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How to ensure reasonable prices of financial market data

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Authors:
Helge Sigurd Næss-Schmidt, Partner
Martin Bo Hansen, Senior Economist
Bruno Basalisco, Economist

Preface

For a while, concerns have been raised that the prices of financial market data have been 'too high'. The reason for this is that trading venues hold significant market power in the market for financial market data. This has been recognised by the Commission who is now exploring – together with ESMA – different regulatory options to ensure that prices become more in line with 'reasonable commercial basis'. Concretely, ESMA has launched both a 'consultation paper' and a 'discussion paper' inviting stakeholders to respond to the topic explored in the two papers.[1]

This report is commissioned by the Danish and Swedish Securities Dealers Associations with the purpose of providing a thorough foundation for the responses to ESMA's process. Our aim is to provide in depth information on how to achieve reasonable pricing of financial market data in practice. Concretely, we suggest a regulation model and suggestions for concrete technical implementation.

In the mandate given to ESMA by the Commission, it is stipulated that 'outright price regulation such as price capping' is not the intention, cf. box below. This wording is later on interpreted as 'quantitative price caps' in the sense that the price caps are arbitrarily determined.

> The background to these rules are that data charges in the EU are too high and that legislation is required to ensure that those charges are set at a reasonable level. The ultimate goal of this rule is to ensure that costs of data are brought down for the benefit of efficiently functioning market, in particular efficient and fair price finding and formation through increased transparency.
>
> Since data must be made available on reasonable 'commercial' basis, the intention is not to provide outright price regulation such as price capping. Rather this formula was chosen to provide a sufficiently flexible but effective criterion to ensure that charges for data are transparent and reasonable compared with relevant measurements such as the cost of producing them but at the same time without hampering investment, innovation and product development.
>
> *European Commission (2014), 23/4/2014 Request to ESMA for technical advice on possible delegated acts and implementing acts concerning the regulation on markets in financial instruments and amending regulation EMIR … page 39*

On the next page, the mandate clarifies that what indeed should be explored is: 'approached for restricting charges by reference to appropriate benchmarks …', cf. box below.

> … Second, it should explore approaches for restricting charges by reference to appropriate benchmarks such as overall revenues or costs.
>
> *European Commission (2014), 23/4/2014 Request to ESMA for technical advice on possible delegated acts and implementing acts concerning the regulation on markets in financial instruments and amending regulation EMIR … page 40*

In this report, we explore exactly this: a concrete suggestion for a regulation model which will restrict charges based on a cost benchmark. We suggest both the criteria which such a model could be established upon, and suggestions on a wide range of technical implementation decisions.

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[1] ESMA (2014a) and ESMA (2014b), which covers many different aspects related to MiFID II and MiFIR besides financial market data

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Executive summary

In order to conduct transactions on a trading venue, it is a necessary condition to have access to the prices you are faced with on the trading venue and the quantities offered. The information about prices and quantities of the different products traded is currently sold by the trading venues in various forms and packages containing different subsets of the information available. This is called financial market data. For a while, concerns have been raised that the prices of these data have been 'too high', due to the market power held by the trading venues in the market for financial market data.[2] This has been recognised by the Commission who are now exploring – together with ESMA – different regulatory options to ensure that prices become more in line with 'reasonable commercial basis' as required by both the original and revised MIFID.

Recognising the need to regulate pricing of market data in order to ensure pricing based upon reasonable commercial basis, three questions are crucial:

- What data should be the focus of regulatory control?
- How should venues be remunerated for provision of market data?
- What regulation model should be pursued to achieve this aim?

In this report we suggest a concrete model dealing with these three questions. We argue that this model can achieve the objective of bringing prices of market data more in line with reasonable commercial basis by giving rise to a competitive market for data provision. Importantly, the model is not overly complex and can designed and implemented without giving rise to excessive compliance or administration costs for regulators and regulated firms. Instead, it will reduce or even remove the substantial costs paid by current data consumers in order to comply with increasingly complex terms of conditions related to data consumption. In addition, we argue that the model will improve conditions for competition between trading venues in the market for trade execution, facilitate the construction of a consolidated tape and order book while maintaining incentives for trading venues to invest in keeping a well-functioning distribution of raw market data.

A key aim in this report is to provide a model that is consistent with the way market data is used by market participants, in particular:

- Users that need low latency data to interact with automated trading will always need a very wide range of data typically consisting of the entire order book of all instruments on a given exchange. This implies that the level of disaggregation need not to be very high, and can be confined to relatively large group of assets classes. This is in line with the suggestions in the ESMA consultation paper: trading venues should not be forced to sell data on individual securities or small segments.
- By contrast users that are provided with market data obtained through screen based terminal-solutions have limited use of very low latency data because the data is al-

[2] See Copenhagen Economics (2012a), where we argue that trading venues' position in the market for financial market data is very similar to a natural monopoly position.

ready 'old' in the context of high speed trading formats. In such contexts, users can ask for data products that provide only a subset of data from the providers of such screen based solutions, and if economically feasible be offered data on individual securities or small segments.
- Screen based data formats can and is today provided by alternative data providers who obtain a very broad range of raw data directly from the trading venues.

Based on this, we recommend a model based on a few simple criteria:

- Impose a cost based price cap on one product: the entire order book and post trade data in a raw data format, including static information such as instrument identifier codes
- Construct the price cap through a Long Run Incremental Cost (LRIC) benchmark based on a bottom-up assessment
- The relevant incremental service should be: the distribution of market data from trading venues

These criteria are designed in line with existing price regulation models. There is vast experience with price regulation especially in network industries such as telecommunications and energy distribution. We have looked to these existing models for inspiration in order to suggest the way to move forward on a broad range of practical implementation decisions. Importantly, this experience shows that price regulation through cost-based price caps is not a novel or exotic option surrounded by uncertainty. Conversely, such models are thoroughly tested, and significant competences for practical handling have been built up at various regulating authorities.

Regarding the practical implementation decisions, we suggest the following avenues:

Raw data

The relevant product to price regulate is *fully bundled raw data* with granularity defined as broad classes of securities as suggested above. The reason to choose raw data is to a large extent a matter of practical convenience. *Firstly*, regulation on more processed data would make it more difficult to assess the true cost behind such products, leaving the actual content of the product more open to discussion. *Secondly*, in order to be effective, the regulation would need to be imposed on several data products increasing the administrative scope and costs. *Thirdly*, by offering raw data to the market, it facilitates the creation of a consolidated tape and order book and even more importantly a competitive market in the provision of market data solutions for users with different needs.

Ownership of data

Once sold from the trading venues, financial market data should not have any *conditions with respect to further internal or external use of data*. This is a rather natural consequence of pursuing cost-based regulation of market data: by accepting that trading venues should be allowed to earn revenue in proportion to their relevant cost, the important issue becomes to allow the trading venues to recuperate this revenue in the most efficient way. As long as the regulation ensures that trading venues obtain a pre-determined revenue sufficient to cover costs and an acceptable return on investment – no more, no less - they

will not gain on a net basis by getting additional fees from subsequently reselling. It will just lower the regulated prices (more volumes, lower price per data sold)

Furthermore, we argue that collection of revenue through redistribution clauses, per-user fees and various other types of non-disclosure requirements is an inefficient way to collect revenue due to the vast amount of administration and compliance costs connected with this. Secondary data providers selling data packages to consumers may continue to impose user restrictions on data: this is an issue of competition as in other fields of provision of digital services. The key point here is to keep such discussion of user restrictions outside the remit of regulation of raw data.

Defining incremental cost through a bottom-up procedure
We agree with the description in the ESMA consultation document that the best cost benchmark to use is based on Long Run Incremental Cost (LRIC), and that the best way to assess this benchmark is through a bottom-up procedure. Distribution of market data to consumers is an incremental service to the trading venues' main activities, and the relevant cost benchmark should indeed be based on the costs relevant to providing this incremental service. Using a bottom-up procedure to derive the benchmark has several beneficial characteristics such as disregarding potential inefficiencies in existing provision of the service. Moreover, it may be practically very difficult to disentangle actual cost figures from trading venues on the provision of raw data versus the provision of processed value added products, which would be needed if pursuing a top-down approach.

Providing incentive for investments in market data distribution
In industries associated with large capital investments it is important to allow firms to recuperate a return on such investments. There are several ways to achieve this. The most promising way is to include a rate of allowable return on capital in the cost benchmark, where this rate is determined according to a weighted average cost of capital (WACC) assessment. We argue however, that this is less important in the market for financial data, as the investments needed to *distribute market data* are relatively small.

The LRIC model should be maintained at a central regulator
Once the LRIC model has been developed for a model-trading venue, it should be maintained in order to ensure that it correctly reflects the costs associated with distributing market data under different circumstances and client bases. This maintenance should preferably be done by a central regulator in order to reduce administrative costs and potentially different applications of the model.

Enforcement can take different shapes
Several models for enforcement of the regulation model could be envisaged. While most regulation is typically enforced by national agencies, others are enforced by a centralised EU agency. It is not clear that there is a priori one strongly preferred model, and several models could thus be brought to the table.

Implications of the regulation model

In this report we argue that adopting this regulation model will significantly improve the functioning of the market for financial market data in several ways:

- Pricing of market data to final consumers will be according to reasonable commercial basis as (new and existing) data vendors will compete by offering value added data products based on the price regulated raw data from trading venues

- If trading venues have exerted market power – as we argue is likely – the regulation model will result in cost savings for brokers and investors. Given that the market for providing value added services to final investors is not characterised by natural market power, these cost savings will be passed on to final investors/end-users

- Market data will be available to investors at a lower cost and in a more transparent manner. This will improve conditions for competition between trading venues on the market for trade execution, as it becomes less burdensome to conduct transactions on other trading venues. In addition, larger availability of market data is likely to spur extra interest in the market

- Incentives to provide investments in order to keep trading venues well-functioning is maintained as the cost benchmark includes a return to capital

- Facilitates the construction of consolidated tapes and consolidated order books

- Meets the objective to provide unbundled products to the market – if this is valued by consumers – as secondary data providers will compete to provide the products demanded by consumers.

Is the model practically feasible for regulators?

Concerns have been raised that price regulation based on an LRIC cost benchmark could be cumbersome and associated with both administration cost for regulators and compliance cost for trading venues. We argue that such price regulation is indeed feasible, which has been demonstrated in several other industries. We acknowledge that some administration and compliance costs are associated with such a model, primarily in the initial process of constructing the LRIC model, but argue that these costs are much less significant than in other regulated industries such as telecommunications and energy distribution where markets and cost structures are much more complex and difficult to disentangle. In addition, these costs should be compared with the current amount of costs incurred by the market data consumers who are currently spending vast amount of resources ensuring that a myriad of complex terms of conditions attached are met.

Chapter 1

Understanding the use of market data

In previous work, we have highlighted that while MiFID has spurred competition in the market for execution, there still remains significant market power in the market for financial market data.[3] Importantly, this market power held by trading venues is derived from a natural monopoly position, which implies that pricing in this market will not be on *reasonable commercial terms* unless regulated.

The question is then: how should a well-functioning regulation model look and what is the likely impact on the market?

In order to design a well-functioning regulation model, it is important to a have a thorough understanding of the market for market data, and how it is used in practice by different stakeholders. Only then, will it be possible to design a regulation scheme and predict the likely impacts on the market.

This chapter describes the different channels whereby consumers of financial market data receive data with different latency (Section 1.1) and the way these data are used by traders and consumers (Section 1.2).

1.1 Data channels and latency

Data is generally consumed through three channels: 1) a direct feed through membership with a trading venue, 2) purchase of data products from trading venue, and 3) purchase of data products via a data vendor.

Table 1 Data channels

	Data supply channels	
(1)	Direct feed to trading venue through membership	Raw data
(2)	Purchase of data products from trading venue	Processed data
(3)	Purchase of data products from data vendors	Processed data

Source: Copenhagen Economics, based on interviews with market participants

The direct feed (1) is characterised by being very close to raw data and delivered in bulk products with very little granularity, such as e.g. all equities, or all bonds. Data from the direct feed is only used in 'all-machine environments' and restricted for monitor-view use. Data consumers can typically transform the raw data into processed data products *in-house* for additional cost.

[3] See Copenhagen Economics (2012a)

Data purchased directly from trading venues or through a data vendor such as Bloomberg or Thomson Reuters (2+3) is characterised by being processed data to be used for monitor-view and downstream redistribution both in-house and externally, e.g. to the home banking solution of private households. This data is typically less bulked than the direct feed, but it is still bundled into aggregate products e.g. equity classes or indices. While data can be purchased directly from trading venues, most consumers tend to buy the data indirectly through a data vendor terminal solution. Some terminal solutions facilitate direct clientship between consumers and trading venues, while other terminal solutions act as a middleman between the two.

Latency

Data is delivered at different speed, typically characterised as latency. For sake of clarity, we define four degrees of latency: A+ to C, cf. Table 2.

Table 2 Four degrees of latency

	Latency
(A+)	Very low latency - same server room
(A)	Very low latency - some distance
(B)	Low latency - Real time connection
(C)	Delayed data

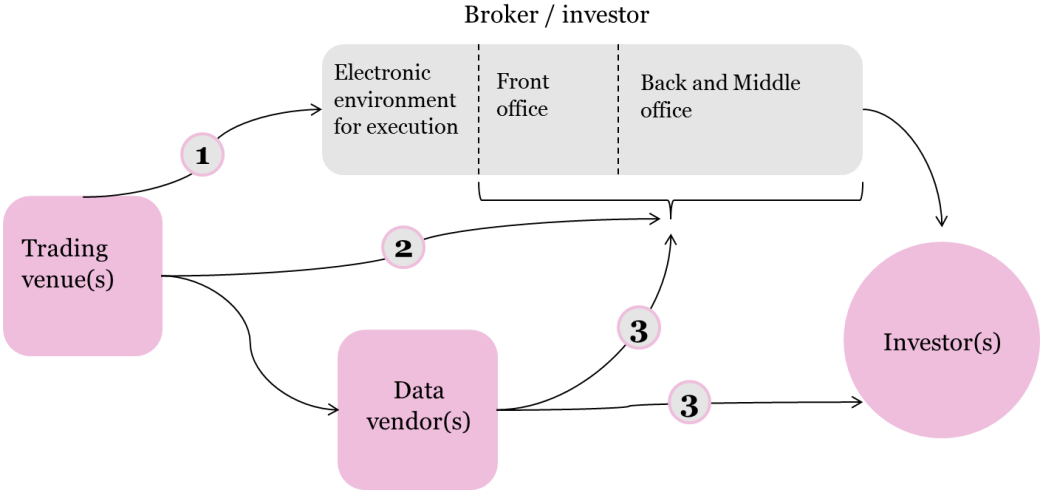
Source: Copenhagen Economics, based on interviews with market participants

(A) is defined as very low latency measured down to nanoseconds. **(A+)** is even faster, and defines the difference by co-locating servers to reduce the distance the information has to travel. **(B)** is defined as real time connection, but not down to nanoseconds, while **(C)** is delayed data defined broadly from, say 15 minutes to several hours.

1.2 How and where is data used?

The data from the different data channels are used to very different purposes even within the same consuming entity such as a broker or a large investor, cf. Figure 1.

Figure 1 Where is data used



Source: Copenhagen Economics, based on interviews with market participants

Data from the direct feed through membership access **(1)** is used to execute transactions in an electronic environment. It is important that latency in data access is very low, **(A)** or **(A+),** in order to achieve the best margins on each transaction. Data is being delivered in a very close to raw data format, which also helps to keep latency low, as it does not have to go through a layer of processing before being delivered from the trading venues. Once trading algorithms have been programmed, executions are conducted electronically without any human ever seeing the direct feed data. The data is typically delivered fully bundled, divided only on asset class (equities, bonds, derivatives).

Processed data from the trading venues **(2)** and **(3)** is used for staff functions from front to back office. Typical uses are to determine the trading strategy and document best execution. Basically, everything appearing on a monitor within a large broker firm is purchased through **(2)** or **(3).** Rough estimates suggest that this data constitutes the vast majority of data use for brokers (70-80 percent). While the front office of such firms typically uses real time data **(B),** middle and back office can also use delayed data **(C)** for many purposes.

No functions other than the high-speed trade execution software uses data of very low latency **(A)** and **(A+)**.

The use and latency of different types of data consumers is summarised in Table 3.

Table 3 Use of market data for a broker/investor

	Electronic environment for execution		Front office		Middle and back office		Downstream investors	
Channel	Use	Latency	Use	Latency	Use	Latency	Use	Latency
(1)	X	A / A+						
(2)			X	B	X	B/C	X	B/C
(3)			X	B	X	B/C	X	B/C

Source: Copenhagen Economics, based on interviews with market participants

Chapter 2

Suggested regulation model

In this chapter we put forward a regulation model which can ensure market data pricing in line with reasonable commercial basis. In section 2.1 we describe the overall criteria for the regulation model and its implications. In section 2.2 we go into detail with which technical design choices to make.

2.1 Criteria for regulation and implications

The regulation model we propose is based on six criteria, cf. Box 1. We go into detail with these criteria in section 2.2 on technical implementation choices.

Box 1 Criteria for regulation of financial market data

1. Regulate certain data product(s) through a cap on prices or a cap on absolute revenue from these products
2. The regulated product should be the entire order book and post trade data in a raw format (defined below)
3. The price or revenue cap should be determined from a benchmark of the cost associated with providing the relevant service. This benchmark should be Long Run Incremental Cost (LRIC) or the so called LRIC+
4. The benchmark should be determined through a bottom-up process (could be complemented by top-down estimates)
5. The relevant incremental service should be defined as 'the distribution of market data to data consumers'

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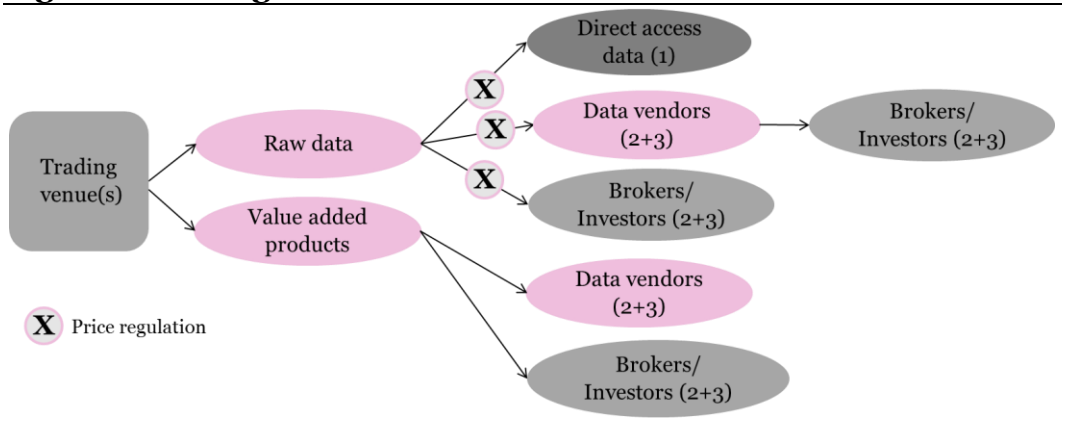
One implication of this model is that we divide the trading venues' data products into two categories: 1) a raw data product, and 2) value added products. The regulation would then target the raw data product and allow trading venues to keep setting prices on other data products entailing some kind of added value, cf. Figure 2.

Figure 2 The regulation model illustrated



Note: Value added products will not be demanded in direct access data due to low-latency requirements. (1), (2) and (3) refers to the type of data access defined in Chapter 1.

Source: Copenhagen Economics

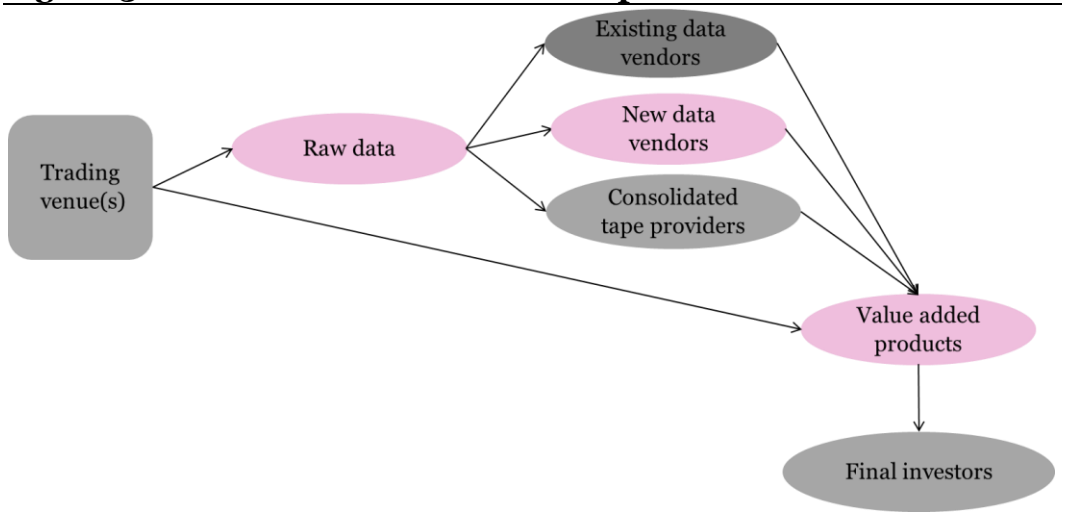
The practical implication of this regulation model is that raw data will be available for anyone at a *reasonable price*. In practice, raw data is only used directly in electronic execution software, while all other uses require some form of processing, either in terms of converting the raw data to a user interface, or in terms of constructing e.g. indices, best bid/offers and consolidated tapes. Consequently, much demand for market data is for value added products, which is not regulated as such in this model.

However, as raw data is available to all market participants at the regulated price, all participants can use this data to construct and offer a variety of value added data products catered to the consumers' need; including both brokers and corporate and private investors. In this secondary market there will be no natural monopoly position. Existing data vendors might compete with new data vendors, perhaps with different business models e.g. consolidated tape providers, or the existing trading venues cf. Figure 3.[4] Given the competitive pressure in this market and the regulated raw data prices, these value added products will be delivered to the market at a *reasonable commercial basis*.[5] This model ensures that the reductions in cost of market data find their way to the final consumers i.e. the investors.

[4] One derived implication could be that the envisaged consolidated tape providers were allowed to compete in this market, making it more likely that such providers would be able to run a commercially viable business model.

[5] There is currently a discussion about the current degree of competitiveness in the market for data vendors due to relatively limited amount of current data providers. There is however no 'natural reason' why there should not be competition in this market, unlike trading venues' provision of market data, which has the characteristics of a natural monopoly. See Copenhagen Economics (2012a) for a discussion of why this is the case.

Figure 3 Market for value added data products



Source: Copenhagen Economics

Regulation following these criteria is not novel or untested. In fact, several regulation regimes make use of similar criteria. One example is in mobile telecommunications, where the price for call termination is regulated based on a bottom-up LRIC benchmark, cf. Box 2. The case about regulation of call termination has several parallels to regulation of market data, as call termination also experiences two-sidedness. Here one market (call origination) is competitive (parallel to trade execution) and the other market (call termination) is characterised by significant market power (parallel to market data). In this case the competitive origination market case is unregulated, while the uncompetitive termination market is price regulated by using a bottom up LRIC cost benchmark.

Box 2 Practical example: Regulating the market for call termination

Recommendation 2007/879/EC on relevant telecoms product markets for ex-ante regulation includes the market for mobile call termination. This is a two-sided market. Call origination (placing a call) is a market with presence of multiple networks competing for mobile customers. Call termination (transferring the call to a specific number) is however characterised by each network having a de facto monopoly. A network A subscriber seeking to call a network B subscriber creates a demand that can ultimately only be satisfied by network B in the termination market. Thus, each network holds significant market power on calls terminating on its own network.

As a result of the strong degree of market power that each operator holds in this market, regulators impose price control obligations. In the past, regulators have considered bottom-up cost models such as Long-Run Incremental Cost (LRIC), with, in certain cases, the recovery of common costs (LRIC+). In some cases, regulators have imposed (asymmetric) caps on termination rates which varied for specific operators (e.g. higher for new entrants). However, the current guidance from recommendation 2009-396-EC specifies that

- Rates are set based on the costs incurred by an efficient operator and, by implication, are equal for all operators
- Efficient costs are evaluated based on current cost and using LRIC bottom-up cost modelling (without the common cost recovery previously allowed by LRIC+)
- The bottom-up results may be compared with those of a top-down model which uses audited data with a view to verifying and improving robustness
- The cost model should be based on efficient technologies available in the time frame considered by the model
- If alternative technologies are available to an operator (e.g. 2G, 3G) costs can be calculated by weighing the costs of the different technologies

As a consequence of the tightening of regulation, termination rates have decreased over time. For instance in the UK, the 2007 Ofcom market review set a glide path at the end of which rates would be capped at 5.1p or 5.9 (for the newest, smallest player) – based on LRIC+. In the 2011 review, based on LRIC, rates were capped at 0.69p (for all operators) at the end of the glide path.

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Implications for latency

Being able to execute trade with very low latency has gained increasing importance the past decade. It is consequently important to consider what this regulation model would imply for latency in trade execution, especially as data vendors will play an important role in the envisaged regulation model in developing and selling value added data products.

We argue that the regulation model will not affect the structure of the current business models with respect to latency. Low latency is relevant for computers, not for humans;

hence for all data that is ever viewed by a human,[6] low latency is not an issue. It is important that data can be viewed in real time, but differences in nanoseconds are redundant. It is therefore not a problem in respect to latency that it could be third party data vendors that construct the value added data products instead of the trading venues.

For the data that is used to execute trades however,[7] low-latency can be very important. As described in Chapter 1, this data is typically supplied through a direct access feed to trading venues, which feeds raw data into an electronic execution environment, where an algorithm executes orders without human interaction (once trading strategies have been programmed into the algorithm). As the envisaged regulation model maintains the direct feed of raw data from trading venues to brokers/investors, the situation is unchanged from the current situation.

Ownership of market data

It is important to clarify which conditions (if any) there should be placed on the price-regulated raw data. Generally there are two options to consider:

1) Imposing restrictions on data vendors' re-selling of raw data and/or processed data, so they pay a fee for redistribution
2) Not imposing any restrictions on the use of the data including for re-selling

We argue that under our recommended regulation model, this choice should not matter for trading venues. Trading venues are allowed to recuperate the costs associated with providing the incremental service of distributing market data. Whether these costs are recuperated through the price of raw data (as we suggest), and/or by other means such as a redistribution fee, a per-user fee or a combination of these will not change the revenue that trading venues can receive from market data, as this is determined through regulation. That is; if regulators were to decide to impose a price cap on raw market data, and a per-user fee associated with using this data for internal usage, these two prices should be determined so to provide exactly the same amount of revenue for the trading venue, as it would have obtained with just a price cap on raw data.

By far the simplest solution – and our recommended solution - is to impose no conditions for resale. This would imply that once the raw data is purchased, consumers of the data can freely dispense over this data including redistributing it both internally and externally. While not affecting the revenues accruing to trading venues, as this is determined by regulation, this solution would greatly reduce administration costs associated with tracking the use of market data within companies. Currently, significant resources are devoted to ensuring that only the allowed users do in fact have access to the data which in practice can be very difficult and costly to ensure as elaborated in Section 3.2.

Price setting in practice

With this regulation model, there is one key objective: that trading venues are able to recuperate the costs associated with distributing raw market data to market participants. In practice, the price of raw data will be defined to ensure that this objective is met.

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6 Equivalent to categories (2) and (3) as defined in Chapter 1.
7 Equivalent to category (1) as defined in Chapter 1.

Generally, there are two possible reasons why price caps may differ across trading venues and over time for the same venue:

1. *Changes in the 'allowable costs'*. This could e.g. be if a new technological innovation could result in much higher quality of data distribution and/or with lower latency. In such a case, the price cap could be raised to incentivise that the trading venues invested in such an innovation. Alternatively, one could adopt the same approach as in e.g. some telecommunications and energy distribution cases, where the assumption of the arrival of new technology leads to a reduction in allowable cost due to the more efficient production technology.
2. *Changes in the demand structure*. If the number of consumers of raw data purchasing directly from a trading venue falls from say 10 to 5, the price of raw data faced by these consumers should increase, leaving the total cost of market data constant.

In practical regulatory settings, reviews are typically conducted at regular intervals, to ensure that the regulated cap in fact allows venues to accrue the required revenue.

This setup implies that different trading venues may charge different prices for raw market data. Unless the underlying cost structure varies significantly between the different venues, they will however earn the same revenue, and the total cost to the consumers of data from these venues will be the same.

2.2 Technical implementation decisions

To implement a regulation model such as the one listed in Section 2.1, several technical implementation decisions must be made. In this section, we go through some of the more fundamental choices and describe in more detail how such a regulation model can be put into place.

Why regulate raw data?

We strongly recommend that regulation should be directed at raw data. There are two main arguments for this:

Firstly, raw data is a relatively similar product across trading venues, and can therefore be a common baseline for regulation. This would imply that there need only be one regulated price. Conversely, if price regulation was exercised on processed data products (e.g. level 2 pre-trade data in a format that can be shown on a monitor to name just one) each data product would need to be price-regulated. Defining the content of these data products within venues and especially across venues would be very cumbersome.

Secondly, it is much easier to derive the cost benchmark – the basis for the price cap – for raw data than for processed data. The process of distributing raw data to consumers is the smallest increment one can envisage meaning that it is the most basic data service the trading venues can deliver. If more processed data products should be regulated, one would need not only to map the costs of distributing market data, but also the cost of processing and packaging the raw data into value added data products. The costs of such

actions are likely to differ depending on the degree of processing, and would therefore be more difficult to map than the service to distribute raw data.

In addition, by supplying the market with raw data, the principle in MiFID about unbundling of products can be satisfied if this is what consumers in fact demand. Secondary data providers will compete in order to satisfy consumer demand and providing unbundled products if the consumers are willing to pay the costs associated with this at a competitive market.

Raw data can be defined according to the definition in Box 3.

Box 3 How do we define raw data?

Raw data is defined as: 'as unprocessed data as possible at the fastest possible delivery'. One could envisage this e.g. as raw data flow containing information on all bids, asks and timestamps of executed orders including instrument identifiers and other 'static information'.

It is important that the definition of raw data is specified in a technology-independent format, such that the regulation is based on the content of the data and not the technology platform applied.

Alternatively to raw data, we define value added products or processed products e.g. as:

- Data reprocessed to a format that can be manipulated on a monitor
- Data transformed from underlying instruments into derived products such as indices of main equities or consolidated tapes or order books

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How to determine the price cap?

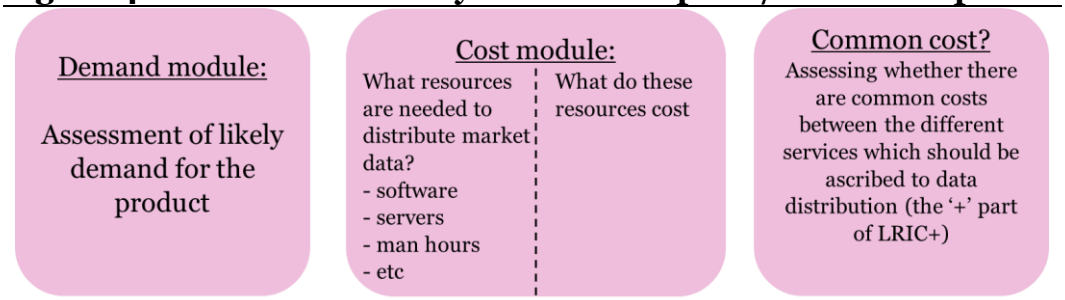
The price cap should be set such that trading venues will earn enough revenue to cover the costs associated with distributing raw data to consumers. Typically the price cap is set according to Equation 1 below, where:

- '*RAB*' is the regulated asset base, being equivalent to the capital equipment necessary to distribute market data
- *r* is the allowable return on investment typically determined as a weighted average cost of capital (WACC). This factor will allow trading venues to earn revenue above their actual costs
- *OPEX* is the operating expenditure necessary to distribute market data
- *Dep* is depreciation of the capital stock necessary to distribute market data

Equation 1: $\boldsymbol{Price\ cap} * units\ sold = RAB * r + OPEX + Dep$

In order to calculate this cap, several elements need to be mapped. The main elements are 1) the expected demand, 2) the costs associated with the service, and 3) whether there are common costs with other services, cf. Figure 4.

Figure 4 Elements necessary to calculate price/revenue cap



Source: Copenhagen Economics based on e.g. Deloitte (2010) and Europe Economics (2012)

The *demand module* is basically a forecast of demand for market data. A good forecast of demand will help to ensure that trading venues will in fact recuperate their costs without the need to change the price cap. This will ensure more stability in the price cap over time. The demand module will provide the 'units sold' in Equation 1 above.

The *cost module* is the key element in determining the price cap. This module will result in a cost benchmark for the activities required to deliver the service of distributing market data. The price cap will then be set to ensure that the costs included in the benchmark are fully recuperated. The cost module will provide the 'RAB', the 'OPEX', and the 'depreciation' in Equation 1 above.

The *common cost module* should determine if there are costs that cannot meaningfully be ascribed to just the service of distributing market data. This would typically be overhead costs, heating cost, facilities cost etc. which are shared with the trading venues' other services such as trade execution and listing. These common costs are typically used to determine the '+' part of the LRIC+ model, which can also be interpreted as a buffer against too strict cost benchmark assessments. It is important that such common costs can in a meaningful way to ascribed to the service of distribution of market data, in order for these costs to be included in the benchmark such that is does not become a 'backdoor' to drive up costs of market data.

How to determine the cost benchmark?

The cost benchmark measures all relevant costs associated with producing the relevant service. In order to measure the cost of one particular activity of a company conducting several activities, the long run incremental cost (LRIC) approach is the most suitable. This approach measures the cost savings that would be associated with discontinuing the particular activity – the incremental activity. The assessment is done in two steps:

The *first step* is to assess which resources are needed to distribute raw market data to consumers *in addition* to providing the other services that a trading venue offers such as

trade execution (and listing) services. Such resources will be servers, software, man hours, facilities used, etc. This can be done either by a bottom-up or a top-down approach, which we explore below. Here it is very important to distinguish between the production of market data, and the distribution of market data to consumers. Production of market data is part of a joint production process with trade execution, and the costs associated with this are borne in common with the cost of facilitating a trade execution platform. However, the distribution of market data to consumers is a different activity which stands alone from the production of market data. This is the relevant incremental service to be measured, and as it is a stand-alone activity, the costs can in fact be distinguished from the joint production of data.

The *second step* is to assess the costs of the incremental resources, which again can be done bottom-up or top-down. Costs are typically measured as capital expenditure (CAPEX) and operational expenditure (OPEX). In addition to cost, the lifetime of the capital equipment should be assessed to determine depreciation rates.

How to determine the required return on capital?

If trading venues were only allowed to recuperate nothing but their costs, there would be no incentive for investors to invest capital in providing this service. Consequently, in order to provide this incentive, price regulation models typically include an 'allowable return on capital', which is the 'r' in equation 1.

This return on capital is typically calculated as a weighted average cost of capital (WACC) based on the equation below, where D is debt financing, E is equity financing, and r_D and r_E is the required return on debt and equity respectively.

Equation 2: $r = \frac{D}{D+E} r_D + \frac{E}{D+E} r_E$

This aspect of price regulation is typically very important in industries with very large investment needs such as the utility sector and telecommunications. However, for financial market data this aspect is not as important, as the size of capital investments associated with distributing market data is likely to be much smaller.

Example of bottom-up benchmark

In contrast to top-down, a bottom-up benchmark is derived, not from actual financial accounts of the companies, but from hypothetical model-examples of these firms. One rationale for doing this is that it may be very difficult to disentangle incremental cost from the existing financial accounts, and that the top-down approach captures inefficiencies in existing companies' production. Therefore, a representative firm is modelled by mapping all the input factors required to distribute market data to consumers and the actual cost of these input factors.

Box 4 Bottom-up modelling – European Commission definition

"'Bottom-up modelling approach' means an approach that develops a cost model starting from the expected demand in terms of subscribers and traffic. It then models the efficient network required to meet the expected demand, and assesses the related costs using a theoretical network-engineering model, for the purpose of calculating the cost on the basis of an efficient network using the latest technology employed in large-scale networks. "

European Commission (2013), Recommendation on consistent non-discrimination obligations and costing methodologies

There are several practical examples where bottom-up benchmarking techniques have been used as a basis for the enforcement of public policy, cf. Box 5. As can be seen, bottom-up models are not only used for price regulation (a traditional application), but also to enforce competition law and to determine the compensation for services of general economic interest (e.g. universal service obligations in the postal sector).

Box 5 Practical example of the use of bottom-up benchmarking

Bottom up models have been used for:

- Competition cases, e.g. to assess abuse of dominance such as predatory pricing or margin squeeze
- Price regulation
- Calculating the cost of Universal Service Obligations (USO) in the postal sector

The following examples demonstrate the variety of applications to which a bottom up model can contribute to enforce public policy and improve market outcomes:

- Assess abuse of dominance

In the AKZO v Commission case on predatory pricing, the European Court of Justice held that it is an abuse for a dominant firm to:
- set prices below average variable costs (AVC); or
- set prices above AVC but below average total costs (ATC), if they are part of a plan for eliminating a competitor.

Since this judgment, antitrust agencies in Europe have evaluated dominant firms' AVC and ATC. In order to cross-check the top-down data provided by the firm and its customers, agencies in Germany and Denmark have investigated postal cases by relying on a bottom-up approach, calculating costs based on measures for elementary activities (e.g. number of visits to mailboxes) multiplied by unit costs for the different resources (e.g. cost per visit per mailbox). The costs of elementary activities are then aggregated to establish the costs for the relevant service – and compared to the prices charged by the dominant firm. (cf. Copenhagen Economics, 2012b)

- Price regulation

Regulators apply bottom-up cost models to enforce regulation intending to bring prices closer to costs. Bottom-up information is used to apply regulatory obligations such as charge controls (e.g. price caps). Regulators can design the parameters of the modelled firm so to reflect market conditions. For instance the bottom-up model can be based on factors that affect efficiency (and ultimately cost level), such as the scale of the firm or the choice of technology. In telecoms regulation, a bottom-up model is specified under the current Commission recommendation relevant for fixed and mobile termination regulation (European Commission, 2009)

- Calculating the cost of Universal Service Obligations (USO)

In the postal sector, firms are designated as universal service provider in order to perform activities linked to a service of general economic interest. A frequent question before regulators is how to assess any costs due to the USO. Finnish regulator FICORA published a manual by Copenhagen Economics, which identifies a bottom-up approach to calculating the net costs of the USO. To calculate the net costs, the regulator assesses which costs would be saved by the designated firm and which revenues would be lost absent the USO. In an analysis published by Belgian regulator BIPT (2014), the bottom-up approach is considered to provide an advantage, given the flexibility to determine USO cost levels as a function of volumes and to perform sensitivity analyses – both features not equally matched in top-down assessments.

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Once a LRIC model of an efficient trading venue has been constructed, it will serve as basis for the price cap on raw market data. While the LRIC model reflects an efficient trading venue, the underlying cost structures of such venues may differ e.g. due to differences in the amount of consumers and thus the need for scale and scope. If these cost differences objectively are large between venues, this would require that the LRIC model should be calibrated to the different venues and maintained over time capturing these objective cost differences.

The level of maintenance and recalibration depends on the underlying cost volatility, which tends to be very different across sectors. CAPEX tend in general to be less volatile especially in industries with a relatively stable production apparatus. OPEX on the other hand varies more as it depends on the produced amount of goods and/or amount of customers. As OPEX changes over time, the cost benchmark should be recalibrated to capture these changes.

The distribution of financial market data is characterised by a relatively stable production apparatus, and importantly quite invariable OPEX. This is because market data is information, where the cost of disseminating the data does not depend much on the amount of consumers who buy the data. Once the distribution setup is in place, it is not associated with many additional costs to distribute to one more consumer. This service provision is in stark contrast to the supply of standard manufactured goods or many other services, where the cost of input is strongly correlated with the amount of output: you need to buy more coal to produce more energy.

Who should maintain the LRIC model?

In the consultation questions from ESMA,[8] it is assumed that the LRIC model should be maintained by each trading venue, consequently giving rise to significant compliance costs. In practice, there are many examples of LRIC models being constructed and maintained by a regulator overseeing multiple (or a single) regulated firms, with little need for recalibration, cf. Box 6.

[8] ESMA (2014), Consultation Paper MiFID II/MiFIR, 22 May 2014, ESMA/2014/549

Box 6 Practical example: The regulator maintains the LRIC model

In the telecommunications sector, national regulators enforce regulation of firms with significant market power (SMP). It is understood that the SMP firm would not have an incentive to self-enforce the price regulation as it would have incentives to charge excessively high prices (i.e. due to market power). Under the EU telecoms law (cf. Framework Directive 2002-21-EC) it is therefore for the telecoms regulator to impose – where appropriate – SMP conditions such as charge controls (i.e. price caps). To do so, most regulators have built and maintained over time a model to track the regulated firm's costs. This is a key task for a telecoms regulator and generally requires 3 types of activities:

- Hire employees with experience within the regulated firms (e.g. engineers with operational understanding of costs). This is key to the success of a new regulator (cf. history of Ofcom - then Oftel – in Hall et al., 1998)
- Use specialised consultants to setup the model first time, if the cost-structure is complex
- Use statutory information request powers to obtain cost data from the regulated firm(s) and other firms interested in regulation (competitors and customers)

One of the most important markets susceptible to ex-ante regulation is the market for wholesale local access, i.e. the bulk sale of the (copper) local loops connecting homes to the local exchange. Firms buy local access at regulated prices from the SMP operator and then use this input to supply broadband to consumers. It is standard for a regulator to use a bottom up model for the purpose (cf. EC Recommendation C(2013) 5761). Thus, for example, in Denmark, regulator DBA enforces a charge control on the SMP firm's local loop wholesale price based on its own model, which relies on a bottom-up modelling exercise. (cf. http://erhvervsstyrelsen.dk/marked-4). In the past, revisions have been performed every three to four years. In addition, both models are updated annually.

Telecoms regulators are due to perform a review of each regulated market every three years. Provided that imposing an obligation such as a charge control is justified, the regulator will then seek to update the model based on any new data provided by the stakeholders. The market review allows the regulator to re-calibrate the model so that it reflects the costs that an efficient operator is expected to sustain to provide the service in question for the prospective review period. Notwithstanding the value of adjustments over time by the regulator to improve the precision of the model, the EC Recommendation C(2013) 5761 is promoting greater consistency in the application of costing methodology, which provides guidance that local loop costs should be generally based on a bottom-up LRIC+ calculation by the regulator – leading to a price expected to range between €8-10/month)

Copenhagen Economics based on interview with regulator Danish Business Authority

In fact, there are several arguments for why such a model should be maintained by a centralised regulator:

- As a public entity accountable to policymakers, a regulator has incentives to pursue the public interest when assessing costs and setting prices – compared to the commercial incentives of a private organisation such as the regulated firm
- A regulator can be given powers to obtain information from multiple stakeholders (e.g. multiple regulated firms but also other stakeholders holding valuable information), which means that model design benefits from broader information and results are more robust due to the cross-checking of information
- A regulator can benefit from specialised expertise, by hiring professionals with a background in multiple firms
- It can be hard to disjoin the assessment of costs from the design and imposition of price regulation as conflicts may emerge if cost assessment and regulated price setting are decided by two different organisations

Who should exercise the price regulation?

In practice, several models for enforcement could be envisaged. Practical experience shows that some type of EU policy is enforced by national agencies while other types are also enforced by a centralised EU agency, cf. Box 7.

Box 7 Practical example: Application of policy by an EU agency

Competition policy: concentrations

The European Commission DG Competition and the national competition authorities in all EU Member States cooperate with each other through the European Competition Network (ECN). In the area of merger control there is a clear separation of competencies between the EC and national competition agencies. The EC has exclusive competence to review the largest, cross-country concentrations, i.e. when the turnover of the parties to the concentration meets the thresholds pursuant to Regulation (EC) No 139/2004.

Concentrations falling below these turnover thresholds remain within the competence of the Member States as provided for by their respective national merger control provisions. However, a referral system makes it possible in certain circumstances for concentrations falling below the above thresholds to be dealt with by the EC, and vice versa.

Telecommunications policy: mobile roaming

With the 2002 EU telecoms regulatory framework, national regulators received new tools to regulate any telecoms firm found to have SMP in their national market. Notwithstanding these new powers at the national level, the cross-border matter of high roaming prices became an issue of EU relevance (e.g. perceived as undermining the digital agenda). However, it became clear that no suitable tool was available for national regulators to address roaming prices.

Thus, the EC (in agreement with all EU legislators) intervened on this specific market in 2007 so to bring roaming charges closer to the cost of providing the service. The regulation specified a maximum roaming tariff that should "reflect a reasonable margin over the wholesale cost of providing a roaming service, whilst allowing operators the freedom to compete by differentiating their offerings and adapting their pricing structures to market conditions and consumer preferences." Source: Regulation (EC) 717/2007, recital 19

While the enforcement of this specific charge control was delegated to the national regulators, it was on the EC's drive that roaming charge caps have been amended over time and the scope of the regulation extended from calls and SMS to data traffic, cf. Regulation (EC) No 544/2009. Therefore, the cost assessment and price cap setting is performed at the EU level, while enforcement of the rules is left to national agencies.

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It is likely to be beneficial to have enforcement at the EU level in situations where these criteria are met:

- Where regulated firms compete in a EU-wide market and are seeking the same customers then national agencies may have too narrow a focus to ensure EU-wide market efficiency (e.g. if a national agency has a mandate to focus on the national consumers' and producers' outcomes, i.e. social welfare within the country)
- Where there are externalities between outcomes in different markets, an EU-level enforcement can take these into account and design intervention based on the EU-wide impact

Compliance cost of regulation

Price regulation, as with many other types of regulation, is associated with cost of administrating the regulation and cost of complying with the regulation. The size of these costs will typically depend on:

- How complex the cost structure is (compliance and administrative cost)
- How often cost benchmarks need to be recalibrated (compliance and administrative cost)
- The number of entities to be enforced (administrative cost)

A *complex cost structure* will tend to require more effort in both constructing and maintaining a cost benchmark model. Many input factors and complex production patterns at multi-product production facilities will tend to raise such costs. The provision of market data however has relatively few input factors, and the production of 'distribution of market data to consumers' is a single product activity, making it relatively simple to disentangle the incremental cost e.g. compared to more complex industries such as the telecommunications or the energy sector. In, say, energy distribution, there are many cost drivers which can vary across distribution companies such as the number of customers, the density of the customer base and the topology of the network (e.g. due to geographic characteristics) which tend to increase the complexity of the model and data requirements. This is to a much lesser extent the case for distribution of market data.

If *benchmarks need to be recalibrated often*, administration and compliance cost will be higher, as the number of data transfers between firms and the regulator will be higher. As argued above, the number of recalibrations depends on the volatility of the underlying cost structure, and as the cost volatility is not expected to be high for distribution of market data, this cost driver is expected to be relatively small, e.g. compared to other industries such as the telecommunications industry.

The *larger the number of entities which need to be regulated*, the higher the administrative cost tend to be as the accumulated amount of data exchanges with the regulator will be higher. For financial market data, the number of trading venues is quite limited compared with e.g. the Danish district heating sector, where more than 600 firms annually report cost data to the regulator.

Experience from other industries where firms are required to report cost data to regulators, suggest that there will be administrative and compliance costs especially associated with setting up the regulatory framework in the first place. Once the framework is in place, reviews of the cost structure and price caps are not associated with significant costs, cf. Box 8. It should be noted that it is difficult to extrapolate the cost of regulation between industries, as the underlying cost structure and regulatory requirements can differ. There are indeed many reasons suggesting that the costs in the case of financial market data are likely to be lower than in other industries, as argued above. Moreover, these costs should be viewed in light of the substantial administration cost associated with the current system, cf. the subsequent section.

Box 8 Practical examples of compliance cost of regulation

In telecommunications, several products/markets are regulated, including fixed wholesale local access and mobile termination. Each cycle of regulatory market review creates a set of costs for both the regulator and the companies involved – the regulated firms but also others which participate in the market review process. For instance, firms will be submitting data for each of the market reviews. Moreover, a regulated firm is often under an SMP obligation to publish regulatory accounts specific to each regulated market (i.e. transparency obligation) – generally a yearly disclosure.

According to estimates based on the experience of Danish regulator DBA, regulation involving bottom up modelling leads to the following costs:

- Fixed wholesale local access: Typically 2-3 regulatory staff are involved in each market review, e.g. 1.5 full-time equivalents (FTE). Moreover, consultancy budget for a review of the LRIC model is €700k. Finally, it is estimated that telecom firms have to employ 4-5 FTEs in total across the industry to assist with the implementation of regulation
- Mobile termination: Each market review requires 1.5 FTE of regulatory staff. The first time a bottom up model was built, this required a consultancy budget of circa €500k. Fewer resources are needed now and an annual update of the model requires no consultancy work and 0.1 FTE of regulatory staff. Telecoms firms employ very limited resources for the annual updates (less than DBA)

Dutch competition and regulatory authority ACM has quantified costs of regulatory proposals while conducting a cost-benefit analysis (ACM, 2013). After quantifying its own staff costs, ACM estimated industry compliance costs using a multiplier of 4 times the ACM's own costs. This rule of thumb was based on Oxera (2004), a survey of Dutch telecom firms finding that the operators' compliance costs (0.3% of their turnover) amounted to 3-4 times the direct costs for the regulator. The factor 4:1 has also been used in other sectors as a rule of thumb.

Finally, the costs of compliance to telecoms regulation are likely to be much higher than corresponding costs emerging from the regulation of the supply of financial market data. First, in telecommunications, there are seven markets susceptible to ex ante regulation (cf. Recommendation 2007/879/EC), each of multiple products – while in the regulation of raw market data prices would be limited to a single market and a single product. Second, telecoms operators have a complex cost structure due to the infrastructure covering the territory served. Cost complexity is likely to be lower for a firm such as a trading venue, which has assets that are more circumscribed.

Copenhagen Economics based on interview with regulator DBA

Administration cost of the current situation

The current system of market data sales has grown very complex, and the administration and compliance cost associated with simply living up to the requirements imposed by trading venues is substantial. By regulating market data distribution according to the proposed model, we argue that these administration and compliance cost are removed.

This reduction should be seen in context with the additional administration costs required to setup the regulation model.

The main reason for the large costs of the current system is the clauses, requirements and terms of conditions attached to the market data products. These requirements stipulate under which conditions the data products can be consumed. Over time these requirements have grown increasingly more complex, and complying with these requirements now demands a significant amount of resources, cf. Box 9.

Box 9 Compliance cost for consumers in the current system

Consumers of market data is currently required to devote vast amount of resources to complying with the different terms of condition attached to the purchase of market data. These resources go into administration and control functions, compliance functions, IT functions and legal functions. A few examples are:

- Administration and control functions
  - Permissioning and entitlements
  - User/usage reporting
- Compliance functions
  - Control of users of data
  - Control of usage of data
  - Audits
- IT function/investments
  - Substantial investments to allow for permissioning and entitlements control in systems
  - Invoicing
- Legal functions
  - Agreements with vendors and trading venues
  - Audits

All the above applies for all systems that in some way carry market data such as:

- front, middle and back office systems
- risk control systems
- asset management systems
- mutual fund management systems
- compliance systems
- finance systems

Besides devoting these resources in addition to purchasing market data, brokers and investors are also exposed to the risk of the complexity of the system. The more complex the system becomes, the more likely it is that some of the terms of conditions will not be fulfilled – not due to bad will, but due to sheer complexity. If these conditions are not met, it is associated with significant extra costs for brokers and investors.

Rough estimates suggest that for mid-sized brokers, 6-7 full time employees are employed to manage contracts regarding market data purchases.

Copenhagen Economics based on interviews with market participants

Common data format

In order to make the most of the increased competition in the (secondary) market for market data vendors which will be spurred by regulating raw market data, it would be efficient to require that trading venues put the data forward in a manner that is easily comparable for data vendors. Requirements should not be on a specific technical platform (in order to keep room for innovation) but on the data content; e.g. ensuring that the same equities have the same calling number across venues.

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