How to respond to declining volumes in postal price caps?

Christian M. Bender[*]*, Antonia Niederprüm*[†] *and Alex Kalevi Dieke*[‡]

Work in progress, do not cite!

Introduction

In many countries, postal regulators have implemented price cap regimes to allow more pricing flexibility and to provide incentives for postal operators for improving efficiency. In the price cap formula (CPI-X), the X-factor reflects expected productivity gains that usually reduce the scope of potential price increases such that average prices may only increase less than inflation (change in CPI). Today, most regulated national postal operators face declining letter volumes due to digitisation and e-substitution so that productivity gains resulting from innovations are compensated by reduced economies of scale and scope. Several European regulators have responded to the changing market conditions by revising and modifying their price cap regulations: either by reducing the scope of price regulated services or by setting negative X-factors. Brennan and Crew (2016) developed a theoretical approach to explicitly link price caps to volume declines by introducing an adjustment factor (Z-factor).

The paper consists of two parts. The first part compares price cap regimes and X-factors determined either by regulators or by legislators in selected European countries (Belgium, France, Germany, Portugal, and Sweden). We provide an overview of current price cap mechanisms and discuss how regulators address incentives for efficiency improvements on the one hand and losses in economies of scale and scope in the price caps on the other hand. The second part of the paper is dedicated to the Z-factor proposed by Brennan and Crew. This factor is based on two components: the elasticity of average costs and the price elasticity of demand. The paper discusses the Brennan-Crew approach and provides recommendations for its implementation and parametrization in regulatory proceedings. For this purpose, the paper presents an economic model that estimates percentage changes in average costs in letter operations depending on the per capita-volume. The percentage change in costs can be used to identify the first component of the Z-factor, the elasticity of average costs to reflect expected changes in average costs due to volume decline. For the second component, the paper summarizes recent studies on price elasticities for letter demand and the implication of the price elasticity on the Z-factor.

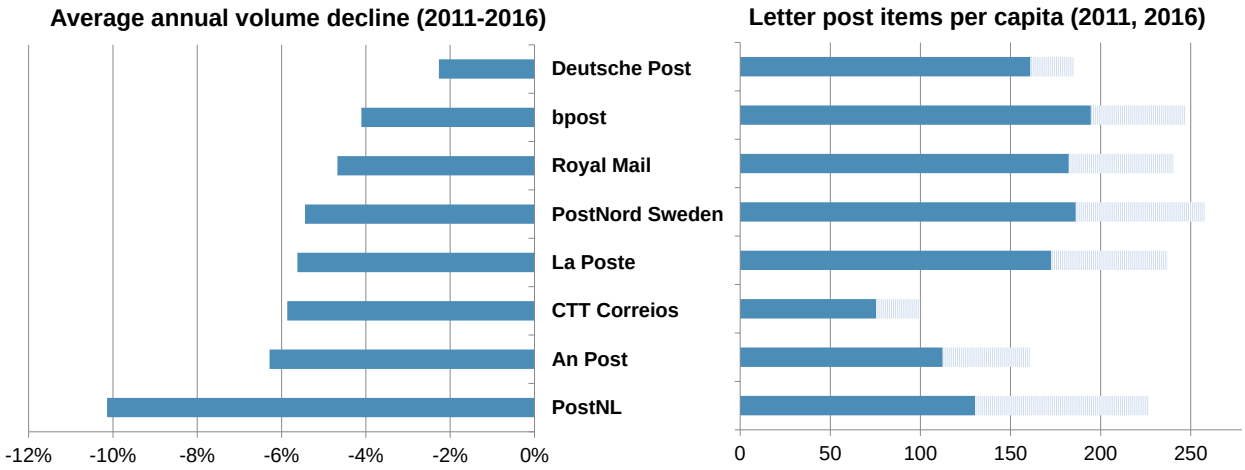
* Senior Economist, WIK Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste, c.bender@wik.org, corresponding author.
† Senior Economist, WIK.
‡ Director and Head of Department “Postal Services and Logistics”, WIK.

The paper concludes with an assessment that combines our findings from recent decisions on price cap mechanisms with our analysis of the Brennan-Crew approach. It gives recommendations for future price control decisions.

Development of postal markets and price caps in Europe

During the last decade, postal operators in Europe faced an accelerating decline in letter volumes (see Figure 1). While Deutsche Post faced moderate volume declines of around 2% p.a., other operators are confronted with accelerating decline in volumes. PostNL, for example, had an average decline in letter volumes of more than 10% each year since 2011. Some of this volume decline, in particular in the Netherlands and in Sweden, may be attributed to competition and does not reflect the development of the total letter market. However, the majority of volume decline is driven by the changes in customers' communication behaviour and e-substitution. As a result all operators lost significant shares of their volumes during the last years.

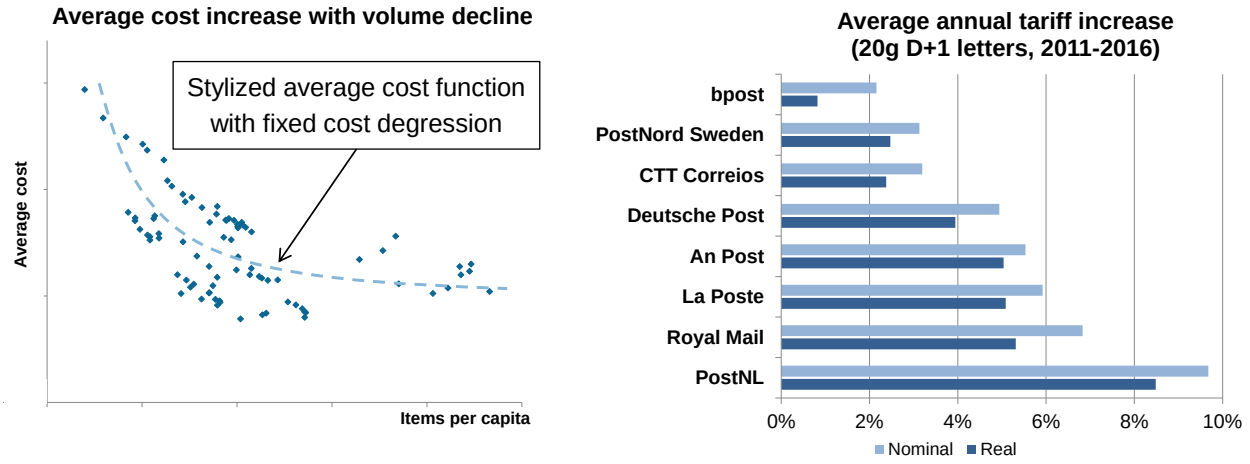
Figure 1 Per capita volume and volume developments of the national postal operators



Sources: Based on regulators' market reports and postal operators' annual reports, and Eurostat (population data).

The provision of postal services is characterized by substantial economies of scale and scope. A significant share of postal costs is fixed. Consequently, average costs decline with increasing letter volume and vice versa (see illustration of the stylized average costs function on the left-hand side in Figure 2). Moreover, the average costs function is not linear. The change in average costs due to volume decline depends on the initial level of per capita volume. Average costs increase slightly in case of initially high volume per capita (flat part of the function), while they explode in case of initially low per capita volume (steep part of the function). Postal operators responded to this increase in average costs by increasing their prices well above inflation (see Figure 2, right hand side).

Figure 2 Development of average costs and annual tariffs



Sources: Left figure: Bender et al. (2014), p.19; right figure: Based on public price lists.

In order to adjust prices to increasing average costs, postal operators require pricing flexibility, which is – to some extent – ensured by price cap regulations. The price cap usually refers to a bundle of postal services ("basket") which allows the regulated postal operator to rebalance the price structure of the basket services within the limits of the cap.

$$\Delta^{\%}P = \Delta^{\%}I - X$$

The allowed percentage change in prices $\Delta^{\%}P$ is determined by the change in inflation rate $\Delta^{\%}I$ (usually approximated by the percentage change of the consumer or retail price index) and the "X-factor". [1] The X-factor represents the projected change in the productivity of postal operations. A positive value of the X–factor results in allowed increases of the weighted average price below inflation. If the company manages to improve its productivity more than projected during the price cap period it can retain the realized "excess" profits. This incentive to improve productivity more than projected is considered as one of the major advantages of the price cap mechanism compared to the more short-sighted rate of return regulation. The effectiveness of efficiency incentives depends on the length of the price cap period and the credibility of the regulator's commitment not to change the price cap design during the term.[2]

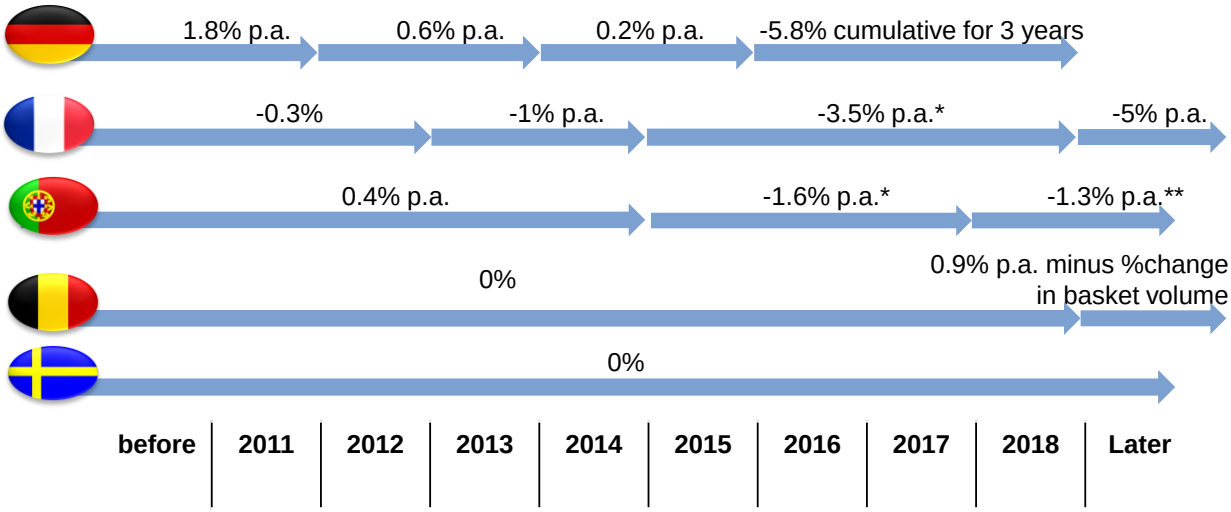
Accelerating volume decline and increasing average costs put the financial stability of regulated postal service providers at risk. Postal regulators in several countries have therefore responded to the changing market conditions by revising and modifying their price cap regulations. [3,4] While price cap mechanisms were often kept rather simple in times of growing mail volume, regulators decide to include volume, revenue and cost effects into the mechanism. Consequently, price

1 For the theoretical underpinning and the properties of price cap regulation see for example Beesley and Littlechild (1989); Littlechild (1986) para 10.21.
2 See for example Guthrie (2006); Armstrong and Sappington (2007), p.1606 sqq.
3 See Dieke et al. (2017).
4 See European Regulators Group for Postal Services (2014).

cap regulation became more complex in this dynamic environment that is characterized by changing costs and demand conditions of the regulated company during the price cap period.[5]

The X-factor, whose initial purpose was to incentivise productivity growth, was also used to incorporate the effect of volume decline on average costs. As a result, regulators have reduced the X-factors over time which even became negative in some cases. Negative values imply that assumed productivity growth was expected to be more than offset by increasing average costs due to volume decline.

Figure 3 Development of the X-factors in the German, French, Irish, Portuguese, Belgian and Swedish price cap over time



Source: BasedWIK based on NRA decisions (BNetzA, ARCEP, ANACOM) and Postal Law (BE, SE).

Notes: * Adjusted for actual volume and CPI developments: FR: 2017, 2018: -3.3%; PT: 2016: -0.6%, 2017: -1.2%
**Anacom's proposed price cap decision, consultation period extended

Figure 3 shows this development of X-factors at the examples of price cap decisions in Germany, France, Portugal, Belgium and Sweden. Over time, in four of the five countries X-factors became negative and the absolute value of the negative X-factor increased resulting in further tariff increases. Additionally, regulators implemented review mechanisms to allow adjustments of the price cap parameters during the price cap period.

In the German price cap regime the X-factor was 1.8% until 2011, i.e. obliging Deutsche Post to reduce their price level of the basket services each year. In 2012, the German regulator Bundesnetzagentur lowered the X-factor to 0.6% p.a. and in 2014 eventually to 0.2% p.a. In 2015, Bundesnetzagentur set a negative X-factor for the first time: the X-factor was set accumulated at -5.8% for the three years of the price cap period, i.e. allowing an increase of 1.9% per year on average. Additionally, Bundesnetzagentur implemented the opportunity to

5 See Niederprüm et al. (2016).

revise the price cap regulation in the case of 'significant' acceleration of letter volume decline in its 2013 price cap decision.[6]

A price cap regime has been in place in France since 2006 which takes into account the effect of volume decline on average costs based on projected volume developments. Between 2006 and 2014, there were relatively few changes in the application of the price cap. In 2014, however, ARCEP decided on substantial changes in the methodology. For the price cap period 2015-2018 an adjustment factor was introduced to take account of actual volume developments if they deviate from forecasts. During or after the second year of the price cap period, the adjustment factor is applied on request by either ARCEP or La Poste. In addition to adjustments requested by either party, a review of the price cap decision after the first two years of the four-year period has been introduced. If realized volume developments deviate from expected developments (of -6.3% p.a.), 70 per cent of the difference is taken into account for correction of the X-factor in the following year according to the formula given below.[7] This mechanism limits the impact of differences between forecasts and actual volume developments on the price cap, thus taking into account the uncertain nature of forecasts.

$$\Delta X_t = -0.7 * \left(Q^{forecast} - Q^{actual}\right)$$

In November 2017, ARCEP decided on the price cap parameters for the regulatory period 2019-2022. ARCEP replaced the 'variable' X-factor by a fixed X-factor of -5%to avoid adjustments during the price cap period, This X-factor incorporates both, the efficiency measure and the effect of volume decline on average costs.[8]

In 2015, ANACOM, the Portuguese regulator, introduced an X-factor in its price cap regulation which takes account of costs effects due to volume decline. They use volume forecasts to estimate the development of average costs. The price cap formula provides a build-in adjustment factor, the "traffic correction factor" (TCF), which adjusts the price cap each year for deviations between the projected and actual volume developments. With the TCF, the X-factor is adjusted each year by:[9]

$$TCF = \begin{cases} -1.9\% & if\ \Delta Q^{actual} - \Delta Q^{forecast} \geq 5\% \\ 0{,}375 * \left(\Delta Q^{actual} - \Delta Q^{forecast}\right) & \\ 1.9\% & if\ \Delta Q^{actual} - \Delta Q^{forecast} \leq -5\% \end{cases}$$

The TCF is based on the assumption on CTT Correios' cost elasticity. According to ANACOM's analysis, a volume decline of 10 per cent increases CTT Correios average costs by 7 per cent, i.e. the elasticity of average costs equals 0.7. In order to take account of the uncertain nature of forecasts and to share the risk of this uncertainty between Correios and its customers, only half

6 Bundesnetzagentur (2013), p. 34-35, p. 43-44. Note that the price cap was adjusted after two years due to legislative changes.
7 ARCEP (2014).
8 ARCEP (2017).
9 ANACOM (2014).

of the costs effect may be transferred to prices (0.5*0.7=0.375). Furthermore, ANACOM implemented a maximum and minimum adjustment.[10]

The approaches applied in Belgium and Sweden used to be very simple: the X factor being set to zero and the price cap generally followed inflation. In contrast to Germany, France and Portugal, the price cap approach is determined by decree without a fixed term and cannot be adapted by regulators' decision. Given the developments in the postal markets, the price cap mechanisms were subject to reviews in both countries recently:

Until 2017, the Belgian price cap was adjusted in line with the development of the Belgian Health Index (i.e. a modified consumer price index). Additionally, the Belgian postal operator bpost had the possibility to qualify for further price increases by outperforming a weighted bundle of quality of service targets.[11] In January 2018, a new postal legislation entered into force that determines a more sophisticated approach which takes into account efficiency improvements and the effect of volume decline on costs. The allowed price adjustment is now determined by

$$\Delta P \leq \left(\frac{I_{t-1}}{I_{t-2}} * \left(1 - \frac{\Delta Q_t^{forecast}}{1 + \Delta Q_t^{forecast}} - X * \sigma \right) - 1 \right)$$

with I_t as value of the Belgian Health Index, $\Delta Q_t^{forecast}$ as projected volume development of single-piece items, X as efficiency measure, and σ as efficiency sharing parameter. Given the proposed X-factor of 2.8 per cent and an efficiency sharing parameter of 0.33, bpost effectively faces an X-factor of (2.8 * 0.33=) 0.92 per cent p.a.[12] This formula allows bpost to translate a volume decline of for example 5 per cent into price increases of 5 per cent only corrected by a small reduction due to assumed efficiency gains. The Belgian legislator implicitly assumes that the costs do not vary with volume, i.e. the costs are completely fixed. The Belgian regulator BIPT concludes that given an estimated decline of 13 per cent by 2021, the price cap provides bpost with the opportunity for significant price increases in the future.[13]

In Sweden, the current price cap strictly follows historical inflation as recorded by the consumer price index. Additionally, there is some additional levy for the operator PostNord Sweden as it may round prices to the nearest 0.50 SEK (whereas the price cap itself remains at its level and will be adjusted from this level in future years). Assuming that input costs rise at the same rate as the consumer price index, PostNord Sweden fully bears the risk of average costs increases due to volume decline. In the past, however, the company successfully managed to reduce costs in pace of volume decline.[14] Recently, PTS proposed an adjustment of the price cap model by implementing a more sophisticated approach based on the theoretical model of Brennan and Crew, which is discussed below, to take account of the effects of volume decline

10 See ANACOM (2017).
11 See BIPT (2014).
12 See Belgian Loi relative aux services postaux entered into force 26 January 2018, Art. 19.
13 See BIPT (2017).
14 See WIK-Consult (2013b) or WIK-Consult (2015) for more information on efficiency efforts made by PostNord.

on average costs.[15] Although PTS and PostNord favoured the application of this approach, the government decided to maintain the current approach.[16]

To summarize, postal regulators reviewed and adjusted their price cap mechanism in the recent decade to consider the accelerating volume decline and its effects on average costs. The complexity of price cap mechanisms increased and more sophisticated approaches are applied. X-factors, which initially aimed at providing incentives for productivity growth, became in some cases a mixture of projected savings in average costs due to improved productivity and projected increases in average costs due to volume decline.

Typically, regulators consider the increase in average costs by adjusting X-factors based on volume forecasts of the operators. Consequently, the price cap parameters are under review and are potentially adjusted during the term if significant deviations between projected and actual volume developments emerge. The review of the parameters during the term may weaken the regulator's commitment on the price cap with negative effects on efficiency incentives.

The Z-factor proposed by Brennan and Crew (2016)

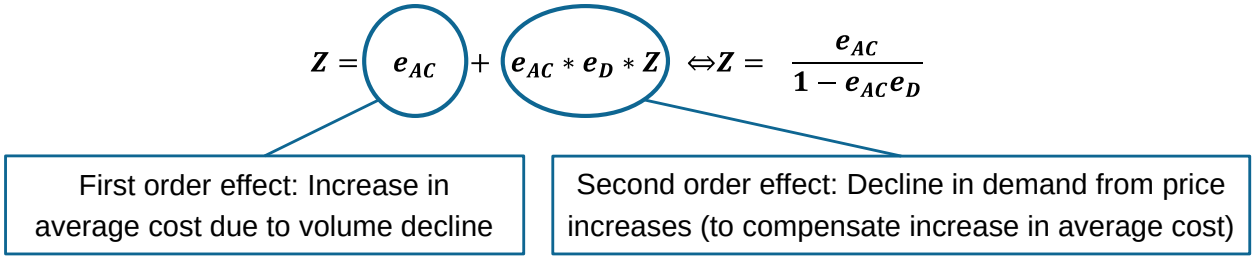
Timothy Brennan and Michael Crew proposed a revised price cap model which explicitly links the allowed price increase to the decline in demand by introducing a "Z-factor" and adjusts the price cap formula as follows

$$\Delta^{\%}P = \Delta^{\%}I - X + Z * \Delta^{\%}Q$$

with Z as adjustment factor and $\Delta^{\%}Q$ as volume development. This approach increases transparency by explicitly separating the price adjustment due to the projected productivity gains (X-factor) and the price adjustment to compensate the effect of volume decline on average costs (Z-factor).

15 SOU (2016); PTS (2016).
16 Postförordning (2010:1049) last update: 1 January 2018.

The proposed Z-factor takes into account two effects: the effect of volume decline on average costs and the second-order effect on demand following a price increase that compensates the increase in average costs. Brennan and Crew define the adjustment factor Z as follows[17]



Hence, two parameters determine ex ante the adjustment of the allowed price increase during the price cap period: the elasticity of average costs and the elasticity of demand.

The idea of implementing an adjustment factor is not new and already applied in many price cap regulations, not only in the postal sector.[18] A separate Z-factor additional to the X-factor is more transparent because it allows a separate consideration of efficiency-driven and volume-driven costs effects. Moreover, this mechanism helps to retain the incentive compatibility of the price cap by setting a credible commitment on costs-driven adjustments over the price cap period. This reduces regulatory uncertainty due to potential reviews during the term. An important question is therefore how this approach could be implemented in regulatory practice.

How to implement the Z-factor in regulatory practice

Following Brennan's and Crew's approach, regulators have to decide on two components: firstly the volume base and its development ($\Delta^{\%}Q$) and, secondly, the Z-factor. The Z-factor itself consists of the elasticity of average costs with respect to volume and the elasticity of demand with respect to price.

Volume base: Basket vs. total mail volume

Brennan and Crew's approach is based on a firm with one product being subject to a price cap. In postal practice, price caps usually refer to a subset of services, usually those relevant for consumers and small business senders. Regulators have two options for the volume base: the volume of basket services and the total volume of the regulated company including non-regulated services. Postal operations are characterized by significant economies of scale and scope because regulated and non-regulated postal services jointly use most elements of the postal value chain.

17 Brennan and Crew (2016).
18 See for example Sappington (2002).

Basically, the Z-factor shall take account for exogenous effects on costs ideally outside the control of the regulated firm.[19] Brennan and Crew implicitly assume in their approach that the decline in mail volume is fully outside the control of the regulated firm. In the postal context this is only partly true. Changing demand patterns due to digitisation are one important reason for volume decline outside the control of the regulated firm. But changes in (the basket) volume are not completely exogenous, particularly in the case that the price cap only includes a subset of provided postal services. Depending on the basket definition, there may be a risk that customers switch from services subject to price cap regulation to "non-regulated" postal services which may additionally reduce the basket volume. Moreover, the regulated firm may reduce the quality of service provision with potentially negative volume effects.[20] For these reasons we would recommend to use the total volume as volume base in price cap regulations instead of the basket volume. This would also imply to consider the effects of changes in total volume on total costs (and not only on the costs of the basket).

Volume developments: Past vs. forecasted developments

On the one hand, the use of past volume data results in a time lag and captures potential accelerations of the volume decline with delay. On the other hand, using forecasts is linked to substantial uncertainties and may require additional ex post adjustments in the one or the other direction if the actual development deviates significantly from the forecast. Moreover, regulators have often to rely on forecasts of the regulated firm (information asymmetry). This uncertainty and resulting ex post adjustments result in a commitment problem. For this reason we recommend to apply the most recent data on past volume developments, i.e. volume data of the last two available years.

The even more difficult task is the decision on the Z-factor itself which requires the determination of two key parameters, the elasticity of average costs with respect to volume (e_{AC}) and the elasticity of demand with respect to price (e_D).

Elasticity of average costs

The main purpose of the Z-factor is to capture the cost effects of exogenously driven volume decline. The question how costs change with volume is a recurring question in the discussion on the regulation of postal services. In 2013, WIK developed a model to estimate the financial impact of volume decline on the financial sustainability of universal service providers in Europe.[21] This model also provides a sound approach to estimate the elasticity of average costs. It is based on a general cost model of postal services developed by Cohen et al. (2002)[22] and Cohen et al. (2004)[23] that considers the relation between average unit costs and letter post volume per capita ('pieces per capita').

19 See for example Sappington (2002).
20 However, quality of service regulation in price cap regulations is a complex issue which should be generally taken into account in price cap regulations. See for example Sappington (2005).
21 WIK-Consult (2013).
22 Cohen et al. (2003).
23 Cohen et al. (2004).

The model distinguishes between costs of four activities and other costs: (1) mail acceptance and collection, (2) mail processing, (3) transportation, and (4) delivery. Other costs refer to activities (e.g. general administration) which cannot be directly or indirectly allocated to one of the four activities. The cost function of each activity consists of a volume-driven variable component and fixed component depending on the size of the network approximated by the population. The cost function of a stylized postal operator for activity i is therefore given by

$$C_i = \underbrace{\alpha_i Q}_{\text{variable costs}} + \underbrace{\beta_i P}_{\text{fixed costs}} .$$

The coefficient α_i determines the variable costs in relation to the letter post volume Q and the coefficient β_i the fixed costs in relation to the population P. It is a linear cost function that implicitly assumes continuous fixed costs, i.e. it neglects the possibility of step costs. In the model, total costs are the weighted sum of activity costs. The weights are given by the activity's share on total costs σ_i and read

$$C = \sum \sigma_i C_i = \sum \sigma_i (a_i\, Q + \beta_i\, P).$$

Average costs are total costs divided by letter post volume. Applying pieces per capita $q = {}^{Q}/_{P}$, the average cost function can be written as

$$AC_i = \alpha_i + \frac{\beta_i}{q} \quad \text{and} \quad AC = \sum \sigma_i \left(\alpha_i + \frac{\beta_i}{q}\right).$$

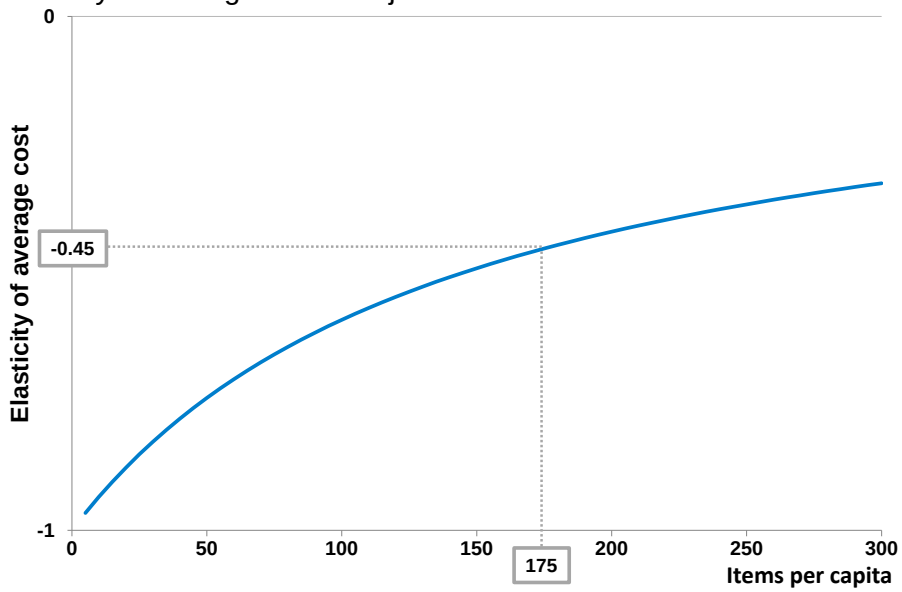
The elasticity of average costs with respect to volume then reads

$$\epsilon_{AC} = \frac{dAC}{dq}\frac{q}{AC} = \frac{MC}{AC} - 1 = \frac{\sum \sigma_i(-\beta_i)}{\sum \sigma_i(\alpha_i q + \beta_i)}$$

and depends on the variable cost coefficient α_i, the fixed cost coefficient β_i, the cost shares of the activities σ_i and the volume in terms of pieces per capita q. It can be shown that the relative change in average costs is independent from the absolute cost level.[24]

24 Given that several postal operators j have the same basic cost function that only varies in the cost level indicated by κ_j, e.g. due to different wage levels, the cost functions read $C_j = \kappa_j\, C$ and $AC_j = \kappa_j\, AC$. The elasticity of average costs remains $\epsilon_{AC} = {}^{\kappa\, MC}/_{\kappa\, AC} - 1$ for all operators.

Figure 4 Elasticity of average costs subject to volume decline



Source: Own figure.

Figure 4 illustrates the model results for a stylized postal operator. In this illustrative example the elasticity of average costs is -0.45 for 175 items per capita, i.e. a marginal volume decline would increase the average costs by 0.45 per cent. The example also shows that the elasticity of average costs increases (in absolute terms) with declining volume, i.e. average costs become more elastic. For example, if volume declines by 10 per cent, i.e. from 175 to 153 items per capita, the elasticity of average costs increases in absolute terms to 0.49.

The example is based on a model for a stylized postal operator. The network size (i.e. population) P and total costs C in this setup are normalized to 1. We used detailed data of the American postal operator USPS and literature reviews as starting point for the parametrization of the activity cost shares σ_i and related cost elasticities. We set the parameters for a stylized postal operator with 150 pieces per capita, which roughly corresponded to the average letter post items per capita in all EU Member States in 2012. Finally, we adjusted these parameters with support of an expert panel of PostEurop.[25]

For regulators, the model has the advantage to facilitate the estimation of volume-driven cost effects without having detailed information on the costs of the regulated company. The model produces useful indications on the effect of volume decline on average costs and it can be adjusted on specific operators to better reflect differences in costs shares and elasticities.

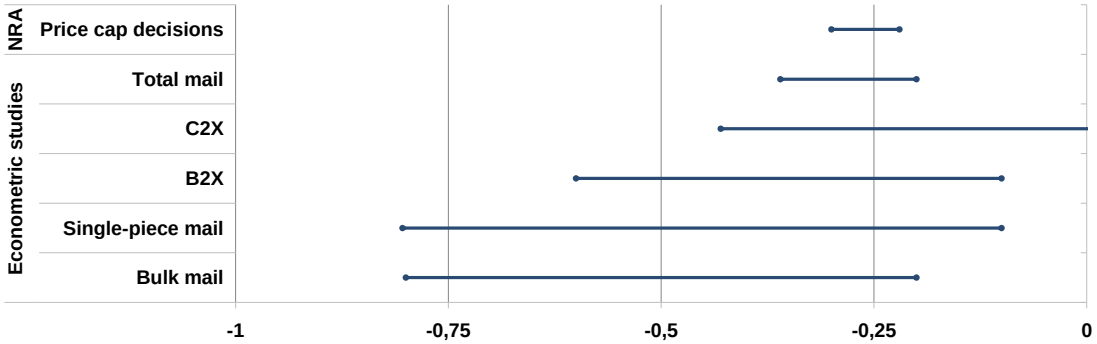
Elasticity of demand

Identifying the elasticity of demand (w.r.t. price) for postal services is a complex and expensive task. There are some econometric studies on the elasticity of demand for postal services which differ with regard to postal products considered, econometric approaches applied, underlying

25 See WIK-Consult (2013).

time series data, and results. They provide some general insights how demand for postal services responds to prices: Generally, demand for almost all letter services appears to be inelastic to price changes, i.e. a price increase will typically yield a less than proportional decrease in demand.[26] Other factors, for example the internet penetration and economic growth, seem to affect demand more than price changes. Empirical evidence also shows that the level of the price elasticity appears to depend on customer groups, e.g. private customers and bulk mailers, on service levels, e.g. first-class and second-class letters, and on content, e.g. correspondence and direct mail.[27] Finally, the level of the price elasticity varies with the level of aggregation: the price elasticity of aggregated services is lower than for single services because in the latter case the substitution between services has not been taken into account.[28]

Figure 5 Elasticity of demand (w.r.t. price) in econometric studies and regulatory decisions



Source: Based on econometric studies and NRA decisions.

Figure 5 shows an overview of the range of estimated price elasticities of demand presented in different econometric studies and price elasticities applied values in regulatory decisions. The ambiguity of results may require own estimations of price elasticities by postal regulators for covering the second order effect on volume as proposed by Brennan and Crew. However, the estimation of demand elasticities is generally a challenging task which requires times series data of letter volumes, prices and other relevant factors, i.a. GDP development, internet usage etc., to isolate the price effect on demand from other effects (including changing demand patterns due to electronic communication channels). Moreover, different economic models and econometric methods may lead to ambiguous and inconsistent results.

26 See for example Robinson (2007);
27 See Fève et al. (2006); Cazals et al. (2011); Veruete-McKay et al. (2011); Nikali (2014); Bozzo et al. (2014); Cigno et al. (2014); Nikali (2015).
28 See Cigno et al. (2013); Bzhilyanskaya et al. (2015).

Figure 6 The value of the Z-factor for different elasticities

Effect of price on demand: Weak → Strong

Share of fixed cost: Low → High

Z-factor		e_D 0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.7	-0.8	-0.9	-1
e_{AC}	**0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3
	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
	-0.4	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.7
	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.7	-0.7	-0.8	-0.8	-0.9	-1.0
	-0.6	-0.6	-0.6	-0.7	-0.7	-0.8	-0.9	-0.9	-1.0	-1.2	-1.3	-1.5
	-0.7	-0.7	-0.8	-0.8	-0.9	-1.0	-1.1	-1.2	-1.4	-1.6	-1.9	-2.3
	-0.8	-0.8	-0.9	-1.0	-1.1	-1.2	-1.3	-1.5	-1.8	-2.2	-2.9	-4.0
	-0.9	-0.9	-1.0	-1.1	-1.2	-1.4	-1.6	-2.0	-2.4	-3.2	-4.7	-9.0
	-1	-1.0	-1.1	-1.3	-1.4	-1.7	-2.0	-2.5	-3.3	-5.0	-10.0	

Source: based on Brennan and Crew (2016).

Figure 6 presents the results for the Z-factor subject to the elasticity of demand (w.r.t. price) and the elasticity of average costs (w.r.t. to volume). The shaded rows represent the estimated elasticities of average costs of the (uncalibrated) WIK model for a stylized operator with 100 items per capita ($e_{AC} = -0.6$) up to 200 items per capita ($e_{AC} = -0.4$). The shaded columns represent elasticities of demand used in past price cap decisions of regulatory authorities.[29] For example, an elasticity of average costs of -0.6 and an elasticity of demand of -0.3 would result in a Z-factor of -0.7, i.e. a volume decline of 10 per cent would increase the price cap by 7 per cent (plus inflation minus X-factor).

The numerical examples in Figure 6 illustrate clearly that for the presented range of elasticities the value of the Z-factor is largely determined by the elasticity of average costs whereas the effect of the elasticity of demand is relatively weak. The impact of the elasticity of demand on the Z-factor would become more perceptible for high elasticities of average costs. This is straightforward because a high elasticity of average costs is linked to very low volume levels. In this area the Z-factor could be absolutely higher than 1 which implies that a volume decline of 10 per cent would increase the cap by more than 10 per cent (and result in a vicious circle of volume decline and price increases).

The numerical examples in Figure 6 clearly illustrate that the value of the Z-factor is predominantly determined by the elasticity of average cost whereas the effect of the elasticity of demand seems rather negligible for the presented range of elasticities. Only for high elasticities of average cost, the impact of the elasticity of demand becomes relevant to some degree. This is straightforward as the slope of the average cost curve is steeper and any additional volume decline increases average cost further. Given the complexity to estimate elasticities of demand and the inconsistency of results the identification of the second order effect appears to be more

29 See ARCEP (2008); PostComm (2011); ComReg (2014).

challenging than the first-order cost effects. Moreover, if demand elasticities w.r.t. prices are considered to be low as applied in past regulatory price decisions they only have a weak effect on the level of the Z-factor.

Conclusions

All over Europe, postal operators face declining letter volumes and as a result an increase in average costs due to fix cost regression and loss in economies of scale and scope. With this development, financial sustainability of universal service providers is at risk. Price cap regulations have proven to be effective to control prices and provide operators with a substantial degree of commercial flexibility to better respond to market developments. Given the current trend of accelerating volume decline, regulators reviewed and adjusted their price cap systems to account for the effects of volume decline on average costs. Subsequently, postal price caps have become more complex than former price cap regulations. X-factors, which initially solely aimed to provide incentives to increase efficiency, became a mix of efficiency-driven costs savings and of volume-driven increases in average costs. Given the uncertain nature of future volume developments, regulators implemented adjustment mechanism to account for deviations between projected and actual volume developments and review mechanism, to adjust X-factors during the term of the price cap period. This weakens the incentives for efficiency improvements and creates additional regulatory uncertainty which may lead to a commitment problem.

Timothy Brennan and Michael Crew developed an approach which may help to avoid commitment problems due to (mid-term) reviews and to retain incentive compatibility. It improves transparency in price cap regulations by explicitly separating projected productivity gains (X-factor) and increasing average costs due to volume decline (Z-factor).

In order to implement this approach in regulatory practice, we recommend regulators to consider total volume development of all letter services. This ensures that economies of scale and scope in the postal value chain are fully taken into account. Moreover, we recommend using actual volume developments for the adjustment of the price cap. While this will imply some lag in the adjustment, the use of actual figures does not require any ex post adjustment and increases the commitment of the regulator not to change the price cap during the term. The most important parameter for the implementation of the Z-factor is the elasticity of average costs with respect to volume. The WIK model provides a sound approach to estimate this elasticity and can be adjusted in a simple and transparent way to produce more customized estimates for specific postal operators. Finally, the Brennan-Crew approach incorporates the price-driven demand effect on average costs. This second order effect is captured by the elasticity of demand. Given the complexity to estimate elasticities of demand and the inconsistency of results the identification of the second order effect appears less relevant at current market conditions.

References

ANACOM (2014), Decision on the Universal Postal Service Pricing Criteria.

ANACOM (2017), Critérios de formação dos preços do serviço postal universal para o período 2018-20.

ARCEP (2008), Décision n° 2008-1286 de l'Autorité de régulation des communications électroniques et des postes en date du 18 novembre 2008 sur les caractéristiques d'encadrement pluriannuel des tariffs des prestations du service universel postal

ARCEP (2014), Décision n° 2014-0841 de l'Autorité de régulation des communications électroniques et des postes en date du 22 juillet 2014 sur les caractéristiques d'encadrement pluriannuel des tarifs des prestations du service universel postal.

ARCEP (2017), Décision n° 2017-1252 de l'Autorité de régulation des communications électroniques et des postes en date du 26 octobre 2017 relative aux caractéristiques d'encadrement pluriannuel des tarifs des prestations du service universel postal sur la période 2019-2022.

Armstrong and Sappington (2007), Recent Developments in the Theory of Regulation, in Mark Armstrong and Robert Porter (eds.): Handbook of Industrial Organization, Volume 3, 2007, Elsevier, 1557-1700.

Beesley, Michael E. und Stephan Littlechild (1989), The regulation of privatized monopolies in the United Kingdom, RAND Journal of Economics, Vol. 20 No. 3, 454-472.

Belgian Chamber of Representatives (2017), Projet de loi relative aux services postaux, 10 October 2017.

Bender, Christian M., Alex Kalevi Dieke and Petra Junk (2014), Productive Efficiency of postal operators, WIK-Discussion paper no. 395.

BIPT (2014) Décision du conseil de l'IBTP du 8 Octobre 2014 concernant l'analyse de la proposition tarifaire de bpost des tarifs pleins a la piece pour l'année.

BIPT (2017), Avis du conseil de l'ibpt du 19 octobre 2017 concernant le projet de loi relative aux services postaux.

Bozzo, A. Thomas, Kristen L. Capogrossi, B. Kelly Eaking, John Picket und Mithuna Srinivasan (2014), Is demand for market dominant products of the United States Postal Service becoming more own-price elastic?, in Crew Michael A., Brennan Timothy J. (eds): The Role of the Postal and Delivery Sector in a Digital Age, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, 28-64.

Brennan Timothy J. and Michael A. Crew (2016), Price Cap Regulation and Declining Demand, in: Crew Michael A., Brennan Timothy J. (eds): The Future of the Postal Sector in a Digital World, Springer International Publishing, 2016, 1-17

Bundesnetzagentur (2013), Beschluss in dem Verwaltungsverfahren BK5b-13/001, Zusammenfassung von Dienstleistungen und Vorgabe von Maßgrößen für die Price-Cap-Regulierung für Briefsendungen bis 1000 Gramm ab 01.01.2014, Decision of 14 November 2013.

Bzhilyanskaya, Lyudmila Y., Magaret M. Cigno und Edward S. Pearsall (2015), A Branching AIDS Model for estimating U.S. Postal Price Elasticities, in Crew Michael A., Brennan Timothy J. (eds): Postal and Delivery Innovation in the Digital Economy, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, 91-113.

Cazals, Catherine, Jean-Pierre Florens, Leticia Veruete-McKay, Frank Rodriguez und Soterios Soteri (2011), UK letter mail demand: A content based time series analysis using overlapping market survey statistical techniques, in Crew Michael A., Kleindorfer Paul R. (eds.): Reinventing the Postal Sector in an Electronic Age, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, 91-108.

Cigno, Magaret M., Katalin L. Clendenim und Edward S. Pearsall (2014) in Crew Michael A., Brennan Timothy J. (eds): The Role of the Postal and Delivery Sector in a Digital Age, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, 46–64.

Cigno, Margaret M., Elena S. Patel und Edward S. Pearsall (2013), Estimates of US postal price elasticities of demand derived from a random-coefficients discrete-choice normal model, in Crew Michael A., Kleindorfer Paul R. (eds.): Liberalization of the Postal and Delivery Sector, Kluwer Academic Publishers, 76-88.

Cohen, Robert, Carla Pace, Antónia Rato, Matthew Robinson, Ricardo Santos, Gennaro Scarfiglieri, Vincenzo Visco Comandini, John Waller and Spyros Xenakis: 'Towards a General Postal Service Cost Function', mimeo, US Postal Rate Commission, 2003.

Cohen, Robert, Matthew Robinson, Gennaro Scarfiglieri, Renee Sheehy, Vincenzo Visco Comandini, John Waller and Spyros Xenakis: 'The Role of Scale Economies in the Cost Behavior of Posts', Wissenschaftliches Institut für Kommunikationsdienste (WIK), 8th Königswinter, 2004.

ComReg (2014), Response to Consultation and Decision on price cap control for universal postal services, ComReg 14/59 and D05/14, 18. June 2014.

Dieke, Alex, Christian M. Bender and Sonja Thiele (2017), International Price Regulation, WIK-Consult, Bad Honnef, appendix to: U.S. Postal Service Office of Inspector General (2017), Lessons in Price Regulation from International Posts, Report no. RARC-WP-17-003.

European Regulators Group for Postal Services (2014), "ERGP report on tariff regulation in a context of declining volumes", Draft report of November 2014

Fève, Frédérique, Jean-Pierre Florens und Sophie Richard (2006), Microeconomic de-mand mod-elling for price elasticities, in Crew Michael A., Kleindorfer Paul R. (eds.): Liberalization of the Postal and Delivery Sector, Kluwer Academic Publishers, 355-366.

Guthrie, Graeme (2006), Regulating Infrastructure: The Impact on Risk and Investment, Journal of Economic Literature, Vol. 44, pp. 952-972.

Littlechild, Stephen (1986), "Economic Regulation of Privatised Water Authorities: A report submitted to the Department of Environment", 26. January, London: HMSO.

Niederprüm, Antonia, Christian M. Bender and Alex Dieke (2016), Scale economies and postal price caps in Europe: Declining volumes, lower productivity, higher postage? In: Crew Michael A., Brennan Timothy J. (eds.): The Future of the Postal Sector in a Digital World, Springer, 18-28.

Nikali, Heikki (2014a), Character of Substitution and Its Significance for Letter Demand: The Finnish Case, in Finger, M., Bukovc, B. und Burham, M. [Hrsg.]: Postal Services in the Digital Age, Ios Press: Amsterdam, 15-29.

Nikali, Heikki (2014b), Sender-receiver-segment-based demand analysis for letters, Paper präsentiert auf der Koferenz 'The Economics of the Postal Sector in the Digital World' Toulouse, April 2014.

PostComm (2011), The building blocks for a sustainable postal service – Initial proposals for regulatory safeguards, April 2011;

Postförordning (2010:1049)

PTS (2016), PTS remissvar på delbetänkandet Som ett brev på posten – postbefordran och pristak i ett digitaliserat samhälle. Answer to official referral, Swedish Post and Telecom Authority, Stockholm.

Robinson, Alan (2007), A review of price elasticity models for postal products, Pitney Bowes Research „The Future of Mail", 2007-1.

Sappington, David E.M. (2002), Price regulation and incentives, in Sumit Majumdar, Ingo Vogelsang, und Martin Cave (eds.): Handbook of Telecommunications Economics 1, North-Holland: Amsterdam, Chapter 5.3, 225-293.

Sappington, David E.M. (2005), Regulating service quality: a survey. Journal of regulatory Economics, Vol. 27 (2), 123–154.

SOU (2016), Som ett brev på Posten – postbefordran och pristak i ett digitaliserat samhälle, Government Official Inquiry, SOU, Stockholm;

Veruete-McKay, Leticia, Soterios Soteri, John C. Nankervis, Frank Rodriguez (2011), Letter Traffic Demand in the UK: An Analysis by Product and Envelope Content Type, Review of Network Economics, Vol. 10(3), September 2011.

WIK-Consult (2013), "Main Developments in Postal Sector (2010-2013)", Study for the European Commission, Directorate General for Internal Market and Services.

WIK-Consult (2013b), "Review of Postal Operator Efficiency", Study for the British regulator Ofcom.

WIK-Consult (2015), Review of Australia Post Efficiency Program in light of international benchmarks, Study for the Australian Competition and Consumer Commission.