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Termination Charges in the International Parcel Market : Competition and Regulation

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Abstract

There is a broad theoretical end empirical economic literature discussing the effects of termination charges on competition and retail prices. Most of this literature has focused on the telecommunications markets. Termination charges in the international parcel market have not yet received much attention in the economic literature. The aim of this paper is to fill this gap and to analyze the economics of termination charges for parcels. We find that the economics of termination charges in the international parcel market are different to termination charges in other markets.

To assess the economics of termination charges in the international parcel market this paper takes three steps. First, a basic outline of the current structure of international parcel markets is presented and existing international termination systems are explained. Second, the literature on termination charges in the telecommunication market is shortly summarized and the crucial differences of the international parcel market to telecommunication markets are elaborated. Third, two game theoretic models are constructed to assess the economics of termination charges. It is found that postal operators are in a "prisoner's dilemma" where bilateral bargaining processes are likely to result in a suboptimal situation with excessive pricing and underinvestment in quality. When accounting for quality, termination charges in the international parcel market are optimally set very differently to access charges in the telecommunication market.

Keywords

parcel market; international termination charges; access; remuneration system

JEL classification

D40; F19; L50; L90

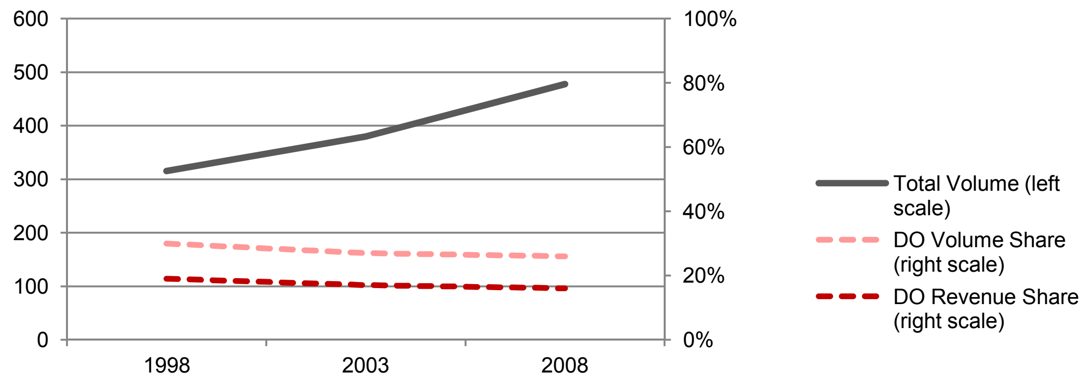
1. The international parcel market[1]

The parcel segment is one of the most liberalized segments in the postal industry. A recent market survey commissioned by the EC[2] has revealed that 30 out of 31 European incumbents perceived competition within the parcel segment as “intense”. In the parcels market, incumbents are typically referred to as “designated operators” (DOs) in that they have been designated by their home country to fulfill the country’s international obligations stemming from the Universal Postal Union (UPU). These obligations include the termination of international inbound parcels sent by other DOs according to the UPU’s remuneration system referred to as “inward land rates” (ILR).

Besides the DOs, the main market players competing in the international parcels market are integrators. Integrators are international companies that provide integrated services between countries, i.e. operating in the country of origin and destination under the same brand. Examples include DHL, FedEx, UPS and TNT. Competition for an international parcel takes place in the country of origin between a DO and integrated operators. Generally, DOs do not compete against each other because sending a parcel to country A is not a substitute to sending a parcel to country B and DOs operate in their domestic market exclusively (exemptions are selected integrators that are dominated by a DO, such as DHL or DPD). Hence, the international parcel market consists of separated but interconnected domestic parcel markets.

The international parcel market is a constantly growing market. Its growth is according to UPU (2010) mainly driven by international trade and retail prices seem to matter for the allocation of market shares mainly, not for determining overall volumes. From 1998 to 2008, worldwide express and light-weight parcel volumes have grown by 51.8%; revenues by 90.0%.[3] In this growing market DOs have been constantly loosing market shares as Figure 1 shows.

Figure 1: Volume and Revenue Share Development in the E&PS market



Source: Trinkner et al. (2011)

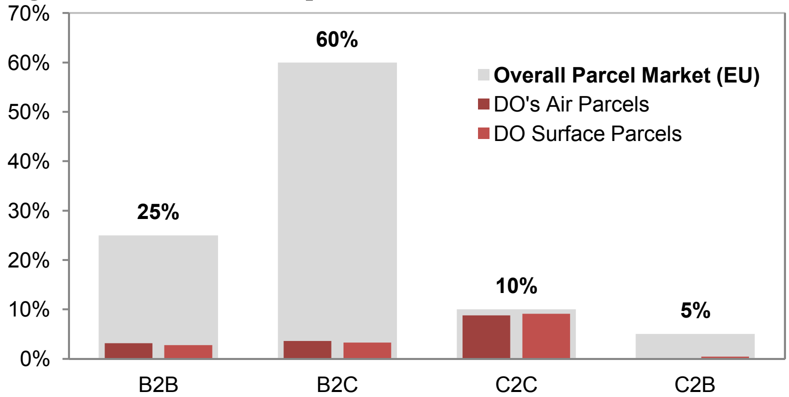
Hence, DOs are either losing their competitiveness compared to the other suppliers in the E&PS market (e.g. in terms of prices or services) or they are not enough involved in the growing segments of the E&PS market.

1 This paper is based on Trinkner et al. (2011)
2 Okholm et al. (2010).
3 Own calculations based on UPU (2010)

The parcels market can be divided into four main sender-receiver segments: business-to-business (B2B), business-to-consumer (B2C), consumer-to-business (C2B), and customer-to-customer (C2C). These segments vary by operating costs, barriers to entry, customers' needs, growth rates, and profit margins.

Figure 2 depicts the segmentation of the European Parcel Market and the approximated market shares of parcels billed under the ILR system in each segment. We observe a rather weak position of the ILR system in the two largest and most dynamic segments, B2B and B2C. In Section 4 we aim to explain this competitive position of the ILR system with a stylized game theoretic model of the international parcel market. The extended version of the model incorporates quality to account for studies on consumer's preferences indicating that quality of service is a crucial issue in the international parcel market.[4]

Figure 2: Market share of parcels billed under UPU ILR termination system



Source: Trinkner et al. (2011)

2. International termination charge systems

In the cross border parcel market, non integrated operators need to buy the service of end delivery in the country of destination from an operator. There are several systems to price such an access to service/network. This section presents the most important termination charge systems in the parcel market.

The ILR system is a termination charge system lead by the UPU. It is decided by its 191 UPU member states in a democratic procedure. All DOs of the member countries can send their international parcels in this pricing regime. It is hence a global, multilateral termination charge system. The ILR pricing system is twofold: The total termination charge is composed of a base rate and a bonus which rewards the supply of defined services with a markup on the base rate.

The base rate is either

A. calculated as 71.4% of a country's ILR taken at 2004 levels (plus any inflation-linked adjustment) or
B. set to the "global minimum base rate" at 2.85 SDR per parcel plus 0.28 SDR per kg.

Under this calculation the global minimum base rate B applies only if A is smaller than B. Otherwise the ILR equals A (UPU 2011). Until 2004 ILRs were set by each DO unilaterally. Hence, the ILR system may be referred to as a "decentralized market solution" as introduced in Section 4.

[4] For an overview, cf. Trinkner et al. (2011). It is stated that on-time performance, end-to-end speed, reliability, and tracking information are the most important quality dimensions for customers. Generally, quality-of-service attributes appear more important to customers than prices.

Next to the UPU ILR there are other termination systems such as E-Parcel Group (EPG) and the Kahala Posts Group (KPG). In addition, DOs can buy termination services from integrators. The pricing of these alternatives to the ILR is not disclosed.

3. Access charges in the literature

As elaborated in Section 1, access in the international parcel market is about two-way access in separated but interconnected markets. Therefore, the one-way access charge literature is not of relevance for the international parcel market and we focus on the literature on two-way access. The literature on two-way access is focused on the national telecommunications market. The national telecommunication market is different from the international parcel market in the following aspects:

i. In the national telecommunication market operators, which seek access to each other's networks, are competing for the same consumers. In the international parcel market, operators do not compete for the same market and hence not against each other.
ii. Competition in the telecommunications market is often in multipart tariffs, while in the postal sector, tariffs are linear.
iii. An operator in the international parcel market faces many different operators (up to about 200) with whom he needs to connect. In the national telecommunication markets there are only a handful of operators to connect with, i.e. bilateral negotiations are less costly.
iv. Characteristics of the network: Telecommunication networks consist to an important extent of physical and durable items (lines and transmitters). Adjusting a telecommunication network therefore takes time, the new lines or transmitters have to be built, and causes sunk costs. The relevant part of the network in the international parcel market, the delivery, is the route the postman drives. Hence, the parcel network cannot be considered physical or durable. Routes are adjusted on a daily basis. Costs are mainly variable or fix, but almost never sunk.
v. Characteristics of the goods: From a technical point of view, terminating any phone call is simply a transmission of binary data in the existing network. Hence, the termination of a phone call can be viewed as a homogenous process. The termination of a parcel service is a more heterogeneous process as not all parcels have the same form, seize or weight. For the termination of a specific parcel, the network has to be adjusted. Similarly, quality ranges considerably among the various operators (for example, some DOs have no home delivery service while others have).

These differences make several issues discussed in the literature on two way access irrelevant for the international parcel market. The first point (i) implies that in the international parcel market predatory access charge pricing or access charges as an instrument of tacit collusion as mentioned by Armstrong (1998), Laffont et al. (1998) and Carter & Wright (1999) will not be of concern. (ii) puts the validity of results derived in multipart tariffs into question. The efficiency of bilateral negotiations of access charges, which is the benchmark in the national telecommunication market, is challenged by (iii). (iv) implies that investment incentives matter in the international parcel market already in the short run and not only in the long run as in the telecommunication market. According to (v) “characteristics“ (quality) of parcel services are adjustable. Hence, quality may be an important additional dimension in the determination of parcel termination charges.

Despite of these differences, some results from the two way access literature may still apply to the international parcel market. The point of reference for the two way access literature is Laffont et al. (1998). They find that in noncompeting networks, which is also the case in the international parcel market, the noncooperative two-stage game in access charges and retail prices leads to double marginalization. Laffont et al. (1998) additionally derive that for small substitutability between the two networks the access charge which maximizes joint profits of the two operators decreases to the marginal costs. Together, this implies that integrators would set their (virtual) access charges equal to marginal costs whereas the noncooperative determination of access charges between two DOs in the international parcel market cannot be expected to be efficient due to the double marginalization. However, Laffont et al. (1998) do not provide any solution to the problem of double marginalization in noncompeting networks and their results are derived under the assumption of balanced calling patterns, i.e. symmetric operators. This assumption of symmetry does not hold in the international parcel market.

Carter and Wright (2003) find in a model of competing networks allowing for asymmetries a particularly simple, optimal regulation: If carriers cannot agree on the terms of interconnection, the larger carrier is entitled to select the access price which is then applied reciprocally.

4. Modelling international parcel termination

In the following we first leave quality issues mentioned above aside and assess whether or not the most striking results from the literature on national termination charges may also apply for the international parcel market. Quality is introduced in Section 4.2.

4.1 Base model

The ineffectiveness of noncooperative access prices in noncompeting networks mentioned by Laffont et al. (1998) as well as Laffont and Tirole (2000, page 184) also applies to the international parcel market as the following simple game theoretic model will show. The model in Annex 1 proves the ineffectiveness of decentralized access charges in the international parcel market in a more general setting.

We model the international parcel business between two countries A and B in the most simple way. The profit function of a designated operator $i = A, B$ is assumed to be:

$$\pi_i = \left(p_i - c_i^u - a_j\right) d_i(p_i, \bar{p}_i) + \left(a_i - c_i^d\right) d_j\left(p_j, \bar{p}_j\right) - F_i$$

where $i, j \in M := \{A, B\}$ und $i \neq j$. p_i stands for the retail price of DO i for an outbound parcel and p_j is the retail price of the other DO j for an outbound parcel (which is an inbound parcel for DO i). c_i^u is the constant marginal cost per outbound parcel and c_i^d is the constant marginal cost of an inbound parcel for operator i. a_j stands for the termination charge which has to be paid by operator i to the foreign operator j for the delivery of a parcel. $d_i(p_i, \bar{p}_i)$ represents the domestic demand for international parcels, which depends on the price of the domestic operator p_i as well as on the price $\bar{p}_i$ of an integrated competitor. F_i represents an amount of fix cost.

Hence, the first term of the profit function represents the revenues from outgoing parcels, i.e. net revenue per parcel multiplied by the domestic demand $d_i(p_i, \bar{p}_i)$. The second term stands for the revenue of incoming parcels, i.e. the termination charge minus marginal costs multiplied by the demand for international parcels in country j.

Following Dietl et al. (2005) and Jaag and Trinkner (2011) a quasi-linear utility function is assumed

$$U = \alpha_i d_i - \frac{\beta}{2}(d_i)^2 + \bar{\alpha}_i \bar{d}_i - \frac{\beta}{2}\left(\bar{d}_i\right)^2 - \varepsilon \beta d_i \bar{d}_i$$

where α_i, α_j, $\beta > 0$ and $\varepsilon \in (0,1)$. A smaller parameter ε indicates a higher degree of differentiation. The parameters α_i and $\overline{\alpha}_i$ determine the market shares of the designated operator i and the integrated operator, respectively, whereas β determines the slope of the demand function. We assume that the parameter constellation is such that the point of local satiation is not reached.

Maximizing the assumed utility function yields to the following demand function

$$d_i = \frac{1}{\beta(1-\varepsilon^2)}(\alpha_i - \varepsilon\bar{\alpha}_i - p_i + \varepsilon\bar{p}_i)$$

An operator therefore has two strategic instruments to maximize its profit: The price for international parcels and the termination charge. We assume that the strategic interaction between the two designated operators is of the nature of a two stage game. First they set their termination charges and then given these charges they decide which price to charge. Hence the game is solved backwards to attain a subgame-perfect nash equilibrium.

Decentralized market equilibrium

Given the access charges, the best responses in stage two of the game are

$$\frac{\partial \pi_i}{\partial p_i}: \quad \frac{a_j + c_i^u - 2p_i + \alpha_i + \bar{p}_i\varepsilon - \bar{\alpha}_i\varepsilon}{\beta - \beta\varepsilon^2} = 0$$

Solving for p_i yields

$$p_i = \frac{1}{2}\left(a_j + c_i^u + \alpha_i + \bar{p}_i\varepsilon - \bar{\alpha}_i\varepsilon\right)$$

Anticipating the best response of the opponent country j in stage two of the game yields the following profit maximizing termination charges

$$a_i = \frac{1}{2}(c_i^d - c_j^u + \alpha_j + \bar{p}_j\varepsilon - \bar{\alpha}_j\varepsilon)$$

Competition in first stage, i.e. insert $\bar{p}_j$depending on fundamental market parameters.

Industry Optimum:

If the two countries collude and maximize the joint industry profit

$$\pi_{IND} = \pi_i + \pi_j,$$

the following prices are chosen

$$p_i = \frac{1}{2}(c_j^d + c_i^u + \alpha_i + \bar{p}_i\varepsilon - \bar{\alpha}_i\varepsilon)$$

These prices imply that the optimal termination charge in the industry optimum is equal to the inbound marginal cost, i.e.

$$a_i = c_i^d$$

It can be shown that operators are strictly worse off with the outcome in the decentralized market compared to the industry optimum for any market constellations, i.e.

$$\pi_{IND} > \pi_{iD} + \pi_{jD}$$

This result can be explained by the issue of double marginalization in the decentralized market equilibrium which is avoided in the industry optimum.

These results rely on the assumption that the operators strictly maximize profits and termination charges are not regulated. These are critical assumptions because designated operators often are regulated and cannot choose their prices freely. If the retail parcel prices of the foreign DO are capped (price-cap regulation), then in the decentralized market solution the terminating operator would aim to set infinitely high termination charges as the retail price of the foreign DO, and hence demand, is not affected by the level of the termination charges (due to the cap).

Further, it is assumed here that designated operators do not have an alternative to cooperating with the foreign designated operator to deliver a parcel in a foreign country. In reality, of course, designated operators can cooperate with integrated operators. But abandoning this assumption does not change the previous result of excessively high termination charges in the decentralized market equilibrium it only implements an upper bound for the level of termination charges.

Social optimum

The optimal termination charge from a welfare point of view depends on the definition of welfare. If one wants to maximize the welfare of a single country, i.e. maximize the sum of domestic profits and consumer surplus, a high access charge for incoming parcels and a low (probably below marginal costs) access charge for outgoing parcels are optimal for this specific country. The high access charge on incoming parcels maximizes profits of the domestic operator without inducing any distortions to the domestic market. The distortions from the high access charge take place in the foreign market which the national social planner does not care about. The access charge on outgoing parcels is from a national social planner's point of view optimally very low as this access charge can be used as an instrument to intensify competition and therefore maximize consumer surplus. This access charge might optimally be below marginal costs as it might be used to correct market imperfections.

If we define welfare from a global perspective, i.e. the sum of all profits and all consumer surpluses, the optimal access charge is equal to the marginal costs. In the global setting the access charge is not a valid instrument to correct national market imperfections and hence access charges below marginal costs are not an option for corrective market interventions. Only if there existed some form of global externalities in the parcel market termination charges different from marginal costs would be justified. Following Armstrong (2002) such an externality could be that the receivers derive a benefit from parcels and not only the sender. Then, the optimal termination charge should be set below marginal costs in order to encourage senders to demand more parcel services.

In this paper we do not assume the existence of such externalities and find that the socially optimal termination charge is equal to the marginal costs and hence coincides with the optimal termination charge from an industry point of view.

With balanced parcel streams between two countries this first best solution is realizable as operators can cover the fix costs of the inbound service with the profits from outbound parcels. But with asymmetric streams this first best result may not be implementable anymore as then the net importing operator may not generate enough revenues from outbound parcels to cover fix costs of inbound services. Hence, a lump sum transfer system is needed for asymmetric situations. But such a transfer system between different operators from different countries seems rather unrealistic and the second best solution therefore is the lowest possible access charge which still covers fix costs, i.e. access charges are set equal to average costs.

Intuition of the result

Intuitively, setting termination charges in noncompeting networks can be interpreted as a prisoner's dilemma. The dominant strategy is to set excessively high termination charges (above marginal costs) which leads to a socially undesirable situation of double marginalization, i.e. not only consumers are worse off with the decentralized market solution but also operators.

Figure 3: Prisoner's Dilemma

		Operator 2	
		Low Access Charge	**High Access Charge**
Operator 1	**Low Access Charge**	Good profit / Good profit	Very low profit / High profit
	High Access Charge	High profit / Very low profit	Low profit / Low profit

Source: Authors' own

Due to the character of a prisoner's dilemma we cannot expect designated operators to voluntarily collaborate in the one shot game. If the game is played repeatedly, infinitely many times collusion might be sustained by the reasoning of Friedman (1971). However, even if the game is played ad infinitum collaboration, i.e. low access charges, might not be achieved as an operator can collaborate with an integrator and therefore the "punishment" for deviating from setting low charges is weakened.

Another solution to this dilemma would be regulation by a third party. Optimally, this third party would set the termination charge equal to the marginal cost. But this raises two problems. First, this would require a third party which has the legal power to regulate termination charges in the international parcel market. Such an institution does not exist. Second, marginal cost is private information of the operators and they may not be willing to reveal this information.

In case of very unbalanced parcel streams setting termination charges might not be considered a prisoner's dilemma. An operator with large numbers of inbound parcels and only few outbound parcels (net importer) can always be better off with high access charges independent of the access charge of the other operators. Letting operators set their access charges unilaterally remains a dilemma from an industry and welfare point of view but the solution of this dilemma becomes even trickier. The collusion (setting low charges) of the operators in case of an infinitely repeated game is not an option anymore and we can expect strong opposition to a regulated access charge system with low rates from net importing operators.

The regulation policy in the telecommunication market of reciprocal termination charges might solve this dilemma. Therefore, we turn to reciprocal termination charges in the following.

Reciprocal termination charges

When designated operators are only allowed to set reciprocal termination charges, they face the following profit function

Applying the same procedure as in the derivation of the decentralized market equilibrium to the new profit function yields for operator *i* the following optimal reciprocal termination charge

If the operators have the same cost structure, i.e. , and their market structures are identical, it follows immediately that the chosen reciprocal termination charge is equal to the inbound marginal cost. Hence, for identical markets and operators, reciprocal termination charges provide an efficient solution.

Reducing the choices to either high or low access charges as in the argumentation of the prisoner's dilemma above delivers the intuition for this result. Allowing only reciprocal access charges reduces the set of choice in the game described in Figure 3 to the choice of setting either low access charges and having good profits or setting high access charges and receiving low profits in case of balanced parcel streams. In case of unbalanced parcel streams the game takes on the form illustrated in Figure 4 and the net importer would prefer high access charges whereas the net exporter would like to have low access charges. The two operators will not agree on the efficient solution.

Figure 4: Reciprocal access charge with asymmetric streams

		Operator 2 Net Exporter: Low Access Charge	Operator 2 Net Exporter: High Access Charge
Operator 1 Net Importer	Low Access Charge	Low profit / Good profit	
Operator 1 Net Importer	High Access Charge		Good Profit / Low profit

Source: Authors' own

Another point of view is that reciprocal termination charges aim to internalize the impact of the chosen termination charge on the profits of the foreign operator to avoid the double marginalization. If the termination charge similarly impacts the profits of both operators it is more likely that they act like an integrator, i.e. set termination charges equal to marginal costs. The termination charge will impact the profits of two operators in a similar way if they face the same form of competition and have the same market position which in turn implies that the parcel streams are balanced.

Therefore, the two conditions for efficiency of reciprocal access charges stated above are to understand as conditions on the balance of parcel streams.

In the international parcels market, it is very unlikely that all parcel streams between any two operators are balanced. Carter and Wright (2003) argue that for asymmetric structures the socially efficient termination charges can be attained in the telecommunication market by letting the larger operator choose the termination charge and then applying this charge reciprocally. This does not necessarily apply to the international parcels market.

Assuming , and all other variables equal for the two operators implies that operator *i* is larger in terms of outbound parcels than operator *j*. Then, the approach of Carter and Wright (2003) would suggest that operator *i* should choose the reciprocal termination charge. The resulting termination charge then might lie below marginal costs. In this case the smaller operator *j* will incur negative profits and hence not participate in the international parcel market with operator *i*. Hence, a pricing system of "forced" reciprocal termination charges might not have many participants.

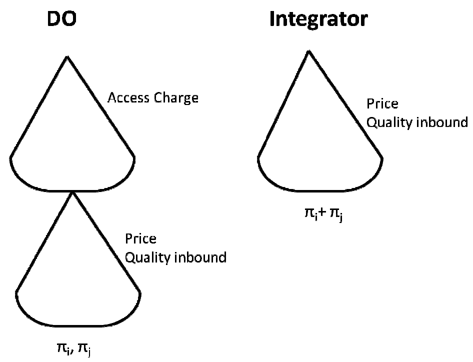
4.2 Extended Model: Quality

As outlined in Section 2, quality is an important factor in the parcel market from the consumer point of view and hence from an industry and welfare point of view as well. So far we have abstracted from quality, in this section we aim to explain the issues that arise when accounting for quality. Quality is closely linked to investments in network industries. The trade-off between competition, regulation and incentives for investment is fundamental in economics. This trade-off becomes particularly important in network industries with access of other operators to the network (Valletti, 2003).

The literature on termination charges hardly deals with the effects of access charges on investment incentives as most these analysis take place in a static framework and investment only matters in a dynamic context (at least in the telecommunication market) as Gans and Williams (1998) and Valletti (2003) point out. However, investment into the network matters in the international parcel market even in the short run. In the parcel market the network (and especially its quality attributions) is built daily. The decisive quality attributions in the parcel market are the reliability and on-time performance according to Section 2. These parameters can be adjusted in the short run by an operator. Hence investment /quality issues arise already in a static framework. Of course, long run investments play a crucial role in the parcel market as well but these issues will be addressed later on.

Accounting for short run quality considerations makes setting termination charges in the international parcel market a two stage game which is depicted in Figure 5. In the first stage, the operators choose their access charge. In the second stage, given the access charges, the operators determine their prices and inbound quality levels.

Figure 5: Game tree extended model



Source: Authors' own

It is assumed that only the quality of service by the operator of destination matters for the consumers. Therefore, we get the following general profit function of a DO

and for an integrator (operating in market *i* and *j*)

where are the variable costs arising by short run quality investments . The rest of the notation is equivalent to Section 4.1.

There is no reason to expect the decentralized market equilibrium to be efficient as the issue of double marginalization still occurs when quality is included, as shown in Annex 1. Intuitively, quality induces an additional free rider problem. If operator *i* invests into its inbound quality , operator *j* can increase its price without any additional costs given the access charge does not account for quality investments. Hence, operator *i* cannot reap all benefits of its investment into quality and will therefore under invest if the access charge does not factor in the dimension quality. This is analytically shown in Annex 2.

The need for regulation of termination charges therefore remains. But what is the optimal termination charge with short run quality? It is straightforward to show that with quality the optimal termination charge is to be set above marginal costs.

By our assumption of no externalities in the parcel market and our definition of welfare as a global concept the integrator will choose the socially optimal price-quality mix. Hence, the optimal access charge makes DOs act like an integrator, as already argued in the model without quality. Given that the access charge is an exogenous variable determined by some regulator or pricing system DOs can optimize profits over their price and offered inbound quality. Therefore, DOs face the following FOCs

$$\frac{\partial \pi_i}{\partial p_i} = d_i(*) + (p_i - c_i^u - a_j)\frac{\partial d_i(*)}{\partial p_i} = 0$$

$$\frac{\partial \pi_i}{\partial q_i} = (a_i - c_i^d)\frac{\partial d_j(*)}{\partial q_i} - C'(q_i) = 0$$

The integrator's FOCs are

$$\frac{\partial \bar{\pi}}{\partial \bar{p}_i} = \bar{d}_i(*) + (\bar{p}_i - \bar{c}_i^u - \bar{c}_j^d)\frac{\partial \bar{d}_i(*)}{\partial \bar{p}_i} = 0$$

$$\frac{\partial \bar{\pi}}{\partial \bar{q}_i} = (\bar{p}_j - \bar{c}_j^u - \bar{c}_i^d)\frac{\partial \bar{d}_j(*)}{\partial \bar{q}_i} - C'(\bar{q}_i) = 0$$

$$\frac{\partial \bar{\pi}}{\partial \bar{p}_j} = \bar{d}_j(*) + (\bar{p}_j - \bar{c}_j^u - \bar{c}_i^d)\frac{\partial \bar{d}_j(*)}{\partial \bar{p}_j} = 0$$

$$\frac{\partial \bar{\pi}}{\partial \bar{q}_j} = (\bar{p}_i - \bar{c}_i^u - \bar{c}_j^d)\frac{\partial \bar{d}_i(*)}{\partial \bar{q}_j} - C'(\bar{q}_j) = 0$$

To make DOs act like the corresponding integrator we need

$$\frac{\partial \pi_i}{\partial p_i} = \frac{\partial \bar{\pi}}{\partial \bar{p}_i} \; and \; \frac{\partial \pi_i}{\partial q_i} = \frac{\partial \bar{\pi}}{\partial \bar{q}_i}$$

By corresponding integrator we mean the DO and the corresponding integrator have the same demand and costs structure, i.e. $\bar{d}_i(*) = d_i(*), \frac{\partial \bar{d}_j(*)}{\partial \bar{p}_j} = \frac{\partial d_i(*)}{\partial p_i}$ and $\frac{\partial \bar{d}_j(*)}{\partial \bar{q}_j} = \frac{\partial d_j(*)}{\partial q_i}$ for $\bar{p}_i = p_i$ and $\bar{q}_i = q_i$, $C'(\bar{q}_i) = C'(q_i), c_i^d = \bar{c}_i^d$ and $c_i^u = \bar{c}_i^u$ for $\bar{p}_i = p_i \; and \; \bar{q}_i = q_i$. Then the condition for efficient investment incentives, $\frac{\partial \pi_i}{\partial q_i} = \frac{\partial \bar{\pi}}{\partial \bar{q}_i}$, can be reduced to

$$a_i{}^* = p_j - c_j^u$$

Hence, the optimal access charge $a_i{}^*$ in terms of investment incentives allocates the total net revenue of a parcel to the operator of destination. As by assumption, only the investment into quality of the operator of destination matters and all costs of the investment are paid by the operator, the DO of destination needs to receive all benefits of the investment. As a consequence, an operator does not earn any profits with its outbound parcels but makes all his profits with its inbound parcels.

From the demand function $d_j(p_j, q_i, \bar{p}_j, \bar{q}_i)$ we know that the price p_j depends on the offered quality q_i, i.e. $p_j(q_i)$, and as a consequence the optimal access charge $a_i{}^*(q_i)$ has to account for quality as well. The exact way how the access charge should account for quality depends on how demand interacts with upstream and downstream quality. Upstream quality is of importance as well. As a consequence, some revenue will need to be attributed to the DO of origin. To fully cover this topic, the model would need an extension to reflect upstream quality that is determined by the DO of origin. These issues are beyond the scope of this paper. The share of revenue allocated to the DO of origin and destination will then depend on the relative importance of price versus upstream and downstream quality. We expect that such an extended framework will result in optimal termination charges above marginal costs with a markup reflecting downstream quality.

The result that it is necessary to shift the entire margin to the downstream operator to create the efficient investment incentives indicates that it may be a challenge to find conditions under which access prices are able to induce the optimal investment behavior of an integrated firm (ensuring profit maximizing prices while investing optimally into quality both up- *and* downstream). Related literature on the investment incentives in vertically structured network industries reveals that is generally difficult to provide optimal up- *or* downstream investment incentives in vertically separated entities relative to integrated operators.[5] Hence, it will be an even greater challenge to provide adequate incentives up- *and* downstream at the same time.

Furthermore, an access charge above marginal costs contradicts the "non-double marginalization" condition, i.e. the second condition from above $\frac{\partial \pi_i}{\partial p_i} = \frac{\partial \bar{\pi}}{\partial \bar{p}_i} \leftrightarrow a_j = c_j$.

Therefore, the optimal access charge seems not to exist. There is a trade-off between optimal investment incentives and avoidance of double marginalization when only allowing linear access charges. Following Buehler and Schmutzler (2008) one possible solution could be a non-linear access charge, which might be implementable as a decentralized solution. This promising approach is topic of our current research.

5. Conclusions

Theory predicts that letting operators set their international access prices (termination charges) unilaterally leads to a socially undesirable situation of double marginalization (base model) and underinvestment (quality model).

In our base model of international parcel markets where we do not account for quality, the first best access charge is equal to inbound marginal cost. This result fits into the existing access charge literature. Our analysis reveals that this first best solution is rather not implementable in practice as there is no powerful (benevolent) regulator in place, and decentralized solutions such as reciprocal access charge will not always work due to asymmetric parcel flows. The second best solution in our base model would be to set access charges equal to average cost.

In our quality model we show that the access charge is optimally set above marginal costs to align benefits and costs of quality investments. Termination systems that do not appropriately reward for quality will lead to a situation with underinvestment and suboptimal quality. Assuming that only downstream quality is of relevance to consumers, the optimal access charge would even imply that an operator does not earn any profits with its outbound parcels but makes all his profits with its inbound parcels. The DO of destination would then optimally invest in quality as it would fully participate in the additional returns caused by its investment. It can be expected however that upstream quality is of importance to consumers as well. As a consequence, optimal termination charges are likely to ensure a markup on marginal costs for both operators. But this mark-up on marginal costs implies again double marginalization. Therefore, one can conclude that the first best outcome is not achievable through a simple

[5] E.g. Buehler et al. (2004, 2006), Buehler and Schmutzler (2008) and Chen and Sappington (2009).

access charge. Further research will be necessary to determine the optimal, probably non-linear, access charge.

The identified inefficiencies of the decentralized market equilibrium may explain the steadily decreasing market shares of DOs operating under the UPU ILR system and the existence of alternative pricing systems introduced by some DOs aiming to remain competitive in the international parcel market.

References

Armstrong, M (1998). "Network Interconnection", *The Economic Journal, 108, 545-564.*

Buehler, S; Schmutzler, A (2008). "Intimidating Competitors - Endogenous Vertical Integration and Downstream Investment in Successive Oligopoly", *International Journal of Industrial Organization*, 26, pp. 247-265.

Buehler, S; Gärtner, D; Halbheer, D (2006). "Deregulating Network Industries: Dealing with Price-Quality Tradeoffs". *Journal of Regulatory Economics*, 30, pp. 99-115.

Buehler, S; Schmutzler, A; Benz, M (2004). „Infrastructure Quality in Deregulated Industries: Is There an Underinvestment Problem?". *International Journal of Industrial Organization*, 22, pp. 253-267.

Carter, M; Wright, J (1999). "Interconnection in Network Industries"., *Review of Industrial Organization, Vol.* 14, pp. 1-25.

Carter, M; Wright, J (2003). "Asymmetric Network Interconnection", *Review of Industrial Organization*, 22, 27-46.

Chen, Y; and Sappington, D E M (2010). "Innovation in vertically related markets", *Journal of Industrial Economics*, vol. 58(2), 373-401

Dietl, H M; Trinkner, U; Bleisch, R (2005). "Liberalization and regulation of the Swiss letter market". In: Crew , M A; Kleindorfer, P R. *Regulatory and Economic Challenges in the Postal and Delivery Sector*. Boston, Mass., 53-72. ISBN 1-402-07972-9 (Print), 0-387-23637-6 (Electronic).

Friedman, J (1971). "A Non-cooperative Equilibrium for Supergames", *Review of Economic Studies,* 38,1-12.

Gans, J; Williams P (1999). "Access Regulation and the Timing of Infrastructure Investment", *Economic Record, 75(2):127-137.*

Jaag, C; Trinkner, U (2011). "The interaction between universal service costing and financing in the postal sector: a calibrated approach", *Journal of Regulatory Economics*, 39(1):89-110.

Laffont, J-J; Rey, P; Tirole J (1998). "Network Competition: I. Overview and Nondiscriminatory Pricing". *Rand Jounral of Economics*, 29, 1-37.

Laffont, J-J; Rey, P; Tirole J (1998). "Network Competition: I. Overview and Nondi-scriminatory Pricing", *The RAND Journal of Economics*, 29 (1), 1-37.

Okholm, H; Winiarczyk M; Möller A (2010). *Main Developments in the Postal Sector (2008-2010)*, Report prepared for the European Commission.

Trinkner, U; Jaag, C; Dietl, H; Haller, A; Verbeek, E; Fürst, O (2011). *International Parcels – Review of Inward Land Rates*. Report prepared by Swiss Economics for the Universal Postal Union.

Universal Postal Union [UPU] (2010). *Market Research on International Letters and Lightweight Parcels and Express Mail Service Items.* Berne: Adrenale Corporation.

Universal Postal Union [UPU] (2011). Parcels inward land rates for 2011. Retrieved February 15, 2011, from http://www.upu.int/en/activities/parcels/inward-land-rates/inward-land-rates-key-documents.html.

Annex 1: Double Marginalization: The General Case

We assume the following general demand function

$$\pi_i = (p_i - a_j)d_i(p_i, \delta_j, \overline{p_\iota}, \overline{\delta_j}) + (a_i)d_j(p_j, \delta_i, \overline{p_j}, \overline{\delta_\iota}) - C(d_i(*)) - C(d_j(*)) - F$$

where δ captures all parameters which next to the price also might affect the demand, like e.g inbound quality. The rest of the notation is equivalent to Section 4.1. The usual assumptions on the demand and costs are assumed to hold such that the equilibrium exists, is unique and stable. We do not want to go into details of existence, stability and uniqueness of the equilibrium as these are fairly technical points, which do not deliver any additional insights and a similar model has already been outlined by Laffont and Tirole (1998) dealing with these technical issues.

As setting termination charges is a two stage game, as depicted in Figure 5, we know that the parameter choices of DO *j* will depend on the access charge a_i of DO *i*. Hence in the first stage of the game the DO faces the following FOC

$$\frac{\partial \pi_i}{\partial a_i} = d_j(*) + (a_i)\frac{\partial d_j}{\partial a_i} - \frac{\partial C_i(d_j(a_i))}{\partial a_i} = 0$$

Defining $\varepsilon_j(a_i)$ as the elasticity of demand $d_j(*)$ with respect to the access charge a_i, i.e. $\varepsilon(a_i) = \frac{\partial d_j}{\partial a_i}\frac{a_i}{d_j}$, and $C'(*) = \frac{\partial C_i(d_j(a_i))}{\partial a_i}$ the above FOC can be rearranged to

$$a_i = \frac{1}{1 - \frac{1}{\varepsilon_j(a_i)}} C'(*)$$

Hence, the access charge is set according to the well known Lerner mark-up rule. In the second stage there also is a mark-up over marginal costs. As access charges are part of the marginal costs of the second stage we will always have double marginalization in the decentralized international parcel market equilibrium. Analytically, in the second stage DO face the following FOC

$$\frac{\partial \pi_j}{\partial p_j} = d_j(*) + (p_j - a_i)\frac{\partial d_j}{\partial p_j} - \frac{\partial C_j}{\partial d_j}\frac{\partial d_j}{\partial p_j} = 0$$

which can be rearranged to

$$p_j = \frac{1}{1 - \frac{1}{\varepsilon_j(p_j)}}\left[a_i + \frac{\partial C_j}{\partial d_j}\frac{\partial d_j}{\partial p_j}\right]$$

where $\varepsilon_j(p_j)$ is the price elasticity of demand d_j. Together,

$$p_j = \frac{1}{1 - \frac{1}{\varepsilon_j(p_j)}}\left[\frac{1}{1 - \frac{1}{\varepsilon_j(a_i)}} C'(*) + \frac{\partial C_j}{\partial d_j}\frac{\partial d_j}{\partial p_j}\right]$$

which proves the claim of the general presence of double marginalization in the decentralized equilibrium in the international parcel market.

Annex 2: Underinvestment in Quality

Underinvestment in quality takes place if $\frac{\partial \pi_i}{\partial q_i} < \frac{\partial \bar{\pi}}{\partial \bar{q}_i}$ as a necessary condition for existence of the equilibrium implies $\frac{\partial^2 \pi_i}{\partial {q_i}^2} < 0$ for $i = i, j$. Taking the FOCs of Section 4.4 and our assumption of the DO and its corresponding integrator having the same demand and costs structure, i.e. $\bar{d}_i(*) = d_i(*), \frac{\partial \bar{d}_i}{\partial \bar{p}_i} = \frac{\partial d_i}{\partial p_i}$ and $\frac{\partial \bar{d}_i}{\partial \bar{q}_i} = \frac{\partial d_j}{\partial q_i}$ for $\bar{p}_i = p_i$ and $\bar{q}_i = q_i$ $C'(\bar{q}_i) = C'(q_i)$ and $c_i = \bar{c}_i$ for $\bar{p}_i = p_i$ and $\bar{q}_i = q_i$ the condition $\frac{\partial \pi_i}{\partial q_i} < \frac{\partial \bar{\pi}}{\partial \bar{q}_i}$ can be reduced to

$$\bar{p}_j > a_i + \bar{c}_j$$

The first best access charge which does not account for quality is equal to the marginal costs as derived in Section 4.1. Hence, by the assumption of the symmetry of DO and integrator the underinvestment condition becomes

$$\bar{p}_j > \bar{c}_i + \bar{c}_j$$

This will always hold in equilibrium as this is a necessary condition for optimality, i.e. $\bar{\pi}_i \geq 0$. Hence, the first best access charge in static telecommunications market models applied to the international parcel market leads to underinvestment into quality.