Relevance of the chain of substitution argument in merger regulation of the telecom market

Bachelor Thesis

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ABSTRACT

In this thesis I investigate the chain of substitution argument in an economic model, as currently there exists no literature doing this. I find that if there exists a chain of substitution as described in the European regulation this does not strictly increase competitive pressure. The latter depends on the demand of the market considered relative to other markets. Furthermore, I find that mergers on these markets strictly increase price and that the magnitude of the price increase depends on the height of demand of the market where the merger takes place. Finally I show that a merger on a market when already a lot of mergers have taken place should be seen as less favourable to a merger when not many mergers have taken place yet. I conclude that competition authorities should be very careful in using the chain of substitution argument as it is not in general supported by economic theory.

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1. Introduction

In this thesis I will discuss the relevance of the chain of substitution argument in the regulation of the telecom market. This argument is used in regulation and merger cases, however there is basically no literature providing the economic foundation for the use of this argument. Therefore, I will show an economic model to analyse the chain of substitution effect. Furthermore, I will show how mergers should be evaluated in such a model. First in this part I will provide an introduction on the regulation concerning the chain of substitution argument, show some literature mentioning it and illustrate an interesting case example on the Dutch telecom market.

According to the European Commission (EC) guidelines for determining the market in competition policy, the main goal of defining the market is systematically identifying the competitive pressure that a firm faces.[1] A distinction is made between the relevant product and relevant geographic market. The relevant product market consists of all those products that are regarded as substitutes by the consumer because of characteristics, price or intended use. The relevant geographic market is defined as 'the area in which the undertakings concerned are involved in the supply and demand of products or services, in which the conditions of competition are sufficiently homogeneous and which can be distinguished form neighbouring areas because the conditions of competition are appreciably different in those area'[2]. The guidelines then describe that there are three main sources of competitive constraints: 'demand substitutability, supply substitutability and potential competition'[3]. Apart from discussing the relevant issues concerning these points, the commission refers to some additional things that should be taken into consideration. One of them concerns the topic of this thesis: the chain of substitution argument. The guidelines explain that for the existence of substitutability between product A and C, it is not necessary for the products to be direct substitutes. When there exists a product B which is a substitute for product A as well as product C and thus falls within the same product market, product A and C do in fact exert competitive pressure on each other through B. This does not necessarily only involve product categories, but also geographic markets. This argumentation is also mentioned in the guidelines on 'market analysis and the

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[1] EC (1997) point 57-58
[2] EC (1997) point 8
[3] EC (1997) point 13

assessment of significant market power under the Community regulatory framework for electronic communications networks and services'[4]. We thus see that the general point in the guidelines of the EC is also named in the specific guidelines for the analysis of market power in the electronic communication network and services market. In a footnote[5] the guidelines refer to an example telling chain of substitution effects can occur when prices of firms on geographically separated markets are bound by a firm that offers service on national scale: 'This may be the case where the prices charged by undertakings providing cable networks in particular areas are constrained by a dominant undertaking operating nationally'[6]. In the guidelines it is also stated that to extend the market definition according to the above-mentioned point there are two main conditions. First, the price levels at the end of the chains must be similar. Second, thorough supporting evidence is necessary. The guidelines thus state that actual evidence is necessary to make use of the chain of substitution argument and part of this evidence is that the final price levels should be similar.

According to Baarsma and Theeuwes (2002) the Dutch competition authority NMa follows the guidelines of the EU. They also find that the NMa used the chain of substitution argumentation in merger cases 'Laurus-Groenwoudt' and 'Schuitema-Sperwer'. Here the NMa concluded that due to a chain of substitution effect the market is of national size. On a European level the argument has for example been used for defining the market in the case of TotalFina/Elf in France[7]. In this case the EC concluded that there exists a single market for motorway fuel sales 'Even supposing that urban areas actually form a natural frontier between motorways, motorway interconnection would then mean that three possible relevant markets could be defined, on each of which there is a chain of substitutability resulting in one distinct market'. This means that although three distinct geographical markets could be defined, there exists one single market because of a chain of substitution effect. Thus, the chain of substitution argument can have a large influence on the market definition used, as through a chain of substitution the actual market could be much larger than without using this argumentation.

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[4] EC (2002)
[5] EC (2002) footnote 49
[6] EC (2002) footnote 49
[7] Commission decision (2002)

It turns out that the argument of a chain of substitution is also used by the Dutch regulator of the telecom sector (OPTA) in its reports as well as in court. Therefore, I will first describe the situation on the Dutch telecom market, as this is an interesting case. This case will also be used occasionally throughout this thesis to illustrate some of the conclusions and to provide some intuition. On the Dutch market for digital and analogue television there are different local cable providers. These providers each have their own region, and consumers within this region are not able to choose between different cable providers, as there is only one cable provider per region. This means that practically the country is divided in several markets with one cable provider. However, there could be competition as there is for example a service from KPN called Digitenne. Digitenne, which works with an antenna instead of cable, is available throughout all of the Netherlands. If the chain of substitution argument is valid, there could be competitive pressure of cable providers in one of the regional markets on cable providers in another regional market. Note that this real case example is very similar to the example mentioned in the guidelines as explained above.

Now I will describe some cases where the argument was actually used. For example in the court case on the market investigation by OPTA of the wholesale market for radio and television signal transmission the firms UPC, Ziggo and Delta argued that the geographic market should not necessarily coincide with the area of service of the different providers. The judgement states that it is important that there are alternative operators that are nationally based, however it also states that this is not decisive. OPTA states that there is no reason to believe that the cable firms are indirectly competing because there are differences in price, the development of market share and product strategy. Concerning the differences in price I will show later that this could actually indicate a chain of substitution. OPTA argued that there were differences in each of these three and thus the demographic markets should coincide with the area of service of the different providers. The judge however, concluded that on each of these three points differences had not been made clear enough and therefore it has not been made clear enough that there is no (indirect) competitive pressure between the cable providers. Recently there also was also the recent pressure on KPN and Caiway not to merge, since the NMa expected that KPN would get a too strong position. The definition of the relevant market is very important in this case and if the market was to be defined as of national scope the merger would more likely to be allowed than if the relevant market is defined as of regional scope.

These cases are interesting as they show that the chain of substitution argument is actually seen as relevant by both OPTA and the court, although it should of course be thoroughly argued for. The latter is also mentioned in the EU guidelines for competition authorities as I showed above. However the question rises how relevant this argument is on economical grounds. Does economic theory support this argument? And would it be appropriate to use this in regulating mergers on the telecom market?
The chain of substitution argument is used in practise, but it is not yet proven to be relevant by economic literature as there is practically no literature examining this argument. Schwarz (2007) argues that 'in addition to demand- and supply-side substitution at the wholesale level'; the size of the market may also depend on substitution in retail. Schwarz argues that both demand- and supply-side substitution forces could be strong enough to make a 5-10% price increase on the EU wholesale broadband access market unprofitable. The main point is that although on a wholesale level company A and B might sell to different retailers, these retailers compete with each other which implies that effectively company A and B also compete.
Furthermore Beckert (2010) suggest a demographic market definition where chain of substitution effects are taken into account. He formalizes an 'empirically implementable framework for the definition of local antitrust markets in retail markets'. The setup of the model allows for different classes of competitors for a certain store depending on how much they are linked to other stores and customers. According to Beckert 'this essentially maps out a topography of competition around a given store or a chain of substitution'.
The above shows that the literature is mentioning the chain of substitution, but there is no research done on finding theoretical evidence for the use of the chain of substitution argument in competition policy. Therefore in this paper I will evaluate what the relevance of the chain of substitution argument is in merger regulation of the telecom market. The model is based on the situation of the Dutch telecom market, but the model can also be used for other situations that are similar.

In the next part of this paper I will first discuss the model and assumptions used to evaluate the chain of substitution argument. In part 3, I will use the simple version of the model discussed in section 2 and discuss the solutions of this model. I will do this for both the price- and quantity-setting model. In part 4 I adapt the model to make it more realistic and introduce a national strategy for the national firm, as to make a link between the two markets considered. Here I will focus on the price-setting model and first analyse what happens when markets are equal, next when markets are differentiated and last generalise the latter findings to *k* markets. In part 5, I will use the findings of the last section of part 4 to analyse mergers in this setting and discuss two research questions: what the effect of a merger is on other markets and what the importance is of the number of markets where a merger has already taken place. In the last part I will give some final conclusions and recommendations concerning the evaluation of the chain of substitution argument and mergers in these types of markets.

2. Model

In this thesis I will evaluate two models, one where price is the strategic variable and another where quantity is the strategic variable. The model is based on the case of the Dutch market for television signal, but could be used in other markets having similar characteristics.

In the model I will consider three firms and two geographical markets. On each market two firms are active. Later I will generalise this to *k* market. There are two different types of firms: the national firm and the regional firm. Logically there is one national player and one regional player on each market. The national player is active in both markets whereas the regional players serve one of the markets each.

Figure 1 below illustrates the model. The two different geographical markets are not overlapping and both of the regional firms are active in only one of the two different markets. Relating this to the Dutch market for television signals, the national firm would be KPN's Digitenne and the regional firms the cable providers active in different regional markets.

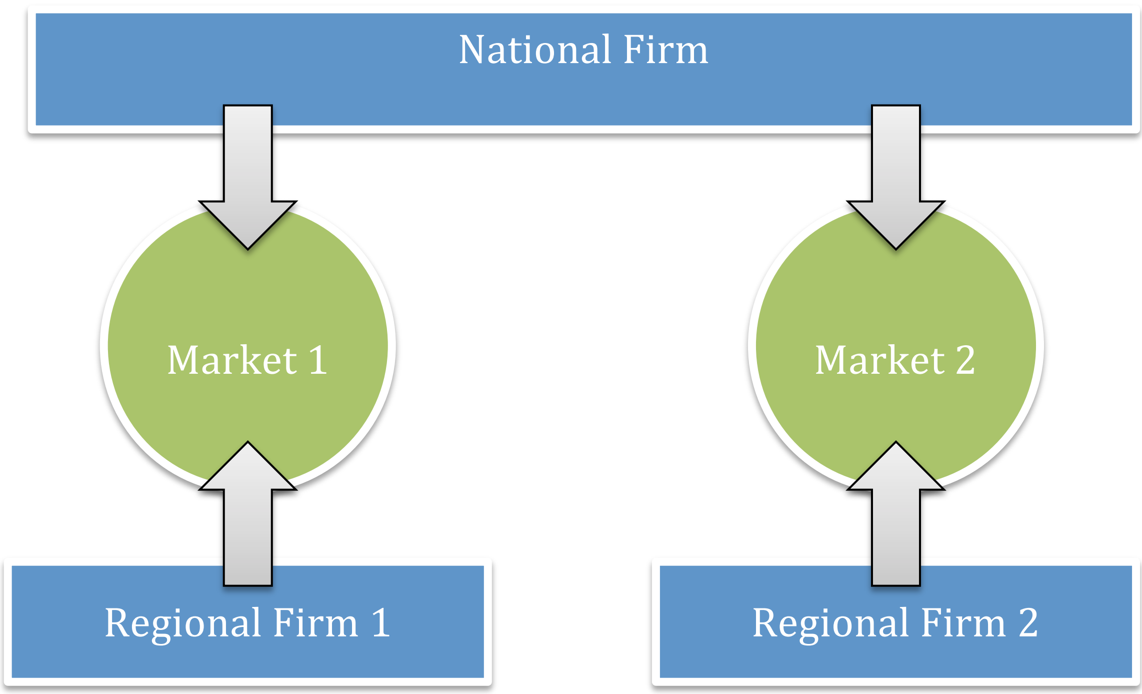

Figure 1

To begin with, I will assume that market 1 and market 2 are identical in everything but their geographic location. I will also assume that all firms have the same and constant marginal cost. The national firm and the regional firm will choose price or quantity simultaneously and the national firm chooses its strategic variable simultaneously for both markets. Later I will introduce demand heterogeneity and generalise the findings to k markets.

3. Simple model

In this part, I will first discuss a very simple price and quantity-setting model as outlined in the former section and make refinements to give a more realistic view in the next parts. The first part will state the properties of the models and in the next part I will discuss the solutions.

3.1 Characteristics

In this section I will introduce the specific model used in this part based on the general description above. First for the model with quantity as strategic variable and second for the model with price as strategic variable. This section will thus provide a more technical description than the general description in part 2. This technical description is necessary to show the results that follow in the next sections.

3.1.1 Quantity as strategic variable

The basics of the model are outlined in part 2. I will consider a normalised demand curve with homogenous goods:

$$q_{ij} = a - p$$

with $i \in (r, n)$ for national and regional firm respectively and $j \in (1,2)$ for market 1 and 2. All the firms have identical and equal marginal cost *c.* The profits of the regional firms can then be written as:

$$\pi_{rj} = (a - c - q_{rj} - q_{nj})q_{rj}$$

where *r* indicates that we consider one of the regional firms and *i* is as indicated above. The profits of the national firm can be written as follows:

$$\pi_n = (a - c - q_{r1} - q_{n1})q_{n1} + (a - c - q_{r2} - q_{n2})q_{n2}$$

The total quantity chosen by the national firm $q_n$will be the sum of q_{n1} and q_{n2}.

3.1.2 Price as strategic variable

The general characteristics are still as described in part 2. For this section with price as strategic variable I will assume differentiated goods, as with price setting models the homogenous goods variant is not very interesting in this case. Again I assume marginal cost to be the same and constant for all firms and equal to *c*. The general demand curve is:

$$q_{ij} = a - bp_{ij} + gp_{vj}$$

with $i \in (r, n)$ for national and regional firm respectively, $j \in (1,2)$for market 1 and 2 and $v \in (r, n)\ with\ v \neq j$. For simplicity I will use b = 2 and g = 1, which also ensures that prices to infinity cannot be optimal. The profit function of the regional firm is than as follows:

$$\pi_{rj} = (a - 2p_{rj} + p_{nj})(p_{rj} - c)$$

And the profit functions for the national firm:

$$\pi_n = (a - 2p_{n1} + p_{r1})(p_{n1} - c) + (a - 2p_{n2} + p_{r2})(p_{n2} - c)$$

3.2 Analysis

In this part I will discuss the solutions of the quantity and price setting models respectively. Based on the profit functions I will analyse what the effects of this model are for prices and quantity sold on the market.

3.2.1. Quantity as strategic variable

Optimizing the profit function of the regional firm gives the following first order condition (FOC):

$$q_{rj}^* = \frac{a - c - q_{nj}}{2}$$

The optimal quantity for the national firm is:

$$q_n^* = \frac{a - c - q_{s1}}{2} + \frac{a - c - q_{s2}}{2}$$

The symmetry of firms implies that the regional and national firm will both choose equal quantities on the respective markets. However this can also be shown mathematically by plugging in the optimal quantities of the two regional firms into the optimal quantity choice of the national firm and plugging in the optimal quantity of the national firm on the relevant market into the optimal quantity of the regional firm. Some algebra will show that:

$$q_{rj}^* = \frac{a - c}{3}$$

The national firm will choose this quantity on both markets and therefore chooses a total optimal quantity:

$$q_n^* = \frac{2(a - c)}{3}$$

This is just the standard Cournot outcome; the price established on this market is also the standard Cournot outcome:

$$p_{ij} = \frac{a + 2c}{3}$$

From the above we see that both firms behave the same, choose equal quantities and that the market quantity and price coincide with the standard Cournot outcome. Under the current assumptions it is optimal for the national firm to choose equal quantities on both markets. From the first q_n^* above we can also see that the national firm is optimizing both markets independently or in other words, the behaviour of regional firm 2 has no influence on the choice of quantity on market 1 of the national firm and vice versa.

3.2.2 Price as strategic variable

In this section I analyse the model with price as strategic variable. The reaction functions of the regional and national firms are respectively:

$$p_{rj}^{*} = \frac{a + p_{nj} + 2c}{4}$$

$$p_{nj}^{*} = \frac{a + p_{si} + 2c}{4}$$

As the markets are symmetric and all firms have equal and constant marginal cost it follows that the national firm asks the same price on both markets and equal to the price of the regional firm. Again this can also be shown by substitution and simplifying. The quantity and price results of the model coincide with the outcome in the quantity setting game:

$$p_{ij} = \frac{a + 2c}{3} \ and \ q_{ij}^{*} = \frac{a - c}{3}$$

This is a result of the parameter choice made in the model section. As I chose *b =1* and *g = 2* and the firms will ask equal prices, the demand function used boils down to the same demand function as used in the quantity setting part. Therefore the above result is not surprising. The conclusion is also similar to the one in the former section, the national firm optimises the price in both markets separately and there is no competitive pressure of the regional firm on market 1 on the regional firm on market 2 and vice versa. I conclude that for this model it does not matter whether price or quantity is used as strategic variable, as the final results (market price and quantity) are equal in both cases.

3.3 Discussion

As from both of these simple models I find no evidence for the chain of substitution argument. The national firm maximises its profits for both markets, as do the regional firms. In this simple setting the actions of regional firm 1 will not have any influence on the actions of regional firm 2 and vice versa. For the quantity-setting case this can be seen from the reaction function q_n^* above. Suppose the regional firm changes its quantity q_{r1}, then the national firm will change its quantity for market 1, but its optimal choice for market 2 will not change. The same holds for the optimal price in the price-setting model. Optimally, the national firm will set prices independently for the two different markets, which can be seen from p_{nj}^* above. Analogously, if the regional firm 1 changes its price the national firm will adapt its price on market 1, but not on market two and vice versa.

According to the EC guidelines similar prices would be necessary for the chain of substitution effect. The EC thus argues that similar prices could indicate that the two markets exert competitive pressure on each other, however (at least) in this case the equal prices on both markets are merely due to the fact that we assumed the markets to be exactly equal. The demand functions for market 1 and market 2 are exactly equal, which is causing the price equality in this case.

From the above I conclude that in a situation characterised by this simple model, the chain of substitution argument would not be valid to use in determining the size of the market. In this setting it is not supported by the model and should therefore not be used to extent the market definition. The market should be defined as local and not national as the two markets exert no competitive pressure on each other.

These results could be expected as in the model now there is not really a relationship between what the national firm does on market 1 and what it does on market 2. The assumptions of the model above, especially equal demand functions for the two markets, are quite restrictive. In the next part therefore, I will adapt some of the assumptions to make the model fit reality better.

4. Model with national strategy

For the basic model I have made a lot of assumptions some of which might not be very realistic. Therefore, in the next part I want to relax some of the assumptions and see how the results change. From the former section it seems that the choice of price or quantity as strategic variable has no influence on the results with the chosen demand functions. For the rest of this thesis I will therefore consider the price model only. Price also seems like a more natural choice of strategic variable, as the capacity of the cable providers will be largely fixed; competition is likely to be mainly in prices. Tirole (1988) states that the Bertrand model ‘may be a better approximation for industries with flat marginal costs’. On the short run capacity is likely to be largely fixed in the telecom industry and marginal cost will than be quite flat. Deneckere and Davidson (1985) argue that when evaluating mergers, price is a ‘much more natural strategic variable than output’.

For the rest of this part I will first introduce the characteristics of the model used here and afterwards analyse and discuss the new results.

4.1 Characteristics

In the price setting model I already allowed for differentiated goods to make the model interesting. In case of homogenous goods we would get the standard Bertrand outcome of equal prices and prices equal to marginal cost. In the next part I will add some assumptions to this model to make it better reflect the actual situation.

From the discussion in section 3.3 we can see that basically there is no chain of substitution effect as the national firm optimises the two markets separately. Therefore, to make the model more interesting I will also add an additional assumption, which is that the national firm is not allowed to ask different prices on the different markets. This seems reasonable as a it would most likely not be feasible if for example Digitenne would cost 15 euro per month in one province and 10 euro per month in another.

Another point of critic to the model in part 3 could be that the assumption that both markets are exactly the same is not very realistic. Therefore, as an addition I will introduce heterogeneity on the demand side. This incorporates that there may be differences between for example the Randstad provinces as Zuid-Holland, Noord-Holland and the far less densely populated areas such as Friesland and Groningen. For simplicity I will incorporate the demand heterogeneity by introducing a different constant for the relevant markets resulting in a new demand function:

$$q_{ij} = a_j - 2p_{ij} + p_{vj}$$

with *i, j* and *v* as defined in part 3. This leads to the following profit functions:

$$\pi_n = (a_1 - 2p_n + p_{r1})(p_n - c) + (a_2 - 2p_n + p_{r2})(p_n - c)$$

$$\pi_{rj} = (a_j - 2p_{rj} + p_n)(p_{rj} - c)$$

To summarise, the two markets are now not considered to be equal anymore. This is incorporated by making a of the demand functions dependent on the market and the national firm can only charge one price for both markets. However, to see if the assumption of demand heterogeneity is influential to the result as well, in the next part I will first analyse what happens when $a_1 = a_2$ and afterwards when $a_1 \neq a_2$.

4.2 Analysis

Similar to in the basic model part, in this part I will discuss the solutions of the models set out above. To start with I will again look at what happens when we consider two markets. In the first section I analyse what happens if the national firm chooses a national strategy, but with equal markets. In the second section I relax the assumption of equal markets as described in the former section. In the third section I generalise the model to *k* markets to show that everything discussed also holds within this general model, which does not make assumptions about the number of markets.

4.2.1 National strategy with equal markets

Optimising the profit function of the national firm gives the following reaction function:

$$p_n^* = \frac{2a + p_{r1} + p_{r2} + 4c}{8}$$

Different from what we have seen earlier (section 3.2.2) the national firm now takes into account the price of both regional firms. This result is quite logical as the national firm must now set one price for both markets, its optimal price will be dependent on the prices of both regional firms. The reaction function of the regional firm is the same as in section 3.2.2. Calculating the equilibrium price gives the following result:

$$p_n^* = \frac{a + 2c}{3}$$

$$p_{rj}^* = \frac{a + 2c}{3}$$

From this we can see that even though the national firm's optimal price is dependent on the price of regional firm 1 and regional firm 2, the equilibrium prices of the regional firms have no influence on each other. We also see that the prices of the regional and national firm are equal, and the prices on both markets are equal. The fact that the national and regional firm have the same equilibrium price follows from the assumption that marginal cost for both firms are equal. Given the market demand it is than for both firms optimal to ask the same price. The optimal price in equilibrium of the regional firm (p_{rj}^*) is also equal to what I found in section 3.2.2. Therefore in this case it does not matter for the regional firm whether the national firm has to choose a national strategy or not. With equal markets the resulting price will not differ.

More interesting is why there is no influence of the price of regional firm 1 on regional firm 2 and vice versa. This follows form the assumption that the two markets are equal. As both markets are equal it is optimal for the national firm to set the same price for both markets. The strategies of the regional firms are also equal as the two different geographical markets they are active on are equal. I conclude that from the above it follows that in case of two equal markets, with the national firm restricted to one strategy for both markets, there is no chain of substitution effect. This means that the price of the one regional firm does not put competitive pressure on the price of the other regional firm. Moreover, this would mean that when the different markets are similar enough there is no reason to worry about the chain of substitution argument. When markets are similar prices will be equal, so empirically when you find (roughly) equal prices across markets the chain of substitution effect is unlikely to hold.[8]

4.2.2 National strategy with differentiated markets

In this section I will show what happens with the optimal price of the national and regional firm when there is difference between the two markets, as indicated by a_j with $j \in (1,2)$ in the demand function.

Optimising the new profit function of the national firm gives:

$$p_n^* = \frac{a_1 + a_2 + 4c + p_{r1} + p_{r2}}{8}$$

The national firm thus takes into account the prices set by both of the two regional firms. Next the optimal price for the regional firm:

$$p_{rj}^* = \frac{a_j + p_n + 2c}{4}$$

The above reaction function of the regional firm shows that the optimal price of the firm on market 1 now depends on the price asked by the regional firm on market 2. Moreover, if the regional firm on market 2 increases its price, it is optimal for the regional firm on market 1 also to increase price and vice versa. This is because of the reaction function of the national firm, since the optimal price set by the national firm depends on the prices of both of the regional firms. Substitution leads to the following prices asked

$$p_n = \frac{a_1 + a_2 + 4c}{6}$$

[8] Note that this actually contradicts one of the EC requirements for a chain of substitution effect. A condition to extend the market definition is that prices at the end of the chains must be similar. However as I note here, when prices are similar it would be unlikely that there exists a chain of substitution effect. The EC guidelines therefore are actually contradicting, as it would actually be more likely to find a chain of substitution effect when the prices at the end of the chain do differ.

$$p_{rj} = \frac{7a_j + a_l + 16c}{24}$$

with $l \in (1,2)$ and $l \neq j$.

This also shows that the regional firm takes into account what happens on both markets as indicated by the a_j and a_l in the equilibrium prices. Now let us look at what the exact effect is. Without loss of generality I illustrate this by looking at market 1, so by looking at p_{r1}. With equal markets $p_{r1} = \frac{a+2c}{3}$ as found in 4.2.1. When comparing with p_{r1} in case of differentiated markets we have two cases; $a_1 > a_2$ and $a_1 < a_2$. When $a_1 > a_2$ price will decrease indicating that competitive pressure increased compared to the case of differentiated markets. [9] This means that on the market with higher demand (higher a_j) the price will decrease. The intuition here is that the firm on market 1 with higher demand would normally set a higher price, but now it is taking into account the lower demand on market 2 it will set its price lower than before. The second market thus exerts competitive pressure on the first as it has lower demand.

However when $a_1 < a_2$ there is an increase in p_{r1}[10]. The intuition for this is similar to the one above. As the firm on market 1 now also takes into account the higher demand on market 2 it will be optimal to set a higher price than if there would have been no connection between the markets (which there is now through p_n).

From this I conclude that in the case with two differentiated markets there exists a chain of substitution effect, however it does not necessarily imply a decrease in price of the regional firm. For the regional firm on the market with the higher a_j the price will decrease, whereas for the firm with the lower a_j the price will increase. Thus, there is an effect of market 1 on market 2 and vice versa through the price of the national firm, however this does not mean an increase in competitive pressure on both markets. This is the case because with differentiated markets and the national firm choosing a national strategy, the national firm bases its price on both market 1 and market 2. It will than set a

[9] Assume: $\frac{7a_1+a_2+16c}{24} < \frac{a_1+2c}{3}$
Solving this yields: $a_1 > a_2$, which proves that prices decreases when $a_1 > a_2$.

[10] From footnote 2 we see that for the price on market 1 to decrease it must be that $a_1 > a_2$, so when $a_1 < a_2$than: $\frac{7a_1+a_2+16c}{24} > \frac{a_1+2c}{3}$.

price lower than what would be optimal for the market with the highest demand and a price higher than would be optimal for the market with the lowest demand. The regional firm on the market with higher demand is thus faced by a lower price than would be optimal when the national firm could differentiate between markets. As can be seen from the reaction function above in this section it will than optimally set a lower price itself. Vice versa, the regional firm on the market with lower demand will be faced with a higher price and as its reaction function is upward sloping (which can be seen from p^*_{rj}) it will also choose a higher price compared to the situation with undifferentiated markets.

4.2.3 Generalisation with national strategy and differentiated markets

In this section I will generalise the results found in the former section to show that the conclusions also hold in a more general model. In this general model I do not consider just two markets, but generalise the model to *k* markets.

The profit function for the national firm is the sum of profits over all *k* markets:

$$\pi_n = \sum_{j=1}^{k} [(a_j - 2p_n + p_{rj})(p_n - c)]$$

with $k = total\ number\ of\ markets$ and $j \in (1, k)$

The regional firm is still active on one market only, which means its profit function is equal to the one in section 4.1. Optimising the above profit function for the national firm gives:

$$p^*_n = \frac{\sum_{j=1}^{k} a_j + \sum_{j=1}^{k} p_{rj} + 2kc}{4k}$$

To find the equilibrium price we also need the sum of p_{rj} as it has to be substituted into the formula above. The sum of p_{rj} is given by:

$$\sum_{j=1}^{k} p^*_{rj} = \frac{\sum_{j=1}^{k} a_j + kp_n + 2kc}{4}$$

Substitution and some algebra lead to the following equilibrium prices:

$$p^*_n = \frac{\sum a_j + 2kc}{3k}$$

$$p^*_{rj} = \frac{(1 + 3k)a_j + \sum_{l \neq j}^{k} a_l + 8kc}{12k}$$

where $l \in (1, k)$.

It can be checked that plugging in $k = 2$ yields the results of section 4.2.2.
The effects found concerning the chain of substitution effect in 4.2.2 can also be found in this general case. In similar fashion as in 4.2.2 it can be shown that the price decreases as compared to the situation with undifferentiated markets when[11]:

$$a_j > \frac{\sum_{j \neq l}^{k} a_l}{k-1}$$

For *k =2* this also gives the same result as found in section 4.2.2. This means that the results from section 4.2.2 can also be found in the general model. Whether the price decreases or increases depends on the demand of the market considered relative to the average of the demand on all other markets. If the demand is higher than average on market *j* price will decrease and if it is relatively lower price will increase. The intuition and explanation are similar to section 4.2.2, this section thus shows that the results found in the former section generalise to *k* markets.

4.3 Discussion

As we have seen from 4.2.2 the change in price of the regional firm on a specific regional market (in the case of two markets) depends on whether it is the market with the higher or lower a_j. This means that the fact that the national firm has to choose a national strategy is beneficial to the firm on the low demand market, as it is able to increase its price and increase profits. Thus, due to the chain of substitution effect prices are higher in markets with low demand and lower in markets with high demand. The regional firms in markets with high demand loose profits due to the national strategy of the national firm. As we have seen from section 4.2.3 these results generalize to *k* markets as well. Concluding, I find a chain of substitution effect, but it is not equal to what is described in the EC guidelines. According to the guidelines, if there is a product A which is not direct substitute of C, but there is a product C which is substitute for both, there is in fact competitive pressure of A on C and vice versa. If this were the case we should see a strict decrease in price between the situation were there is a connection between markets and the situation where there is not. As seen in the former section this strict decrease in price is not found in the model used.

[11] This can be shown by: $\frac{(1+3k)a_j + \sum_{l \neq j}^{k} a_l + 8kc}{12k} < \frac{a_j + 2c}{3}$, which solves for the result given.

Therefore the competitive pressure the EC guidelines are mentioning does not really exist and competition authorities should be very careful in using this argumentation when using it to extent the market definition.
Empirically if we would be able to find the optimal price given market demand (so the price in case of no national strategy of the national firm) in markets characterised by the discussed features and there exists a chain of substitution effect, than we should find a price lower than optimal in markets with demand higher than average and prices higher than optimal in markets with demand lower than average.

5. Mergers

In this part I will look at the influence of a merger between the national firm and one of the regional firm. I will examine the effects of a merger between the national firm and the regional firm in the general model, with differentiated markets. In the first section I will look at the adaptations needed to incorporate mergers and in the second section analyse the effects of mergers between the national and regional firm(s) in this model. In the third part I will discuss two research questions concerning the effect of a merger in one market on the other markets and the importance of the number of markets where a merger has already taken place.

5.1 The general merger model

As the model in section 4.2.3 turned out to be the most interesting, in this part I will adapt this model to incorporate mergers between the national and one or more of the regional firms. The use of notation will be slightly different to the former sections, as we now need to make a distinction between the markets where the national and regional firm merged and the markets where they did not. I assume that when the national and a regional firm merge the regional firm does not disappear, but stays active on the market. However, the profits of the former regional firm are now also taken into account by the national firm and thus taken into the profit function of the national firm. The new profit function will than be as below:

$$\pi_n = \sum_{s=1}^{m}[(a_s - 2p_n + p_{rs})(p_n - c)] + \sum_{s=1}^{m}[(a_s - 2p_{rs} + p_n)(p_{rs} - c)] + \sum_{j=m+1}^{k}\left[\left(a_j - 2p_n + p_{rj}\right)(p_n - c)\right]$$

k = total number of markets

m = total number of markets with merger between national and regional firm

$s \in (1, m)$, $j \in (m+1, k)$, $t \in (1, k)$

Please notice that different from earlier notation the *j* firms are now only the independent regional firms, the merged regional firms are characterised by *s*. Above I also noted *t* as representing all different markets. This will be useful in the next section for summing a_s and a_j as these do not depend on the type of firm but only on the market.

I assume here that the markets are ordered according to the sequence of mergers. This means that when the national firm merges with one regional firm this regional firm is on market 1. When the national firm merges with two regional firms these are on market 1 and market 2, and so on. Another assumption will be that $a_t > c > 0$. This is a plausible assumption as the marginal cost of firms in this sector tend to be very low and than the above assumption is logical. Marginal cost of network companies, as cable providers in the telecom industry, are typically low as there are high fixed cost of investments but when investment is done serving an extra customer typically involves low marginal cost. This is mentioned for example by Noam (2006).

As can be seen from the equations above, the national firm optimises both p_n and all p_{rs} simultaneously. The p_{rs} are found on all *m* markets where the national and regional firm merged. The remaining *k* – *m* markets contain independent regional firms characterised by p_{rj}. The profit function for these remains:

$$\pi_{rj} = (a_j - 2p_{rj} + p_n)(p_{rj} - c)$$

5.2 Analysis

In this part I will show what the reaction functions and equilibrium prices are of the model described in the former section. The national firm maximises its profit function with respect to p_n and all p_{rs}. Let us first look at the first order conditions for the national firm[12]:

$$4kp_n = \sum_{t=1}^{k} a_t + 2\sum_{s=1}^{m} p_{rs} + \sum_{j=m+1}^{k} p_{rj} + (2k-m)c$$

$$4p_{rs} = a_s + 2p_n + c$$

Logically the price of the national firm depends on all markets as it is still active in all regional markets and the price of the merged regional firm depends on the market *s* it is active on and the price of the national firm. According to Deneckere and Davidson (1985) in Bertrand competition there are incentives to merge, moreover 'mergers of any size are beneficial and are so increasingly'[13]. This means that larger mergers yield higher profits than smaller ones. Deneckere and Davidson (1985) consider a price-setting model with differentiated goods, which are each produced by a different firm. Therefore it is interesting to see whether these results also hold in this model. The intuition behind increasing profits with mergers is that market power increases and that more market power would be advantageous to the firm as it will be able to set higher prices and earn higher profits, argued by Steiner (1975, chapters 2 and 3). In our model, intuitively, you would also expect profits to rise with mergers, as when the national firm merges with a regional firm it will have a very dominant position on that market and should be able to profit from that. As we have seen, this effect is constraint by the fact that the national firm has to set one overall price. However the more markets where the national and regional firms merge the more market power you would expect for the national firm. In line with this intuition p_n and p_{rs} should be higher than the ones found in section 4.2.3 and should increase in the number of mergers. The former can be derived in this model under the condition that $p_n > c$ and all $p_{rs} > c$, which is quite reasonable as pricing below marginal cost is not sustainable in the long run. The derivation of these results can be found in Appendix 1, the fact that the price increases in the number of mergers is derived and discussed in section 5.3.1. Thus, I can confirm that the findings of Deneckere and Davidson (1985) that, ceteris paribus and under the condition above, mergers are beneficial to

[12] a_t represents all *a* as defined in 5.1. By definition the sum of a_t is equal to the sum of a_s plus the sum of a_j:

$$\sum_{t=1}^{k} a_t = \sum_{s=1}^{m} a_s + \sum_{j=m+1}^{k} a_j$$

[13] Deneckere and Davidson (1985) page 173

the firm and the higher the number of mergers the more beneficial they are to the firm also hold in the model considered in this thesis.

Now we have the first order conditions for the national firm we need to look at the outside regional firm(s). The corresponding first order condition is:

$$4p_{rj} = a_j + p_n + 2c$$

This is equivalent to what we have seen before in section 4.2.3.

To solve for the price of the national firm we need to sum all p_{rs} and p_{rj} and substitute them into the reactions function of p_n. The derivation of these summations can be found in Appendix 2. Substituting these summations into p_n gives the following result:

$$p_n^* = \frac{5\sum_{t=1}^{k} a_t + \sum_{s=1}^{m} a_s + (4k - m)c}{15k - 3m}$$

We can see that the price depends on the demand of all markets, but more heavily on the demand of the markets where the national firm merged with the regional firm. This is the case as all a_t markets are taken into account and all a_s markets once more. The intuition behind this is that on the markets where the national firm has merged with the regional firm it now has a very strong position. On these markets the regional and national firm are not competing anymore. This will provide an incentive to raise prices on these markets and this incentive will increase in the number of markets the national firm has merged the regional firm. Since the national firm cannot set its optimal price for each individual market it will need the find the new optimal price. Raising price is profitable on the markets where they merged, but not profitable on markets where there is no merger.

Substituting the above expression for p_n^* into p_{rs} and p_{rj} and some simplifying gives the following optimal prices for the merged and independent regional firms:

$$p_{rs}^* = \frac{10\sum_{t=1}^{k} a_t + 2\sum_{s=1}^{m} a_s + a_s(15k - 3m) + (23k - 5m)c}{60k - 12m}$$

$$p_{rj}^* = \frac{5\sum_{t=1}^{k} a_t + \sum_{s=1}^{m} a_s + (34k - 7m)c}{60k - 12m}$$

From the equations we can see that the optimal prices p_{rs} and p_{rj} depend on all markets demand as indicated by the sum of a_t. Furthermore for the optimal p_{rs} the demand of the other markets with a merger is weighted more strongly as indicated by the second term of p_{rs}^{*} and the own market demand is weighted according to the number of markets and mergers as can be seen from the third term.

5.3 Discussion

In this section I discuss two research questions. First, what the determinants are of the magnitude of effect of the merger on other markets. Second, whether the disadvantages of another merger depend on the number of markets in which a merger has already taken place. The next two sections will deal with one of the questions each.

5.3.1 Effect of a merger on other markets

In this section I will discuss the effect a merger has on the price on the markets. By which factors is the price influenced and where does the magnitude of the effect depend on?

When we look at p_n^* in section 5.2 we can see that there are effects both in the numerator and the denominator. The first term of the numerator however, is not affected as this comprises the total sum of all *a* of the demand curves and the total number of markets will not change when a merger takes place, in other words *k* can be considered constant. The second term of the numerator (the sum of all a_s) is affected by a merger, as with *m +1* mergers we add a_{m+1} to the sum. This partial effect increases p_n. For the last term, if we have *m +1* mergers the numerator decreases with *c*. By assumption $a_t > c$ and therefore the first effect will dominate and the numerator will thus increase.

For the denominator the effect is easier to see. As we established before, *k* will be constant for a new merger. Then the denominator will strictly decrease for *m + 1* mergers, which will of course increase p_n. The assumption $a_t > c$ however, is not necessary for p_n to strictly increase in the number of mergers. Comparing the situation of *m* mergers and *m + 1* mergers it can be shown that the price p_n will always be larger in the case of *m + 1* mergers. Prove of this can be found in Appendix 3.

From p_{rs}^{*} and p_{rj}^{*} in section 5.2, similar conclusions can be drawn. The merger increases price in the numerator by adding an extra a_s and decreases by *c*. Furthermore for both the numerator decreases with *12m*. I conclude that a merger

always increases p_n, so the price increases with the number of mergers. As discussed in section 5.2 this is also found by Deneckere and Davidson (1985) in a more general price-setting model.
The next question was where the magnitude of the effect discussed above depends on. As I discussed above the price of the national firm changes due to three effects, the sum of a_s and c in the numerator and the number of mergers m in the denominator. The effect of c in the numerator is the same for every merger; it decreases with c for every merger. The effect in the denominator, which decreases with 3 for every merger, is also the same for every merger. The only effect that differs per merger is the extra a_s that will be added in the numerator. From this we can see that the magnitude of the change in price depends on the market where the merger is taking place. If the merger takes place on a market with high demand (high a_s) the increase in p_n will be larger than on a market with low demand (low a_s). Following Deneckere and Davidson (1985) the merger is beneficial as it allows the partners to absorb a positive externality and starts a spiral of response from rival firms. This externality concerns the effect that if a firm raises its price it does not take into account the effect this has on the other firm(s) on the market. If the firm merges however, it does take this into account and is able to optimise the joint profits. Therefore, when considering a merger on a market with high demand the positive externality that is incorporated is higher, resulting in a higher p_n than when you incorporate an externality on a market with lower demand. Concluding, the magnitude of the effect depends on demand of the market where the merger takes place. Markets with higher demand cause higher price increases than markets with lower demand.

5.3.2 Importance of the number of markets where a merger has taken place

As we have seen from the former section the price strictly increases in the number of mergers. This means that every merger results in a higher p_n and as the reaction functions of the merged and independent regional firms are upward sloping (which can be seen from 5.2) this will mean that all prices in the market(s) will increase. As discussed by Motta (2004)[14] mergers increase market power when efficiency gains are absent and this is also what we see here. In the model used there are no efficiency gains as marginal cost c are equal and constant. If there are efficiency gains when the

[14] See Motta(2004), chapter 5 pages 233-250

national and regional firm merge this could change the outcome, but without efficiency gains the price increases in the number of mergers and this means consumer surplus decreases. This also means that the merger increases the deadweight loss, as price is above marginal cost in the first place and now increases even more. Each time price rises there will be customers that continue to buy. They of course loose money, however this results in extra profits for the monopolist. Due to customers that will not buy the product anymore as the price increases a deadweight loss is created. As more firms merge price gets closer to the monopoly price each time, which will increase the deadweight loss. This is as moving up the demand curve the elasticity increases which means that an increase in price will cause a larger amount of people to stop buying the product. As price keeps on increasing and price is thus higher for a higher m the resulting increase in the deadweight loss for $m + 1$ will be higher in case of a higher m in the first place.
Concluding, the deadweight loss resulting from mergers increases each time a new merger takes place and therefore a new merger can be seen as more problematic when m was high already, since price gets closer to monopoly price. If m is still relatively low the deadweight loss will be smaller. It will still be present, although as every merger increases price which was proved in the former section.

6. Conclusions and recommendations

In this section I will summarise the conclusions of this thesis and provide some recommendations on the use of the chain of substitution argumentation and the evaluation of markets characterised by the model used.
First of all in part 3 I showed that in the simple model presented in part 3, no chain of substitution effect could be found. Thus, when the national firm is allowed to differentiate between markets and these markets are equal, it will choose exactly the same price/quantity on both markets and equal to the regional firm. Therefore if the market would be characterised by these assumptions there would be no valid reason to make use of the chain of substitution argumentation. However, as argued before the assumptions are probably a bit too restrictive and therefore I relaxed some of the assumptions in part 4. In the latter part I analysed what happens if the national firm has to choose one national strategy. I showed that when the two markets are equal, there is no difference with the simple model. The chosen prices of the national and regional firm will be equal and also equal on both markets. Therefore, only a national

strategy for the national firm does not lead to a chain of substitution effect. Next I added differentiated geographic markets and some interesting results followed. In case of differentiated markets there exists a chain of substitution effect, however it does not necessarily decrease price. It decreases price on the market with relatively high demand and increases price on the market with relatively low demand. I proved that these results also hold in a general model with k markets. In this case the price decreases when the demand on the market considered was higher than the weighted average of a_l and increases when demand is lower than the weighted average of a_l. Evaluating mergers in the general model with differentiated markets I find that the results of Deneckere and Davidson (1985) hold. Mergers are profitable for the merging firms and the profits increase in the number of mergers. Furthermore, I find that mergers strictly increase prices. The magnitude of the effect depends on the height of demand of the market where the merger takes place. Merging leads to incorporating a positive externality. On markets with higher demand this externality will be higher, resulting in a higher increase in price. Finally, I argue that the deadweight loss of a merger increases in the number of markets where a merger has already taken place.

The above findings provide some insight in how to use the chain of substitution argument and how to evaluate mergers on markets characterised by the model used. The findings show that in any case one should be very careful in using the chain of substitution argument to extend the market definition, as a chain of substitution will not always mean an increase in competitive pressure. Therefore, the condition in the EC guidelines that a chain of substitution argument should be accompanied by empirical evidence is wise. One could even ask if the chain of substitution argument should be used at all in defining the relevant market. Currently according to the regulation the chain of substitution argument can be used to extend the market definition (see section 1). However, as I showed that even if there is an effect of the separate markets on each other this does not necessarily mean an increase in competitive pressure, merely showing an effect between markets does not justify extending the market definition. One could argue that the market should be extended when the competitive pressure increases, however as shown this depends on the relative demand between markets. To make use of this argumentation then, it should first be established which markets are considered. In this case the chain of substitution argument is very hard to use in defining the market. As I discuss next, when evaluating mergers the chain of substitution argument can provide some inside in the effect of a merger. It seems more logical then to take this effect into account in the analysis after defining the market than when defining the market itself. When evaluating mergers I find that the number of markets where a merger has already taken place is quite important. When m is low the merger should be seen as more favourable than when m is high. Another important consideration is whether the national firm merges a regional firm on a market with relatively high demand or low relatively low. If the intended merger takes place on a market with high demand this can be seen as less favourable as it will increase price more, while if the merger takes place on a market with low demand the price increase will be lower. Overall, mergers on these markets are not beneficial to welfare however if m is small and the market where the merger takes place has low demand the effect is not likely to be large. As there might be efficiency considerations in such cases the merger could be allowed. Clearly all these arguments should always be thoroughly argued for. Considering the case of the Dutch market for television signals, the pressure of the Dutch competition authorities on KPN not to merge with Caiway is not strange in the light of the model of this thesis. For KPN it seems beneficial to merge as it would be able to increase price, however this would not benefit consumer. If the competition authorities do not expect significant efficiency gains, it seems reasonable to block a merger like this. However, the points mentioned above could be taken into consideration. If not many mergers have taken place yet and the demand on Caiway's market is relatively low it could be that the merger is not very harmful. Upfront however, the decision of the competition authorities seems justified by my model.

Further research concerning the chain of substitution effect can be interesting. For example relaxing some more assumptions considering the parameters of the demand functions could give more insight. One could also try to look for some empirical evidence. For example checking whether prices on markets characterised by the assumptions in this model show similar prices at the end of the chain or not. Until further research is done competition authorities should be very careful in using the chain of substitution argument, as there is still no thorough economic theory for general use of this argument.

Appendix 1

In this appendix I will prove that in the model considered in section 5.2, a merger is profitable and the profits increase with the number of mergers. Without loss of generality let us assume that indeed p_n after merger (section 5.2) is larger than p_n in section 4.2.3 than:

$$\frac{\sum_{t=1}^{k} a_t + 2\sum_{s=1}^{m} p_{rs} + \sum_{j=m+1}^{k} p_{rj} + (2k-m)c}{4k} > \frac{\sum_{t=1}^{k} a_t + \sum_{t=1}^{k} p_{rt} + 2kc}{4k}$$

Please notice that the notation is defined a little bit different in section 5.2 and 4.2.3. In section 4.2.3 $j \in (1, k)$, however in section 5.2 this is not the case since there $t \in (1, k)$. To make it equivalent on the right hand side I changed j into t as than the notation is equivalent again. Taking into account that

$$2\sum_{s=1}^{m} p_{rs} + \sum_{j=m+1}^{k} p_{rj} = \sum_{t=1}^{k} p_{rt} + \sum_{s=1}^{m} p_{rs}$$

this can be solved for:

$$\sum_{s=1}^{m} p_{rs} > mc$$

This is true under the assumption that all individual $p_{rs} > c$, which is reasonable as pricing below marginal cost cannot be sustained in the long run.

Now we can also check whether p_{rs} is now also higher than before:

$$\frac{a_s + 2p_n + c}{4} > \frac{a_s + p_n + 2c}{4}$$

This holds when $p_n > c$, which can be motivated in the same way as for p_{rs}.

Appendix 2

This appendix corresponds to section 5.2. I will show here the derivation of the summations of all p_{rs} and p_{rj}. Let us start with p_{rs}, which was optimised as follows:

$$p_{rs} = \frac{a_s + 2p_n + c}{4}$$

The only difference between individual p_{rs} thus is the component a_s. The total sum of all p_{rs} is than:

$$\sum_{s=1}^{m} p_{rs} = \frac{\sum a_s + 2mp_n + mc}{4}$$

with m = *total number of markets with merger between national and regional firm*

The same reasoning can be used for summing all p_{rj}:

$$p_{rj} = \frac{a_j + p_n + 2c}{2}$$

which will lead to:

$$\sum_{j=m+1}^{k} p_{rj} = \frac{\sum a_j + (k-m)p_n + 2(k-m)c}{4}$$

where *(k – m)* represents the number of market where there is no merger between regional and national firm, which is the total number of market *k* minus the total number of markets where there is a merger *m*.

Appendix 3

This appendix corresponds to section 5.3.1. In this appendix I prove that p_n always increases with a merger, even without assuming $a_t > c$, by comparing the situation of *m* and *m + 1* mergers. Without loss of generality let us assume that this is indeed the case than:

$$\frac{5\sum_{t=1}^{k} a_t + \sum_{s=1}^{m+1} a_s + (4k-(m+1))c}{15k - 3(m+1)} > \frac{5\sum_{t=1}^{k} a_t + \sum_{s=1}^{m} a_s + (4k-m)c}{15k - 3m}$$

which solves for:

$$10\sum_{t=1}^{k} a_t + 2\sum_{s=1}^{m} a_s + a_s + 8kc > c$$

Since *k > 0,* $a_t > 0$ *and* $a_s > 0$ it always holds that $8kc > c$, which proves that p_n is larger with *m +1* mergers than with *m* mergers.

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