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Waiting for Rowland Hill: Elements of Postal Reform in Sub-Saharan Africa

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Waiting for "Rowland Hill" ― Elements of Reform of Postal Services in Sub-Saharan Africa

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1. INTRODUCTION

Mail communication in Sub-Saharan Africa (SSA) struggles to maintain even its current extremely low level. While only 3.4 postal items per capita are exchanged on average in SSA (2004), receivers must pay an annual fee equivalent to 56 stamps for receiving mail through the exclusive P.O. Box delivery system chosen by most SSA countries.

Once structural factors such as literacy and the youth of the population were taken into account, no statistically significant relationship was found between the level of mail and income per capita in low-income countries in one of our recent studies (Ansón, Cuadra, Linhares, Ronderos and Toledano, 2006). The purpose of this research is to shed light on the determinants that hinder postal development in SSA.

A survey of postal delivery in SSA (Ansón and Toledano, 2007) was organized so as to get detailed insights on the organization of postal delivery that could ease the understanding of postal markets in SSA. Economic theory - two-sided markets theories (e.g. Armstrong (2006), Rochet and Tirole (2003)), and a dynamic panel econometric estimation *à la* Arellano and Bond (1991) - supports the insights arising from the survey.

It is puzzling to notice that while network infrastructure is steadily expanding in SSA (Estache and Goicoechea, 2005), postal communication and networks are not so doing. As a matter of fact, the postal infrastructure barely benefits from increasing access to other infrastructure services, such as water, telecommunications, electricity or transportation.

The paper shows that the value of postal services in SSA is reduced for utilities and other firms in the segment of businesses-to-customers (B2C) communication, due to actual recipients' costs and low quality of service. Designated postal operators are failing to develop B2C mail services since most potential addressees cannot afford the charge for renting a P.O. Box, which in turn prevents the development of positive indirect network externalities on postal traffics. It is then econometrically shown that a move towards delivery free-of-charge for addressees should be undertaken, since sufficiently positive club effects could compensate the loss of P.O. Box revenue thanks to a large enough traffic increase, provided that a sufficiently high quality of service is ensured.

The paper is organized as follows. Section 2 covers the main results of the survey in three blocks: the delivery network, the pricing of postal and delivery services, and the trust in the designated postal operators. Then section 3 presents a two-sided markets economic analysis of SSA postal markets. A dynamic panel econometric estimation showing a strong consistency with the survey results and the two-sided markets analysis follows in section 4. Section 5 concludes. A technical appendix provides more details of the dynamic panel econometric estimation.

2. SURVEY OF POSTAL DELIVERY IN SUB-SAHARAN AFRICA

Organization of the survey

The survey (Ansón and Toledano, 2007) was organized during Winter 2006 so that information was gathered in four areas: the geography of the country, the delivery network with respect to its organization and costs, the prices of postal services relative to basic goods, and the postal market environment with a focus on big mailers and the level of competition.

As for geography, questions were raised at four hierarchical layers: the most populated city of the country, the second most populated city of the country, the third most populated city of the country, and the rest of the country, that is less populated cities and rural areas.

Various dimensions of the delivery network were covered. The purpose was to get a better knowledge of the level of access offered to postal services as well as the organization of the networks and its relevant costs.

A questionnaire was built to serve as a basis for personal interviews of Sub-Saharan postal administrations. Interviews were conducted either by phone or directly. Responses were analyzed and categorized to provide a view of the best, worst and median (average) case for each issue. Countries' comments, reactions and suggestions were acknowledged. Further anecdotal evidence was gathered by the authors through three field missions in Benin, Malawi and Niger.

Coverage of the survey

26 SSA (SSA) countries out of a total of 47 SSA countries participated in the survey, and provided first-hand information about the organization of their postal delivery system. A vast majority of them (21 of the 26) belong to the group of least developed countries using the United Nations ECOSOC definition. 25 countries are also classified as low-income countries by the World Bank.

The gross domestic product (GDP) per capita reaches an average of USD 667 within the group of participating countries. In terms of economic production, the surveyed countries account for 72 % of the overall GDP of SSA countries. The population is in average 17.3 millions inhabitants per surveyed country, and the country's land area average is 641 thousand square kilometers. Our sample represents 64 % of the overall population of SSA countries.

In terms of postal specific indicators, the countries participating to the survey account for 91 % of the total domestic mail volumes in SSA countries.

A focus on low-income countries

The Universal Postal Union's postal statistics for the low-income SSA countries in the sample show a traffic per capita varying from 0.01 to 2.9 domestic letters per capita. One must understand that the average share of literate adults in the population is only 33%. This in turn represents the average share of potential postal users in low-income SSA countries. Once we take into account each country's literacy rate, the volumes per potential postal user vary from 0.02 to 5.9 domestic letters.

In terms of network coverage, the number of inhabitants per post office ranges from 25,433 to 421,340 in our sample of low-income SSA countries, for an average of 93,000 (the distribution of this statistic being skewed to the left).

Results: The postal delivery network

The delivery network has been studied at four geographical levels as shown by summary table 1 below: the most populated city of a SSA country where 9.3% of the population lives at the median, the second most populated city where 2.5% of the population lives at the median, the third most populated city where 1.2% of the population lives at the median, and the rest of country where 82.5% of the population lives at the median. The geographical layer named as "Rest of the country" encompasses small- and medium-sized cities as well as rural areas.

When one examines the geographical distribution of the postal delivery network, one can notice that access to postal delivery, in terms of reception, tends to be low, and is geographically unbalanced. This is because, out of 26 SSA countries, 24 countries have chosen to mostly deliver into P.O. Boxes. Only 2 have free home delivery as their main delivery mode; only 32 % of the countries offer partial home delivery; and when home delivery exists, the median number of inhabitant per postman varies from 70,000 to 176,580 across the four geographical levels (most populated city, second most populated city, third most populated city, and the rest of the country). So there is low delivery coverage of the population in terms of letter-post reception with 50% of SSA countries above 297 inhabitants per P.O. Box.

Furthermore, P.O. Boxes, which must be rented for receiving mail, are not distributed proportionally to the population of the various cities and regions in most SSA countries. More than half of the total P.O. Boxes of a country are concentrated in the most populated city at the median. The median number of inhabitants per P.O. Box ranges from 67.4 in the most populated city, with a median share of total population of 9.3 %, to 1,554.9 in smaller cities and rural areas where, at the median, 82.5 % of the population lives. The econometric study of section 3 will examine why the expansion of the delivery network through P.O. Boxes has not helped develop postal traffic in SSA over time.

Table 1: the postal delivery network

	Most populated city	Second most populated city	Third most populated city	Rest of the country (smaller cities and rural)
Median share of the population living in	9.3 % (2.9 to 22.3 %)	2.5 % (0.3 to 8.1 %)	1.2 % (0.2 to 5.1 %)	82.5 % (73.3 to 95.4 %)
Median number of inhabitants per P.O. Box in	67.4 (8.5 to 281.4)	107.2 (12.8 to 2,046)	136.2 (15.2 to 849.6)	1,554.9 (11.5 to 14,378.3)
Median share of total P.O. Boxes placed in	53.1 % (14.6 to 83.6 %)	6.7 % (1.2 to 26.1 %)	3.5 % (1.5 to 12.1 %)	32.0 % (10.7 to 78.7 %)
Median number of inhabitants per post in	100,000 (23,250 to 186,065)	77,077 (3,979 to 800,000)	57,500 (3,518 to 666,666)	151,222 (13,574 to 604,551)
Median share of total post offices placed in	10.1 % (2.2 to 74.0 %)	2.9 % (0.5 to 21.7 %)	1.9 % (0.2 to 14.7 %)	80.8 % (23.0 to 95.0 %)
Median number of inhabitants per postman	79,730 (5,440 to 244,171)	176,580 (1,968 to 365,533)	70,000 (1,568 to 515,723)	n/a
Posts/private MO operators	0.24	0.42	0.72	6.45

Note: minimum and maximum values are indicated between parentheses below the median values for 25 low-income SSA countries. Data source: UPU 2006 Survey of Postal Delivery in SSA.

Unlike P.O. Boxes, post offices and counters are distributed proportionally to the population of the various cities and regions in most SSA countries: at the median, 13 % of the country's population actually living in the three main cities benefits from 14.9 % of total post offices, while 82.5 % of the country's population living in smaller cites and rural areas can access 80.2 % of total post offices. This is a remarkably well-distributed network with respect to the access to counters. However, access could still be further improved since the median number of inhabitants per post office ranges between 57,500 and 100,000 in the three most populated cities up to 151,222 in smaller cities and rural areas. Eventually, compared to private networks such as money order transfer networks (MO operators), the postal network offers a much denser access in less populated cities (i.e. beyond the three most populated cities of a country) and rural areas (see last line in table 1).

Results: Pricing of basic postal and delivery services

Table 2 below provides a summary of the survey results for the pricing of postal services in SSA. Prices for postal service can be compared to prices of basic goods and services, such as one kilogram of bread, of rice, of meat or one minute of mobile telephony (i.e. air time). The comparisons lead to the conclusion that the price for sending a first weight step letter is usually very affordable in SSA. At the median, it corresponds to the price paid for 0.21 kg of bread, 0.33 kg of rice, 0.10 kg of meat respectively, and exactly one minute of cellular phone call.

However, renting a P.O. Box is much less affordable. P.O. Boxes prices were compared to the price for sending a letter as well as to the aforementioned basic goods and services. At the median, the P.O. Box annual rental fee is equivalent to sending 56.3 letters, buying 13.3 kilograms of bread, or 19.7 kilograms of rice, or 6.2 kilograms of meat. It costs almost the equivalent of one hour of mobile telephony. When one takes into account SSA's citizens' habits to consume goods and services that have a very low cost per unit purchased due to their severe short-run financial constraints, the usual requirement of paying P.O. Box rental fees by means of a single yearly payment further reduces the affordability of accessing postal delivery services.

Once the overall transaction price is computed for a mail exchange, the apparent affordability of the letter-post is very much reduced. For example, the cost for a domestic letter exchange is equivalent to 0.54 kg of bread instead of 0.21 kg paid by the sender only, once both prices for sending and receiving a letter-post item are taken into account together. So the affordability of letter-post services is more apparent than real in SSA.

Table 2: the pricing of postal and delivery services

	Median service price relative to bread price (1 kg)	Median service price relative to rice price (1 kg)	Median service price relative to meat price (1 kg)	Median service price relative to air time price (1 minute call)	Median service price relative to the price for sending a letter by the post
Sending a first weight step letter	0.21 (0.04 to 1.75)	0.33 (0.07 to 1.25)	0.10 (0.01 to 1.00)	1.00 (0.27 to 7.14)	1.00
Renting a P.O. Box (annual fee)	13.3 (2.5 to 73.9)	19.7 (4.3 to 80.3)	6.2 (0.7 to 50.0)	57.3 (32.1 to 275.0)	56.3 (19.3 to 334.6)
Exchanging one letter (i.e. sender + addressee overall charge)	0.54 (0.07 to 8.14)	0.69 (0.12 to 11.01)	0.25 (0.02 to 2.75)	1.76 (0.52 to 23.67)	—
Receiving a "self-delivered" letter (e.g. utility bill)	0	0	0	0	0
Competitor's price for sending a letter (i.e at the charge of the sender)	1.11 (0.11 to 6.06)	3.33 (0.11 to 5.61)	1.00 (0.05 to 1.16)	8.75 (1.33 to 25.00)	7.5 (1.0 to 50.0)
Competitor's price for receiving a letter (i.e. at the charge of the addressee)	0	0	0	0	0

Note: minimum and maximum values are indicated between parentheses below the median values for 25 low-income SSA countries. Data source: UPU 2006 Survey of Postal Delivery in SSA.

Interestingly, designated postal operators' competitors in the domestic letter-post market never charge the addressee but only the sender in SSA. Likewise, firms delivering their own mail to customers never charge the addressee for delivering items. Competitors' prices are, however, much higher for sending a letter than the designated postal operators' rates. At the median in SSA, the competitors charge the sender 7.5 times as much as the designated postal operator.

Results: Trust in designated postal operators

The survey indirectly assessed the postal customers' trust in SSA designated postal operators. Self-delivery, illegal competition, and higher competitors' prices could provide signals of public distrust towards the designated postal operator.

As far as utilities are concerned, 7 out of 10 utility companies deliver their mail themselves in SSA: this is the case for 87 % of the electricity companies, 86 % of the water companies, and 33 % of the telecommunications companies. Utilities' firms also collect payment for their bills in 94 % of the cases. As far as the financial sector is concerned, 24 % of the banks do not contract the designated postal operators to deliver their mail.

Illegal competition was found in all countries participating to the survey. In terms of pricing, as already shown before, 50 % of the competitors, either legal or not, charge more than 7.5 times the price of the designated postal operator.

All these results tend to suggest that clients do not fully trust designated postal operators in SSA countries. The econometric results of section 4 are fully consistent with these survey results.

3. TWO-SIDED MARKETS ANALYSIS AND CLUB EFFECTS: AN APPLICATION TO POSTAL DELIVERY NETWORKS IN SSA

It is worth highlighting the fact that pricing of postal services is an old debate in many countries. For a long time, addressees were charged for the mail they received according to the distance covered by mail from the origin to the destination. This was true for most European and North American countries until Rowland Hill's reform in Great Britain introduced the principle of a delivery free of charge for the addressee in the first half of the 19th century (e.g. Crew and Kleindorfer, 1991). Generalized in 1840, the penny post faced lower and lower financial losses year after year until the service became profitable in 1852. The reform was extensively followed by other countries; the sender became the only party to be charged for any exchange of letters. However the issue of knowing who pays for a mail exchange has been periodically opened and discussed in a number of countries that have adopted free delivery. Yet none of them has decided to come back to a model where the addressee is either charged for usage or access so far. Exceptions are to be found in SSA where several countries gave up free delivery and established a paying P.O. Box delivery mode.

Besides postal history, economic theory also brings important insights to this debate. Although very recent and in continuous development, two-sided markets economic theories can help shed light on the current underlying mechanisms behind the functioning of today's SSA postal markets.

The main result of the two-sided markets literature (e.g. Armstrong (2005), Rochet and Tirole (2003)) is that each side participating in a common exchange platform (herein the postal communication platform) is not charged according to the costs it respectively triggers. There could be a number of reasons why one side of the platform could be charged in a different manner. If one side is more sensitive to price variations than another, it could then well be that the side with the highest price-elasticity is charged relatively less compared to the other, or even not at all. It could also well be that if one side triggers a positive externality on the participation of the other, i.e. attract the participation of the other, then again, this side would benefit from relatively lower prices. Following the same logic and approach, one could also wonder whether reducing transaction costs could be another reason for charging one side while not charging the other.

On SSA postal markets, too little is known with respect to the two sides' reactions to price variations (i.e. the reaction of senders to the stamp price

and of the addressee to the P.O. Box rental fee). Therefore little can be said with respect to the impact of price-elasticity on two-sided pricing. Yet it is worth noticing that almost all studies estimating price-elasticity for sending mail on monopolistic postal markets in ICs have not only found values lower than one, but very often much lower than one (Fève, Florens and Richard, 2006). Furthermore, while receiving mail into a P.O. Box, and thus renting it, is a choice in ICs (e.g. for a firm willing to be delivered earlier or to benefit from other value-added services), this is not the case in SSA where renting a P.O. Box is a *de facto* obligation to receive letter-post items. So reactions to price variations could be very different on ICs and SSAs' postal markets in this regard.

While only very little can be said in terms of price-elasticity, this is not so in terms of inter-group externalities and transactions costs on SSA postal markets. Regarding inter-group externalities, the development of postal B2C communication requires a very high number of addressees to be reachable. One must keep in mind that B2C is the segment with the best prospects in terms of postal traffic growth for SSA countries. Businesses, and particularly utilities in SSA, need to be able to communicate with an increasing number of customers. They need to reach more citizens in order to help their markets grow. When these customers are not reachable through the designated postal operators, they do not hesitate to organize their own delivery network for reaching them, and they are able to do so as the results of the survey show. The fact that these businesses are ready to bear extra costs for organizing delivery is also probably indicative of a low sensitivity to price variations for sending letter-post items to their customers, provided that the quality of service is high enough. This is likely to be untrue for the business-to-business (B2B) postal market segment: B2B is less likely to be sharply impacted by inter-group externalities due to the "closed club" communication between businesses.

With respect to transactions costs, a large number of addressees in SSA are facing very tight budget constraints in the short run, which in turn prevent them from renting a P.O. Box. The lack of human resources for managing complex pricing schemes probably further increases the real impact of the actual transactions costs on SSA postal markets.

So examining whether the addressee could be free of any charge for receiving mail is both consistent with the expected inter-group externalities related to the development of the B2C segment, and the reduction of transactions costs for highly budget-constrained citizens.

Should inter-group externalities be developed and transactions costs reduced, one would expect postal traffic to increase due to the potential for

indirect network externalities in SSA, which are also referred to as club effects. This issue did not attract much attention in the postal economics literature developed for industrialized countries (ICs), because all potential addressees are covered by postal delivery services in the developed world. Therefore, giving access to delivery to a potential addressee is considered as granted in ICs. As highlighted by the survey, this is not the case in SSA. Only a very limited share of the potential addressees is reachable by the letter-post, and thus makes the postal network less attractive at use. In SSA, there is little doubt that significant potential exists for the development of club effects through a much larger access of citizens to postal delivery. Section 4 econometrically estimates these club effects, and shows how they could in turn sustain a move towards free delivery.

Designated postal operators and competitors in SSA: two opposite pricing strategies leading to postal exclusion

The survey results particularly outline the different pricing strategies respectively applied by the designated postal operators, and their competitors. Interestingly, the literature on competition on two-sided markets provides theoretical foundations for the existence of this kind of market equilibrium (e.g. Armstrong (2005), Rochet and Tirole (2003)). Most notably, these models points out the possible negative welfare effect that could be triggered by this competitive equilibrium.

The reality of SSA postal markets turns out to reflect these theoretical propositions very well. On the one hand, the designated postal operators usually charge any addressee for receiving a letter-post item by asking a relatively high fee for renting a P.O. Box while sending an item remains affordable. On the other hand, the designated postal operators' competitors never charge the addressee for delivering an item, but apply very high rates to the sender. This corresponds to a situation where one of the operators supplies postal services applying a high access charge to the delivery network (i.e. the designated public operator through the P.O. Box rental), whilst the others pursue the opposite strategy of charging relatively high transactions fees for the usage of the delivery network (e.g. the bus company transporting letter-post items). In practice, customers who cannot access a P.O. Box are thus receiving their letters, flats, packets and parcels through the networks of designated postal operators' competitors, or are using other more informal delivery channels.

The end result of the current state of competition in SSA postal markets is that a large share of the population in SSA is excluded from the mail communication markets, either because they cannot afford the P.O. Box supplied by the designated postal operator, or due to the very high tariff the

sender must pay to competitors. Unlike in industrialized countries, with very few exceptions, universal service cannot be actually supplied in the current market conditions of SSA countries.

4. FREE DELIVERY AND CLUB EFFECTS

From the economic analysis insights provided in section 3, it follows that freeing the addressee of any charge for receiving mail would reduce transactions costs, and further foster the development of the inter-group externalities necessary for a sustainable growth of B2C postal traffic. Yet an empirical question remains open: would the development of a club effect have a large enough quantitative impact on postal traffic to sustain a move towards free delivery in SSA? Or in other words, would revenue streams generated by the increased postal traffic compensate for the revenue loss resulting if P.O. Boxes, or other delivery points, were offered for free?

In order to tackle this concern, the possible effect of greater access to delivery on the volumes of mail must be assessed. To do so, the evolution of domestic and international incoming letter-post traffics in response to an increased access to the delivery network through P.O. Boxes is modelled using the dynamic panel approach of Arellano-Bond (1991). Details of the econometric analysis implementation as well as complementary results are provided in the Technical Appendix. The most important econometric estimation results regarding the dynamics that network externalities trigger on postal traffic development over time are directly provided in the following paragraphs.

The short- and long-run effects of an increase in the number of delivery points (P.O. Boxes in most of SSA countries) on postal traffic development are computed using an unbalanced panel of 32 SSA countries over a 26 years time period (1980-2005). In order to enable a better assessment of the club effect dynamics, the cumulated and marginal effects of an increase in P.O. Boxes on the volumes of mail are computed over 5 periods using the econometric results provided in the Technical Appendix. Figure 1 presents the results for domestic mail: the dashed line represents the cumulated effects of one new P.O. Box on total domestic mail volumes, and the plain line traces its marginal effects.

Figure 1: GMM estimation *à la* Arellano and Bond of the cumulative and marginal effects of a p.o. Box on total domestic mail volumes over 5 periods
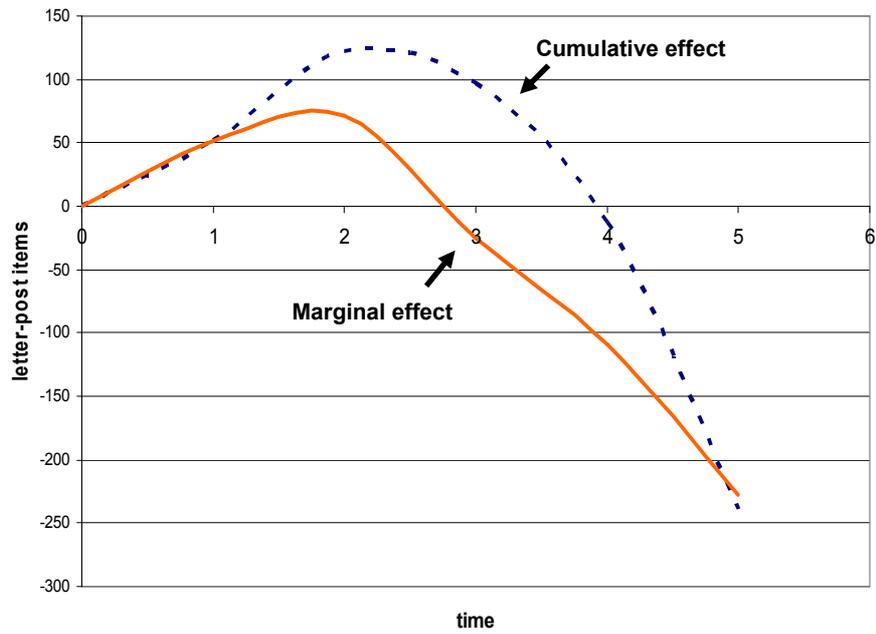
Figure 2: real price of Boxes vs. real marginal variations in mail volumes
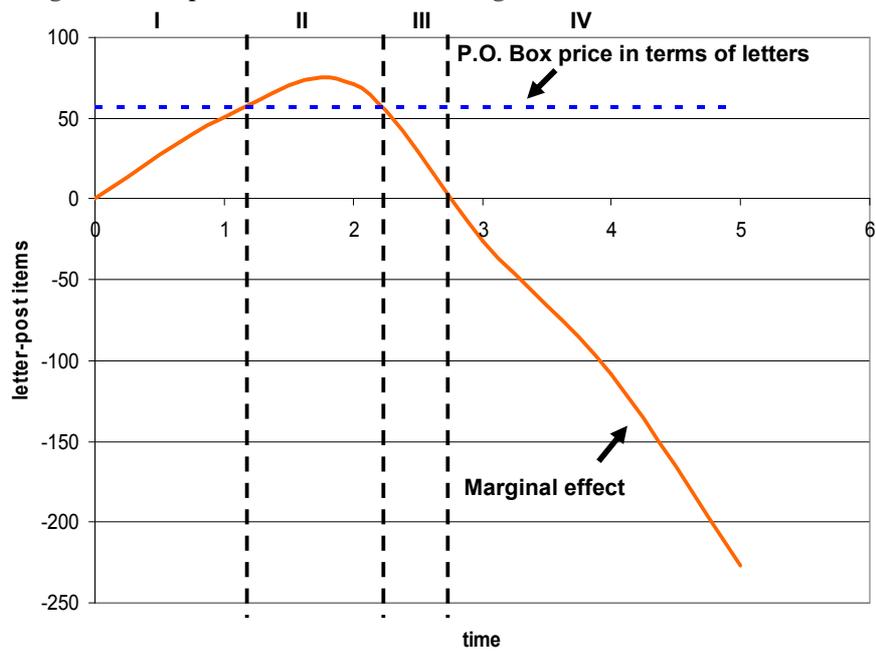
Except for the first period, short- and long-run effects are statistically significant for domestic mail. As shown in figure 1, statistically significant marginal effects vary from a marginal increase of 70 domestic letter-post items in the short run due to a marginal P.O. Box to a marginal decrease of 227 domestic letter-post items in the medium term and the long run. Relatively similar results are found in the long run for international incoming mail as shown in Appendix.

As for the pricing of postal services, the econometric results help shed light on the logic applied for setting the prices that the sender and the addressee are respectively paying for an exchange of mail in SSA. Figure 2 compares the time-varying marginal effect of a supplementary P.O. Box on total domestic volumes over 5 years to the current SSA median annual price for renting a P.O. Box in terms of first weight step letters. In other words, it thus compares the real increase in terms of letters due to one more Box to the current real price of a P.O. Box in terms of letters. The interest of this exercise is the following: should the increase in domestic mail volumes due to one more Box be higher than the current price equivalent of this Box in terms of letters, then this one more delivery Box could be offered for free. The club effect would thus enable a move towards free delivery.

As obtained in the 2006 survey of postal delivery in SSA presented at section 2, the current median price for renting a P.O. Box is the equivalent of 56 first weight step letters (or 56 stamps if one assumes one stamp for a basic letter). Four different phases can thus be noticed in figure 2; in phase I, the marginal effect of one more P.O. Box in terms of total letters exchanged is lower than the current price, in terms of letters, asked for renting this supplementary P.O. Box; in phase II, the marginal effect of one more P.O. Box in terms of total letters exchanged is higher than the current price for renting a Box; in phase III, the marginal effect of a P.O. Box in terms of letters is again lower than the current price for renting a Box as this was already the case in phase I; eventually, in phase IV, not only the marginal effect of a P.O. Box on the domestic traffic is lower than the current rental fee of a Box in terms of letters, but the marginal effect of a P.O. Box increase has now become negative.

In two-sided markets such as the postal market, the transactions costs triggered by charging both the sender and the addressee in a context of people on severely constrained budgets, as in SSA, are very likely to limit the number of participants in the postal platform (i.e. the senders and the addressees in our case). So in order to foster participation to the postal communication platform and postal traffic development in SSA, could those

transactions costs be reduced by charging only one side: the sender? Should it be so, inter-group externalities could further feed B2C traffic increases.

The four phases in figure 2 help answer this question. Since the marginal effect of a P.O. Box in terms of letter-post traffic increase in phase II is higher than the current real price of a supplementary Box in terms of letters, the real price for renting a P.O. Box could be set to zero: marginal free delivery could arise in this phase. This is not the case in phase I, and financial support by the government may be needed in this transition phase where statistically significant positive club effects do not appear. Unfortunately, phases III and IV very quickly emerge. In phase III, the increase in traffic no longer covers the current real price of a Box, which jeopardizes any move towards free delivery. In phase IV, the situation is even worse since the marginal decrease in postal traffic is likely to be compensated by an increase of P.O. Box real prices, closing a vicious circle where expanding access to delivery into initially paying P.O. Boxes eventually lead to even more expensive delivery for addressees compared to the initial situation. Anecdotal evidence tends to confirm this analysis with losses in postal volumes compensated by P.O. Box prices increases. Therefore, a sustainable introduction of free delivery, i.e. a time-consistent affordable pricing policy, requires phase III an IV to be avoided so that the benefits of positive club effects could be harvested in freeing the addressee of any charge for receipt of mail.

How could phases III an IV be avoided? Answering this question requires us to understand what is likely to trigger the puzzling negative club effects in the long run as depicted in the above three figures. What is the rationale for an increase in access to delivery to lead to lower levels of postal traffic than initially?

Research often focuses on network positive externalities; negative network externalities are barely considered. In SSA postal context, however, the possible existence of negative network externalities makes great sense at some point. Although an increase in the number of P.O. Boxes fosters the overall development of domestic letter-post in the short run by attracting more and more senders, e.g. utilities and banks, this can also quickly create bottlenecks in the postal process due to insufficient quality of service (e.g. if the postal process cannot absorb the increasing volumes of mail). Those bottlenecks then trigger negative boomerang effects on postal volumes in the medium term and the long run. These boomerang effects are even stronger for the public postal operator since unsatisfied customers have more and more access to unlicensed competitors, and do not hesitate to organize their own self-delivery networks. Furthermore, the principle of using a P.O. Box as a delivery technology could also represent a bottleneck in itself should the

Box be shared among many people, or should the recipient ignore, as is usually the case, that mail was delivered to his Box. The quality of service provided by a P.O. Box delivery system will also suffer from these weaknesses.

Our econometric results on potential negative externalities are, for instance, consistent with the current low utilization of the designated postal operators by most utilities companies in SSA, as revealed by the survey. In spite of higher and higher access to utilities for SSA's citizens, the increase in P.O. Boxes provided by many designated postal operators has not proven to be a sensible solution for answering utilities' needs in terms of the delivery of bills, and thus they retain this key segment of postal traffic, with self-delivery of bills by utilities companies remaining the dominant mode of bill delivery. With negative indirect network externalities on postal volumes in the long run, the current prospects for B2C traffic development by most of the current designated postal operators in SSA are not good.

The above results strongly suggest that, in terms of policy timing, a reform providing for significant increases in access to free delivery first requires a sufficiently dimensioned network in terms of size in order to allow increasing traffic volumes to be processed smoothly over the postal chain and enable a high enough quality of service. Otherwise, the short-run benefits of an increase in terms of access to delivery would be quickly overturned in the medium term and long run due to severe bottlenecks. This also implies that it is preferable to have management accountability for revenue and volume development targeting a five rather than a two-year period, in order to provide managers with incentives which are aligned on the right time-horizon.

4. CONCLUSION

The survey of postal delivery in SSA (Ansón and Toledano, 2007) provides important insights into the organization of SSA postal markets: P.O. Boxes are used as the main mode for delivery, which is not free of charge for the recipient. Large mailers such as utilities companies, are unsatisfied with the service offered by the actual designated postal operators, and tend to organize their own delivery networks.

The paper suggests that any reform approach should consist of implementing delivery free of charge for the recipient. Interestingly, this approach is already apparent in Rowland Hill's famous reform pamphlet of 1837, as discussed in Crew and Kleindorfer (1991). Previously to Hill's proposal, both senders and recipients were charged for any exchange of mail,

usually according to the distance covered from the origin to the destination. Importantly, Hill also noted that there would be significant costs associated with final free delivery in certain areas. He therefore argued that his original Penny Post proposal apply only for "post town to post town", that is for free delivery to some central location (e.g., the post office) in each town. Final distribution (which he referred to as "secondary distribution") was to be left in the hands of local districts.

Rowland Hill's proposal has nevertheless been progressively extended beyond its original scope, and home delivery free of charge for the recipient became universal over the years in Great Britain, as well as in other industrializing countries in the 19th century.

Like the reform proposed by Rowland Hill in the 19th century in Great Britain, a reform of postal delivery in SSA towards delivery free of charge for the recipient could dramatically change the evolution of their postal markets. While Rowland Hill justified his reform proposal in terms of costs, this paper shows that postal service can be viewed as a club good, where externalities suggest cross-subsidization of recipients by senders, namely free delivery. Once a well-enough dimensioned postal network offering a good quality of service is provided, the value of postal services increases in the absence of recipients' costs.

In order to remedy the problems that poor quality and high recipient cost have in reducing the value of postal service in SSA, as shown in this paper, any reform approach consistent with Rowland Hill's revolution should implement free delivery, although the detailed implementation of it must be worked out, and may vary according to the geographical areas to be served. In this regard, little can be learnt from the Rowland Hill experience in terms of detailed reform implementation in Great Britain, since the geography and organization of the economy may well be different between Great Britain in the 19th century and SSA countries today. Yet one could easily have the sense that today's value of postal service is higher the nearer it is to the final recipient, due to B2C postal delivery demand such as billing.

Adapting Rowland Hill's revolution to SSA countries conditions today may consist of allowing a controlled expansion of free delivery, with control on quality so that congestion does not undermine the value of the service as volume increases in response to price decreases for recipients. The biggest challenge for adapting Rowland Hill's proposal is probably the choice of delivery points. While a more centralized delivery system, such as delivery into satellite free P.O. Boxes (e.g. the recent experience in Israel), could dramatically reduces delivery costs, this offering would also represent a step back for B2C large mailers and recipients which are already provided with

home bill delivery in most SSA largest cities. There is thus a trade off between the cost saved by centralized delivery points and the value of postal services in terms of delivery proximity. This trade off requires further local studies in order to achieve a balanced solution where maintaining the value of postal services does not trigger unbearable costs, but also where controlling costs does not jeopardize the present and future value of postal services, where B2C senders' needs must be fulfilled. Mixed solutions with free home delivery in the largest cities and low-cost areas, and satellite free P.O. boxes delivery in the high-cost and rural areas, could also be assessed.

APPENDIX

This is the first time in postal economics that the Arellano and Bond (1991) GMM dynamic panel econometric estimation method has been applied. This enables us to track the cumulated and marginal effects of variations in the number of P.O. Boxes and post offices on traffics over 5 years after a change. The numbers of P.O. Boxes and post offices are treated as endogenous covariates in the econometric estimation.

Domestic and international incoming traffics, respectively denoted n and w, are modeled by means of a dynamic econometric setting *à la* Arellano and Bond (1991), i.e.

$$n_{it} = a\, n_{i,t-1} + \mathbf{x}_{it}\, \boldsymbol{b} + v_i + e_{it} \quad i = 1,...,31 \quad t \in 1980,...,2005 \quad (1)$$

$$w_{it} = c\, w_{i,t-1} + \mathbf{y}_{it}\, \boldsymbol{d} + u_i + \varepsilon_{it} \quad i = 1,...,32 \quad t \in 1980,...,2005. \quad (2)$$

$\mathbf{x}_{it}$ and $\mathbf{y}_{it}$ are vectors of covariates which include the number of P.O. Boxes p_{it} and post offices o_{it} in the domestic mail equation (1) but only P.O. Boxes p_{it} in the international incoming mail equation (2); a and c are parameters to be estimated, $\boldsymbol{b}$ and $\boldsymbol{d}$ are vectors of coefficients to be estimated, v_i and u_i the random effects that are independent and identically distributed over the panels, and e_{it} and ε_{it} the error terms. Index i represents countries and t years.

In order to use the Arellano and Bond (1991) dynamic panel-data estimator, the first differences for equations (1) and (2) are derived. This implies that any time-invariant fixed effect is removed. So are time-invariant measurement errors and omitted variables effects. The generalized method-of-moments can then be applied. No second-order autocorrelation in the first-differenced idiosyncratic errors is assumed. This assumption will be tested below following Arellano and Bond's seminal paper (1991).

P.O. Boxes p_{it} and post offices o_{it} are suspected to be endogenous (e.g. Boxes may depend upon their rental fees and postal rates) in that $E[p_{it} e_{it}] \neq 0$, $E[o_{it} e_{it}] \neq 0$ for $s \leq t$ but $E[p_{it} e_{it}] = 0$, $E[o_{it} e_{it}] = 0$ for $s > t$ in equation (1), and $E[p_{it} \varepsilon_{it}] \neq 0$ for $s \leq t$ but $E[p_{it} \varepsilon_{it}] = 0$ for $s > t$ in equation (2). Therefore, on top of the country population h_{it}, levels of the endogenous variables p_{it} and o_{it} lagged up to five periods serve as instruments.

Econometric estimations results are presented in table 3 below. First, the statistical validity of the econometric model must be checked. The Arellano and Bond (1991) underlying assumption of no second-order autocorrelation in the first-differenced idiosyncratic errors is met as shown by the values for the AR(1) and AR(2) tests. The Sargan test of overidentifying restrictions also confirms a sound choice of instruments. Once the validity of the econometric model is confirmed by the AR(1), AR(2) and the Sargan tests, the results can be interpreted.

Table 3: dynamic unbalanced panel econometric estimation results

	Domestic mail (1)	International mail (2)
Lagged one domestic mail	0.3773** (0.0243)	
Lagged one international mail		0.7635** (0.0310)
P.O. Boxes		
First difference	92.34* (36.98)	98.58** (25.03)
Lagged one	-41.36 (47.46)	-52.78 (33.50)
Lagged two	70.81 (49.52)	-7.39 (30.98)
Lagged three	-25.65 (48.25)	-78.03** (15.20)
Lagged four	-108.65* (42.54)	15.34 (9.85)
Lagged five	-227.18** (34.18)	-169.58** (18.70)
Post offices		
First difference	3 007.27 (10 761.90)	
Lagged one	-17 258.30 (13 510.89)	
Lagged two	-4 063.78 (12 943.89)	
Lagged three	-5 221.55 (13 388.12)	
Lagged four	2 586.37 (13 951.50)	
Lagged five	-2 128.64 (11 813.25)	
Constant	84 711.64 (146 680.50)	
Observations	269	266
Sargan Test	463.63	313.14
AR(1) Test	-3.01	-7.07
AR(2) Test	0.31	0.44

Note: ** and * respectively denotes 1 % and 5 % statistical significance levels;
Standard errors between parentheses below coefficients. Data: UPU Postal Statistics.

Figure 3: GMM estimation *à la* Arellano and Bond of the cumulative and marginal effects of a p.o. Box on international incoming mail over 5 periods
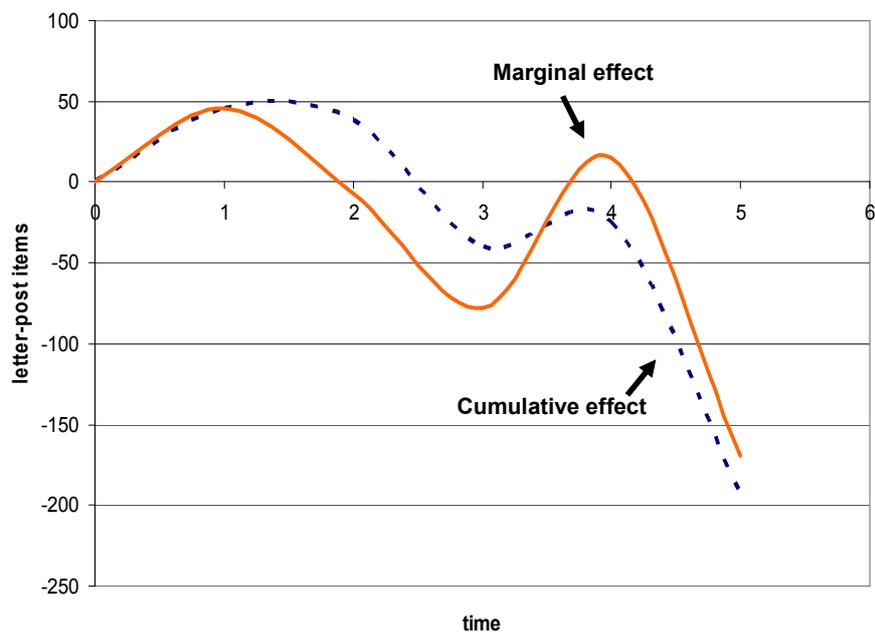
For international incoming mail, short run effects are not statistically significant. As shown in figure 3, statistically significant marginal effects in response to a supplementary P.O. Box vary from a marginal decrease of 78 international incoming letter-post items in the third period ("medium run") to a marginal decrease of 169 international incoming letter-post items in the fifth period ("long run").

Unlike domestic letter-post where a few senders are trying to reach many addressees at a time (e.g. B2C), international letter-post incoming to SSA is more likely to consist of many foreign senders trying to reach rather few addressees at a time. So there is a less obvious case for the development of a positive club effect. Yet the bottlenecks triggered by the higher network attractiveness for domestic purposes following an increase in the number of P.O. Boxes also affect negatively the evolution of international mail exchanges in the long run. This is an *a priori* unexpected perverse effect of expanding access to mail delivery in SSA under the current conditions.

REFERENCES

Ansón, J. and J. Toledano (2007). "Survey of Postal Delivery in Sub-Saharan Africa: Final Report". Universal Postal Union, mimeo, Bern.

Ansón, J, Cuadra, R., Lindares, A., Ronderos, G., and J. Toledano (2006). "First Steps towards New Postal Economics Models for Developing Countries: Learning from the Latin American Experience". In *Liberalization of the Postal and Delivery Sector*, edited by Michael A. Crew and Paul R. Kleindorfer, Cheltenham, UK: Edward Elgar.

Arellano, M. and S. Bond (1991). "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations". *Review of Economic Studies*, 58, p.277-297.

Armstrong, M. (2006). "Competition in Two-Sided Markets". *RAND Journal of Economics*, 37(3).

Crew, Michael A., and Paul R. Kleindorfer (1991). "Rowland Hill's Contribution as an Economist." In *Competition and Innovation in Postal Services*, edited by Michael A. Crew and Paul R. Kleindorfer. Boston, MA: Kluwer Academic Publishers.

Estache, A. and A. Goicoechea, M. (2005). "A Research Database on Infrastructure Economic Performance". *World Bank Policy Working Paper 3643*.

Fève, F., Florens, J.-P., and S. Richard (2006). "Microeconomic Demand Modelling for Price Elasticities". In *Liberalization of the Postal and Delivery Sector*, edited by Michael A. Crew and Paul R. Kleindorfer, Cheltenham, UK: Edward Elgar.

Rochet, J.-C. and J. Tirole (2003). "Platform Competition in Two-Sided Market". *Journal of the European Economic Association*, 1(4), p.990-1029

Universal Postal Union (1980-2005). "Postal Statistics", Bern.