

Sender-receiver-segment-based demand analysis for letters

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1 Introduction

The reduction of letter volumes is an international phenomenon apparent in all developed countries. For this reason postal organizations have ran into considerable difficulties when trying to find alternative avenues for replacing income lost through falling letter volumes. Developing countries are, according to the limits set by progress, moving mainly towards electronic forms of communication, and letter messaging will never attain the status it has for long had in the developed nations.

Theoretically, there are three significant factors related to letter demand: economic activity, letter pricing itself and its relationship to competitive services, and substitution (Boldron et al., 2011; Veruete-McKay et al., 2011; Nikali, 2008). Apart from this, other factors also affect letter demand, such as population size and the quality of letter services. However, the simultaneous cross effect of all these factors creates swiftly changing situations wherein some factors cause growth in letter demand and others diminish it. Depending on the focal point, letter volumes can, in consecutive years, switch from increase to decrease and vice versa.

The main reason for the slowing trend in letter demand has been the development of new communication technology and its introduction, in other words, the substitution of the paper letter by electronic messaging (Boldron et al., 2011; Veruete-McKay et al., 2011; Nikali, 2008 and 2011). Nevertheless, the substitutions of letters and, in particular, the related legal aspects, have been little studied internationally. The research on determining whether or not substitution in the sender and receiver segments in the same country takes places at different times and for different reasons has been rather modest. This is because the relevant research data on the phenomenon of substitution, especially from the time series perspective, is inadequate, since the collection of data related to the volumes of letters sent and received is a systematic and time consuming process.

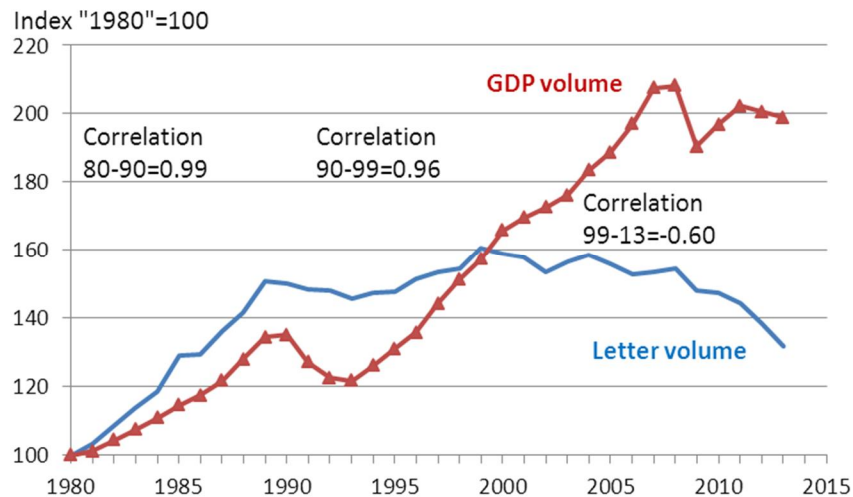
This type of systematic data collection was being carried out in Finland as early as 1991. It is only now that the time series cover a sufficiently long period for reliable sender and receiver specific time series analyses to be made.

This paper analyses the factors affecting letter demand in the sender and receiver segments while also considering why all of the fundamental factors regarding demand affect letter demand in different ways in different segments. A segmental approach, that is, segment by segment, sheds light on many new perspectives affecting demand which cannot be identified in a total analysis of letters. The paper is structured in the following way. Section 2 compares demand for letters according to segment with the development of the Finnish economy. Then in Section 3 price elasticity of demand in the various segments is analysed and the reasons are considered why letter demand is cross-flexible with the prices of competition communication forms in different ways in different segments. Section 4 concentrates on substitution and the factors which bear on this. Next, Section 5 places letter price flexibility alongside temporal changes in substitution. Finally, Section 6 summarises the conclusions.

2 Effect of national economy on letter demand

During the 1980s letter volume continued to increase fuelled by the growth in the economy. It was at the beginning of the 1990s when Finland sank into a deep economic recession that a change in this course of events took place. Nevertheless, letter volume did not decrease as fast as gross domestic product (GDP). When the slump was over in 1994 the Finnish economy began to grow extremely rapidly, at its best 5–6 per cent annually. But now letter volumes no longer followed the pattern of the national economy. The next significant change in letter demand and economic development took place at the turn of the millennium. The Finnish economy continued to increase, but letter volume's growth came to a halt and slowly the trend turned downward. Then followed another dramatic change in the national economy in 2009 when Finland's GDP fell by 8.5 per cent. At the same time the letter demand trend made a sharp turn downwards. These different stages related to letter demand and economic trends are presented in Figure 1.

Figure 1. Correlation between the total volume of 1st and 2nd class letters and GDP in Finland 1980–2013.



When total letter volume is divided into different sender and receiver segments and these are compared to the development of GDP, the resulting correlations in different segments vary considerably. Figure 2 shows the development of business to business (B2B) letter volume in relation to the Finnish economy. This diverges considerably from the total letter volume development displayed in Figure 1. While there have been several different stages related to the development of the total letter volume and correlations with GDP go from a strong positive to a negative in these different stages, B2B letter volume has followed the same trend during the entire period under examination beginning in 1991. The number of B2B letters has fallen 60 per cent during the last 20 years. The correlation is very strong and negative in relation to GDP. It should be observed as far as the development of letters is concerned that the descent has been rectilinear during the entire period. During the years 2004–2008 letter volume bounced about somewhat and it is difficult to say whether there was change in demand or whether this was due to statistical fallacy. It is also noteworthy that in the rectilinear volume reduction even the sizeable fall in GDP in 2009 is not to be observed.

Figure 2. Correlation between B2B letter volume and GDP in Finland 1991–2013.

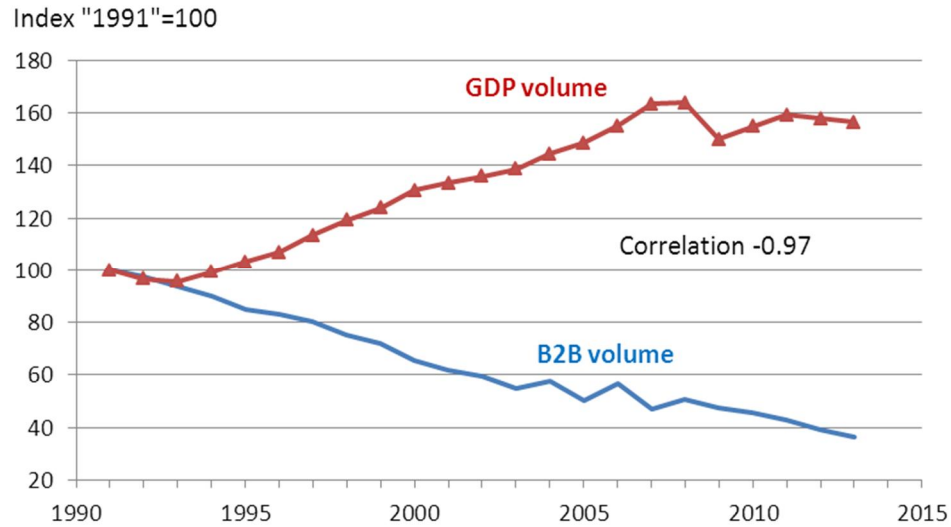
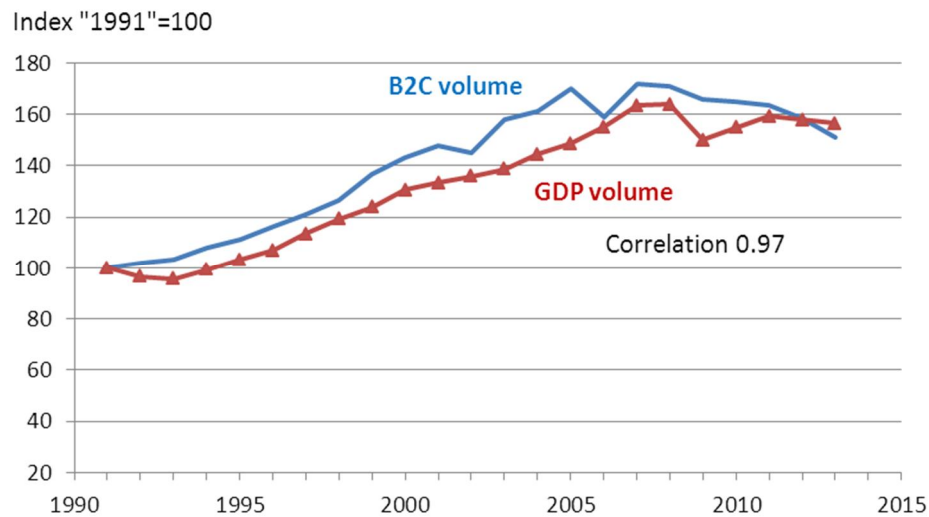


Figure 3 shows the development of business to consumers (B2C) letter volume and its correlation with GDP. This situation differs completely from the development of B2B letters as presented in Figure 2. The correlation between B2C letter volume and GDP is very high; the coefficient is 0.97. This value is the same as the coefficient for B2B volume and GDP, but with different signs. Even from this analysis it can be concluded that the national economy has raised the amount of B2C letters very considerably, while in the development of B2B letters its role has been rather small. Demand factors in these segments differ substantially from each other.

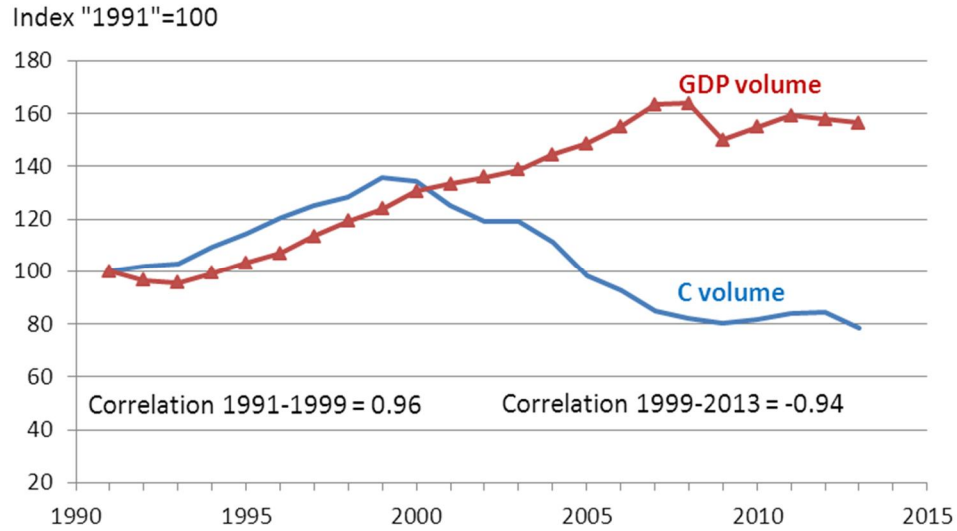
Figure 3. Correlation between B2C letter volume and GDP in Finland 1991–2013.



The share of letters sent by consumers (C letters) of the total volume is about ten per cent (Nikali et al.,

2013). Even though the significance of this segment in considering the total letter demand is not great the changes that have taken place in its demand are of particular interest. At least until the turn of the millennium the development of letter volume sent by consumers was entirely driven by GDP (Figure 4). At the turn of the millennium a dramatic reversal took place when the development of the amount of letters began to differ completely from the trend of GDP. At the same time the correlation coefficient shifted from one extreme to the other. Demand for letters began to be driven by entirely other causes than the national economy.

Figure 4. Correlation between C letter volume and GDP in Finland 1991–2013.



By comparing the Figures 2–4 it can be observed that modelling only the total demand for letters cannot provide a sufficiently deep interpretation as to which factors in the different time spans drive letter demand. The analysis must be done segmentally. This will be emphasised in the next sections.

3 Effect of the price on the letter demand

The demand of letters in different sender-receiver segments is estimated by the demand model

$$Q_t = Q_t(g_t, P_t, K_t, T_t, S_t) = Q_t\{g_t(f_t(y_i), P_t, K_t, T_t, S_t)\} \quad (1)$$

where Q is volume of letters, g describes substitution, P is price of letter mail, K price of competitive service, T trend and S business cycle variable. In the logarithmic linear estimations the models are given the following form:

$$q_t^i = \alpha_i * T_t^{\beta_i} * S_t^{\phi_i} * P_t^{\chi_i} * K_t^{\delta_i} * e^{\varphi_i} * G_t^i * \varepsilon_t^i \quad (2)$$

where i = segment (B2B, B2C or C=letters sent by consumers) and t = time (the years 1991 – 2013)

q_t^i = domestic 1st and 2nd class letter volumes in the segment i;

T_t = general economic activity variable;

S_t = business cycle variable;

P_t^i = real tariff index of letters in segment i ;

K_t = real tariff index of phone services;

G_t^i = variable for describing the possibility of using replaceable electronic forms of communication in segment i ; and

ε_t^i = residual error.

The analysis is made on the basis of annual time series. The demand for letter services by segment has been measured since the beginning of 1991, whereby there are observations for 23 years, which seems to be enough for reliable time series analyses (Nikali et al., 2013). The analysis will provide viewpoints how different the demand factors for letter services in different segments are. It is of particular interest to analyse the importance of substitution in different segments, because the preconceived hypothesis is that substitution progresses in different ways in different segments.

The price of letters paid by stamps has varied in Finland. The real price in 2013 is about 40 per cent more than in 1990. Since 2009 the real consumer price has fallen first on account of a decrease in price and in 2011 a barrier to send these as single 2nd class mail items was lifted, which left the consumer with uniform choice for sending 1st and 2nd class letters. At the same time value-added tax was also removed from letters sent with a postage stamp, although in this case the price to the consumer did not change. The price of the business letter on the other hand has remained quite stable. In 2013 the real price of the business letter is only about ten per cent higher than in 1990. Yet, the price of telecommunication services which compete with letters has decreased during the whole entire period under investigation. The real price in 2013 is only one-third that of 1990. It can be determined from the drop in price of telecommunication services that, in those sender and receiver segments of letters in which it has been possible to substitute letter by electronic communication, letter demand has also influenced by the cross-price elasticity of telecommunication services. Table 1 shows segmentally letter demand correlations in relation to the letter's own price and that of the telecommunication services.

Table 1. Correlation between service prices and letter demand in different sender-receiver-segments 1991–2013.

	B2B	B2C	C
Letter own price	-0.38	0.14	-0.17
Telecomm. service price	0.98	-0.94	0.56

It can be seen from Table 1 that the segmental letter demand correlations in relation to the letter's own price are significantly smaller than the telecommunication services' price. Especially in the B2B but also in the C segments correlations with the telecommunication services' prices are positive and strong, which implies the possibility of cross elasticity. Yet in the B2C segment the correlation is also strong, but negative. All in all, correlations in the B2C segment are bewildering. The correlation in relation to its own price is very low and positive, but with the telecommunication services the correlation is strong, but negative. This can be explained by the steady growth until 2007 of the letter volume trend in the B2C segment, after which it started slowly to accelerate in a downward direction. At the same time the

telecommunication services' real price trend has fallen steadily right up to the recent years, and the price of the business letter was very stable for a long time. The estimated price elasticities for different time spans based on model (2) are presented in Table 2.

Table 2. Estimated letter's own and gross price elasticity

Time period	B2B Cross elasticity with telecommunication services (P/K)	B2C No cross elasticity (K)	C Cross elasticity with telecommunication services (P/K)
1991-2007	-0.37 (t = -6.10)	-1.38 (t = -3.47)	-0.004 (t = -0.05)
1991-2009	-0.37 (t = -8.29)	-0.93 (t = -2.18)	0.12 (t = 1.26)
1995-2013	-0.35 (t = -7.11)	-0.77 (t = -1.09)	0.04 (t = 0.27)

As was observed earlier on the basis of the correlations, the most reliable price variable was the letter price in relation to the telecommunication services' price in the B2B and C segments. Price elasticity in the B2B segment has been very stable and its significance measured by the t-value, great. Yet in the C segment price elasticity remains systemically small and its significance low. Once again the B2C segment becomes the most interesting. From the demand perspective the most significant price variable is the letter's own price, there is no cross elasticity. Elasticity is great and its level of significance, with the exception of the up-to-the-minute model, quite adequate. Price sensitivity would appear to be getting smaller. What is confusing is that in the B2B and B2C segments price elasticity is so different, even though in principle the prices of letters in these segments are the same. Further, in the B2B segment price sensitivity remains almost unaltered over the course of time and in the B2C segment it diminishes, even though the development of prices is the same in both segments.

The dissimilarity in price elasticity between the B2B and B2C segments can basically be explained by two different phenomena, the volume differences between segments and the factors influencing choice of communication channel.

In the B2C segment delivery volumes are large compared to the B2B segment. For example, invoice letters to consumers occur often in the form of mass mailing in the B2C segment, which are not found in the B2B segment. Large volumes provide possibilities for granting better reductions in price. This again leads to lower unit prices in the B2C segment compared to those in the B2B. Sizeable volumes in the B2C segment has also led to a situation in which use of the lower service level (D+2) is clearly more common in the B2C segment than in that of the B2B (Nikali, et al., 2013). This also reduces the unit price. The lower price does not explain the greater price elasticity. Instead mass mailing in the B2C segment support greater price sensitivity, since letter price increases will become realised as bigger total cost changes compared to the smaller mailing volumes. In both segments senders have avoided the effect on the letter price by shifting the emphasis to the cheaper D+2 at the expense of the D+1 service. Surprisingly, even this development started in the smaller price flexibility segment, that is, B2B, many years before the B2C segment. All things considered, a segmental examination of volume results in contradictory explanations of the differences in price elasticities.

The differences between price elasticity can be understood when the opinions of the users of communication concerning the most important reasons for using a particular communication channel are considered. The price of sending a message is not the most important factor, but it turns out that matters related to reliability, as well as easiness of communication channel are of greater importance (Elkelä et al. 2001, Elkelä et al., 2009). If several channels are available for use, then properties related to the channel itself will determine the channel choice. This is true of both segments, B2B and C2C. In such event that the paper letter is the only alternative on hand, in which case properties related to a channel will be unobtainable, the service price will be in an important position. This, again, leads to considerable price sensitivity as far as the letter is concerned. This has been the situation for a long time in B2C segment, but now this is changing when invoicing process is electrifying at the expense of letters. Big volumes, although cheaper unit prices in the B2C segment support this phenomenon.

It is easy to understand the minor letter price sensitivity to the consumer. On average consumers send one letter or postcard a month, which means an item of expenditure of less than one euro. Finnish households spend an average of 24 euros a year on letters and postcards while at the same time devoting a total of 770 euros to communication in general (Statistics of Finland, 2013a). The letter share of consumers' communication expenditure is thus three per cent. This all means that letter expenses do not play a big role in the consumers' economy which implies a low letter price elasticity. The situation was the same even 15 years ago.

4 Effect of competition from electronic communication on the demand of letters

Letter substitution is not at all a new phenomenon. With econometric modelling based on the data which described communication behaviour at the beginning of the 1990s, it could then be seen that electronic communication was becoming more common and that letter volumes were diminishing (Nikali, 1997). However, this was difficult to accept, because at the same time number of letters was still increasing rapidly in most countries. There was also a credibility issue: how is it possible that with the introduction of new technology letter demand could begin to fall after having continually grown for hundreds of years? The letter has always been one of the oldest and most popular forms of communication, so how can it be that an entirely new technology can now replace it? After all there has always been much technological innovation in the past. Not until the 2000s did the postal organizations really wake up to substitution, when a trend appeared showing letter numbers decreasing, as substitution began to achieve an edge over other letter demand factors.

Substitution of paper letters by electronic communication is a phenomenon whose impact is difficult to foresee, but subsequently, when substitution is well advanced, its detection is easy. The reason for this is that there are two different forms of substitution: *direct substitution* means communication which earlier took the form of the paper letter and became electronically transmitted; *indirect substitution* is connected to the growth potential of letter demand and it is the share of that potential, which is not realized because of the mushrooming of electronic communication (Nikali, 2011). When substitution is not so well developed, economic factors generally increase the number of letters, in which case direct substitution stays in the shadow of increasing letter volumes and a reduction in potential growth is in general difficult to detect. This means that examination of substitution is always more or less theoretical and on that account difficult. Such research requires econometric modelling and special data, which in turn demands systematic data collection.

The fact that substitution takes place at different speeds in different segments makes its measurement complicated. Substitution models that do not take possible changes in speed in different time periods and progression differences in different letter services user groups into consideration can lead to erroneous conclusions. In order for substitution to be analyzed with the help of an econometric model, an analysis must be made of both the possibilities for using and the actual use of those electronic communication channels that replace letters, not only from the senders' point of view, but also from that of the receivers. To use only one electronic substitution measurement variable in models that analyze letter demand can evidently also be too limited, because substitution is such a complex matter (Boldron et al., 2010). "This can be a major problem in an environment where electronic substitution tends to be seen as one of the main drivers of volume evolution" (Boldron et al., 2010).

Finland has been a particularly suitable country for the study of letter substitution. Data have been systematically collated on letter demand and its structure for a period of already over 20 years (Nikali et al., 2013). The collection of information concerning different sender and receiver segments has been especially beneficial in trying to understand demand and substitution factors. The use of technology that is able to replace letter demand has spread swiftly in Finland and information concerning this has been collated systematically, too.

The use of email at work began to increase rapidly in Finland as early as the beginning of the 1990s, and use of e-mail at home began to become general about five years later (Nikali et al., 2013). E-mail has played a dominant role in influencing the use of letters, having from the beginning replaced the "not so important" letters, such as letters of announcement and quick exchange. Household e-mail penetration in Finland already exceeds over 90 per cent, although 65 per cent of Finnish people said they also use e-mail at home in 2013 (Statistics Finland, 2013b and Nikali et al., 2013). E-mail use at work became fast more common in the 1990's and is about 70 per cent now but has no longer increased since the turn of the millennium (Nikali et al., 2013).

The substitution of letters by electronic communication is not a uniform process; indeed it is a very complex and multidimensional phenomenon. Substitution is not a consequence of one technology diffusion curve; it follows the result of the impact of many concurrent diffusion curves. This is the reason why substitution as a process can have different stages (Nikali, 2008).

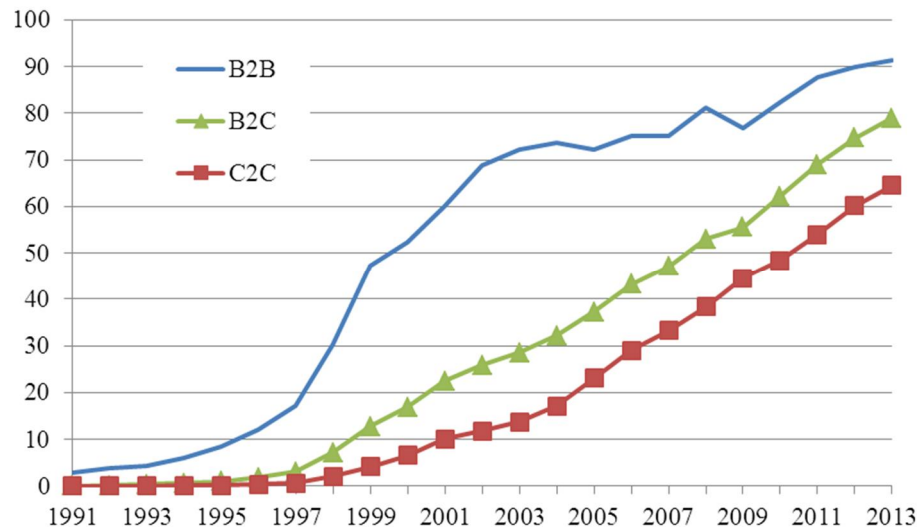
Depending on how new technologies are adopted, substitution can be fast or slow. If there are few technological advances or senders of letters do not make much use of these, substitution may come to a standstill. However, substitution is only a one-way process: when a letter has moved from paper to an electronic channel, there is no return to the paper letter. It has also been observed that rapid substitution and structural changes in letter flow as well as slow substitution and a relatively stable structure of letter flow are correlated (Nikali, 2008). This implies that the speed of substitution does not only depend on the senders' and receivers' ability to use new technology, but also on the strong effect the communication purpose and content of the letter have.

The reasons for substitution from the companies' and consumers' points of view are different: companies seek savings in their communication processes and consumers ease of communication (Elkelä et al., 2001a, b; Elkelä et al., 2009). This means that it is more difficult to motivate consumers to support the substitution compared to companies. One must also remember that the consumers' role in the letter communication process is almost always as a receiver of messages. To motivate consumers, the carrot and stick approach can be imposed. If positive lures do not help, sanctions can be implemented. The most useful sanction would be an extra receiver payment for a paper letter and a very simple method: to give only one opportunity, for example, to the invoice receivers, that is, to use only electronic channels (Elkelä,

2011). Banks use a very effective method in relation to this, simply announcing to their customers that they plan to shift the customer's bank statements from paper to an electronic channel and if they want to continue to receive paper statements, they have to pay extra.

In the demand equation (2) the factor G describes substitution. G illustrates the possibility of using electronic channels in X2Y segment communication. This means penetration of e-mail use as well as the shares of electronic invoices in different segments. The degree of substitution is the ratio between actual and theoretical volumes. Theoretical volume is described by the above demand function without the substitution factor. The idea of this examination is to describe the development of theoretical letter volume in the type of situation in which substitution would not have taken place. Because the substitution factor is in exponential form in the models, it specifies the yearly degree of replacement as a time series. The ideas behind segment demand models and the variables that have been used with them are more precisely described in Nikali (2008). The only important change in the 2008 models concerns the G variable, e-mail penetration, to which was added the segment-specific electronic invoicing proportions. The used substitution variables are described in the Figure 5.

Figure 5. Segment based substitution variables 1991–2013.

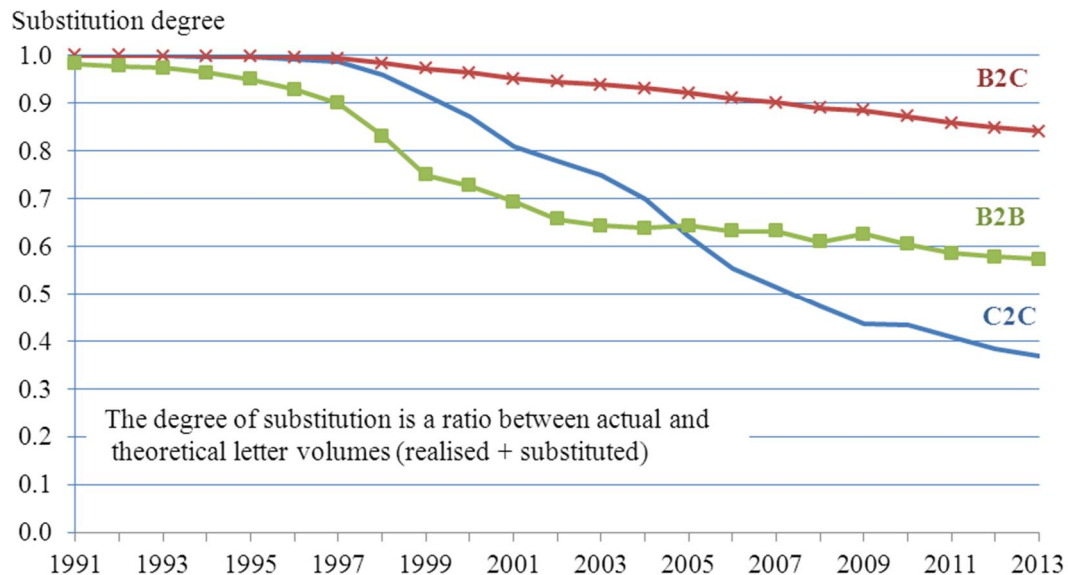


Even though the segment-specific substitution variables that have been used in the demand models resemble each other closely, their effects as factors which explain demand vary a lot and substitution will be realized in different sender and receiver segments at different times. Figure 6 presents estimated substitution progress curves in Finland since 1991. These curves describe the ratio of the actual volume to the theoretical letter volume without substitution. The lower the curve dips, the more replacement there has been in volume. As long as the value of the ratio remains at one, no substitution has taken place.

Substitution in the C2C segment is by far the most developed. It began at the end of the 1990s and since then it has continued at an almost even pace. The deep economic depression in 2009 stopped its progress, but when the recession was over, substitution has accelerated again. As has been said earlier, substitution is quite a theoretical phenomenon, but based on the models it can be estimated that letter volume in the C2C segment should be 2.7-fold without substitution compared to the actual. Substitution

has been the reason why letter demand in C segment changed its course from the growth to the decrease in the turn of the millennium and the volume has dropped more than 40 per cent since then.

Figure 6. Substitution degrees for letters in Finland 1991–2013.



It was in the B2B segment that substitution started to advance first, even at the beginning of the 1990s. After that, different periods of progress have been experienced. The fastest period was 1997–2003. After that, substitution did not progress at all until it accelerated again after 2009. The actual number of letters in the B2B segment has fallen to the 36 per cent of that in 1991. In order to understand the significance of substitution for letter demand, it can be estimated that without substitution the volume would be about 1.7-fold compared to the actual.

In the B2C segment, substitution got under way at the end of the 1990s, although so far it has not yet achieved a rapid state of advancement. The phenomenon has advanced slowly, but steadily. This is why the volume of letters in the B2C segment increased until the year 2007, after which it has dropped 12 per cent totally.

In comparing the results in all three segments, it would appear that substitution has been reflected most in the communication behaviour of consumers, even though the penetration of new electronic channels in households remains lower than at the workplace. The explanation as to why substitution is most advanced in households is that activities at home are simpler than at work, where processes such as bookkeeping, invoicing, etc., must also be taken into consideration. Attention must also be paid to the business processes of a company when receiving messages in B2B communication, for example, an invoice cannot be transferred to an electronic network unless the company receiving the invoice approves the transaction and is able to accept it. Substitution progress has been the slowest in B2C communication, because companies do not know their consumers' e-mail addresses or the cultural environment for receiving messages, and this prevents the substitution of letters. Finnish consumers have also found it difficult to accept invoices sent by companies in electronic form rather than as a paper (Elkelä, 2013). Among consumers, changing the form of communication is the easiest. Messages are generally such that they can easily be sent electronically. It is enough to know the recipient's e-mail address or mobile phone number and consumers normally send messages to those they know.

The effect of substitution has been that the significance of different sender and receiver segments to total letter demand in Finland has changed considerably over the last 20 years. Back in 1991 there were two strong segments B2B (46% of total demand) and B2C (42%). Now there is only one such segment left, B2C (71%), with the importance of B2B having fallen substantially (19%). Although the volume of letters sent to consumers from other consumers has almost halved in the last ten years, the significance of the C2C segment has always been rather small (under 10%), and the C2B segment share has been only a few per cent over the whole period under discussion.

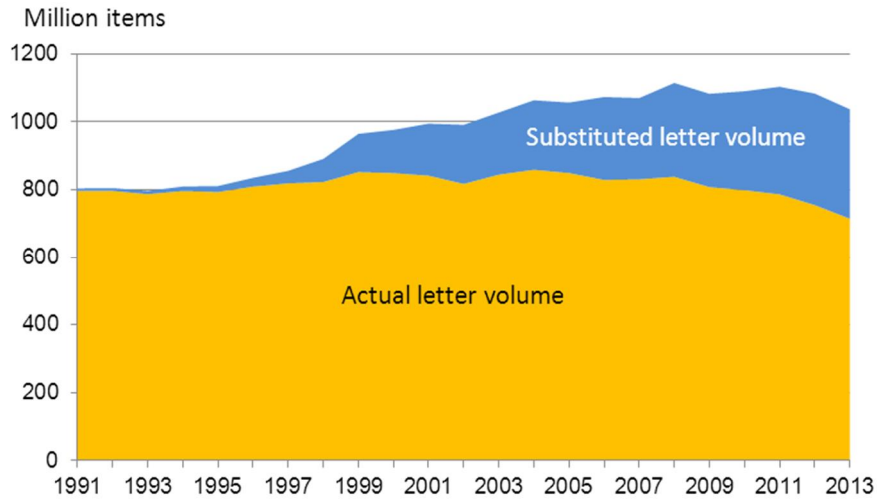
The most predominant effects that substitution has had on the letter market in Finland are listed in Table 3. These influences can be divided into segment-specific demand effects and inter-segmental structural effects. The table also shows the different temporal aspects of substitution in the different segments. The maximum volume of letters achieved in the different segments also varies considerably with time. Nevertheless, it should be remembered that development of the communication markets without substitution would have been quite different from that to which we have become accustomed, for which reason the study of substitution must be theoretical, although its effect on the fall in letter demand cannot be underestimated.

Table 3. The impact of substitution on the progress of letter demand and market structure change in Finland 1991–2013. C=C2C + C2B.

	Segment			Total
	B2B	B2C	C	
Share of total market 1991 (%)	46 %	42 %	12 %	100 %
Volume index value 1991 ("1991"=100)	100	100	100	100
The highest volume index value _{year} during the years 1991-2013	100 ₁₉₉₁	172 ₂₀₀₇	136 ₁₉₉₉	108 ₂₀₀₄
Volume index value 2013	36	151	78	90
Share of total market 2013 (%)	19 %	71 %	10 %	100 %
Theoretical volume index value 2013 without substitution	62	180	213	129

It will be observed from the table that substitution has not been the only factor in the B2B segment that has reduced the demand for letters. Even without substitution volume in 2013 would be clearly smaller than in 1991. Instead, in other segments the number of letters would have continued to increase without substitution. Indeed even in the B2B segment the amount of letters would be about double that of what it actually is. Without substitution the total amount of letters would be at the moment about 45 per cent greater compared to the present volume. Again, without substitution the total volume of letters since 1991 would have increased about 30 per cent, whereas in reality it has decreased ten per cent. Substitution has been the most significant single factor affecting the development of letter volumes during the last 20 years. This situation is depicted in Figure 7.

Figure 7. Actual and substituted letter volume in Finland 1991–2013.



5 Correlation between substitution and price elasticity

When demand for letters in different sender and receiver segments is studied, an interesting correlation between price elasticity and substitution becomes apparent (Nikali, 2011). It would seem that there is a significant negative correlation between the advancement of substitution and changes in price elasticity. Figure 8 shows how the elasticity of letter prices fluctuates in different segments with the advancement of substitution. The results are based on the demand models used formula (2) and represent mean price flexibilities for the periods 1991–2007, 1991–2009 and 1995–2013, as well as degrees of substitution for the years 2007, 2009 and 2013¹. In the figure, between the flexibility-substitution points, the logarithmic trend is also estimated.

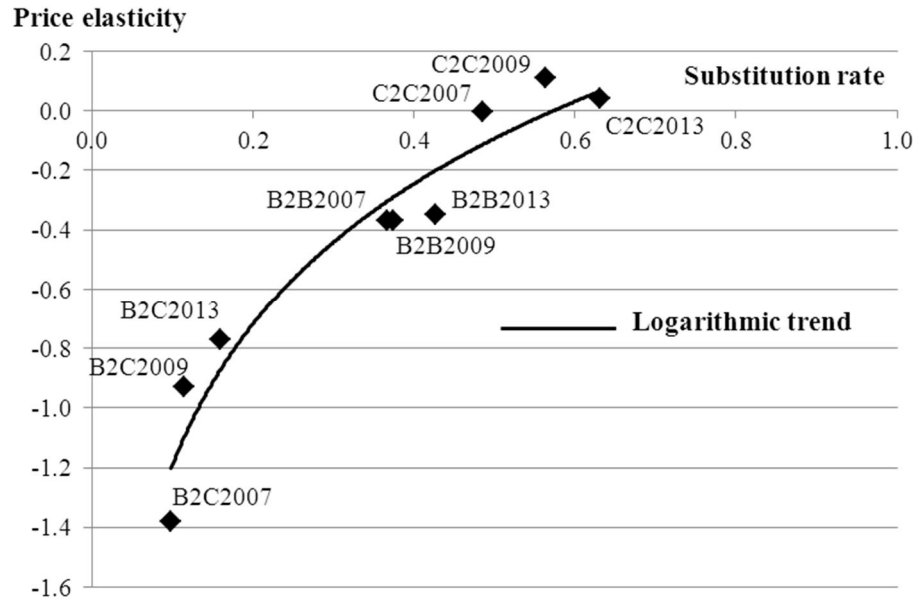
Substitution in the B2C segment is in its infancy, as already discussed in Section 4. Nevertheless, even a small advance in the rate of substitution has significantly decreased the price sensitivity of the letter services. Between 2007–2009 substitution in the B2B segment failed to advance at all and between 2009–2013 it advanced but quite slowly, but however price elasticity remained almost unaltered. In the C2C segment substitution has progressed rapidly since the turn of the millennium and at a quite steady speed. However, in all estimated models based on different time periods the price elasticity has been insignificant. As far as letters sent by consumers are concerned, we can speak of a service completely without price elasticity as discussed already in Section 3.

Of course, when the correlation between the substitution rate and price elasticity change using cross-segmental data is under discussion it must be borne in mind that those factors affecting demand vary according to the sender and receiver segments. Volume differences in mailing, factors affecting the choice of communication channel and the significance of the letter price to consumers and business were already discussed earlier, and all these have had their influence on price elasticity and its change. In addition to this we must remember that substitution and price elasticity are actually quite different in character. Substitution is a multidimensional, complex and not at all even process; however, it is a unidirectional and

¹ The substitution rate is 1-substitution degree (Figure 6). When the substitution rate is 0 no substitution has been realised. Value 1 for substitution means the complete progress of substitution.

long-term process. Price elasticity is by its very nature cyclical and symmetric, and very rarely are trend-related properties attached to it.

Figure 8. Interdependency between substitution rate and price elasticity for 1st and 2nd class letters in different sender and receiver segments in Finland 1991–2013.



What kind of formula could be applied to describe the price elasticity and substitution rate? Based on Figure 8 the formula should be as follows:

$$\beta_1 = k_1 r_1^{\alpha_1} \quad (3)$$

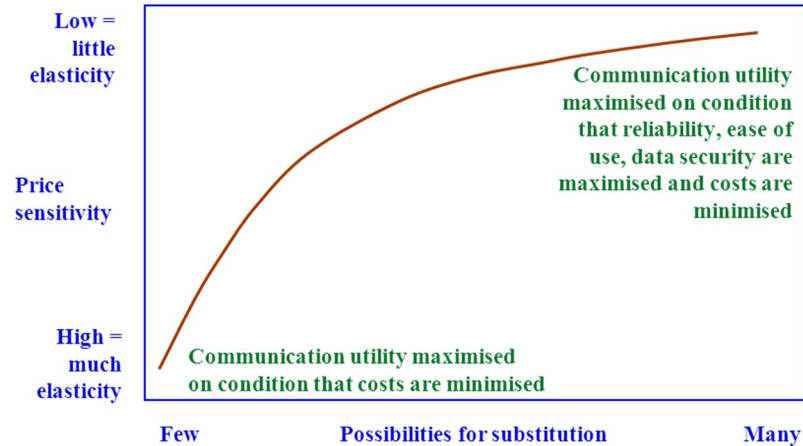
where β_1 = price elasticity, r_1 = substitution rate and k_1, α_1 = constants for the letter service l ($k_1 < 0$, $\alpha_1 > 0$ and $0\% \leq r_1 \leq 100\%$). The constants k and α vary according to the letter service (1st and 2nd class letters) and evidently also according to sender and receiver segment. The actual form of the formula can be determined by monitoring the development of demand for letter services throughout the entire process of substitution and estimating price elasticity at different stages in the progression of substitution. The problem is that in an analysis of this kind there is really very little data available and it would be a tortuous and long process to collect the data. The results of measurements presented in Figure 8 provide a simplified description of the dependency between price elasticity and substitution. The correlation between price elasticity and substitution progress is in principle presented in Figure 9.

As the possibilities of using channels that can replace the paper letter grow and begin to be implemented, the choice of communication channel is affected more by those factors related to usability than to the price of its use. If these possibilities did not exist, letter price sensitivity would be great. As substitution gains momentum, price sensitivity swiftly begins to diminish.

By comparing price elasticities between sender and receiver segments as well as development inside the segments, it will be observed that changes in price elasticity that accompany the advancement of substitution are remarkably clear and consistent. This inevitably leads to the impression that there is a

considerable negative correlation between the advancement of substitution and change in price elasticity: as substitution increases, price sensitivity diminishes.

Figure 9. Correlation between price elasticity and substitution.



6 Conclusions

In order for us to understand profoundly enough the factors in the real world affecting letter demand, modeling of total letter demand would not seem to suffice. Factors dependent on various sender groups and also different receiver groups can only be properly separated when we have at our disposal the sender and receiver demand volumes. Even essential demand factors may not be discovered in an analysis of total demand, because a factor having an impact in one segment can become dominant and overshadow a key factor in another. Letter demand and the factors affecting it in different sender and receiver segments differ substantially from each other. A good example of this is the process of substitution, which includes many differences in form and timing in the different segments.

Whenever the past or coming decade of the letter is talked about or studied, the focus of attention is fixed on reduction in volume and particularly the impact of new communication technology in this development. Since 2005, the volume of addressed letters has dropped in the Nordic countries by about 30 per cent and in Western Europe by about 25 per cent. The substitution of letters by electronic communication is the main reason for the reduction and it will also be the most imminent threat to the future of letter services. This is especially true in the B2C sector, because here substitution is only in its initial stages, and of all letters, about two thirds are sent in this sector. How enterprises continue to use letters when communicating with consumers will determine the whole future of letter communication. If electronic channels are applicable from the enterprise's point of view and are more cost-effective than letters, the cheapest mode of operation will be selected.

It would seem that there is a clear correlation between the progression of substitution and price elasticity: when there is little chance of replacing a letter with an electronic channel, as in the B2C segment, price is important as a selection criterion and its price elasticity seems to be great. After all, the sender of messages is hoping to minimize communication expenditure. Then again, when there are many alternatives for substituting the letter with other channels as there are for B2B and especially C2C, the most important selection criteria of the communicational channels are connected to the usability and

reliability of the channels. Price comes only after these factors, whereupon the significance of price elasticity seems to be clearly smaller than in the former case.

In choosing between different communication channels, price is no “medalist”. New technology must be easy to use, the communication channel reliable and communication data secure. All of these three factors are important for substitution: if these conditions are met, substitution is to be expected and price will lose much of its importance. Development seems to be as follows: the further substitution has progressed, the lower price sensitivity will be. This is especially apparent in the B2C segment in Finland. Substitution has started to advance only in recent years and even though for the time being it has been slow, the relevance of the price to letter demand has lessened, which is reflected in the diminishing of price elasticity

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