# Introduction

The purpose of this document is to establish the existence or severity of anti-competitive effects of the investment scheme for expanding VHCN in Cyprus. The Cypriot authorities are planning on a market intervention, namely, to subsidize, the expansion of high-speed internet networks to areas where such a network does not exist.

Before diving into the economic arguments that could arise in such situations, we will begin by first giving a brief description of the Cypriot markets involved, and the players in them, as well as describe some economically important details of the investment scheme the Cypriot authorities have envisioned.

In the second section, we will describe the investment scheme designed by the Cypriot authorities.

Finally, we will dive into a few economic arguments that could be raised as objections to the scheme being implemented, and evaluate the risk that they pose towards strengthening the incumbent’s market power. Some of these will be counterbalanced by the countermeasures the Cypriot government will or has already put into place.

## Cyprus fixed broadband: the wholesale and retail markets

In Cyprus, the supply side of the telecommunication market consists of four companies: the incumbent, Cyta, which used to be a state-owned company, and three smaller companies which have gradually gained a foothold in the market, MTN, EPIC and Cablenet.

The market which is relevant for the intervention envisioned by the Cypriot authorities is the market for fixed broadband. We will distinguish between the retail market for fixed broadband, where the demand side consists of the consumers seeking to purchase internet services, and the wholesale market, where the demand side is captured by telecom companies seeking access to the network owned by other companies.

We will first give a brief summary of the distribution of market value on the retail market. To help put things into perspective, we present in the table right below the distribution of market value on each of the three main segments of the telecommunication retail market: fixed broadband, but also mobile and TV services.

As can be seen from the table, the four providers have heterogeneous presence on the three segments. The incumbent, Cyta, captures roughly half of the total market value on each segment. Cablenet specializes in fixed broadband (27%) and has low presence in Mobile (1%) and TV services (13%). In comparison, Epic has a strong presence in the Mobile Market (39%) but limited presence in Fixed (9%) and TV services (0%).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Retail market shares[[1]](#footnote-1) | | | | | |
|  | Cablenet | Cyta | Epic | Primetel/MTN | Total market value | HHI[[2]](#footnote-2) |
| ***Mobile*** | 1% | 51% | 39% | 9% | 218M | |  | | --- | | 4204 | |  | |  | |
| ***Fixed*** | 27% | 48% | 9% | 16% | 124M | 3370 |
| ***TV Services*** | 13% | 69% | 0% | 18% | 30M | |  | | --- | | 5254 | |

We now turn to a quick introduction of the wholesale market. The size of mobile and fixed broadband wholesale markets are, respectively, 26M and 20M Euros.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Wholesale market share[[3]](#footnote-3) | | | |
|  | Cablenet | Cyta | Epic | Primetel/MTN |
| ***Mobile*** | 0% | 68.6% | 29.6% | 1.8% |
| ***Fixed*** | 0% | 40% | 2% | 58% |

It is worthwhile noting that the supply on the wholesale market is a duopoly, on each of the two segments (mobile and fixed broadband). A constant across the two markets is the presence of Cyta. In contrast, the second duopolist is Epic for the mobile segment and MTN on the fixed broadband segment.

## The Cypriot investment scheme

The objective of the Cypriot government is to extend the access to fast internet connections (download speed > 100Mbps, upgradable to 1Gbps), and extend gigabit connectivity for SEDs (socio-economic drivers) across the island*.* Urban areas being well-connected to high-speed broadband, the objective is thus to extend VHCN to relatively more rural and peri-urban areas. The target areas (identified with a light green colour on the document *Investment 1)* represent a number of 42,975 premises.

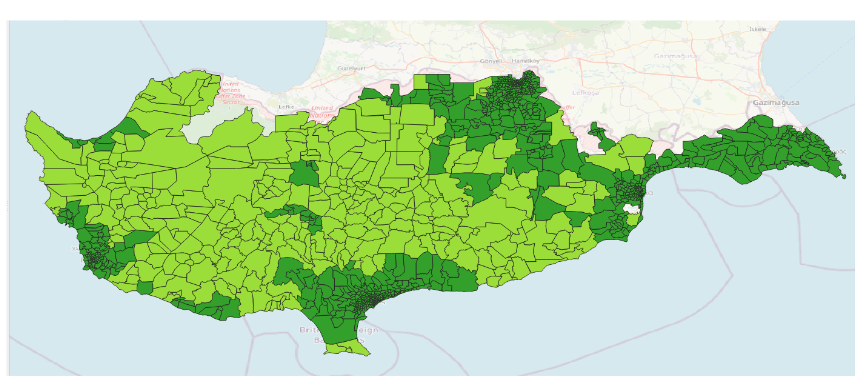
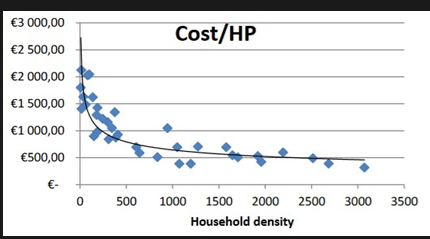


Figure: target areas in light green.

The development cost per premise has been estimated at EUR 1250, which is twice more expensive than for premises in urban areas. Cyta estimates its funding gap of EUR 27.9 million. This is due to the economies of scale effects that occurs in urban areas. The cost per household connected is seen below, where if a few dozen are connected, the cost is around 2000 Euros a household, whilst if around 100, the it drops to around 100.

The implementation of the investments will follow a Private DBO (Design, Build and Operate) – Gap Funding model. The Contractor will undertake the design, construction, and operation of the network, as well as part of the financing, and the public sector will cover the funding gap with a grant, calculated on the basis of a percentage of eligible investment costs for the deployment of subsidized infrastructure, following an open tender procedure.

As will be explained in detail below, the geographical territory of the Republic of Cyprus will be divided into 3 lots. Each lot will include a combination of type A, B and C investments, grouped in the respective intervention area. For each lot, the maximum amount of public financial contribution will be set and awarding criteria will include the requested public support as well as the price offered to end-users and to other retail operators.



The selection procedure will work by first dividing the areas that need to be serviced into 3 lots. The lots will sometimes span numerous districts. Lot A will predominantly serve Nicosia and Larnaka and will be 50% larger than the other two and will service 35 thousand people; Lot B will predominantly service Limassol and reach 22 thousand; and Lot C will primarily service Paphos and reach approximately 21 thousand people. This is summarized in the table below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Lot\District | Larnaka | Limassol | Nicosia | Paphos | population served |
| A | 43% | 2% | 55% |  | 35,648 |
| B | 17% | 76% |  | 7% | 22,869 |
| C |  |  | 6% | 94% | 21,635 |

The premises have been identified through a mapping process lead by the NRA in consulation with the operators. The intervention mal was presented to the operators in a public consulation, with a view to exclude certain areas in case of planned private investment by the operators. No areas were names by the operators as part of their investment plans in the coming three years. This confirms the lack of economic interest of the selected target objects.

Each lot will be allocated to one of the operators via multi-criteria auction.

## 1.3 Market participants to the subsidy scheme

Cyta, Cablenet and Epic are currently investing in new infrastructure with the aim of increasing connectivity to 90% of premises by 2026. Epic has secured 19M from the European Investment Bank which will double the number of homes it can connect to the fiber network (from 25k to 50k homes).

# The intended function of the Cypriot investment scheme

Areas of Cyprus with lower population density have been unable to have access to faster internet connection speeds. As these areas do tend to connect to the internet when it is available, it seems reasonable to conclude that there is not necessarily a shortage of demand.

Instead, the reason why these areas are generally poorly connected is one of supply. Specifically, it does not appear to be profitable to develop these projects. In such a market, the main costs that usually prevent infrastructure from developing are the fixed costs. As such, the Cypriot scheme intends to use a subsidy scheme to give the providers an incentive to develop the infrastructureto serve these areas that fall outside of the economically driven investment areas. .

To minimize the distortive effects of this subsidy, the government intends to use an selection procedure for the aid beneficiaries that will be open and competitive, such that the subsidy is kept to minimum and that conditions on retail pricing can be set beforehand in a clear and transparent manner.

# Market failures in presence of network externalities

Cyprus suffers from a severe inequality in fast BB deployment between urban and rural areas. A natural explanation for under provision is *network externalities*, i.e., when a consumer’s utility depends positively on the number of other consumers using the service. In the case of broadband services, network externalities may arise as a consequence of the *subscriber effect*, i.e., when the benefit to society from adding a subscriber is larger than the benefit the subscriber derives from joining the network. E.g., suppose a network counts N users, and each individual gains a benefit of 1 from being able to communicate with any other individual. In that case, adding an N+1th individual to the network increases the total value by 2N. Of lesser importance is the *ubiquity effect*, when joining the network allows a subscriber to more efficiently engage in business or leisure activities independent of location. Typically, a subscriber living in an urban area in Cyprus, thus principally located there, may still derive value from having a fast BB connection in relatively more rural places (holidays, development of remote work after the pandemic, etc.)

By definition, externalities are not accounted for by market participants, leading to an inefficient provision of the good or service. In the Cypriot case, under provision is regarding access to fast BB networks. Fast BB is not deployed in any of the three target areas, and households in these areas rely on older technologies that cannot carry speeds faster than X (find the data).

# Addressing potential market issues associated with the VHCN investment scheme

## Technology restrictions

Technology restrictions could decrease the number of participants, and give an advantage to the companies with the highest willingness to pay. Market concentration would result. Restrictions should be instead on the speed the network can support, and not on the actual technology used.

The Cypriot government does not plan to create any such restriction, as such there is little reason to believe technological filtering will be an issue.

## Monopoly pricing

A potential issue may arise if the Cypriot government does not make the company which wins the selection procedure for building the network in a given area commit to either (a) allow its competitors access to the network, (b) also bid on the retail price of fixed broadband. Indeed, the failure of having none of these two conditions fulfilled will certainly lead to a situation where the owner of the newly built network has a captive demand and thus can lead to a very high price.

The relationship between monopolies and monopoly prices is not as straightforward as it initially seems. Indeed, a monopolist may have less market power than firms competing.[[4]](#footnote-4) This point is especially true when it comes to tendering lots. As such it is important that the criteria for the selection procedure be carefully selected.

An important criterion to determine if the market price will be a monopoly price is the weight of the **expected price to be charged to consumers** in the future. For example, if there were to be a competitive selection procedure where a single firm receives operational rights, if the bidding amount is a commitment to the price that will be charged to consumers, then we will have a competitive outcome even if the selected bidder has a local monopoly. In the ideal scenario the Cypriot authorities would then simply ask each of the possible operators to submit the cost they would be willing to charge consumers and take the lowest one. The reserve price literature also indicates that the authorities should try and create a maximum price that can be charged to consumers, probably based on current pricing.

The ideal scenario is somewhat thwarted because there are three additional constraints that the government of Cyprus must take into account. **The first additional criterion is the number of consumers serviced**. Introducing this as a criterion could increase the risk of the selection procedure creating a monopoly as a provider who can service the additional consumers more cheaply than the providers, may be tempted to compete on the number of consumers serviced and hence not offer a competitive bid. On the other hand, this criterion could be welfare improving if it allows for more providers to enter the process which would potential decrease prices.

The second additional criterion the Cypriot government must take into account is the **total price of the lot**. If a provider requires less or more government investment then the government will be taking this into consideration. Note that this criterion is directly related to the subsidy. That is, from both the firm and the government perspective, a bid of 10m and a subsidy of 12m is equivalent to a bid of 8m and a subsidy of 14m. So a bid of 12m means that the government has not in effect subsidized the firm.

Finally, the **third criterion the government will require is the quality of service (speed of the connection) to be provided.** This constraint however is unlikely to reduce competition as the providers who will participate can all meet the required standards.

The Cypriot authorities will also take into consideration the environmental impact which can entail some trade-offs. Specifically, Fibre has the lowest CO2 footprint per Megabit transmitted and 5G would have the highest impact. On the one hand the government wants to encourage faster internet which encourages less fibre, and on the other it encourages fibre by having an environmental standard.

## What is the expectation from the bidding?

What we can currently say is that there exist areas that the providers don’t reach. Why does this occur? The most basic reason is that it is not profitable to do so. The simplest representation of this is to say that the net present value of the project (NPV) is negative for all players.

Though to our judgment here it is likely the NPV is negative, there could also be game theoretic reasons why we see no investment even though the NPV is positive. Specifically, for Cyta, since Cyta is required to give wholesale access to its network to other providers, and is also likely one of the most efficient operators, it is possible that the project could be profitable but lack of monopoly on the retail price causes them to not invest. In summary, for Cyta we must assume that the wholesale NPV is close to zero because of regulation and that the retail NPV is not sufficient to overcome the cost of investing. [[5]](#footnote-5)

For other players who can potentially develop this infrastructure and are not obligated to give wholesale access, such as Cablenet and Primetel we can make a different inference. Since these players would have had the potential to make both wholesale profits and retail profits, had they developed infrastructure in these areas, then we can make a more general inference about their NPV. Given that they have not developed infrastructure we can say that the **total NPV** of both Cablenet and Primetel must have been negative after taking into account the fixed costs. In developing this infrastructure. If the Cypriot government were to retain this present asymmetric structure where Cyta must give wholesale access but not it’s competitors, then it seems like Cyta would in fact only bid based on the difference between it’s retail NPV and it’s cost of development whilst Cablenet and Primetel would bid on the difference between the maximum of the retail price and wholesale price from the cost of development. In other words, competitors might be ready to bid on the lot even if they do not expect it to be profitable for them to operate it because they can just rent it to Cyta so Cyta can operate it.

So why would companies invest in these lots if the NPV is negative? We now come to the reason why the subsidy is necessary. The subsidy is meant to act to overcome the fixed cost. Since the subsidy for each lot is 12million, this means we expect that the bid amounts will be strictly less than 12 million.

If the Cypriot government requires that the winner of the selection procedures give wholesale access to its competitors, as is currently intended, the result could be lower prices on the lots for all bidders. This is equivalent to saying that the profits of all competitors must be of the same form as Cyta, which is the difference between the NPV of retail and the NPV of development. The annual retail profit of the firm is given by -- where p is the annual retail cost, c is the annual cost of having a user on the network, and Q is the number of users. Over a period of time this is, where t is the year and i the firms annualized internal rate of return. The complete profit of the firm is ; where F is the fixed cost of developing the infrastructure, and S is the subsidy. We know that this is the maximum willingness to pay each firm has. We know that without the subsidy the sum of the first two terms is negative from the argument above.

Whether operators know or don’t know the total profitability of their competitors can be both beneficial or harmful depending on the circumstances. If the operators know that their competitors have very similar cost structures then we can expect transparency to give an outcome very close to the marginal costs, which would be the best possible outcome for consumers. If however, some of the operators have a much higher total profitability than their competitors and know that this is the case, then we can expect them to bid significantly less aggressively, in line with that they expect their competitors to bid. In other words, if we expect supplier to be symmetric with respect to their efficiencies, then transparency of cost structure is a good thing but if we expect an asymmetric situation then transparency will be bad for consumers. In practice it is difficult to infer which case we are in: Cyta does have a lower cost to operate but it isn’t clear if it is because it has slower internet or perhaps more users per construct.

# Consumer welfare

Welfare in this situation is fairly straightforward, in classic economics fashion the government is indifferent if money is transferred to the government or directly to the consumer. Lower retail prices transfer directly to the consumer, whilst higher lot prices transfer directly to the government. From the point of view of economic theory there is no reason to prefer the direct transfer to the consumer to the direct transfer to the government as the direct transfer to the government can simply be re-transferred to the consumer. As such the retail price and lot price are substitutable and there is no technical need to employ both dimensions. As such whether money is transferred to users or the government should not be a criterion used for selection but only the total money transferred is of importance.

Welfare is then only characterized by the total money transferred from the firm to consumers and government, and the number of consumers that have been serviced.

the consumer the welfare is characterized by

where

# Bidding behaviour

From auction theory we have a few expectations. We expect that if only a single firm can credibly develop the lot with a 12million subsidy, and this firm is aware they are the only one who can do so, then we would expect this firm to bid as close to zero as possible, this is because it has no incentive to bid anymore than it has to secure a plot. On the other hand if there are two firms who can credibly develop this project, then we expect the bidding behaviour to be about half of what the project is worth to them, which in this case would be 12m+NPV(which we expect to be negative as it includes fixed costs). So if the NPV of the project is -2million, we would expect that two bidders will opt for 5million as their bid. If there are 3 bidders, then we expect them to bid ¾ of the value, so 7.5m, and if there are four equally credible bidders, we expect them to bid 4/5 of their value, or 8m. [[6]](#footnote-6)

What will be the effect of the retail price bid? In general, it is expected that the lower the retail bid, the correspondingly lower will be the bid for the lot. The scheme could use a desired price index as a starting bid or it could just fix a low price form the beginning. Nevertheless, this should carefully be weighted against the risk that the 12m+NPV amount does not go into negative territory as this could mean the operators do not participate. In general, the government must make a decision for the length that the retail price bid will commit the firm to charging said price. For instance, if they bid for providing internet services for 30 euros a household, are they legally mandated to keep this up for 5, 10, 15 years? This also needs to be carefully crafted such that the provider does not wish to simply rent this out to a competitor who is not bound by such an agreement. In other words, the constraint must apply to anyone using this network. A similar obligation must be imposed for the number of households that the operators have committed to serve.

Finally, the coverage of the network is another criterion the government considers important. Specifically, the government aims to use the number of buildings connected as the measure of success. The coverage aspect should be considered complementary to the retail price. For example, suppose the bid takes the following form (retail price, lot price, coverage). If the government deems that (20 euros per person, 10m, 20k buildings) is equally as attractive as (40 euros a person, 8m bid, 20k buildings), then an increase in coverage, say from 20 to 22 in both packages, should lead the government to prefer the first package to the second. This is because those extra two thousand buildings will receive the service at a lower retail price and hence the program should be better for consumers. Note that from the point of view of the company, the monetary transfer is all that matters, that is, there is no sense in using subsidy amount as a criterion as the lot price already encompasses the net transfer of cash from the government to the company(if subsidy>lot price) or from the company to the government(if subsidy<lot price).

# Suggested selection criteria

Since no selection procedure has been proposed as of yet, we aim in this section to

The final criterion to be used by the government could take the following form:

Which is maximized when the annual retail price(P) is zero and all the buildings(Q) are connected, since there are around 30000 buildings, then a score of 100/100 is granted when this equals, maximum=30000\*C, where C is simply either the average annual cost per customer or simply some price index the Cypriot government constructs as a minimum price to be used. The minimum this value can take is the minimum Q, which is 15000. Taking the maximum annual price currently on the market is one possible approach to P is 66\*12 which is around 800. As such the minimum score should be: minimum=15,000(C-800)[[7]](#footnote-7). So for any given offer, S, to construct the score out of 100, we simply do the following operation:

The second criteria for the score can be similarly constructed. The minimum lot price bid is zero or some minimum reserve price chosen by the government, let’s call it K. The maximum price is the subsidy amount, 12million, which would mean that the provider is willing to not accept a subsidy at all. In this case the score is then:

Finally, a simple pollution score could also be constructed, where the very pollutant 5G can be scored at a 0 and the least polluting Fibre can be scored at 100 and other technologies placed between.

For convenience the Cypriot government can then weight each of these accordingly. A suggested weighting function is the following:

That is, half the weight on the number of consumers and the retail price charged in the end, another 45% on the subsidy demanded, and a final 5% on the environmental impact.

# Other prospected welfare effects on the retail market

To evaluate the impact of the aid scheme, one must anticipate its potential effects on the retail market. The auction winners will continue to compete against other companies in the markets they already serve outside the target areas. A question that may be raised is under which circumstances the creation of new market segments leads to price changes in already existing ones.

The principle of uniform pricing is a regulatory obligation on companies to charge the same price for a good or service to all their consumers, regardless of their differences (such as geographical localization).

In practice, consumers with different characteristics – such as their geographical localization – represent different markets. Besides, a company can face different competitors on the different market segments it serves.

If no regulatory obligation compels companies to apply the same price in every region, then the different regional markets can be considered independent. Regions with higher average costs will be served at a higher price than urban regions where the cost of connecting a household is relatively cheaper. When segments are independent, the price can vary depending on the regional cost of connecting consumers to the network.

 If companies are not allowed to price discriminate consumers based on their location, the several market segments are correlated. For the sake of argument, suppose that company X has invested in deploying the BB network in rural area A. Typically, its cost for serving that particular segment is high – X has to recoup the fixed cost of building the network, and local conditions may just make it more difficult to connect households. Company X is also active in the retail market for fixed BB in region B (an urban region that is relatively cheaper to serve) and faces competition from company Y. Company Y, however, is not present in region A. Uniform pricing disadvantages X on segment B. This is because the average of X’s marginal and average costs over the two regions it serves are higher than on segment B. Because of this, X can no longer offer as cheap a price on segment B; this ultimately benefits its competitor, Y.

In our view, uniform pricing involves a trade-off between decreasing the incumbent’s market power and decreasing consumer surplus in urban areas. Uniform pricing prevents a firm from setting a high price and cashing in on its captive consumers. This may give small firms with weaker financials than Cyta an additional incentive not to participate in the program. A pessimistic -- though realistic -- scenario would be that Cyta takes on most of the targeted areas. Its prices may rise, and Cyta may thus lose customers in urban areas to its competitors. The inflation in Cyta’s prices would not necessarily lead to a decrease in consumer surplus if it were charging higher prices than its competitors. Indeed, this could even positively incentivize captive consumers (because of high search costs, brand loyalty, etc.) to turn to cheaper operators. However, as seen in the table below, Cyta currently offers the most affordable plans. Hence, the most modest households may be particularly affected.

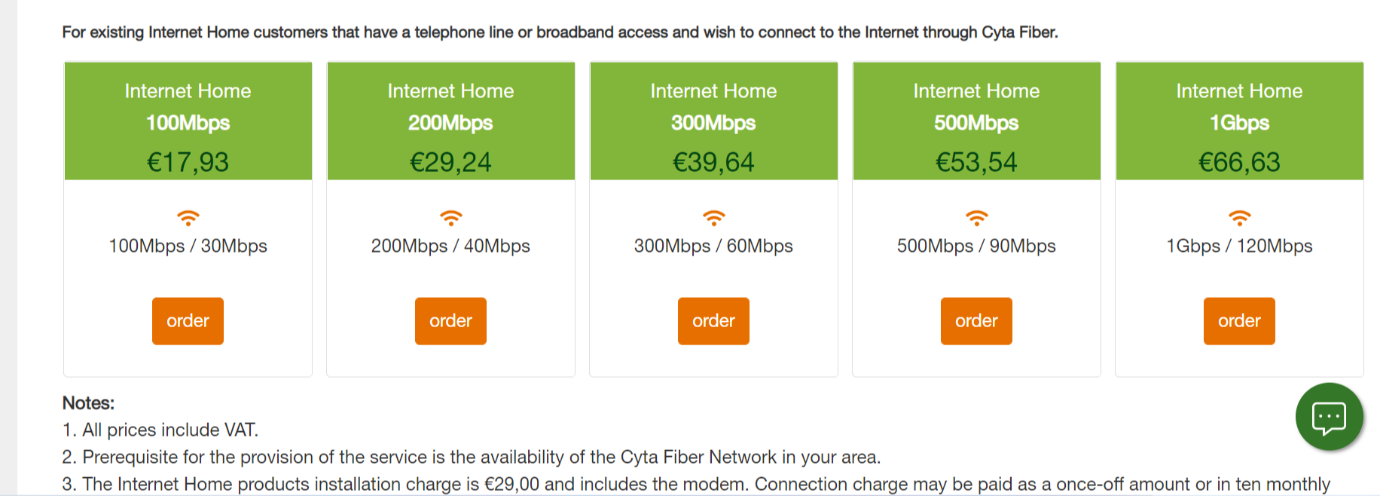


Figure: Cyta’s retail prices – fast BB services

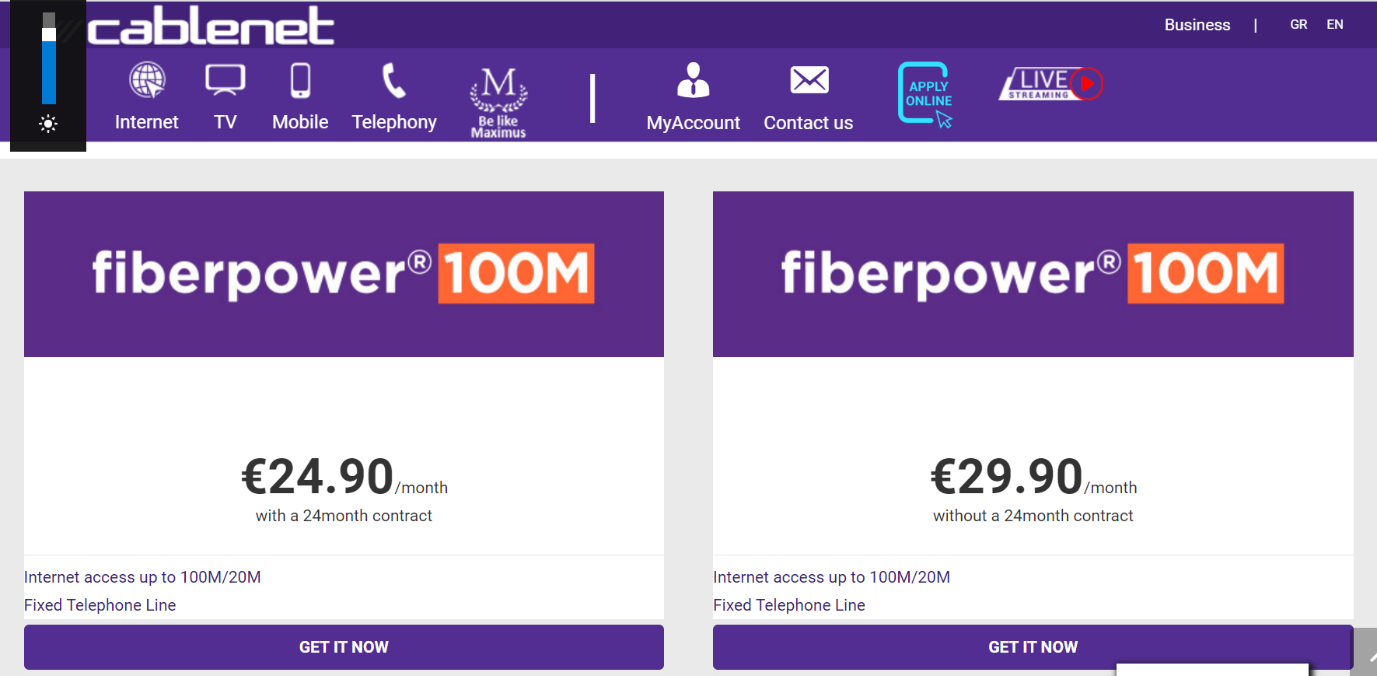


Figure: Cablenet’s retail prices – fast BB services

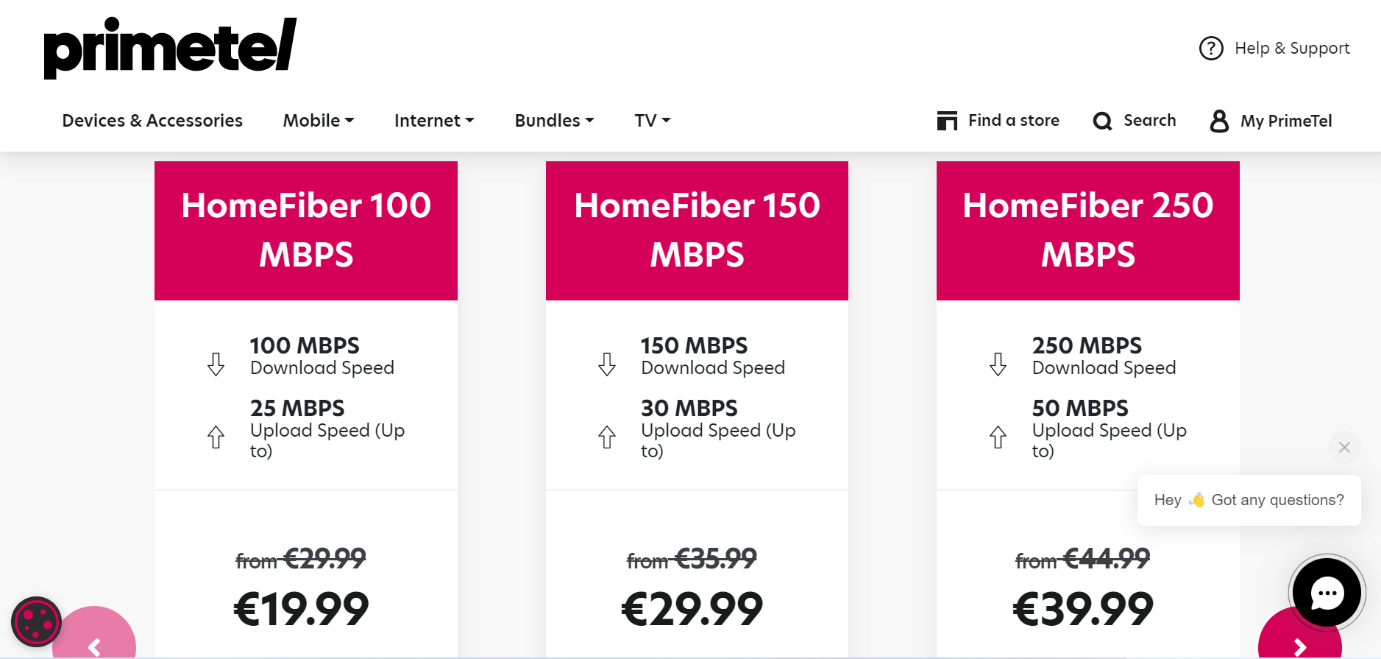


Figure: Primetel’s retail prices – fast BB services

The program by the Cypriot authorities strives to correct the undesirable effects on

consumer surplus and market power associated with uniform and differential pricing.

On the consumers' front, the Cypriot authorities' aid scheme is immune to price increases in the regions outside the targeted areas. Indeed, the authorities have decided to allow differential pricing. I.e., a selection proceedings winner in a given target area will have the possibility to charge a higher price in that market segment. The virtue of differential pricing is that it will boost participation, as companies can count on earning higher profits in the regions where they invest. The downside, however, could be high-priced services in the target regions. The Cypriot authorities' bidding system tackles this issue without depressing participation. First, they propose to have companies bid, among other things, on the retail price of the BB services they will offer should they win the auction. In other words, the auction format has been designed so as to incentivize participants to set competitive prices on the retail market. Second, the Cypriot aid scheme requires from the lot winners to give wholesale access to their competitors. This obligation limits the risk of local monopoly on the retail market of the three lots.

On the front of market power, a concern could be that Cyta strengthens its dominant position by taking on most of the target areas. Indeed, the high fixed cost of building the network remains a barrier to participation for smaller firms with weaker financials than Cyta’s, although partially financed by the program. The Cypriot authorities intend to extend Cyta’s legal obligation to grant its competitors access to its infrastructures at a regulated price. This way, Cyta’s possible dominant position in the wholesale market will not spill over to the retail market.

# Conclusion

In conclusion, from standard economic theory, we conclude that the subsidy is the least distortive way that the government can achieve its goals. This is because it simultaneously gives a good incentive to the providers to develop said infrastructure by using a subsidy, whilst using competition against the providers so that the subsidy is kept to a minimum. This is achieved by an auction that will function on three criteria (retail price, net monetary transfer, and coverage) and numerous conditions such that standard agreements are met.

1. This data is collected by the national regulatory authority of Cyprus (henceforth, NRA). [↑](#footnote-ref-1)
2. The Hershfindal Index is computed by squaring the market shares\*100 and summing them [↑](#footnote-ref-2)
3. NRA data. [↑](#footnote-ref-3)
4. This point was first introduced in the economic literature by the article: Demsetz, Harold. "Why regulate utilities?." *The Journal of Law and Economics* 11.1 (1968): 55-65. [↑](#footnote-ref-4)
5. The winners profits are: max(retail NPV, wholesale NPV) – NPV of fixed cost [↑](#footnote-ref-5)
6. This assumes that firms put a uniform distribution on other firms’ willingness to bid [↑](#footnote-ref-6)
7. Note that this can be negative without affecting the result [↑](#footnote-ref-7)