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Termination Charges in the International Parcel Market

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1. INTRODUCTION: 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 has revealed that 30 out of 31 European incumbents perceived competition within the parcel segment as “intense” (Okholm et al., 2010). 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 for 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.

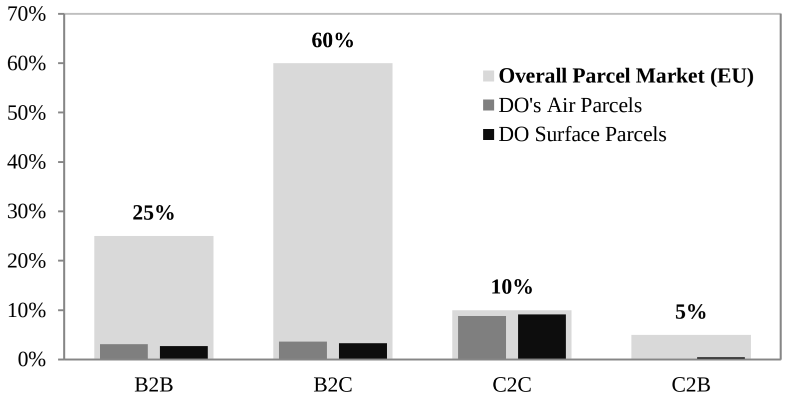
The international parcel market is a constantly growing market. According to UPU (2010) its growth is mainly driven by international trade and retail prices seem to matter for the allocation of market shares, not for determining overall volumes. From 1998 to 2008, worldwide express and light-weight parcel volumes have grown by 52%; revenues by 90%.[2] In this growing market DOs have been constantly losing market shares from 30 to 26% in terms of volumes and from 19% to 16% in revenues.

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 involved enough in the growing segments of the E&PS market. The figures also reveal that revenue shares remain considerably lower than volume shares. This may indicate a weakness of DOs in market segments where quality is of high importance.

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 shows the segmentation of the European Parcel Market and the approximated market shares of parcels billed under the ILR system in each segment. The figure reveals a rather weak position of the ILR system in the two largest and most dynamic segments, B2B and B2C.

Figure 1: Market share of parcels billed under UPU ILR termination system



Source: Trinkner et al. (2011)

The weak position of the ILR termination system in the international parcel market can be explained by the design of the system itself. Studies find that the ILR rates in some countries are excessive compared to domestic parcel prices: Values for the ILR inbound rates of up to 347% of domestic parcel prices are reported (see e.g. UPU, 2010). Trinkner et al (2011) provide additional evidence that the current ILR termination charges seem not to be cost-based. They also find that the current ILR termination system is too limited in its accounting for quality. Campbell (2011) finds "Both types of delivery charges [terminal dues[3] and ILR] are fixed by the UPU by means of elaborate rate agreements that are unrelated to costs. The effect on international trade is distortive, inefficient, and anticompetitive."

This chapter explains the potentially excessive termination charges and low quality levels with a stylized game theoretic model of the international parcel market. Within this model it is possible to elaborate the distortions currently in place. The model incorporates quality to account for empirical findings on consumer preferences which indicate that quality of service is a crucial issue in the international parcel market.[4]

Section 2 outlines the current termination charge system of the UPU. Section 3 identifies the main issues that are relevant for the international parcels market: avoidance of double marginalization and provision of adequate incentives for quality and investments. It then discusses these issues based on a game theoretic model. It is shown that only two-part termination charges will be able to resolve both issues at the same time. Section 4 concludes.

2. INTERNATIONAL TERMINATION CHARGE SYSTEMS

In the cross border parcel market, non-integrated operators need to purchase final delivery in the country of destination from an operator. There are several systems to price access to such a 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 calculated as 71.4% of a country's ILR taken at 2004 levels (plus any inflation-linked adjustment) or 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. In addition to the base rate, a DO can qualify for additional bonus payments of between 5% and 40% of the base rate when meeting certain quality criteria such as the provision of track and trace, home delivery, fulfilling delivery standards or the usage of the common internet-based inquiry system. If a country qualifies for the full bonus payment, the current ILR of this country is approximately equal to the ILR in 2004.

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

3. MODELLING INTERNATIONAL PARCEL TERMINATION

As elaborated in Section 1, termination in the international parcel market can be analyzed as two-way access in separated (noncompeting) but interconnected markets.

The two-way access literature has mainly focused on the national telecommunications market. The point of reference for this literature is Laffont et al. (1998). They find that in noncompeting networks, , the non-cooperative two-stage game in access charges and retail prices leads to double marginalization, namely, an excessive markup on marginal cost through iterated profit maximization in the upstream and downstream part of the value chain, resulting in suboptimally high prices. Double marginalization occurs when both the upstream and downstream operators have market-power and therefore are price setters. Taking the parcels market as an example the downstream operator considers, when determining the termination charge for final delivery, the effect on its own profits only, implying termination charges above marginal costs. This increases input prices for the upstream operator and leads to higher consumer prices and lower volumes compared to a situation with an integrated operator with market-power. The externality of the downstream operator on the upstream operator hence results in lower joint profits. Consequently, under double marginalization, consumers as well as operators are strictly worse off compared to a situation with integrated operators. Laffont et al. (1998) additionally show that for small substitutability between two networks, the access charge which, maximizes joint profits equals marginal cost. This implies that integrators would set their (virtual, internal) access charges equal to marginal cost whereas the non-cooperative determination of access charges between two DOs in the international parcel market cannot be expected to be efficient due to double marginalization.

Laffont et al. (1998) do not provide a 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 that in a model of competing networks allowing for asymmetries, a particularly simple, optimal regulation obtains: If carriers cannot agree on the terms of interconnection, the larger carrier is entitled to select the access price which is then applied reciprocally.

In the following, the quality issues mentioned above are left aside in a first step and it is assessed whether or not the most striking results from the literature on national termination charges apply to the international parcel market. Quality is then introduced in Section 3.2.

3.1 Base model

The ineffectiveness of non-cooperative access prices in non-competing 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 game theoretic model will show. The model in Appendix 1 proves the ineffectiveness of decentralized access charges in the international parcel market in a more general setting.

The international parcel business between two countries A and B is modeled in the simplest way. It is assumed that there are no network externalities.[5] The profit function of a DO $i = A, B$ is assumed to be:

$$\pi_i = \left(p_i - c_i^u - a_j\right) d_i(p_i, \bar{p}_i) + \left(a_i - c_i^d\right) d_j\left(p_j, \bar{p}_j\right) - F_i \qquad (1)$$

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 fixed 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 $\alpha_i, \alpha_j, \beta > 0$ and $\varepsilon \in (0,1)$. A smaller parameter ε indicates a higher degree of differentiation. The parameters α_i and $\bar{\alpha}_i$ determine the market shares of the DO *i* and the integrated operator, respectively, whereas β determines the slope of the demand function. It is assumed 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. The strategic interaction between the two DOs is treated as 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.

3.1.1 Decentralized market equilibrium

In the decentralized equilibrium, operators can set their access charges without restrictions and profits are defined as in equation (1).

In stage two of the game, treating access charges as exogenous, the best price responses satisfy

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

Solving for p_i yields the following best responses:

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

Prices are strategic complements and increase with higher termination fees and upstream costs.

Anticipating the best response of the opponent country *j* in stage two of the game (equation 2) yields in stage one the following profit maximizing termination charges in a decentralized termination system:

$$a_i^* = \frac{1}{2}(c_i^d - c_j^u + \alpha_j + \bar{p}_j\varepsilon - \bar{\alpha}_j\varepsilon). \qquad (3)$$

A DO's (inbound) access charge is hence positively related to the integrator's price for the DO's home market $\bar{p}_j$ (strategic complement). The higher the international competitive pressure, the lower will be the termination charge. If own delivery cost c_i^d increase, this will be reflected in a higher access charge. If however the partner DO has increasing upstream cost c_j^u, this will be partially offset by lower access charges to increase the competitiveness of the DO stream. These results are in line with intuition.

3.1.2 Industry Optimum

If the two countries collude and maximize the joint industry profit

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

then 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.

$$a_i = c_i^d. \qquad (4)$$

Comparing equations (3) and (4) 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 constellation, 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 (see also Appendix 1).

These results rely on the assumption that the operators strictly maximize profits and that termination charges are not regulated. These are critical assumptions because DOs often are regulated and cannot choose their prices freely. For example, if the retail parcel prices of the originating DO would be capped (with a cap independent from termination charges of foreign DOs), then the optimum for the terminating operator in the decentralized market solution would be to set infinitely high termination charges as the retail price of the originating DO, and hence demand, is not affected by the level of the termination charges.

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

3.1.3 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. Conversely, the termination rate charged by a foreign DO on outgoing parcels is 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 upstream market imperfections.

From a global perspective welfare is the sum of all profits and all consumer surpluses in all countries. Assuming perfect upstream market conditions, the optimal access charge is equal to marginal costs.[6] This coincides with the optimal termination charge from an industry point of view (equation 4).

With balanced parcel streams between two countries this first best solution is realizable as operators can cover the fixed costs of the inbound service with the profits from outbound parcels. But with asymmetric streams this first best result may not be implementable since the net importing operator may not generate enough revenues from outbound parcels to cover the fixed 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 fixed costs, i.e. access charges are set equal to average costs.

Intuitively, unilaterally setting termination charges in non-competing 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	Operator 2: 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

The nature of a prisoner's dilemma implies that DOs will not collaborate in the one-shot game. If the game is played infinitely many times then 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 third-party regulation. 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 that 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 a 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 both an industry and a welfare point of view but the solution to this dilemma becomes even trickier. The collusion (setting low charges) by the operators in case of an infinitely repeated game is not an option anymore and one 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, reciprocal termination charges are analyzed in the following.

3.1.4 Reciprocal termination charges

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

$$\pi_i = (p_i - c_i^u - a) d_i(p_i, \overline{p_i}) + \left(a - c_i^d\right) d_j(p_j, \overline{p_j}).$$

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

$$a = c_i^d + c_i^u - c_j^u - \alpha_i + \alpha_j + \left(\bar{\alpha}_i - \bar{p}_i + \bar{p}_j - \bar{\alpha}_j\right) \varepsilon. \qquad (5)$$

If the operators have the same cost structure, i.e. $c_i^u = c_j^u$, and their market structures are identical resulting in **balanced parcel streams**, equation (5) equals equation (4) and hence 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 discussion 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	**High Access Charge**
Operator 1 Net Importer	**Low Access Charge**	Low profit Good profit	
	High Access Charge		Good Profit Low profit

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 double marginalization. If the termination charge similarly impacts the profits of both operators it is more likely that they will 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 conditions on the balance of parcel streams.

In the international parcel 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 $c_i^u < c_j^u$, $\alpha_i > \alpha_j$ and that all other variables are 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.

Using actual cost data or implementing a mechanism to obtain them indirectly to get cost-based termination charges seems not like a viable solution. An alternative would be to use inland tariffs as a proxy for actual costs. However, cost-based termination charges might not solve all issues in the international parcel market. This point will be elaborated in the next section.

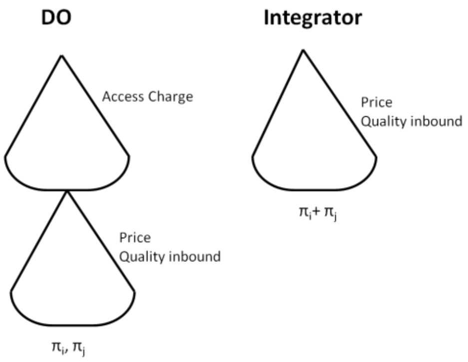
3.2 Accounting for quality with linear termination charges

As outlined in Section 1, 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 it was abstracted from quality. This section discusses 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 of 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 in 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 attributes of the parcel market are the reliability and on-time performance. These parameters can be adjusted in the short run by an operator. Hence investment /quality issues also arise 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



It is assumed that only the quality of service by the operator of destination matters for the consumers. The general profit function of a DO is then

$$\pi_i = \left(p_i - c_i^u - a_j\right) d_i(p_i, q_j, \bar{p}_i, \bar{q}_j) + (a_i - c_i^d) d_j(p_j, q_i, \bar{p}_j, \bar{q}_i) - C(q_i) - F, \qquad (6)$$

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

$$\bar{\pi} = \left(\bar{p}_i - \bar{c}_i^u - \bar{c}_j^d\right) \bar{d}_i\left(p_i, q_j, \bar{p}_i, \bar{q}_j\right) + \left(\bar{p}_j - \bar{c}_j^u - \bar{c}_i^d\right) \bar{d}_j(p_j, q_i, \bar{p}_j, \bar{q}_i) - C(\bar{q}_i) - C(\bar{q}_j) - F, \qquad (7)$$

where $C(q_i)$ are the variable costs arising by short-run quality investments q_i. The rest of the notation is equivalent to Section 3.1.

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 Appendix 1. Intuitively, quality induces an additional free rider problem. If operator *i* invests in its inbound quality q_i, operator *j* can increase its price without any additional costs given that the access charge does not account for quality investments. Hence, operator *i* cannot reap all the benefits of its investment into quality and will therefore underinvest if the access charge does not factor in the dimension quality. This is analytically shown in Appendix 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 first order conditions

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

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

The integrator's first order conditions are

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

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

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

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

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 that 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 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. It is expected 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, see for example Buehler et al. (2004, 2006), Buehler and Schmutzler (2008), and Chen and Sappington (2010). 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 $\frac{\partial\pi_i}{\partial p_i} = \frac{\partial\bar{\pi}}{\partial\bar{p}_i} \leftrightarrow a_j = c_j^d$.

Therefore, the optimal linear access charge does not exist. There is a trade-off between optimal investment incentives and avoidance of double marginalization when only allowing linear access charges.

3.3 Accounting for quality with two-part termination charges

Two-part access charges can solve this dilemma. If an operator is free to set any arbitrary two-part tariff of the form $T_i(\tilde{a}_i) = A_i + \tilde{a}_i d_j(*)$, it will choose

$$A_i = \pi_j^{out} = (p_j - c_j^u - \tilde{a}_i)d_i(p_i, q_j, \bar{p}_i, \bar{q}_j)$$

$$\tilde{a}_i = c_i^d.$$

The proposed two-part (affine) access charge follows from profit maximization of the charging operator. The two-part access charge allows the operator of the country of destination to fully extract the rent of an inbound parcel without distorting the behavior of the operator of origin.

By the previous discussion it becomes immediately clear that this two-part access charge is also socially desirable, namely double marginalization is avoided and the optimal level of quality investments is reached. Avoidance of double marginalization is guaranteed by $\tilde{a}_i = c_i^d$. The optimal quality is supplied as with this access charge the incentive to invest into quality is the same for an integrator and a DO. This can be seen by inserting the two-part access charges into the profit function (6) and comparing the result with the integrator's profit function in equation (7).

Hence, allowing two-part access charges will lead to a decentralized and (socially) optimal equilibrium. All operators will adapt the optimal two-part access charge irrespective of asymmetric parcels streams.[7]

4. CONCLUSION

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 the base model of an international parcel market where quality is not accounted for, the first best access charge is equal to inbound marginal cost. This result fits into the existing access charge literature. The analysis reveals that this first best solution is difficult to implement 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 the base model would be to set access charges equal to average cost.

In the quality model it is shown 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 even implies that an operator does not earn any profits with its outbound parcels but makes all his profits with its inbound parcels. The destinating DO then optimally invests in quality as it fully participates 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 ensure a markup on marginal costs for both operators. But this mark-up on marginal costs implies again double marginalization. Therefore, the first best outcome is not achievable through a simple linear access charge. It is shown that two-part access charges can solve this problem and an optimal and decentralized solution is provided.

The identified inefficiencies of the decentralized market equilibrium in the theoretical model closely mirror the observed problems in international parcel markets. The model suggests that the UPU's recent efforts to make termination charges more cost-based will offset some of the distortions implied by the current system. However, linear tariffs will not result in an efficient solution in a situation where quality is important. This implies that termination charge systems should move away from item-based linear access charges to two-part pricing.

NOTES

1 This paper is an extended version of Haller et al. (2011). It is based on Trinkner et al. (2011).

2 Own calculations based on UPU (2010).

3 Terminal dues are the UPU termination charges of international letters.

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.

[5] The existence of global externalities in the international parcel market may lead to a mark-down on termination charges to encourage senders to demand more parcel services. See for example Armstrong (2001) or, for a discussion of the two-sidedness of the postal market, Jaag and Trinkner (2008). It is unlikely that such a markdown would alter the main findings in a significant way.

[6] In the absence of perfect upstream market conditions, termination rates below marginal costs may be necessary to achieve optimality. In such a situation it would however be more straightforward to regulate the competitive distortion where it occurs (in the upstream market) while setting termination rates according to marginal costs.

[7] However, a transition from a linear system to two part tariffs might be opposed by DOs with large net outbound parcel streams as they potentially make lower profits under the new system. At the industry level the net benefits of two part termination charges are strictly positive.

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APPENDIX 1: DOUBLE MARGINALIZATION – THE GENERAL CASE

Assume the following general demand function

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

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 3.1. The usual assumptions on demand and costs are assumed to hold such that the equilibrium exists, is unique and stable. Details of existence, stability and uniqueness of the equilibrium are not examined as they 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 shown in Figure 5, 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 double marginalization will always be present 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.

APPENDIX 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 3.2 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 $\bar{q}_i = q_i$ $\quad C^{'}(\bar{q}_i) = C^{'}(q_i)$ 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 3.1. 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.