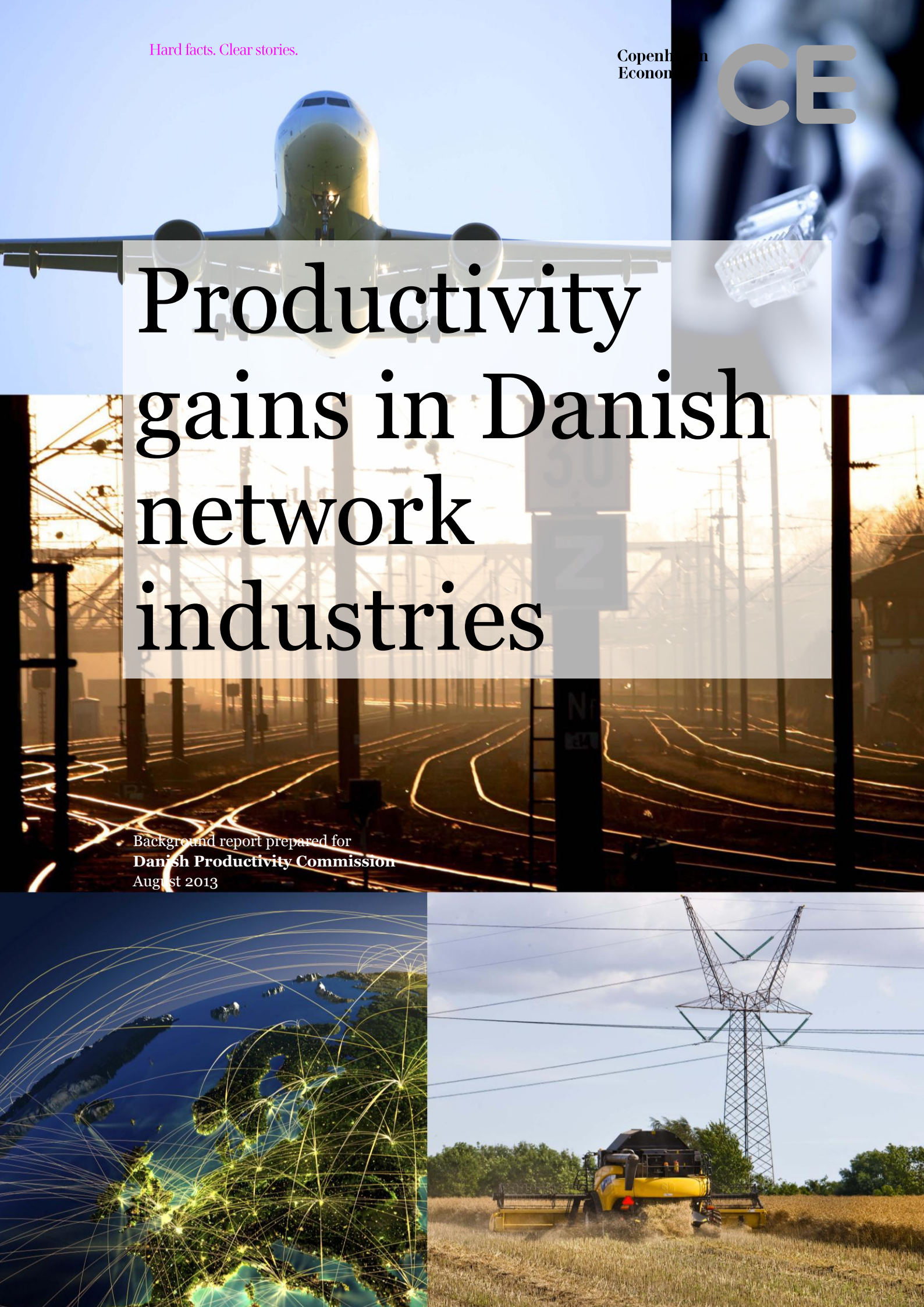


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Productivity gains in Danish network industries

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Chapter 1

Market opening and productivity

The term “network industries” is used as a common denominator for the industries: telecommunication, postal services, rail transport, urban transport, air transport, electricity and gas. These are all industries using a network of some sort as their key asset. For electricity it is the transmission and distribution cables transmitting electricity from generators to electricity users. For postal services, it is the network of postmen and –women distributing mail to businesses and households. The definition comprises the entire value chain, so for example the whole electricity sector from generation to distribution is covered.

1.1 Productivity and impacts on the rest of the economy

Network industries are important suppliers to almost all other industries and to final consumers. Every business is using electricity, postal services, telecommunication and transportation, and consequently it is essential for the economy that these sectors perform well and that they deliver the desired quality and competitive prices. If not, it will have significant negative impacts on the competitiveness of other Danish businesses. Low productivity in network sectors is therefore not only harmful in its own right, but has a detrimental effect on many other businesses.

Spillovers arise when other businesses are purchasing services from the network industries, but there are additional impacts on the economy from well-functioning network industries and the key elements can be summarised as follows:

- **Telecommunication** (including internet operators, cable television providers, and mobile operators): The use of modern communication technologies and the internet has significant productivity spillovers on all types of businesses. Use of the internet has spurred many types of innovation and created many new businesses, and consequently, a well-functioning and well-regulated market for these services is essential for overall productivity growth of modern economies.
- **Postal services** (including express carriers and other postal and delivery operators): Although traditional mail markets are declining in volume, postal services play a crucial role in the economy. Not only for business-to-business, but also business-to-consumer distribution is important for many businesses. Furthermore, efficient and competitive delivery services are important for achieving the benefits from for example e-commerce, and the parcel delivery business is seeing a significant growth following the rapid growth of online shopping and e-commerce. Furthermore, globalisation and internationalisation of Danish businesses is also spurring demand for global express carriers such as UPS, DHL, FedEx and TNT Express as well as their local competitors. These firms deliver key services to businesses and thereby influencing on their productivity.
- **Rail transport and urban transport** (including buses and taxis): Rail transport is relevant for both passengers and goods. Efficient goods transport on

rail at competitive prices is important for certain types of products, and consequently these services have positive productivity spillovers on these industries. Efficient and competitive transportation of passengers has a number of indirect impacts on the economy, which are often labelled as *wider economic benefits*. Efficient urban transport at competitive prices is essential for many businesses for business trips and travels to meetings. Furthermore, efficient transportation is important for commuting and for labour mobility, and has an impact on the productivity of other businesses by making it easier to hire the right employees, and with a better match, productivity increases.

- **Air transport** (including airlines, airports and auxiliary services): Air transport plays an important role for economic growth as it connects Denmark to the rest of the world, and better connectivity and higher accessibility provides a number of benefits for businesses and households alike. It generates trade and tourism, and it helps attracting foreign companies to invest in the country. Econometric estimates have established a productivity impact from improved connectivity.¹

1.2 The process of market opening in network industries

The network industries have undergone a significant process of market opening, which has taken place in Europe since the early 1990s. During this period, the network industries have been transformed from being almost entirely under public ownership to being exposed to competition in varying degrees and at different speeds. Common to all these industries is the challenge of balancing the gains from strong competition against the natural efficiencies of having one single and coordinated network.

Our economic analysis of the market opening in network industries shows that the process has already produced significant economic gains in the European Union. During the 1990s, market opening succeeded in increasing productivity and reducing prices in the network industries in general, and specifically in the individual industries, however at differing degrees. As network industries provide crucial inputs for production in all other sectors of the economy, market opening has led to significant spill-over effects to the rest of the economy contributing significantly to the overall economic gains in terms of welfare, consumption and employment. This was the main conclusion of our 2005-study on market opening in network industries which we carried out for the European Commission.²

Nevertheless, we argue that significant benefits may be in store from pursuing further market opening in network industries. In a study for the UK Government, we found that value added in the EU15 may increase by 1.0-1.6 percent in response to full market opening.

¹ See IATA (2007), "Aviation Economic Benefits", IATA Economics Briefing No. 8. The study uses an econometric model to derive the relationship between connectivity and labour productivity. The model identifies and quantifies the relationship between connectivity and productivity while controlling for other factors that may influence productivity, such as education levels, research and development, capital spending, institutional and regulatory factors. The model shows that connectivity has a statistically significant relationship with labour productivity levels. It shows that a 10% rise in connectivity, relative to a country's GDP, will boost labour productivity levels by 0.07%.

² See Copenhagen Economics' 2005-study *Market Opening in Network Industries* for the European Commission on www.copenhageneconomics.com.

The potential gains at the EU level were found to be primarily driven by market opening in telecommunications, electricity, and postal services for two reasons. *First*, these three industries are economically important, since they account for more than three quarters of output from the network industries. Hence, changes in their prices and productivity levels have a particular large effect on the rest of the economy. *Second*, the expected price and productivity changes brought about by full market opening are larger in these industries than in most of the other network industries; this is particularly the case for the telecommunications and postal services.

1.3 Productivity impacts of market opening

Our study from 2005 found that the historic market opening had led to measurably higher productivity and measurably lower mark-ups in network industries. The combination of lower mark-ups leading to lower prices and higher productivity leading to larger production and lower prices, results in a modest increase in value of output in the network industries as shown in Table 1.

Table 1 Aggregate effects of market opening on the provision of network services

	Telecom	Electricity	Rail transport	Air transport	Gas	Postal services
Prices	-11%	-13%	-17%	-2%	1%	-21%
Output	4%	3%	3%	4%	3%	5%
Cross border trade	29%	31%	55%	6%	5%	55%

Note: The table shows average EU15 changes in prices and market size in network industries as a result of market opening. Output is measured as the total value of output.

Source: CETM model – Copenhagen Economics (2005).

The impacts in telecommunication, electricity, and postal services are the main drivers of the economy-wide gains. These three industries dominate the picture because 1) they represent a relatively large share of the total economy compared to the remaining three industries; and 2) they experience medium to large drops in price along with rises in productivity levels stimulating demand from other sectors in the economy and reducing their input prices, leading to further productivity gains and price declines in these sectors, cf. Table 2. This accelerator mechanism is an important driver of economy-wide gains.

Table 2 Industry contribution to economy-wide welfare gain

Industry	Size of industry	Size of price and productivity effect in full market opening
Telecommunication	Large	Large
Electricity	Large	Large
Postal services	Medium	Large
Rail (freight + pas.)	Small	Large
Air	Medium	Medium
Gas	Small	Small

Note: Size of industry refers to the share of the total EU15 economy. Large reflects a share larger than 1%, medium 0.5-1% and small is given by a share below 0.5%. 'Effects' refer to price impacts from the model simulation of full market opening. Small effects are defined as price drops of less than 1%. Medium shocks are defined as price drops between 1-10%. Large shocks are defined as price drops of more than 10%.

Source: CETM model – Copenhagen Economics (2005).

The spillover effects across non-network industries tend to be slightly stronger for the service sectors as a result of their more intensive use of network services. For example, business services experience increases in value added of 2 percent while the metal industry experiences a rise of 1 percent cf. Table 5.

Table 3 Spillover effects on key non-network sectors

	Business services	Distributive trade	Other services	Metal and electro-technical industries	Petroleum and chemical industries
Value added	+2%	+2%	+1%	+1%	+2%
Employment	+1%	+0%	-0%	-0%	+1%

Note: The table shows average EU15 changes in value added and employment in select non-network industries as a result of market opening.

Source: CETM model – Copenhagen Economics (2005)

1.4 Methodology

The economy-wide impacts from market opening are assessed through three stages:

- *Market opening index* measuring the degree of market opening in each country and in each network industry
- *Econometric estimation* of the possible measurable impact of market opening on firm-level price and productivity for each network industry
- *CGE-modelling* of the wide-economy impacts as price and productivity improvements in the network industries are passed on to the rest of the economy

Below we briefly describe the content of the first two stages, however, the more interested reader is encouraged to read through the detailed description in the 2005-study³. The results reported in this report are the productivity impacts within the individual network sectors exclusive of the spillover impacts on other industries.

³ A more detailed description of the methodology including the CETM model can be found in our 2005-study, which can be downloaded from www.copenhageneconomics.com.

Constructing market opening indices

In the *first stage*, we measure – in quantitative terms – the level of market opening each of the six network industries in each of the EU15 Member States via the Market Opening Index (MOI). The index measures the level of market opening on a scale between zero and unity. The index is constructed such that full market opening, by definition of concrete market opening milestones, corresponds to unity value. We do not exclude that further market opening is possible beyond what was found as the maximum number of market opening steps which we identified in 2005.

The index values were originally calculated for the year 2003/2004, and the data was updated to represent the 2006-situation through a study for the UK government. In the next chapter, we provide the results of an update to the 2013-situation for Denmark.

To illustrate the market opening index, the average market opening index for the EU15 Member States in postal services takes on the value 0.56 in 2006 implying that the market for postal services is far from fully opened. In contrast, the market opening index for air transport is 0.84, implying that the industry is 16 percentage-points away from attaining full market opening.

Some indicators are also comparable across sectors at the most detailed level. For example indicators of the degree of market opening exist in most network industries, and even though the formulation of the indicator is different in each sector the interpretation is the same.

Market opening of network industries includes the following activities:

- Make sure that new companies can enter the industry
- Make sure that consumers are allowed to choose freely between suppliers
- Make sure that prices for the use of the common network reflect the costs needed for maintaining and possibly extending the network to the desired level
- Give firms incentives to be efficient, innovative and concerned with the needs and demands of the consumers

This menu of actions to be taken by policy makers corresponds to the main areas that are addressed in the regulatory database. These are included under the following headlines:

1. Market opening – demand side
 - Percentage of demand legally opened to competition
 - Percentage of demand actually opened to competition
 - Date of full legal market opening
2. Third party access
 - Type of Third Party Access (regulated versus negotiated and other types of access for specific network segments) for both domestic and foreign competitors,
3. Access pricing
 - Type of access charges (type of price)
 - Size of access charges to the network for domestic and for foreign competitors (including access charges for import, export, and transit)
4. Network unbundling
 - Types of unbundling (accounting, management, legal, ownership)
5. Network ownership

- Identification of key network
- Network ownership (private, public, intermediate)

Under each of these headlines detailed indicators are developed sector by sector (see annex for details).

Econometric estimates of market opening on prices and productivity

In the *second stage*, we estimate the impact on industry productivity and prices from introducing market opening. In order to do this, we make use of industry specific parameters estimated in our 2005-study. The parameters measure the link between price and productivity, and market opening; and based on these parameters, we calculate the industry specific price and productivity effects implied by the business as usual scenario and the pessimistic scenario.

We set up econometric models explaining changes in the dependent variable, sector performance (i.e. price or productivity), as a function of market opening taking into due consideration the impact of other explanatory variables. The most important output of the econometric analysis is statistically significant and economically meaningful parameters telling us how sector performance changes when certain market opening policies are implemented. Since we have information on market opening over time and across member states, the set-up is an econometric panel data model.

The regression results demonstrate clear evidence of a statistically significant link between market opening and sector performance, in particular prices and productivity. Importantly, the estimated parameters have the expected sign in most cases, such that market opening leads to *lower* prices and *higher* productivity.

The regression results are able to identify market opening policies (milestones) that contribute more to economic performance than others. This is done by gradually excluding insignificant variables until we reach a preferred simple and parsimonious model with sole significant variables. These market opening policies can – from a statistical point of view – be viewed as important determinants of sector performance.

In some cases the variable representing market opening is the Market Opening Index. In these cases we can conclude that no single market opening policy can explain performance as market opening policies complement each other and should be viewed as a package. In other cases we are left with a single or two market opening policies as the sole significant variables. In these cases, however, we cannot conclude that these policies are *the only relevant* market opening policies. We have to acknowledge that other market opening policies may play an important role because many Market Opening Milestones are heavily correlated with each other so that any exercise to isolate partial impacts must be subject to due reservation.

We estimated price and productivity equations in nine separate network industries splitting out rail transport in passenger and freight transport and telecom in fixed and mobile making 18 potential final models. We failed to identify a final model in the case of gas

productivity, due to unavailability of a proper productivity measure⁴, ending up with 17 valid final models.

In the 17 final models we identified 23 significant variables capturing market opening. Out of this total 18 variables or almost 80 percent were significant and had the expected sign. One of the variables were not highly significant but had the expected sign. The remaining four variables were significant but had the wrong sign, cf. Table 3.2. The variables with significant but wrong signs were all identified in network industries with limited data availability. For example, in the urban price equation we had only 25 observations. In contrast, the results from electricity, telecommunications and rail freight are in particular convincing, since the results fulfil expectations with respect to sign and significance in both price and productivity equations and the estimations are often based on a significantly higher number of observations. More details on the estimations are available in the 2005-report.

Comparing the market opening index to the OECD regulatory index

The OECD produces a regulatory index (REGREF) for the same six network industries as we cover in this study. As the REGREF and the Market Opening Index (MOI) basically set out to measure the same regulatory aspects, it is interesting to know to what extent they succeed.

To find out, we have calculated the correlation coefficient between the REGREF and the MOI. If the correlation coefficient is one, it means that the two indices measure the exact same aspects of market opening. On the other hand, if the correlation coefficient is zero, it means that the two indices measure completely different aspects of market opening. We find correlation coefficients to lie within the range of 0.50 to 0.90, cf. Table 4.

Table 4 Correlation between OECD's REGREF and Copenhagen Economics' MOI

	Telecom	Electricity	Rail transport	Air transport	Gas	Postal services
Correlation coefficient	0.90	0.89	0.84 ¹	0.76	0.50	0.61

Note: The table shows the correlation coefficient for each industry between REGREF and MOI. 1: The REGREF only has one index for rail transport while passenger and freight transport has a MOI each. We calculated the correlation coefficient between the REGREF and each of the two MOIs finding coefficients of 0.83 and 0.85 for passenger and freight, respectively.

Source: Copenhagen Economics and OECD (2005), "Product market regulation and productivity growth", Paris November 2005, DSTI/EAS/IND/SWP(2005)11.

There are strong similarities between the way the REGREF and MOI are structured since they are both centred around three core categories:

- Barriers to entry
- Public ownership
- Vertical integration

⁴ The analysis of productivity changes in the gas is made difficult because of the unavailability of data. We have tried using the gas throughput and distribution losses as a proxy for productivity. More traditional productivity measures such as labour productivity is not possible to construct since neither employment data nor value added data is reported for the gas sector alone. In all available EU statistics the gas sector is as a minimum joined with the electricity sector making the comparison of labour productivity over time and between countries impossible.

The MOI includes more questions in the category ‘Barriers to entry’ than does the REGREF, cf. Table 5. For the remaining two categories, the differences are small, although there is a tendency for the REGREF to include more questions on ownership.

Table 5 Number of questions in the three categories

		Airlines	Telecoms	Electricity	Gas	Post	Rail
		----- Number of questions -----					
Barriers to entry	REGREF	3	3	3	3	3	2
	MOI	11	14	6	7	10	9
Public ownership	REGREF	1	1	1	3	3	4
	MOI	1	1	1	1	1	2
Vertical integration	REGREF	-	-	2	3	-	1
	MOI	1	-	2	2	1	4

Source: Copenhagen Economics and OECD (2005), “Product market regulation and productivity growth”, Paris November 2005, DSTI/EAS/IND/SWP(2005)11.

In addition to the core categories measuring the regulatory framework, the REGREF includes a ‘Market structure’ category measuring e.g. the number of service providers in an industry. The MOI does not include market structure as we from the beginning did not want mix together indicators of how the market reacts to changes in the regulatory framework with the regulatory framework itself (the core categories).

Chapter 2

Productivity gains from further market opening in Denmark

In this chapter we provide an updated status on market opening in Danish network industries, and we estimate the overall potential from further market opening in these sectors.

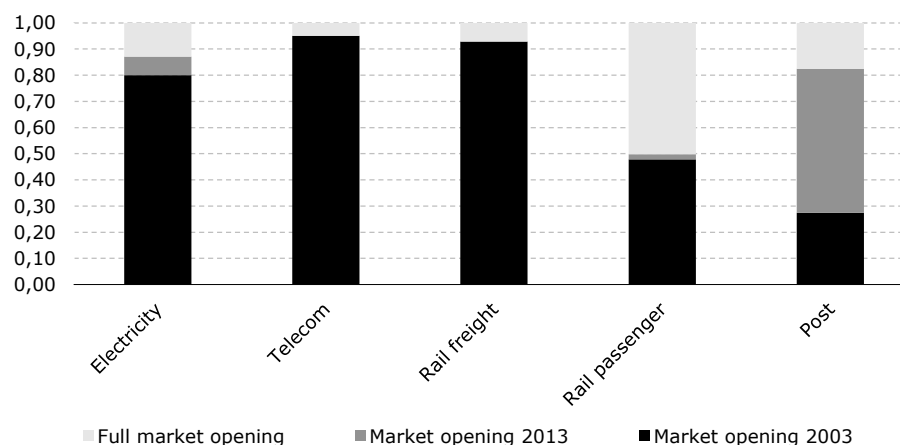
We shall assess the productivity impacts from further market opening in key network sectors. The gas sector is excluded from the estimations because no empirical relation has been established in this sector between market opening and productivity, but this does not exclude that there are productivity gains from regulatory changes in the gas sector. Market opening in air transport is not addressed in further detail, since almost all possible steps to open up the sector has been taken at the European level.⁵

First we present an updated picture of the market opening situation in Denmark as per 2013 following the same methodology as described in the previous chapter. Second we estimate the potential productivity improvements from moving to full market opening in the sectors which are still not fully opened.

2.1 Market opening in Denmark

Denmark did already proceed quite rapidly and quite far with opening up the market for telecommunications, rail freight and to some degree in electricity (and gas although impacts are not assessed here). On the contrary, rail passenger transport and postal services were still several steps from full market opening in 2003. Since 2003, steps have been taken in Denmark to further open the postal sector to more competition, and consequently, the market opening index for postal services has increased substantially by 2013. Still, steps can be taken to achieve full market opening as defined by the market opening index. For passenger rail, only limited steps have been taken on the regulatory side to open up the market further and consequently there is still an untapped potential for further market opening in rail services, cf. Figure 1.

⁵ There are still potential for further opening up of the EU's external aviation agreements with non-EU countries, and this policy is being pursued by the European Commission.

Figure 1 Market opening index, Denmark (2013)

Source: The 2013 status is updated based on consultations with the relevant Danish Authorities.

In the electricity sector, the 2003 situation already represented a high degree of market opening, but a number of smaller steps can be taken to further open up the market. Only minimal potential is found from further market opening in rail freight and telecommunications.

2.2 Estimated potential from further market opening

The potential from further market opening in Danish network industries is assessed by combining the results presented above on the econometric relationship between market opening and productivity with the updated market opening index for the situation in Denmark in 2013. The scenario we assess is one where the remaining market opening towards full market opening (as defined by the market opening milestone in the index) is completed, cf. Table 6. This does not exclude that there can be further benefits in the sectors analysed.

Table 6 Market opening potential in Denmark 2013

	Electricity	Telecom	Rail freight	Rail passenger	Post
Market opening 2003	0,80	0,95	0,93	0,48	0,27
Market opening 2013	0,87	0,95	0,93	0,50	0,83
Full market opening	1,00	1,00	1,00	1,00	1,00
Potential percentage change from current to full market Opening	15%	5%	8%	100%	21%

Source: CE based on updated market opening status for Danish network sectors and 2005-report.

Translating these potential market opening steps into estimates of the likely productivity impact, we use the results from the estimations in the 2005-study regarding the impact of historic impacts of market opening. We use the estimated short-run impacts. Long-run impacts are higher, but also more uncertain, and to minimise uncertainty, short-run estimates are used.

The results in the 2005-study showed that the productivity impact of market opening in electricity of 2 percent was associated with an increase in the country-specific market opening indices of between 7 and 24 percent. For telecoms, the productivity gain of 24 percent was associated with an increase in the market opening index of 46-47 percent, while the impact of market opening in rail freight generated a productivity improvement of 47 percent from an underlying change in market opening of 48-59 percent. For postal services, the increase of market opening varied from 16 to 55 percent and the related productivity improvements were 28 percent, cf. Table 7. For passenger rail, no robust relationship could be found, but existing analyses indicates a potential of 15-25 percent for rail transport (see next chapter).

Table 7 Impact of historic market opening on productivity

	Telecom	Rail freight	Rail passenger	Postal services
Change in pct market opening, (min-max)	46-47	48-59	20-68	16-55
Short-run change in sectoral productivity	24	47	n/a	28

Note: The estimates are from a panel data set with varying degree of market opening. The results on productivity are the average impact across the EU15 countries. The reported changes in market opening therefore shows the minimum and maximum change in market opening across the 15 EU countries to show the possible range of changes in market opening underlying the impacts on productivity.

Source: CE based on updated market opening status for Danish network sectors and 2005-report.

Combining the historic impact of market opening with the remaining potential to full market opening, we can compute the expected productivity impact for individual network sectors in Denmark. This shows a potential from further market opening in electricity of 1-5 percent higher productivity and around 3 percent higher productivity in telecommunication. The impact for rail freight is somewhat higher, but still moderate due to the already open market, and we assess a small potential of 6-8 percent higher productivity. The largest potential for sectoral productivity improvements is found in the postal sector, where the estimate is 10-20 percent higher productivity. In postal services, the calculated maximum potential is in fact much higher, but this estimate is resulting from countries with very low degree of initial market opening, and therefore a potential which is not a useful benchmark in the case of Denmark. Consequently we apply the 20 percent potential as the maximum estimate and use a 10 percent minimum potential in postal services, cf. Table 8.

Table 8 Potential productivity improvement from full opening

	Telecom	Rail freight	Rail passenger	Postal services
Potential to full opening, min.	3%	6%	15%*	10%
Potential to full opening, max.	3%	8%	20%*	20%*

Note: The estimates are derived from combining the potential to full market opening in table 6 with the historic impact of market opening from table 7. *) see chapter 3.

Source: CE based on updated market opening status for Danish network sectors and 2005-report.

When assessing the overall contribution to productivity improvements in the private services sector need to take the size of the sectors into account, and we need to take into account, that we do not estimate further market opening in all subsectors.

For telecommunications there is a 100 percent overlap between the market opening estimates and the national accounts sector with the same name.

Postal services, however, belongs to the national accounts sector called *warehousing and support activities for transportation* which includes postal and courier services, of which detail accounting data shows that postal services account for 27 percent.

The rail services belong to the larger national accounts sector *land transport* which also includes road transportation such as trucks, busses and taxis. From the detailed accounts, we know the combined share of value added for rail, buses and taxis is 55 percent of total land transport. We also know the share of regional and long-distance rail, which is 22 percentage-points of the 55 percent share, while buses, local trains and taxis combined stand for 33 percentage-points. We have no direct estimates of the productivity potential for taxis and buses, but a small 3-5 percent potential is assumed as discussed in the following chapter.

Thus, taking into account that the affected activities with a productivity potential (i.e. rail transport, buses and taxis) only makes up 55 percent of the aggregated sector *land transport* and that postal services only makes up around 27 percent of the aggregate sector *warehousing and support activities for transportation + postal and courier activities*, we find that the overall contribution to private service sector productivity from market opening in network sectors is estimated at around DKK 2-3 billion in 2010 (at 2005-prices), which corresponds to 2-3 percent increase in the value added in the aggregate, cf. Table 9.

Table 9 Estimated impact on productivity in Denmark 2010

	Value added 2010 Mio. DKK (2005-prices)	Impacted share	Impact low	Impact high
Land transport and transport via pipelines	27.517	55%	7%	10%
Telecommunications	28.011	100%	3%	3%
Warehousing and support activities for transportation + Postal and courier activities	24.198	27%	10%	20%
Water transport	23.889	Not assessed	n/a	n/a
Air transport	3.947	Not assessed	n/a	n/a
Total (mio. DKK)	107.561		1.982	2.897
In percent			+2%	+3%

Source: CE based on updated market opening status for Danish network sectors and 2005-report.

The underlying regulatory challenges in these sectors are discussed in the following chapter. It should be noted, that there is also a productivity potential in the electricity sector not included in the above, since the sector belongs to the utilities sector, and not private services.

Chapter 3

Regulatory challenges in Danish network sectors

In this chapter we present the regulatory challenges needed to be solved in each of the network industries to bring about the estimated productivity improvements from the previous chapter.

3.1 Further market opening in electricity

From a regulatory perspective, the electricity market contains segments that are highly contestable and other parts, largely characterised as a natural monopoly. This combination implies that market regulation needs to be segmented to obtain efficient economic outcomes. This is reflected in the present Danish and EU approach to regulation of the industry.

Electricity generation – the contestable part

Generation (i.e. the production) of electricity can be subject to a market design that encourages substantial competition between alternative producers. This has been the case for Denmark which has been integrated in the Nordic market for electricity – Nord Pool – since 2000. Essentially, this market is organised around the principles that power producers from the entire region provide explicit supply curves for their production the coming days, hour by hour. In turn, the Nord Pool constructs a consolidated supply curve based on these legally binding offers and combines that with a demand curve for the following day: in this way a market clearing price of electricity is established.

For the system to work as effectively as possible, two key factors are important:

Firstly, that there are a sufficient number of potential electricity suppliers to avoid that individual producers can obtain market power. The integration with the much larger electricity markets in the other Nordic countries as well as the 2009 transmission link to the German market are both important in this respect. Since the market integration between different areas suffers some capacity constraints, temporary local price imbalances remain possible. For instance, this implies that if Denmark is consuming all the power produced locally and the capacity limit on the German interconnector has been reached, the Danish clearing price will increase relative to the German. Since these temporary price imbalances between price areas are more or less unpredictable, they do not alter the overall conclusion that the market is characterized by competition.

Secondly, that the ownership of the production of power is separated from the ownership of the transmission and distribution network as discussed below.

Our verdict is that the gains from isolated additional Danish regulation in terms of lower costs and high efficiency in the electricity generation is limited. By contrast, focus on more integration of the Danish electricity market with Germany and the rest of continent

will be more important in the coming years. This assessment is especially driven by the fact that the high and increasing shares of wind energy production in Denmark and the countries around us need to be absorbed. This requires action at the EU level and particularly in Germany.

The transmission and distribution networks are natural monopolies

The grid system for transmission and distribution of electricity is a natural monopoly. The main grid is owned by Energinet.dk while the distribution network is owned by the energy companies. The monopoly status implies a lack of incentive to perform cost minimization. Hence in order to secure economic efficiency, this market segment is subject to regulation:

- The Act concerning Energinet.dk instructs a user grid tariff which covers operation and maintenance costs as well as costs related to the international connections. To instruct further cost efficiency, the Energy Act of 2012 imposed cost savings of DKK 755 million on Energinet.dk by 2020.
- The regulation on the distribution network is mixed. Hence, capital returns are capped by an enforced upper bound while costs are regulated via benchmarking models.

In all these regulatory initiatives are implemented to ensure that that end consumers do not face “too high” prices.

Current Regulation of the Retail market can potentially be improved

In contrast to the whole sale power market, ownership of the distribution network is private and the relevant retail operators are also producers of electricity, so while there is full separation of the transmission network, the distribution network is not fully unbundled.

The companies are then being subjected to two regulatory instruments to contain costs and prices. Firstly, benchmarking comparing the relative efficiency with which distributors provide energy to final customers. Distributors with below accepted efficiency benchmarks will be asked to cut costs and prices. Secondly, distributors are also subjected return on capital regulation: return on measured equity investment cannot exceed a benchmark defined as a long term risk return plus a risk premium.

The focus of regulation and compliance disputes has tended to focus on three issues. Firstly, regulation encourages a sharper split between the role of servicing final customers and running the distribution grid network. The former includes tasks such as helping customers to find the cheapest energy source, handling bills, and potentially also acting as the customer’s advisors on energy savings – by installing meters etc. Secondly, on-going discussion on whether the benchmarking of costs is a fair reflection of the underlying real costs drivers such as density of population, costs of sourcing employment from high wage areas close to Copenhagen, etc. Thirdly, how to handle the additional costs resulting from the need to integrate volatile wind power in the energy system. The “traditional” benchmarking system focuses on costs per energy unit delivered to final customers, however, to deal with volatility, distributors and other market participants will have to invest in solu-

tions that do not increase the amount of electricity delivered but help the grid to adapt to large volatility.

To handle the issues raised above, the Energy Agreement of 2012 has initiated a transition towards better regulation of network operators. The agreement is expected to trigger efficiency gains of DKK 300 million.⁶ In contrast, the current benchmark regulation implies that network operators need to save DKK 102 million.

Thus, the act instructs actions to strengthen cost efficiency among the network operators. Amongst all, this is done by initiating new benchmark studies – comparing both with intra- and extra-sectorial cost efficiencies. These studies are expected to reveal where and how efficiency gains can be obtained. The fact that, that there are relatively many network operators in Denmark imply that reaping more economics of scale by further consolidation of local networks could be a candidate for efficiency gains.

In our assessment, the estimated productivity gains in the electricity sector are primarily to be found from improving the regulation and benchmark systems of the distribution networks.

3.2 Further market opening in passenger rail

The European Commission announced its fourth package of rail liberalisation in January 2013.⁷ The Commission is proposing that domestic passenger railways should be opened up to new entrants and services from December 2019. According to the proposal, companies will be able to offer domestic rail passenger services across the EU: either by offering competing commercial services or through bidding for public service rail contracts, which account for a majority (over 90%) of EU rail journeys and will become subject to mandatory tendering.

The Commission is expecting the proposals to bring benefits to passengers in terms of improved services and increasing choice. Combined with structural reforms, it is expected to produce more than €40 billion of financial benefits for citizens and companies involved by 2035 and would allow provision of up to about 16 billion additional passenger-km according to Commission estimates. Furthermore, the Commission estimates that tendering of public service contracts in liberalised markets yields savings of 20-30 percent for a given level of service.⁸

The Danish passenger rail sector is still dominated by the state-owned railway company DSB operating the vast majority of passenger rail services in the country. Only the lines in Mid- and West Jutland are operated by another supplier, Arriva, after having won the tender for the business in 2001 and started to operate in 2003. The traffic is approximately 15 percent of total rail passenger traffic.

⁶ See the terms of reference for the Government committee in charge of the review.

http://www.ens.dk/da-DK/Info/Nyheder/Nyhedsarkiv/2012/Documents/Kommissorium_regulering_endeligt_juni12.pdf

⁷ See Press release Reference: IP/13/65, 30 January 2013, http://europa.eu/rapid/press-release_IP-13-65_en.htm.

⁸ See impact assessment accompanying the proposal for the fourth rail package, SWD(2013) 12 final.

http://ec.europa.eu/governance/impact/ia_carried_out/docs/ia_2013/swd_2013_0012_en.pdf

The experience from tendering rail traffic is good, despite the small scale. A recent report from *Rigsrevisionen* showed that the tender of the traffic to Arriva had saved the government around DKK 300 mio. compared to having continued with DSB as the operator, albeit this is less than the DKK 416 mio. expected to result from the tendering.⁹ It is also concluded that Arriva, for a smaller budget, has delivered more train-kilometres than before the tendering. The savings are derived from a comparison with the DKK 1860 mio. with which the contract payment to DSB has been reduced over the period. Thus the net saving over the period corresponds to a reduction of around 15 percent assuming that the DKK 1860 mio. corresponds to the costs for DSB of the operation.

It is also shown that the quality as measured by customer satisfaction is high and increasing and higher than before the tender. Arriva have received bonus for a high customer satisfaction throughout the period. It is also shown that punctuality and reliability has been high. The contract includes a target of 97 percent punctuality, which gives a bonus. This has been achieved in six out of eight years.

Furthermore, the prolongation of the tender to Arriva was estimated by the Transport Authority to deliver a 10 percent saving for the Government.¹⁰

The rail-line between Elsinore and Malmø (*Kystbanen*) was also put out for tender, and this was won by the DSB affiliated company DSB First, who have ceased to exist and the operation of line is now returned to DSB.

So far, no other rail-lines have been price tested through a competitive tender, but several analyses have assessed the potential savings from doing so. A study for the Danish Transport Ministry in 2009 estimated a cost saving potential from tendering of passenger railway services in various packages, and it was estimated that this could result in savings of DKK 400-650 mio. based on the 2007 situation.¹¹

A later report, commissioned by the Transport Ministry and the Ministry of Finance, assessed there is a possibility of efficiency gains in DSB's core business of DKK 1.05 billion.¹² This corresponds to a reduction of 24 percent of their core cost base in 2010. Knowing that DSB is operating around 85 percent of the traffic, the potential cost reduction is around 20 percent of the entire market, if it is assumed that no further efficiency gains can be found for the traffic already tendered.

Based on the 2010 situation, the lack of tendering, and the less than complete market opening and regulatory deficiencies in rail transport showed an untapped gross potential of between 15-20 percent, with the 15 percent corresponding to what has actually been realised from the first tendering, and the 20 percent corresponding to the maximum gross potential from benchmarking of DSB's business.

⁹ [http://www.rigsrevisionen.dk/media\(2205,1030\)/A404-12.pdf](http://www.rigsrevisionen.dk/media(2205,1030)/A404-12.pdf)

¹⁰ See press release from the Transport Authority, 12 March 2009.

¹¹ Boston Consulting Group (2009), "Øget konkurrenceudsættelse af jernbanesektoren".

¹² See Quartz+co (2011), "Effektivisering af DSB",
<http://www.trm.dk/da/publikationer/2011/analyse+af+effektivisering+af+dsb/>

In 2012, the rail incumbent DSB presented a plan for a “healthy DSB” (“Sundt DSB”) including the ambition to improve economic results by DKK 1 billion by 2014. DSB’s annual report for 2012 showed improvements of DKK 0.5 billion. To the extent that these improvements constitute permanent efficiency improvements since the most recent benchmarking based on 2010 data, such efficiency improvements will reduce the potential for productivity gains. At the same time, improvements by the competitors since 2010 should be factored in. It is likely that competing operators also improve their productivity in parallel with DSB, and the efficiency gap between DSB and the most efficient competitor will only narrow if DSB’s improvements between 2010 and 2012 are above the improvements for the most efficient competitor during the same period. Furthermore, increased competition – whether potential or actual – in the Danish rail passenger market would provide additional incentives for productivity gains for both the incumbent and its competitors.¹³

It should also be noted that Denmark is ranked as relatively opened when comparing with the rest of Europe, and only countries such as Sweden and the UK are more open.¹⁴ This does not imply, however, that there are no further steps to be taken towards more market opening, and the market opening index in the previous chapter indicated that the passenger rail sector is roughly halfway to full market opening, and therefore that further gains are to be had from regulatory changes in the industry.

The report by IBM on rail liberalisation is, however, also pointing at challenges in Denmark, where improvements can be made. The report points to the relatively high infrastructure costs in Denmark as an access barrier¹⁵ and the report points the attention to the main contract between the government and DSB and is raising the question of an eventual overcompensation of the state-owned railway.

The regulatory changes which could bring about the estimated productivity gains in passenger rail service are:

- Increase tendering or price testing of more regional and intercity rail-lines
- Changing the procedure for allocating slots for rail services (i.e. *kanaltildeling*) such that competing operators can apply for slots on equal terms with public service traffic. This will imply changing BEK 59 (2004) with respect to the clause ranking the public service supplier (DSB) first when there is congestion
- Full transparency on costs of operating different segments/rail-lines and transparency about cost allocation principles for the public service supplier (DSB)
- Considering models for ensuring access to rolling stock for competitors. Rolling stock (locomotives and trains) are tailored specifically to national markets, and consequently having access to rolling stock can be a challenge for competitors, and appropriate leasing or rent arrangements could be necessary for a well-functioning competition.

¹³ We note that the efficiency potentials presented here are gross potentials before deduction of eventual tendering costs and any eventual loss of scale efficiencies for DSB, and that this approach is used for passenger rail as well as all other sectors in this report. The size of tendering costs and the eventual loss of scale efficiencies have not been assessed by Copenhagen Economics.

¹⁴ See IBM (2011), *Rail Liberalisation Index*.

¹⁵ The comparison is based on a standard freight train between the two main freight terminals, which in the case of Denmark includes the charge for crossing the Great Belt link. Furthermore, the comparison excludes the so-called environment-support (miljøtilskud), since it does not apply to all transit transports (see also section 3.3).

- Considering measures to assure full independence between the infrastructure owner (Banedanmark) and the public service supplier (DSB).
- Review the network charging scheme
- Access and pricing of access to key facilities (ticketing system, stations, etc.)

At the same time, it should be noted that instilling more competition in the rail sector includes several challenges, and a process of further market opening shall *inter alia* ensure adequate attention is given to at least the following elements:

- Railroad infrastructure is extremely expensive and the tracks constitute a natural monopoly (although competing tracks exist in the U.S.)
- High capacity costs imply that capacity is utilised to the maximum and congestion occurs at key rail lines.
- Tracks are used for both passenger and goods with very different needs and very different degrees of willingness to pay, but the two operator types shall in combination cover the cost of maintaining, operating and renewing the tracks and infrastructure
- There are public service requirements for serving remote areas and possibly unprofitable rail-lines
- There is a risk of cross-subsidisation between competitive and non-competitive areas
- There are significant economies of scale for operators and significant entry costs to start operations
- Technical and regulatory requirements constitute an entry barrier for new operators, e.g. related to requirements of new security systems.

3.3 Further market opening in freight rail transport

The market for rail freight has been open for competition for a long period of time, and the separation of the ownership of the tracks and the goods operator took place in 2001, and today, a number of private rail companies are competing for rail goods traffic in Denmark.

As such, there is already full competition for the entire market, and therefore the potential for further productivity gains is limited and will result from regulatory changes which improve the functioning of the competition.

One area is again related to the allocation of rail slots, and how slots for access to the same infrastructure are allocated between passenger operations and goods operations. According to our assessment, the allocation principle is still giving high priority to the incumbent passenger rail operator. A different slot allocation mechanism based on other criteria than allocating the slots for congested lines to the incumbent first, could give a more efficient allocation, and allow for competition in the rail goods segment to develop further, which again could lead to efficiency gains for the operators.

Rail charges are set by the rail regulator (Banedanmark) following EU regulation. The benchmarking report from IBM for 2011 pointed out that the Danish rail infrastructure

charge for goods operators is more than double of the German one (in Denmark the average is €5.44 per train-kilometre, while in Germany the corresponding average charge is €2.46 per train-kilometre). It should be noted that the comparison includes the charge for the Great Belt and it excludes the environment support to goods transport on rail. An updated calculation from Banedanmark based on the 2013-charges shows an average charge of €5.47 per train-kilometre for a standard train including the Great Belt link and excluding the environment support.¹⁶

National freight transport on rail receives an environment support compensating for the charges exclusive of the Great Belt charge. The environmental support also applies to international freight transport on rail (import/export) with start or finish in Denmark as well as intermodal transit traffic where a shift to road is made for at least one of the ends of the journey, whereas factory-to-factory transit through Denmark does not receive the environmental support.¹⁷ It should be noted, that the vast majority of rail freight in Denmark is transit (more than 85 percent of total ton-kilometres).¹⁸ Using the same standard train, goods transports eligible for environmental support pays a net fee of €2.65 per train-kilometre (including the charge for the Great Belt), whereas goods transports not eligible for environmental support pays the above 5.47 per train-kilometre (including the charge for the Great Belt).

Another area of interest is the goods terminals. Today, the so-called kombi-terminals are operated by private operators (currently DB Schenker and TX Logistik). This requires competitors to purchase services from a competitor, which in certain circumstances can give raise to concerns, although the arrangement is generally working well in practice. Access on non-discriminatory terms is ensured by regulation.¹⁹

A final area, where certain cost efficiencies can be achieved is in relation to the regulatory requirements for operators. The administrative procedures for approval are seen as cumbersome and costly for the operators, and the costs for approval are assessed by operators to amount to around DKK 200.000 per operator.

All in all, we assess that there is still a potential for productivity improvements from resolving the above issues and the order of magnitude is around 5 percent increase, which is a conservative assessment of the estimate of 6-8 percent following from the market opening estimations.

3.4 Productivity gains from further market opening in postal services

The postal incumbents in Sweden and Denmark merged in 2009 to form *Posten Norden* owned by the Danish state (40%) and the Swedish state (60%).

¹⁶ Banedanmark has assumed a standard train of 1600 gross tons (exclusive of the locomotive) and carrying 1000 tons of freight travelling between Høje Taastrup and Taulov (distance of 180 km exclusive of the Great Belt crossing).

¹⁷ See BEK nr 1107 af 21/11/2012.

¹⁸ See NYT fra Danmarks Statistik nr. 344, 25. juni 2013.

¹⁹ See BEK nr 168 af 03/03/2009.

The market for postal services was formally opened for competition in all segments by 1 January 2011, when the reserved area for letters below 50 grams was opened up.²⁰

As in many of the other network sectors, formally opening up for competition does not necessarily imply that effective competition will materialise overnight. This is also the case in postal services.

The potential from increased competition for ordinary mail items is likely to be small because of the high and continued e-substitution, which leads to lower volumes and makes the letter segment commercially less interesting for entrants. The potential for productivity gains from increased competition lies in our view in other areas of the postal markets (parcels, unaddressed items, magazines and new papers).²¹

The postal market is formally open to competition, but several factors are still impeding an effective competition. Some of the key challenges relates to access to important facilities such as post office boxes and address databases and the ownership of the postal incumbent still being public. Access is based on individual negotiations which are subject to the general requirements of non-discrimination, cost-orientation, and transparency in the postal directive, and Danish Postal Act. Some countries have chosen other solutions. In Sweden the national address database is managed by a company which is co-owned by the two largest postal operators (Posten AB and Bring Citymail). All information about changes of addresses are reported to the company, which distributes this information to the two postal operators.

One challenge in the postal sector relates to the universal service obligation (USO) and the financial compensation to the incumbent for delivering mail according to the requirements in the USO. This is one of the possible sources to productivity gains, which could be obtained by gradually reducing the required service, e.g. Saturday delivery. The declining mail volumes makes it more and more costly to maintain the same service level, and at the same time alternatives to mail improve as more and more digital solutions become available and widely used. This implies that the economic value of maintaining the current service level will decline over time. Thus, one way to improve productivity in the postal sector would be to allow Post Danmark to reduce some of the most costly services by reducing the required service levels in the universal service obligation. The postal Directive does leave some room for such reductions, e.g. by reducing the required number of delivery days per week from six to five. It could also be considered to introduce Swedish style letter boxes in apartment buildings.²²

Another challenge, perhaps of smaller importance, is the access for competing postal operators to be inserting mail items into the incumbent's network. Access is required because Post Danmark's competitors do not have full national coverage in their distribution

²⁰ See the new postal law, LOV nr 1536 of 21/12/2010.

²¹ Distribution of unaddressed mail and some parcel distribution are not postal services and do not require a license. This means that some competitors do not have the same rights and obligations as licensed postal operators have.

²² These are letter boxes for a complete block of for example 20 individual letter boxes where the front cover can be opened once for all letter boxes for the apartments in the building. This saves time for the mailman.

networks and use Post Danmark to distribute in some areas.²³ Ensuring correct pricing and transparency for this access is one of the ways to an effective and well-functioning competition.

A final key issue in the postal markets, not just in Denmark, but throughout Europe, is the issue of VAT. Products within the USO are exempted from VAT, which gives the incumbent a direct competitive advantage compared to other postal and delivery operators. However, this issue can only be addressed by a revision of the European Commission's VAT directive. So far attempts to change the VAT directive to find a solution to the VAT distortions in the postal sector have failed.

In our assessments, regulatory steps can be taken to further strengthen the transparency of the cost allocation for the incumbent and to helping competition to arise by removing barriers/creating good conditions for competition to emerge.

Estimates based on the market opening index from the 2005-study indicate that these gains could further increase productivity of the sector by 10-20 percent.

3.5 Further market opening in urban transport

Busses

The market for urban transport (buses) has changed dramatically during the 1990s and early 2000s. Today, all contracts for buss traffic both in cities and inter-city is put to tender. The process started in the greater Copenhagen area in the 1990s and has now spread to virtually all areas of the country.

Around 2002, most traffic was open to tendering except for the two cities Odense and Aarhus. These have now followed track, and only a very minor fragment of the traffic is still not put to tender. Long-distance busses were completely opened for any licensed operator in 2007. Only the small island of Bornholm still has some own-production under public ownership because of the small scale.

A common "model contract" has emerged, and all tenders are conducted more or less along the same lines and contracts are very similar between cities and regions, which is an advantage for bidders because it reduces the bidding costs when conditions and formats are similar across the market.

The "model contract" is a gross contract to deliver a certain amount of buss-hours according to a predefined time table presented by the regional transport authority. The operators are then competing on delivering the requested amount of traffic and the specified time tables at the lowest possible amount. The winning bidder is then awarded a gross contract with a fixed payment for the delivery of traffic regardless of the revenues generated from the operations. The public traffic authority is then receiving the revenue from passengers, and will cover any eventual losses resulting from fewer passengers than ex-

²³ Another form of access would be downstream access where competitors handle collection and pre-sorting but use Post Danmark to distribute the mail. However, this is form of access is less relevant since competitors have own distribution.

pected. Most contracts have bonus incentives related to passenger satisfaction and punctuality. Only very few contracts are so-called net contracts, where the operator is allowed to keep the passenger revenues, and thereby is given an incentive to increase passenger volumes, but also the freedom to influence the traffic planning and time tables. There are of course mixed variants in between the two extremes.

Countries such as Sweden and the UK have been using net contracts more than in Denmark. On 1 January 2012, a new Public Transport Act came into force in Sweden. New regional public transport authorities are formed to be responsible for developing the public transport system in each region. Strategic decisions on public transport will be made by these authorities, with the aim of greater insight and better co-ordination with other forms of social planning. Experience from Sweden suggests that gains of 15-20 percent have been achieved in certain circumstances, but there are no systematic evaluations of the aggregate impacts.²⁴

In the absence of a precise empirical evidence available for the Danish market, we have assumed a small productivity potential of 3-5 percent for the busses and taxis.

Taxis

For taxis, there are quantitative constraints and the number of licenses is restricted and new licenses are granted by the local “taxi authority” (*Taxanævnet*).²⁵ Not only are the number of taxis constrained, but there are also restrictions on ownership and how many taxis can be owned by each individual. The acquired licenses cannot be traded and is strictly personal. Prices and price structure is also determined for all taxis by the taxi authority.²⁶

In addition, charges are set according to a cost-model.²⁷ Using a cost index with no productivity element to regulate charges is clearly counter-productive with respect to productivity gains. Productivity gains are “assumed away” by this approach, and to the extent there are gains, they are by definition not passed on to consumers. This is highly problematic for the productivity gains in the taxi market. It implies that taxi drivers/owners are guaranteed their income even if they do not improve their productivity. This gives an insufficient incentive and unlike other businesses, taxis are not forced to improve their productivity. With the cost-model, productivity gains rests with the taxi-owners.

Comparisons made by the Danish Competition Authority showed that prices increased by 5 percentage points more for taxi than the general price of services.²⁸

Experience from other countries such as the Netherlands and Sweden shows that removal of the quantity restrictions will increase the number of taxis and reduce waiting times.

²⁴ http://www.svenskkollektivtrafik.se/Global/In%20english/reports/Public%20transport%20in%20Sweden_2002_06_10.pdf

²⁵ The local taxi authorities (*Taxinævn*) consist of politicians elected in the municipality.

²⁶ See Møller, Michael & Nielsen, Niels Chr. (2012), *Taxi Økonomi*. See also op ed in *Berlingske Tidende* 26 November 2012, ”Holberg, H.C. Andersen – og taxierhvervet”.

²⁷ See the taxi authority’s *Indeks til regulering af takster for taxikørsel*.

²⁸ Konkurrenceregørelse 2008.

Reducing the restrictions on price regulation on the contrary has led to higher and more differentiated prices.²⁹

3.6 Further market opening in telecommunications

Our market opening index shows that the telecommunications market in Denmark was already very close to the defined benchmark of full market opening and on that background we estimate modest remaining potential. Based on the chosen approach, we estimate a potential of 1-5 percent further increase in productivity.

However, the telecom market, including mobile, internet and fibre technologies is evolving rapidly and has evolved enormously since the market opening process started.

A number of new regulatory challenges are emerging, including the challenge of securing new investment by market players in the so-called “next-generation network” – i.e. the superfast broadband which can fuel innovation and productivity throughout the economy. Here the challenge is finding a balance between ex-ante regulation addressing competition concerns and the eventual negative impact on the incentive to invest. If the sector is too heavily regulated, market players will be reluctant to invest in new infrastructure, and on the other hand, if regulation is too lax, the new investments could lead to future problems with market concentration and market power.

In this light, the Danish regulator has for example identified a number of regulatory challenges in the so-called wholesale market for broadband.³⁰

Strictly speaking, and based alone on the market opening index, the potential for further productivity gains in telecommunication appears to be modest – around 1-5 percent, and we will use this estimate as a minimum expectation.

However, this estimate is most likely much too low given the rapid evolution of the sector, and the new regulatory challenges emerging, but we do not have access to studies with empirical evidence of the size of these potential, so the modest 1-5 percent is used.

²⁹ Konkurrenceregørelse 2008.

³⁰ www.erhvervsstyrelsen.dk/file/252879/analyse-af-engrosregulering.pdf