the frequency of counterfeit certificates in circulation is non-zero, the signals become markedly reduced in strength. Second, the *cost* of signals, refers to the transaction expenses associated with implementing a signal (Connelly *et al.,* 2011). The classical analysis of signaling (Spence, 1973) is that either signallers must have a reputation for signal reliability or the costs of signaling must be negatively correlated with quality – making it too costly for poor quality actors to signal high quality. Since imitating trademarks has very little direct cost, the false signaling involved in counterfeiting is always a distinct possibility. The third construct is *distortion*, which refers to noise introduced by the signaling environment, external referents, or other signallers (Connelly *et al.,* 2011). In several of our cases, manufacturers sometimes appeared to play up the counterfeiting risk to justify exclusive distribution contracts with particular wholesalers, but at other times appeared to play down the risk to avoid loss of consumer confidence. Their signals to both supply chain partners and consumers could be distorted by scepticism about the firms' motives. And clearly a large part of what counterfeiters do is to distort signals – whether this involves obscuring signals that they want to avoid sending (such as who they are) or enhancing false signals that their products are authentic.

5.2 Counterfeiting as a Signaling-Resource Phenomenon

The problem with signaling theory alone is that it says little about what is ultimately at stake: the

harm done to the legitimate supply chain and focal producer, and particularly their reputational resources. Although signals often concern the value of some entity (e.g. Cohen & Dean, 2005), the origins of this value, and what threatens it, do not lie within the ambit of signaling. Thus, to develop theory on counterfeiting as a supply chain hazard, we also draw on the RBV (Penrose, 1959; Rubin, 1973; Wernerfelt, 1984; Barney, 1991) and the notion that sustained competitive advantage derives from the valuable, rare, imperfectly imitable and non-substitutable resources and capabilities that a firm, or supply chain (Ketchen & Hult, 2007), controls. Counterfeiters effectively avoid the resource barrier that competitors otherwise face (Wernerfelt, 1984), particularly when the imitation is superficial, i.e. with no attempt to make a functional product. In addition, counterfeiters control their own advantageous resources, and so have their own resource-based rationale in the illegal economy. Resource-based theories therefore become important for examining the persistence of counterfeiting organisations as well as the threats they pose. Equally, the response to counterfeiting by a legitimate firm may involve enhancing its resources. It may make quality improvements and develop dynamic capabilities (Teece *et al.*, 1997) that enable it to adapt its resource base over time (Eisenhardt & Martin, 2000; Barney *et al.*, 2001) and make such resources harder to imitate.

The essential resources concerned in product counterfeiting are: (i) the fundamental resource of quality, typically acquired through long experience of production, scientific investigation and investment in expertise; (ii) the institutionalised resource of trademark, typically acquired via a straightforward legal transaction, but lacking virtually any intrinsic value at inception; and, (iii) reputation, typically acquired over a substantial period as consumers increasingly associate their experiences of high quality goods with the trademark. All three broadly fall within received definitions of 'resource' in the RBV. They are consistent with the notion that a resource can be intangible as much as tangible, and is in some sense owned, controlled or accessible to an organisation on a semi-permanent basis (Helfat & Peteraf, 2003). Reputation is a derived resource in that it refers to another, more fundamental resource (quality).

We argue that the key relationship between signaling theory and the RBV is that signaling facilitates (or undermines) the development, maintenance and exploitation of certain kinds of resource value. Figure 2 outlines how this essentially works, showing a developmental relationship between signals and resources over time. The distance between signal symbols represents the time density of signals, although in practice they will be more continuous than discrete – trademarked goods available in a market continuously emit signals while they are

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available, and such signals are 'received' every time a consumer pays attention to them. Signals are exchanged in conditions of information asymmetry, but the extent to which they resolve such asymmetry is diminished by noise.

[Take in Figure 2]

The producer in the stylised example in Figure 2 starts with a high quality product (see point A in the figure), a trademark (B) but no reputation (C). As Zahra & Filatotchev (2006) pointed out, developing new capabilities produces information asymmetry. The trademark signals, however, that the producer takes its reputation for quality seriously, that this reputation can be protected, and that its products can be unequivocally associated with itself. With experience, consumers associate the trademark with high levels of experienced quality, and increasingly it becomes a direct signal of product quality. The value of the trademark and reputational resources therefore rise accordingly (see D and E, respectively). At a specific time, a counterfeit product becomes available and a period of signaling starts in which consumers receive false signals from the counterfeiter (e.g. F), counterfeiters obscure signals that could reveal their provenance (G), and producers signal to counterfeiters their determination to defend the trademark (H). These signals affect the value of the producer's trademark and reputation resources.

An advantage of trademark as a signal of product quality is that it does not disclose proprietary information that would help a competitor reproduce the same quality (Ndofor & Levitas, 2004). A corresponding drawback is that this means it takes time for trademark to be associated with high quality goods; and, perhaps more importantly for our analysis, it is easy to imitate. The costs of signaling have to be negatively correlated with quality, thus the low cost of imitating a trademark means it is important that the legal penalties and probability of enforcement are high. But this probability of enforcement itself has to be signalled, both by state authorities and producers. Therefore, signals from the state authorities to the counterfeiter (as well as from the producer) also become important (I). Similarly, rebuilding the value of trademark and reputation resources (points J and K, respectively) after counterfeiting may involve substantive actions, such as enhancing quality still further or prosecuting counterfeiters, but it will also involve signaling, e.g. to consumers about falling risk, to counterfeiters about sanctions, and to other supply chain members not to provide materials to counterfeiters, infiltrate counterfeits into the legitimate supply chain, or allow end-of-life streams to be used by counterfeiters. Our results in Section 4 give a sense of the variety of signals that are potentially

involved in any specific case.

Finally, although Figure 2 does not show resource value becoming negative, it is possible for this to occur (Wernerfelt, 1995; Leonard-Barton, 1992). In the case of reputation and trademark, a high frequency of publically-known counterfeiting, particularly for safety-critical products, could make such reputational resources 'toxic'. Famous cases of product contamination, e.g. the Tylenol case (Dowdell *et al.,* 1992), show how seriously the value of a firm can be undermined by loss of confidence in a trademark, and how it can be redeemed by swift, appropriate action that signals a firm's concern for consumer safety (Maak & Pless, 2006).

6 Implications for Counter-Measures

In this section, we propose a series of counter-measures for enhancing resilience to the counterfeiting threat. The counter-measures, as shown in Table X, are organised around the counterfeiting strategies identified in Section 4.1 and summarised in Figure 1. They also draw on the general notions of signaling developed in Section 5. The subsections that follow explain our suggestions and discuss the underlying principles.

[Take in Table X]

6.1 Dealing with Material Flows into the Counterfeiting Process

All the extraction strategies identified earlier involved the flow of legitimate items into the counterfeiting process. Logically, the two counter-strategies are to: (i) interrupt this flow so counterfeiters cannot obtain their raw materials and components; and, (ii) render the flow useless somehow when used in counterfeit products.

The first approach is perhaps the most feasible. In the case of counterfeiters obtaining materials from end-of-life streams, this requires re-acquisition or assured destruction, which may rely on creating a market in returned materials or certificates of destruction. In the case of stolen materials, greater security is necessary. And in the case of counterfeiters acquiring materials by open procurement, legitimate suppliers must be persuaded to take reasonable precautions against inadvertent (or even knowing) sales to counterfeiters. All these actions have important signaling aspects. The threatened supply chains must signal the need for product destruction, facilitate the destruction process (which itself helps to signal its importance), and signal the dangers of supplying counterfeiters. But supply chains also need to avoid inadvertent signaling. For example, discontinuing products may signal to counterfeiters that: (a) there may an increased

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flow of disposed-of products, which they can recover; and, (b) there will be residual, unfulfilled demand for the obsolescent products.

The second strategy, of rendering materials and products useless, presents fewer opportunities and requires more specialised approaches. For example, where counterfeiters modify disposed-of items, e.g. changing their 'sell-by' date or serial numbers, one response would be to develop product markings that are hard to obliterate without destroying the product. It may also be possible to find technologies that render an item non-functional, or of changed appearance, when removed from its original use. By using legitimate materials and components, counterfeiters not only make fake products functional, they also signal legitimate origins – and this signaling needs to be counteracted. If markings are hard to obliterate, it becomes difficult for the counterfeiter not to signal that a component has been tampered with or used previously.

6.2 Dealing with Agency Failures in the Supply Chain

Three production strategies involved supply chain actors exploiting their position to counterfeit a partner's product. This reflects an agency failure, and countering it involves enhancing supply chain controls, either by agreeing more rigorous controls or enforcing controls more rigorously. This does not have to mean punishing suppliers – it could involve incentivising actors so they do not exploit their position in the first place.

Signaling is likely to be a part of any response. Contractual controls, e.g. against production over-runs, need to be accompanied by signals that infringements will be detected and acted upon. Taking court action is costly to the legitimate producer but signals that counterfeiting is taken very seriously. Any costless actions may be attractive but may not have a strong signaling function. Also, there is a danger of inadvertent signals indicating that a producer does *not* take counterfeiting seriously. For example, prioritising price may be taken as a signal by a supplier that it is legitimate and even expected that they should look for a low-cost subcontractor whose products they can pass off as their own.

6.3 Dealing with Early Market Entry of Counterfeits

One of the production strategies we identified involved early market entry by counterfeiters, who exploit intelligence about forthcoming products and launch a counterfeit when demand is high and before customers are familiar with the genuine product. The obvious counter-measure is to inform customers to expect counterfeits and tell them how to differentiate between counterfeit and genuine products. It may be possible for the producer to provide customers with codes,

passwords or keys directly so they can authenticate a product. The drawback of this information disclosure ahead of a product release is that it may signal to potential customers that they are at risk of buying a counterfeit, and thus depress the market. Genuine producers also need to consider the signals they unintentionally send to counterfeiters about the opportunities for lucrative, and perhaps unfulfilled, demand among naïve consumers ahead of a launch. But in practice, it may be difficult to avoid such signals given the need to create a successful market for a product. The key is perhaps to recognise the possibility of this inadvertent signaling, and to ensure that potential customers receive signals that the risk of inadvertently buying a counterfeit can be nullified in some way.

6.4 Dealing with Material Dilution

Another production strategy for counterfeiters involved diluting a genuine product, e.g. pharmaceuticals, beverages or detergents, in order both to: (i) replicate some functionality and obtain repeat orders; and, (ii) reduce costs. One counter-measure would be to somehow produce a genuine product that clearly indicates when it has been diluted or adulterated in some way, perhaps chemically. Another would be to inform consumers about how to distinguish between diluted and non-diluted forms, and to warn them of the risks of procuring via informal channels that are likely to be inhabited by counterfeiters.

The problem, from a signaling standpoint, is that issuing warnings may be perceived by consumers as an attempt to direct them to channels that are lucrative for the producer – such as high-margin retailers. Hence, for a warning signal to be trusted, it needs to be seen as costly to generate. This might be self-fulfilling, in the sense that consumers would recognise that a producer engaged in such signaling runs the risk of customers defecting to competing products. But it might not, and the possibility of defection may of course persuade a legitimate producer *not* to indicate that its products are being counterfeited.

6.5 Dealing with Engineered Credibility

Two distribution strategies were aimed at creating credibility in the market: bundling counterfeits with genuine products, and using legitimate service providers and locations in the final stages of distribution. The bundling problem arises because products are not completely self-contained: they are bought with accessories or associated products, e.g. specialised hardware and accompanying software. Even if one or more bundled components are counterfeit, they may go undetected if others are genuine. This could be counteracted by preventing bundling altogether,

but this is difficult in an open market and may only be feasible where products are specialised and market players known to each other. Distributors might be able, in such circumstances, to avoid selling genuine components in suspiciously large volumes that counterfeiters would otherwise split up and repackage with counterfeits. Alternatively, consumers could be informed so they can detect bundles containing counterfeits.

Again, however, this runs the risk of producing unintended signals. Informing consumers may signal to them that counterfeiting is rife and that they should switch to competing trademarks. Alternatively, they may dismiss it as scaremongering aimed at diverting them to official high-margin distribution and retail channels. The firm may be able to signal the *bona fides* nature of its disclosure by getting a trusted third-party consumer association to make or endorse the communication. Meanwhile, asking distributors to avoid high-volume component sales to possible counterfeiters may signal to disreputable distributors that they can profit from selling to counterfeiters. This all suggests that the best strategy is *not* simply to act in some predetermined way but to *calculate* the best course of action given the signaling involved in acting.

6.6 Dealing with Unofficial Markets

Several infiltration strategies were based on unofficial markets, e.g. parallel import markets, flea markets, and online markets, including auction sites, where counterfeiters can remain anonymous and avoid entry costs. Trading in such markets should itself induce caution to buyers: the very fact they are anonymous is a warning. Whether such cues are acted on is debatable, and when counterfeits are consumed knowingly, they are counter-productive. In principle, well-known, reputable brokers can operate in informal markets – at least on the Internet – but experience suggests that their capacity to detect and prohibit counterfeiters trading informally is limited. Hence, there is a danger that their reputation, and their promises of strong controls on counterfeits and other kinds of fraudulent trading, send reassuring signals that are misleadingly optimistic.

6.7 Dealing with Counterfeit Flows into the Legitimate Supply Chain

The remaining infiltration strategies concerned intra-supply chain problems. Hence, similar counter-measures to those needed for dealing with agency failures in the context of production strategies apply. Again, costly actions will send strong signals, but these are the least attractive actions because they are so costly. A case-by-case judgement on the best actions to follow is necessary. Arguably, the importance of signaling grows as supply chains become more extended.

For example, in the absence of direct contracts, the signaling implications of actions like creating financial incentives for retailers to report intelligence on counterfeiting to a manufacturer become more significant. But such schemes could also create incentives for false reporting, or even the creation of counterfeits themselves.

7. Conclusion

This study began with the research question: *What strategies can be identified that are employed by product counterfeiters to exploit legitimate supply chains? And how can supply chains become more resilient to the counterfeiting threat?* A range of strategies have been identified which are used by counterfeiters to extract materials from the legitimate economy, produce in parallel to genuine producers, distribute counterfeits via both criminal and legal networks, and/or infiltrate counterfeits into legitimate supply networks. The strategies serve a variety of ends, including minimising counterfeiters' costs and the probability of detection. The strategies also widely share a common aspect – that of signaling. They variously generate false signals, suppress true signals, and exploit signals intended for others. A set of counter-measures have been proposed for dealing with the counterfeiting strategies to help supply chains become more resilient to the counterfeiting threat.

Overall, this paper makes four contributions. First, it provides an introduction to the highly topical theme of counterfeiting, which – given its spread to safety-critical products – is of increasing societal significance, yet has received only limited attention in the OM literature. Second, it reports a two-stage, grounded analysis of how counterfeiting takes place, based on the notion of counterfeiters as goal-oriented actors exploiting legitimate supply chains. Third, it synthesises signaling theory and the RBV to explain counterfeiting and its impact on competitive resources. This responds to the need for a more dynamic view of resources (Helfat & Peteraf, 2003), illustrating how they are developed and eroded over time in a way that is shaped by signaling. Finally, it proposes counter-measures towards improving the counterfeit-resilience of supply chains, tracing these to the principles underlying the various counterfeiting strategies evident in the secondary cases. Perhaps the most important message of this part of the paper is that signals can be uncertain and complex, and every case needs to be assessed on its own merits.

7.1 Practical Implications

The analysis of counterfeiters' strategies represents an important step in helping operations managers take a structured and methodical approach to dealing with counterfeiting. Managers can use the strategies in Figure 1 to anticipate the counterfeiting threats their products and supply chains may face, while the counter-measures proposed may help them to respond. The way of thinking about counterfeiting illustrated in Figure 2 that can be applied to specific products or supply chains is also a potentially important step towards dealing with counterfeits. Such analysis shows how counterfeiters are encouraged and discouraged by signals of various kinds; and, how legitimate actors contribute to this in the way they generate and receive signals. We suggest that there needs to be a systematic analysis of all signaling that goes on around counterfeiting – including the 'mixed signals' that firms send and the signals that they do not intend to send.

7.2 Limitations

The secondary data we used was originally compiled for purposes other than scholarly research. It was therefore vulnerable to the biases of individual compilers and the institutional biases of their employers and sponsors. This includes biases of selection (which cases were reported on) and of interpretation (which facts were reported and what was made of them). Although we have drawn on multiple sources, and avoided quantitative inferences, the data is limited to cases of detected counterfeiting – other counterfeiting strategies that go undetected may exist but are not captured in Figure 1. Meanwhile, although our approach was highly suited to theory building, it does not provide strong theory confirmation. We cannot infer the extent of the phenomena we observed or generalise on its relevance to industries not represented in the data.

We believe, however, that understanding how counterfeiters exploit legitimate supply chains, and how they are influenced by both the deliberate and inadvertent signals generated in those supply chains, is an important first step in helping them achieve some measure of resilience to what is potentially a fundamental threat to operations in legitimate economies.

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List of Tables and Figures

Table I: A Summary of Threats Cited in the Literature and Related Gaps

Theme	Example Threats in the Literature	Threats Neglected in the Literature
Supplier Selection	Suppliers exploiting production knowledge to go into business as a complete product manufacturer; Suppliers 'disintermediating' in the aftermarket for replacement parts.	Suppliers counterfeiting their own goods by illicitly subcontracting to a lower cost producer; Suppliers passing-off goods under the OEM's trademark.
Supplier Integration	Undesirable knowledge transfers if governance mechanisms fail; Blurring of IP ownership boundaries through supplier integration.	Undesirable reputational transfers consequent upon counterfeiting; Blurring of trademark scope in integrated supply networks.
Product Traceability	Traceability and authenticity problems avoided via the use of RFID technology.	Counterfeiters' capacities to replicate the technology, and the way in which re-packaging rules defeat such measures in international supply chains.
End-of-Life Issues	Environmental harm avoided by reverse logistics or closed-loop supply chain management.	Counterfeiters' sourcing from end-of-life sources, and counterfeiting opportunities in end-of-type-life situations.
Offshoring	Lack of observability and opportunistic supplier behavior, such as IP theft; Technology appropriation and transfer to 'pirate' suppliers; Knowledge transfer problems avoided by 'out-tasking'; Patent infringement as an integrated international manufacturing network emerges, and as employees/skills become increasingly transient.	Opportunistic counterfeiting by suppliers; Reputation appropriation by using trademark; Counterfeiting that involves no deep knowledge of the legitimate product; Trademark infringement with increasingly international networks.

Table II: Secondary Case Data Search Process - Number of Reports by Source and Stage of Data Reduction

Search Results	CIB	FBI	Nexis (NEX)	Total
All Search Results: No. of Reports	527*	525	230	1,282
Non-duplicate Results	362	525	230	1,117
Final Sample (which refer to cases)	71	30	26	127

*   *CIB search conducted twice with a 3-month intervening period to check stability;*
27 cases from the first search were not present in the second.

Table III: Breakdown of Final Sample - Number of Reports by Source and Industry

Industry (and Abbreviation)	CIB	FBI	Nexis	Total
Pharmaceuticals (PHA)	25	2	20	47
Automotive (AU)	9	1	0	10
Electronics & Equipment (EL)	7	3	0	10
Computer hard/software (CPU)	3	4	0	7
Aerospace (AE)	4	2	0	6
Luxury & Fashion Goods (LUX)	5	1	0	6
Music & Movies (MUS)	1	5	0	6
Currency & Minting (CUR)	0	5	0	5
Food & Beverage (FOO)	5	0	0	5
General* (GEN)	1	0	4	5
Tobacco (TOB)	3	0	1	4
Medical Equipment (MED)	2	1	0	3
Legal Documents (LEG)	0	2	0	2
Sporting Memorabilia (SPO)	1	1	0	2
Transport (TRA)	1	1	0	2
Construction (CON)	1	0	0	1
Fine Art (FA)	0	1	0	1
Hygiene Products (HYG)	0	0	1	1
Marine (MAR)	1	0	0	1
Oil & Gas (OIL)	0	1	0	1
Satellite TV Subscription (SAT)	1	0	0	1
Toys (TOY)	1	0	0	1
Total	71	30	26	127

*   *'General' cases present a broad argument on counterfeiting and include an insight*
into counterfeiting strategy with some cross-sectional reference to specific cases to
support the argument.

Table IV: Extraction Strategies and Example Supporting Case Evidence

Extraction Strategy	Evidence (Excerpt from Case)	Case Reference *
Recovery and overhaul of disposed genuine products	'The investigation led to a company in the US that dismantles old planes and sells on the spare parts. The FBI discovered that the parts were being bought and shipped to Ireland, where it is believed they may have been reconditioned and sold on as new.'	CIB-AE-4
Theft and repackaging of components (e.g. from repair operations)	'Russian police intercepted and arrested a criminal group last month that they say illegally produced aircraft parts and sold them in Russia, as well as to other nations ... The organised group was arrested after allegedly stealing components from the Saturn plant in central Russia ...'	CIB-AE-3
Acquisition of parts/products from an unsuspecting legitimate source	'... a private mint in Massachusetts had already made millions of the fake tokens and was almost ready to deliver another shipment. Mint officials said they didn't realize the orders weren't legit and cooperated fully with the investigation.'	FBI-TRA-1

* *Case references are based on data source, industry and case number within these categories: e.g. CIB-AE-4 is the 4th case from the CIB source referring to the aerospace industry. All further tables use the same convention.*

Table V: Production Strategies and Example Supporting Case Evidence

Production Strategy	Evidence (Excerpt from Case)	Case Reference
Produce for early market entry	'Counterfeiters with operations to rival manufacturing giants such as Gillette or Sony employ tens of thousands of people ... They send representatives to trade shows to collect samples of the latest goods and produce replicas, sometimes before the real thing hits the shops.'	NEX-GEN-3
Postpone assembly of product and trademark	'The bag may be made in China, then shipped to another factory in Eastern Europe to have the signature Gucci or Christian Dior fittings attached to avoid detection, before being smuggled in small batches into the UK ... many factories employ illegal immigrants in sweatshops to make final additions to handbags.'	CIB-LUX-2
Production over-run by subcontractor	'Many western manufacturers have moved production to China, helping to lift the quality of the fakes. Some factories have been caught out producing genuine articles during the day and knocking out illegal copies at night.'	NEX-GEN-2
Parallel production of near-copies by subcontractor	'Some factories have a 'day shift' devoted to the production of genuine designer goods... followed by an illegal 'night shift' staffed by an entirely new batch of illegal workers and children who produce cheap replicas to be sold in markets across the globe.'	CIB-LUX-2
Illicit subcontracting of a product to a cheaper producer	'Once they were awarded a contract for the aircraft parts, defendants [...] and [...] contacted unauthorized local manufacturers, including [...], to manufacture the parts, in violation of the specific contract specifications that required either new surplus parts or parts that had been manufactured by Boeing or other approved sources. Once the parts had been illegally manufactured, defendants [...] and [...] would complete false Certificates of Conformance, also known as a "Parts or Material Certification Form" or "ATA 106" forms, and other paperwork, including packing slips and invoices, all falsely representing either the condition or manufacturer of the parts.'	FBI-AE-1
Dilution of genuine product	'... forensic examinations of fake treatments have revealed toxic impurities such as anti-freeze and tiny amounts of the active ingredient, if there are any at all.'	NEX-PHA-20

Table VI: Distribution Strategies and Example Supporting Case Evidence

Distribution Strategy	Evidence (Excerpt from Case)	Case Reference
Ship via multiple ports and addresses	'From China, the fake medicines head west, typically passing through the transit point of Dubai, then the porous borders of Europe. Here the route becomes increasingly opaque. Intelligence reports from the medicines agency show that a single consignment of drugs can change hands up to 30 times before it reaches a British high-street chemist ...'	NEX-PHA-6
Obscure trademark until close to customer	'[Genuine Producer's] products are also being copied in Taiwan and other countries in East Asia. Mr. [...] showed the Subcommittee one pair of glasses (the genuine glasses are made in Austria) which bore on the temple piece a sticker which said, "Made in Taiwan, Republic of China." However, when the label is removed, the legend "Made in Austria" is permanently engraved underneath. As Mr. [...] explained: "….as soon as they get into the United States, the stickers go off and it looks like the right product in the store."'	CIB-LUX-3
Over-produce and accept high attrition rates from seizures	'A syndicate can afford to lose four out of five container loads at frontier checks but the fifth with 8.5m cigarettes that slips into the UK and sold at half the recommended price will net the criminals around £1.2m in profit.'	NEX-TOB-1
Bundle counterfeit and genuine products together	'Last year the Medicines and Healthcare products Regulatory Agency issued a recall notice for a batch of [Legitimate Drug] ... It contained some active ingredient, but the fakers had made illegal inhalers and dosage counters - meaning patients could receive incorrect quantities.'	NEX-PHA-1
Using a legitimate service provider or credible location	'... They then used the U.S. mail and other private commercial carriers to distribute the counterfeit software to victim-consumers across the U.S. and Canada.'	FBI-CPU-2

Table VII: Infiltration Strategies and Example Supporting Case Evidence

Infiltration Strategy	Evidence (Excerpt from Case)	Case Reference
Infiltration of parallel markets	'More than 140 million medicine packs are parallel-traded like this every year ... an estimated 90 per cent of Britain's pharmacies have some product that has come via parallel trade ... On their journey around Europe, medicines can change hands 20 to 30 times. Because the original packaging and inserts are often in foreign languages, packs and literature are changed. The vast majority of drugs that enter Britain the parallel-trade route are repackaged. Anti-counterfeiting features such as holograms or shifting ink vanish.'	NEX-PHA-18
Retail via informal markets	'The counterfeits ... are being sold at outdoor markets, car boot sales, building sites, hotels, country field days and liquidation auctions.'	CIB-EL-5
Using impersonal media (e.g. via the Internet)	'The investigation began when engine parts in US Air Force plants were found to be counterfeit. Contractors had bought the parts from an internet site run by an Irish company, but when they realised the parts were counterfeit they contacted the FBI.'	CIB-AE-4
Recruiting an otherwise legitimate retailer or wholesaler	'The price, 20 yuan a bottle, was cheap and he bought 50 bottles. [...] confessed he had known the vaccine was fake when he sold it.'	CIB-PHA-5
Injection into less-controlled maintenance & repair after-markets	'Significant changes since the 1990s have led the military to move toward commercial manufacturers for parts, unfortunately granting counterfeiters a new way in. Because the military "has moved away from mil-spec components and now relies almost exclusively on commercial manufacturers for parts," it's even easier for counterfeiters to pass off uncertified products as the real deal, Military and Aerospace Electronics reported ...'	CIB-AE-1
Passing off a legitimate supplier's product as the OEM's	'"... Genuine Toyota parts can only be bought from Toyota Uganda," the company says in adverts running in various media. However, this campaign did not go down well with other dealers who say they too sell original parts. [...], the managing director of [Dealer Name], said counterfeits are increasing and posing a threat to the industry, but refuted the assertion that Toyota Uganda was the sole distributor of Toyota parts in the country.'	CIB-AU-3

Table VIII: What Counterfeiters were doing with Respect to Signals

Action	Explanation	Example	Case Reference
Transmitting	Sending some signal deliberately or inadvertently	'[the defendants] ... conspired in a counterfeiting scheme to manufacture and sell oilfield pipe couplings stamped with a certification mark owned and registered by the American Petroleum Institute (API), without a license or authorization to do so ... profited at the expense of customers by manufacturing many of those couplings using substandard materials.'	FBI-OIL-1
Obscuring	Hiding or suppressing some signal that would otherwise be sent	'Customs only catches 2% of the fakes. Instead of people trying to smuggle bags over the border in mass quantities, they are selling it over the internet in single shipments. Customs obviously can't catch that.'	CIB-LUX-1
Acting on	Acting on some signal not necessarily directed at counterfeiters	'The current boom in the construction industry and the increasing height of buildings mean crane hire companies have come under extreme pressure to get more crane sections - a demand crane manufacturers are struggling to meet.'	CIB-CON-1
Exploiting	Exploiting some signal intended or exchanged among other actors	'India lacks the investigative bodies to carry out accident and fatality analysis of road traffic incidents so raising driver awareness of the issue is proving difficult.'	CIB-AU-4
Ignoring	Ignoring some signal directed at counterfeiters	'A syndicate can afford to lose four out of five container loads at frontier checks but the fifth with 8.5m cigarettes that slips into the UK and sold at half the recommended price will net the criminals around pounds 1.2M in profit.'	NEX-TOB-1

Table IX: What the Signals Concerned

Object	Explanation	Example	Case Reference
Authenticity	Signals about how genuine a product or producer is	'The box was an exact copy; the lenses contain [genuine producer's] registered trademark and its logo; and there was even a false registration number inside the box. The Brazilian pirate even brazenly included a post card with which the unsuspecting consumer could register the false serial number with the company.'	CIB-LUX-3
Quality	Signals about the quality, performance or the reliability of products	'Fraudsters want to avoid detection and keep their customers returning. Selling dud or harmful products is not in their interests. In the five cases so far detected in which counterfeit drugs have reached the NHS [National Health Service], no patients have suffered detectable harm.'	NEX-PHA-14
Traceability	Signals containing information that would allow counterfeiters to be traced	'...original spam messages originated from an address licensed to someone in Russia, the website server was in China, the credit card payee phone number was in the UK, the card payment was processed in Australia and the drugs were mailed from Chicago.'	NEX-PHA-8
Organisation	Signals about the presence and operation of organised counterfeiting	''Customs only catches 2% of the fakes. Instead of people trying to smuggle bags over the border in mass quantities, they are selling it over the internet in single shipments. Customs obviously can't catch that.''	CIB-LUX-1
Destination	Signals about the destination of legitimate materials in counterfeit products	'In October 2005, a U.S. token broker reported that someone wanted to order two million of the Toronto tokens. The customer said that the tokens would be thrown from floats during a holiday parade in the Caribbean and that he wanted them delivered to Niagara Falls, New York ... After talking with the token broker, Gross learned that a private mint in Massachusetts had already made millions of the fake tokens and was almost ready to deliver another shipment. Mint officials said they didn't realize the orders weren't legit ...'	FBI-TRA-1
Accessibility	Signals about the ease of access to a market	'Significant changes since the 1990s have led the military to move toward commercial manufacturers for parts, unfortunately granting counterfeiters a new way in. Because the military "has moved away from mil-spec components and now relies almost exclusively on commercial manufacturers for parts," it's even easier for counterfeiters to pass off uncertified products as the real deal, Military and Aerospace Electronics reported in mid-July 2007.'	CIB-AE-1
Demand	Signals about the need	'Because many aerospace systems and components are designed to last a long	CIB-AE-1

	or desire for some product or service	time, it can be difficult to procure the same part from a manufacturer to replace the original — a dilemma that makes aerospace applications an especially desirable target for counterfeiters ... because of part unavailability from the original manufacturer, many industries find they must turn to independent distributors.'	
Availability	Signals about the availability of some product	'[...] and [...] created various eBay merchant accounts and other commercial Web sites from which to sell and distribute greatly discounted counterfeit software. The pair, doing business as SoftwareDiner.com, Thesoftwareyard.com, Argyleequity.com, Eagletronics.com, Tekdealer.com, and other business names, advertised on Internet listings that they were authorized distributors of numerous brand name software from legitimate companies.'	FBI-CPU-2
Recourse	Signals about recourse to the producer	'[...], 49, used his MSH World Traders website to drum up business from people suffering from sexual dysfunction. Many of his customers quickly realised they had been duped but were too embarrassed to complain.'	NEX-PHA-4
Jurisdiction	Signals about regional differences and discontinuities in law and standards	'Thus ended the worst ever counterfeiting scam of its kind in Canada … a crime that was enabled here in the U.S. "The fact is, law enforcement has to respect borders but criminals don't."'	FBI-TRA-1
Penalty	Signals about the punishment or sanctions for counterfeiting	'[...] could not even be charged with manufacturing the illegal substances, because under law he had not "produced" anything, but simply altered the way the chemicals were stored.'	NEX-PHA-19

Table X: Counter-Measures to the Counterfeiting Strategies Identified

	Counterfeiting Strategy	Counter Strategies
Extraction	Recovery and overhaul of disposed genuine products	Stopping the flow of end-of-life, stolen, and legitimately acquired (but destined for counterfeits) materials and products by: • Re-acquiring obsolete products, incentivising returns by customers and meeting the costs of returns • Requiring destruction of obsolete products and components, incentivising destruction, e.g. by paying for certificates of destruction or destroyed items, and providing resources for destruction processes • Informing inadvertent suppliers of counterfeiters and incentivising them not to supply counterfeiters, paying for intelligence from suppliers, and designing appropriate and perhaps exclusive supply contracts • In-sourcing the production of particularly critical materials • Incorporating the potential for 'leakage' in the supplier selection process • Avoiding the over-rapid discontinuation of product lines Making acquired materials and products useless for counterfeiting by: • Undermining physical functions and appearance, e.g. after a certain shelf life • Making it costly for counterfeiters to change marks and labels that would show components and materials have been in prior use
	Theft and repackaging of components (e.g. from repair operations)	
	Acquisition of parts/products from an unsuspecting legitimate source	
Production	Production over-run by subcontractor	Dealing with failures of agency in the supply chain by: • Designing contracts that prohibit dealings with counterfeiters • Enforcing contracts with closer personal relationships, auditing and monitoring • Incentivising conformant behaviour, such as by paying for intelligence about counterfeits • Providing suppliers with strict quantities of materials and components just in time • Forbidding unauthorised subcontracting by suppliers
	Parallel production of near-copies by subcontractor	
	Illicit subcontracting of a product to a cheaper producer	
	Produce for early market entry	Informing the market by: • Creating market expectations that counterfeits are in circulation Creating activation requirements that increase counterfeiters' costs by: • Requiring codes, passwords or keys that activate the product after the market entry date Avoiding the over-regular introduction of new products
	Postpone assembly of product and trademark	Sharing intelligence with customs and trading authorities; but, otherwise, this is beyond the legitimate supply chain's influence
	Dilution of genuine product	Communicating the potential for dilution to customers and consumers For experience products, making dilution physically costly or impossible by: • e.g. using chemical markers
Distribution	Ship via multiple ports and addresses	Sharing intelligence with customs and trading authorities; but, otherwise, this is beyond the legitimate supply chain's influence
	Obscure trademark until close to customer	
	Over-produce and accept high attrition rates from seizures	
	Bundle counterfeit and genuine products together	Undermining the false credibility of the counterfeiter's distribution process by: • Informing potential customers of the possibility • Educating customers how to differentiate between genuine and counterfeit products • Informing and negotiating with other supply chain actors like logistics providers (alerting them to specific cues, e.g. divided consignments) and accessory distributors, alerting them to relevant cues, e.g. bulk buying of accessories
	Using a legitimate service provider or credible location	

Infiltration	Infiltration of parallel markets	Raising risk awareness and knowledge among potential consumers by: • Admitting your products are being counterfeited • Explaining the consequences of consuming counterfeits • Educating consumers about different channels, their characteristics and how to authenticate them
	Retail via informal markets	• Educating consumers about how to differentiate between genuine and counterfeit products • Developing distinctive and hard-to-imitate packaging • Developing packaging that is frequently changed and can be authenticated in real time Dealing with market institutions by:
	Using impersonal media (e.g. via the Internet)	• Lobbying for more rigorous counterfeit controls, e.g. controls on auction websites Designing market and product strategies in anticipation of counterfeiting by: • Recognising that segmentation in free trade areas leads to parallel importing and thereby facilitates the infiltration of counterfeits • Recognising that setting high prices incentivises counterfeiting further
	Recruiting an otherwise legitimate retailer or wholesaler	Controlling supply chains more effectively: • In-sourcing and vertical integration • Providing suppliers with strict quantities of materials and components just in time • Incentivising actors to report rather than collaborate with counterfeiters • Communicating risk to after-market consumers especially, informing them about high-risk channels and authentication tests
	Injection into less-controlled maintenance & repair after-markets	
	Passing off a legitimate supplier's product as the OEM's	

Figure 1: Counterfeiting Strategies Model (Strategies Non-Mutually Exclusive)

Likely goals of counterfeiters

Maximise revenues (e.g.)
    Maximise credibility of product and source

Minimise detection probability (e.g.)
    Minimise visibility of production
    Maximise authenticity of appearance
    Minimise suspiciousness of consignments

Minimise enforcement penalties (e.g.)
    Minimise operations in regulated jurisdictions

Extraction strategies
Recovery and overhaul of disposed genuine products
Theft and repackaging of components (e.g. from repair operations)
Acquisition of parts/products from an unsuspecting legitimate source

Production strategies
Produce for early market entry
Postpone assembly of product and trademark
Production over-run by subcontractor
Parallel production of near-copies by subcontractor
Illicit subcontracting of a product to a cheaper producer
Dilution of genuine product

Distribution strategies
Ship via multiple ports and addresses
Obscure trademark until close to customer
Over-produce and accept high attrition rates from seizures
Bundle counterfeit and genuine products together
Using a legitimate distributor or credible location

Infiltration strategies
Infiltration of parallel markets
Retail via informal markets
Using impersonal media (e.g. via the Internet)
Recruiting an otherwise legitimate retailer or wholesaler
Injection into less-controlled maintenance & repair after-markets
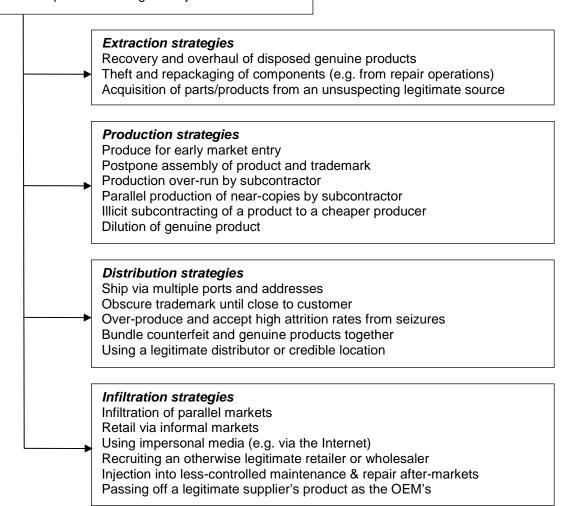Passing off a legitimate supplier's product as the OEM's

Figure 2: Signaling and Resource Value Over Time

Signal type key: spacing between arrows in the diagram denotes likely time density of signaling

Product quality   Threat alert/sanction   Obscured/hidden signal   False signal

Value of producer's quality resource

A

Time

Value of producer's trademark resource

D   J

B   Time

Value of producer's reputation resource

E   K

C   Time

Supply chain partners

Noise   Information asymmetry

Producer

Noise   Information asymmetry

Consumers

F   G

Noise   Information asymmetry

Counterfeiters

H

I

Noise   Information asymmetry

Authorities

3