

Ultrabroadband telco investment models

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This paper explores why investment models explain different fiber deployment patterns, thereby conditioning the path to ultrabroadband

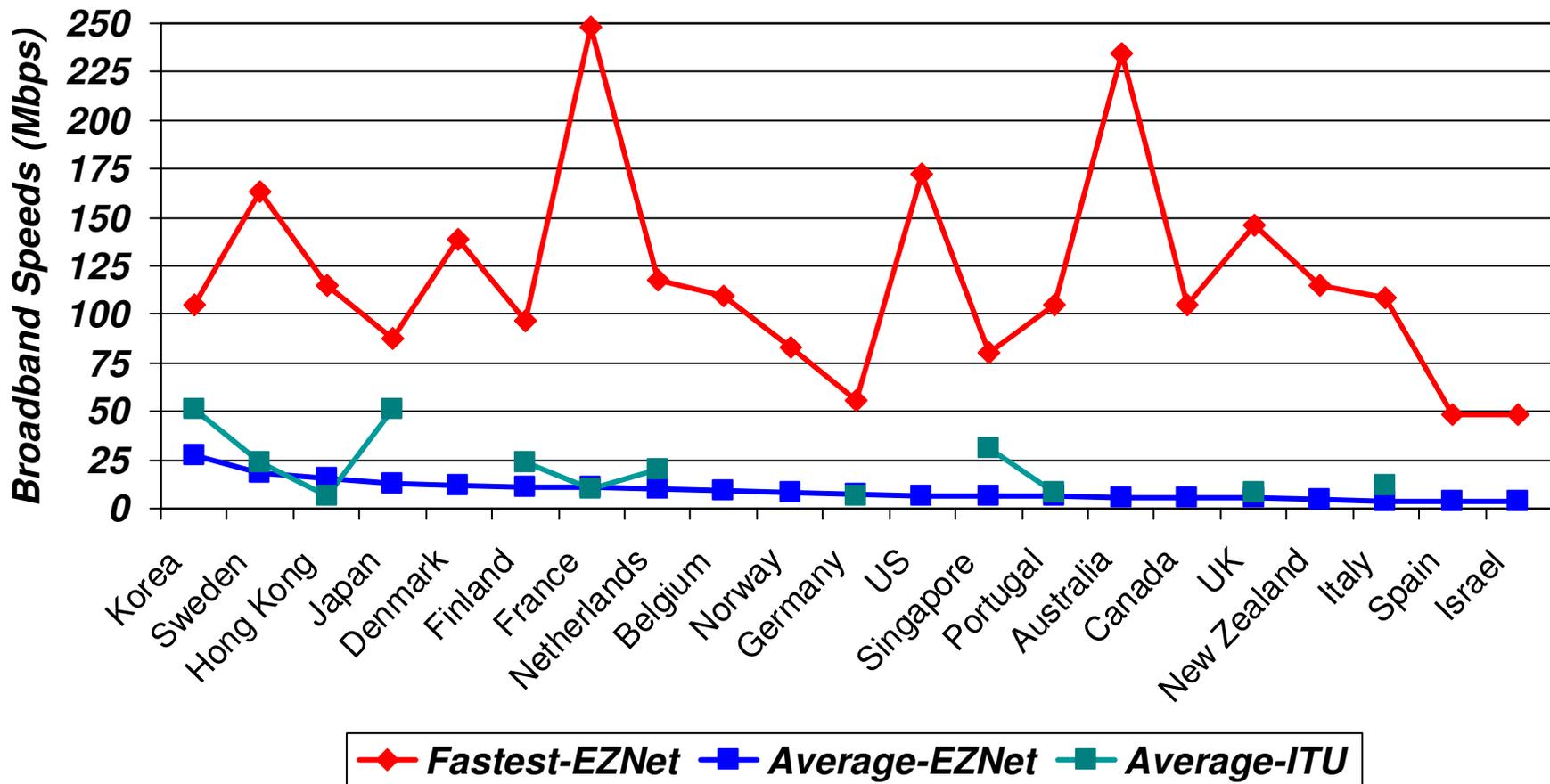
- The delivery of ultrabroadband to the residential market requires significant infrastructure investments, beyond FTTH
- Since FTTH G-Pon is the path to delivering ultrabroadband, fiber deployment could indicate which geographies would benefit from the new platform
- Three fiber access deployment patterns can be identified around the world: 1) Japan and South Korea (approx. 20% of broadband accesses), 2) United States (7 % of broadband accesses) and 3) Europe (2% of broadband connections)
- Explanations of different deployment patterns have focused so far on regulatory variables (Crandall, 2007; Katz, 2008; Waverman et al., 2008)
- This paper will attempt to explain these differential deployment patterns by building a uniform investment model:
 - Are uncertain returns explaining limited deployment?
 - Do strategic imperatives override the concerns on low profitability?
 - How do regulatory and public policy interventions lessen the concerns about low profits?

Agenda

- 1. Differential fiber deployment and ultrabroadband**
- 2. Ultrabroadband investment model structure and sensitivities**
- 3. Geographic specific parameters**
- 4. Conclusion**

None of the broadband infrastructure deployed today handles ultrabroadband throughputs

BROADBAND SPEEDS BY COUNTRY



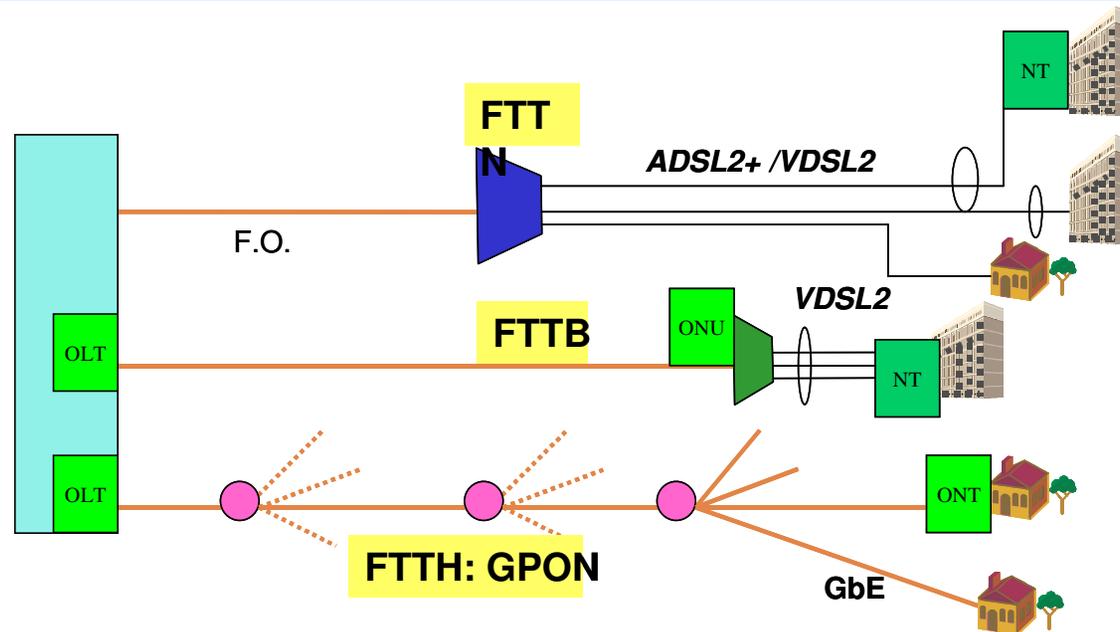
Sources: ITU (2006); ZDNet Australia

Delivering ultrabroadband will only be possible once the access point of networks is upgraded

<p>ACCESS</p>	<ul style="list-style-type: none"> • Telco wireline; FTTX where X is home, node or curb) • Cable • Wireless (based on new spectrum auction) 	<ul style="list-style-type: none"> • Today: 10-15 Mbps • Mid-Term: 100 Mbps • Long Term: 1 Gbps
<p>METRO</p>	<ul style="list-style-type: none"> • Wireline – fiber based, IP and Optical networks • Wireless – some-point-to-point backhaul • Multiple competitors (Telco, CLEC, Cable) 	<ul style="list-style-type: none"> • 10 Gbps Ethernet
<p>LONG HAUL</p>	<ul style="list-style-type: none"> • Wireline – fiber based, IP and smart optical networks • Multiple providers/competitors 	<ul style="list-style-type: none"> • 40-100 Gbps

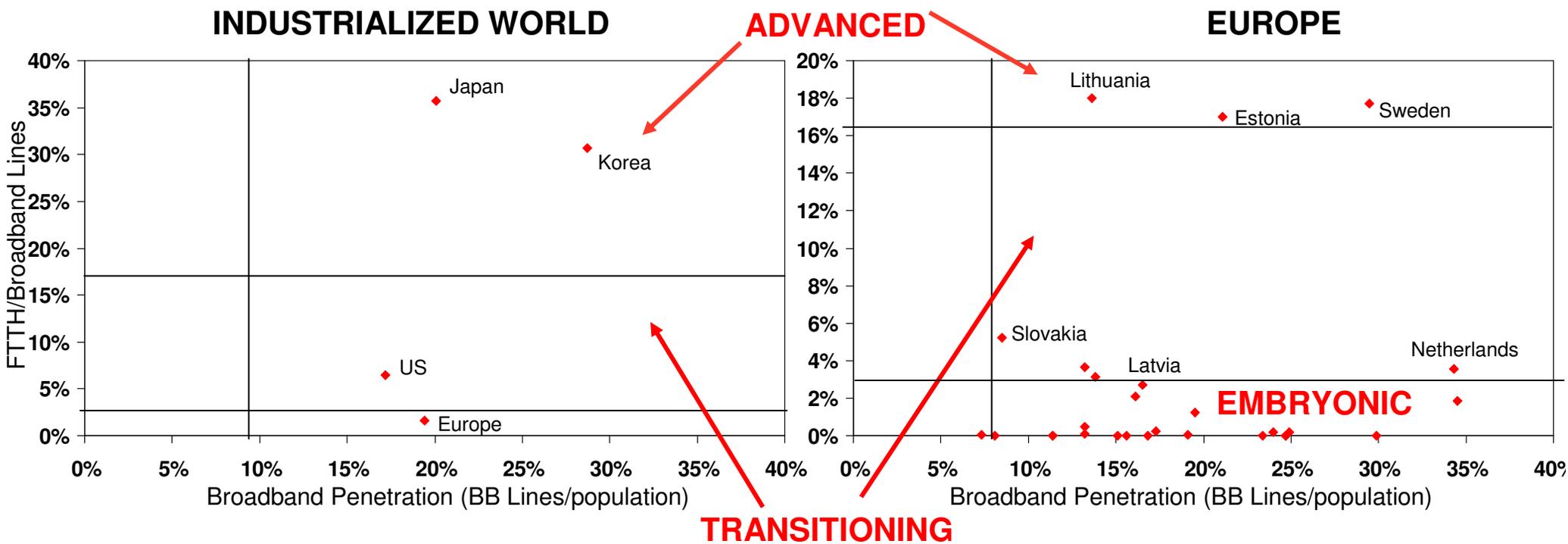
However, since FTTH is a pre-condition to 1 Gbps throughput, we have focused the analysis of investment models on fiber deployment

- FTTN (Fiber to the Node)**: fiber reaches the node located in the street, from which service is delivered through the copper network
- FTTB (Fiber to the Building)**: fiber reaches the building, with an optical network termination. Household is reached through the copper network
- FTTH (Fiber to the Home)**: Fiber reaches the household



Three deployment patterns of fiber can be identified around the industrialized world

FTTH DEPLOYMENT VS. BROADBAND PENETRATION



Sources: ECTA (2007); OECD; Analysis by the author

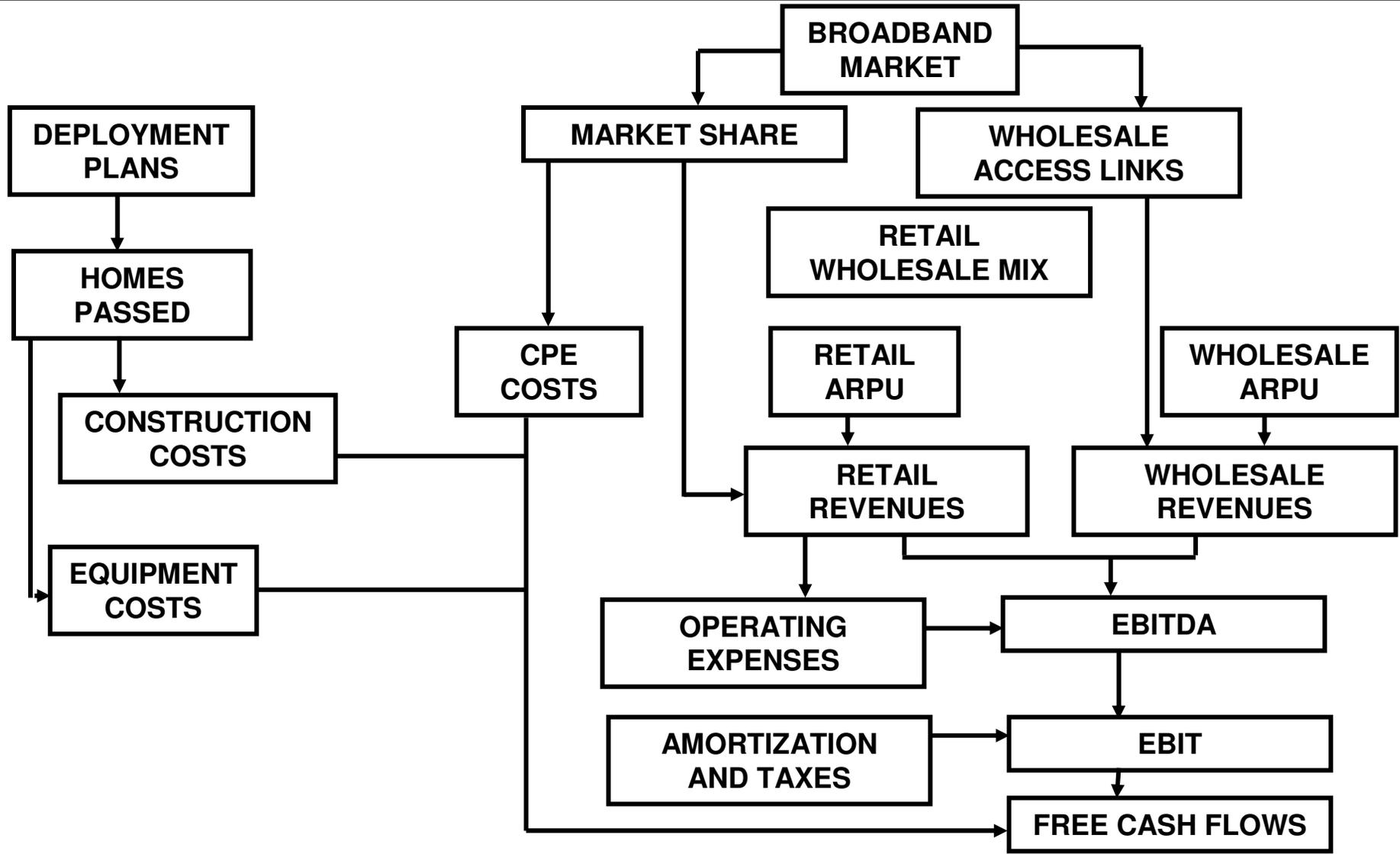
Why are the deployment patterns so different across the industrialized world?

- Explanations so far tend to focus on regulatory variables
 - Lack of NGAN investment protection in Europe to explain the delay
 - intermodal competition in the US as a driver of acceleration of deployment after 2005
 - industrial policy in Japan and Korea
- We will try to prove these hypotheses by testing the behavior of an investment models under different scenarios
 - Is the Japanese deployment of FTTH yielding a positive return? How is the government supporting the carrier to stimulate deployment?
 - Is the investment model under intermodal competitive conditions in the US yielding a positive return on the investment?
 - Or are strategic imperatives (i.e., defend the franchise) leading carriers to invest despite unclear returns?
 - In the case of Europe, are the EC policies affecting all member states uniformly, or can we establish differences between countries?

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We constructed an investment model that captures all commercial and financial variables of a FTTH business plan



Investment model assumptions

TYPES	ITEM	ASSUMPTION	RATIONALE
CAPITAL	EQUIPMENT COSTS	<ul style="list-style-type: none"> • FTTB-G-PON: 289.5 € • FTTH-G-PON: 393.4 € 	<ul style="list-style-type: none"> •Sanford Bernstein estimates 950 € for home connected, split as 650 € for home passed and 300 € incremental for connected
	CONSTRUCTION COSTS (OSP and CO labor)	•29.5 €	<ul style="list-style-type: none"> •Verizon mentions that at 5 million homes passed, homes passed are 382 € and 213 € incremental for connected
	CPE COSTS (ONT, OLT and equipment)	• 320 €	
REVENUES	RETAIL ARPU (average over five years)	•€ 63	<ul style="list-style-type: none"> •Starting point is the ARPU of a digital household (around 62 Euros) •Assumed to increase by adding other value-added services aimed at capturing a portion of the consumer surplus (raising to 73 Euros) •Prices would start diminishing at 2% per annum
	CUSTOMER CHURN	•1.4%/Month	<ul style="list-style-type: none"> •Consistent with international triple play experience (e.g. Cox)
	WHOLESALE ARPU	• 28 €	<ul style="list-style-type: none"> •Driven by approximately 40% wholesale/retail ratio
	WHOLESALE/RETAIL MIX	• 89% to 85 %	<ul style="list-style-type: none"> • Assumes that 90% of fiber is deployed in areas of competition, triggering ULL provisioning

Investment model assumptions (cont.)

ITEM	ASSUMPTION	RATIONALE
OPEX	• 54 Euros/line/month	<ul style="list-style-type: none"> • Operating expenses comprise four categories: customer acquisition costs, provisioning costs (installation and activation of service), maintenance and customer assistance costs, and general costs • These costs are known to be lower than those of the legacy network (approximately 70%) reaching 54 Euros/ line/month
WACC	• 8.26	<ul style="list-style-type: none"> • Driven by Beta=1.36 (averaging internet and data transport firms)
g	• 2%	<ul style="list-style-type: none"> • Average of analysts assessment for Iliad and CSFB for Fastweb

Our base case estimates costs and revenues for a moderate deployment plan

HOMES PASSED	5,600,000
HOMES CONNECTED	1,400,000 (25%)
CAPITAL INVESTMENT	€ 1,300,000,000

The model output (in million €) for our base case indicates a positive NPV, although most of it resides in its terminal value

	Year 1	Year 2	Year 3	Year 4	Year 5
REVENUES	115	335	563	799	1,022
OPEX	31.4	56.9	84.4	113.6	131.4
EBITDA	83.7	277.9	478.4	685.8	879.4
EBIT	55.1	214.5	374.2	582.5	776.9
FCF	(170.6)	(83.3)	17.24	208.7	349.6

NET PRESENT VALUE (W/O terminal value)	€ 105 MM
NET PRESENT VALUE (W/terminal value)	€ 3,373 MM

As expected, the investment model is highly sensitivity to the percentage of homes passed that are connected

**BASE
CASE**

HOMES CONNECTED/HOMES PASSED (average over five years)	NET PRESENT VALUE (W/O terminal value)	NET PRESENT VALUE (W/terminal value)
10 %	€(207) MM	€ 597 MM
15 %	€(103) MM	€ 1,522 MM
20 %	€ 1 MM	€ 2,448 MM
25 %	€ 105 MM	€ 3,373 MM
30 %	€ 209 MM	€ 4,298 MM
35 %	€ 313 MM	€ 5,223 MM
40 %	€ 417 MM	€ 6,148 MM
45 %	€ 521 MM	€ 7,072 MM
50 %	€ 625 MM	€ 7,996 MM

**Similarly, the business case is very sensitivity to retail ARPU
(revenues to be generated by household)**

Pricing scenarios	RETAIL ARPU (average over five years)	NET PRESENT VALUE (W/O terminal value)	NET PRESENT VALUE (W/terminal value)
Broadband prices fall at ~8% p.a.	€ 47.1	€ (166) MM	€ 1,696 MM
Copper broadband drops 8.6% and fiber 6%	€ 48.8	€ (141) MM	€ 1,851 MM
Broadband prices decline uniformly 6% p.a.	€ 51.5	€ (99) MM	€ 2,109 MM
Fiber prices align with copper	€ 54.0	€ (83) MM	€ 2,212 MM
Baseline case (price tiering)	€ 63.0	€ 105 MM	€ 3,373 MM

**BASE
CASE**

When the investment model is stress-tested, it exhibits a high potential to yield negative NPVs

BASE CASE

HOMES CONNECTED/HOMES PASSED	25 %	20%	15%
PRICES	Price tiering	Fiber aligned with copper and decline 4.8%	Fiber aligned with copper and decline 6.0%
CAPEX DEPLOYMENT COSTS	As forecast	>10%	>20%



NET PRESENT VALUE (W/O terminal value)	€ 105 MM	(237) MM	(374) MM
NET PRESENT VALUE (W/terminal value)	€ 3,373 MM	1,202 MM	237 MM

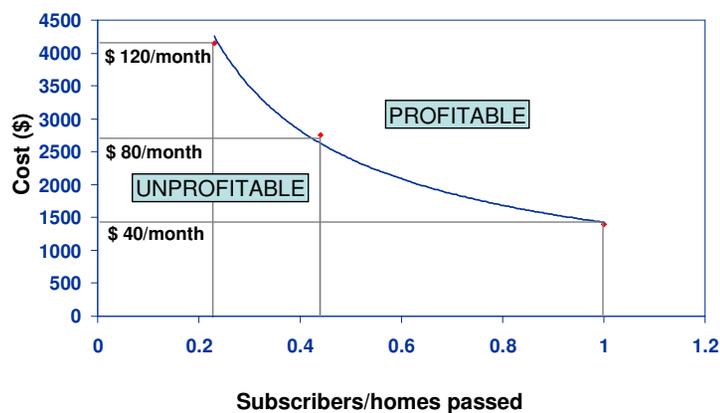
Key take-aways

- The deployment of FTTH under certain specific conditions yields positive NPVs
 - Homes connected/homes passed: 25%
 - Retail ARPU: 63 Euros
 - Wholesale ARPU: 28 Euros
 - Retail/Wholesale mix: 85/15
- However, the investment model is highly sensitive to two variables: homes connected/passed (a proxy for share in overbuilt environments) and Retail ARPU
- Deployment of fiber in new developments or MDUs with no competing infrastructure is highly profitable. Market share equals homes connected/homes passed, which under broadband installation assumptions can reach 50%
- Deployment of fiber in areas where copper DSL is already offered requires an increase in fiber retail pricing to compensate for cannibalization; this must be approximately 15%; how do we do it?
 - Raise prices: consumers might balk mirroring their behavior with regards to upgrades in the laptop market (more memory, more speed but always pay the same price)
 - Still, this can be partially achieved by price tiering
 - Add new services that can be enabled by new infrastructure: pressure on innovation but benefits consumers; however, one should remember factoring product development costs in financial returns

Our results are consistent with other estimates

- Credit Suisse (“Fiber in the streets”, July 4, 2006)
 - Overall conclusion: without favorable regulation, estimates fiber deployments to be NPV negative
 - Biggest sensitivities are installation costs and retail ARPU
- Sanford Bernstein (“The couch potato war”, May 2005)
 - FTTH business case yields IRR of 19%, but it is highly sensitive to operating savings (63% of opex per line of \$186)
- Corning Fiber Systems:
 - Fixed costs for adding fiber in existing neighborhoods is approximately \$821 per household
 - The variable costs of premise equipment for each subscriber is approximately \$600
 - The total cost per subscriber is lower when the subscriber density increases
 - The service is profitable with either high monthly revenue per user (which means new services) or high penetration rate (approximately 35%)

BREAK-EVEN POINT FOR FTTH



Delivering 1 Gbps to the household would require additional investment per FTTH access, further stressing the business case

- If carrier has FTTB, upgrade fiber link to FTTH: GPON (Gigabit Passive Optical Network)
 - Change ONU (Optical Network Unit)
 - Remove any splitters (most carriers currently use 16 or 32:1)
 - Add more fiber from splitters to ONT (Optical Network Termination): 82.6 Euros
 - Add more ONT ports
 - Add capacity to aggregation network
- If carrier has deployed already FTTH: GPON, the carrier needs to remove GPON splitters, and do one of two things:
 - Add more fiber and ONT ports
 - Place small exthernet switch with 1 Gbps to home and 10 Gbps to Central Office
- Incremental capex per household is estimated between \$200 and \$400 incrementally

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We will now examine how the investment model behaves under different regulatory and market conditions

- United States: fiber deployment occurring under conditions of intermodal competition with no wholesale obligations imposed on the incumbent
- Japan: fiber deployment occurring under service-based competition, coupled with wholesale rate flexibility and investment incentives to incumbent
- Europe: embryonic fiber deployment occurring under fluid regulatory conditions (service based competition for legacy networks with evolving framework for NGAN)

The carrier deploying fiber under intermodal conditions makes strategic decisions aimed at optimizing return on infrastructure deployed

- Tiered pricing strategy to lessen the impact of cannibalization
- “Success-based” deployment of infrastructure to reduce temporary capex commitments: deploy fiber to the premise only when getting a commitment of the customer
- Market testing versus competition to reduce uncertainties in market share gain

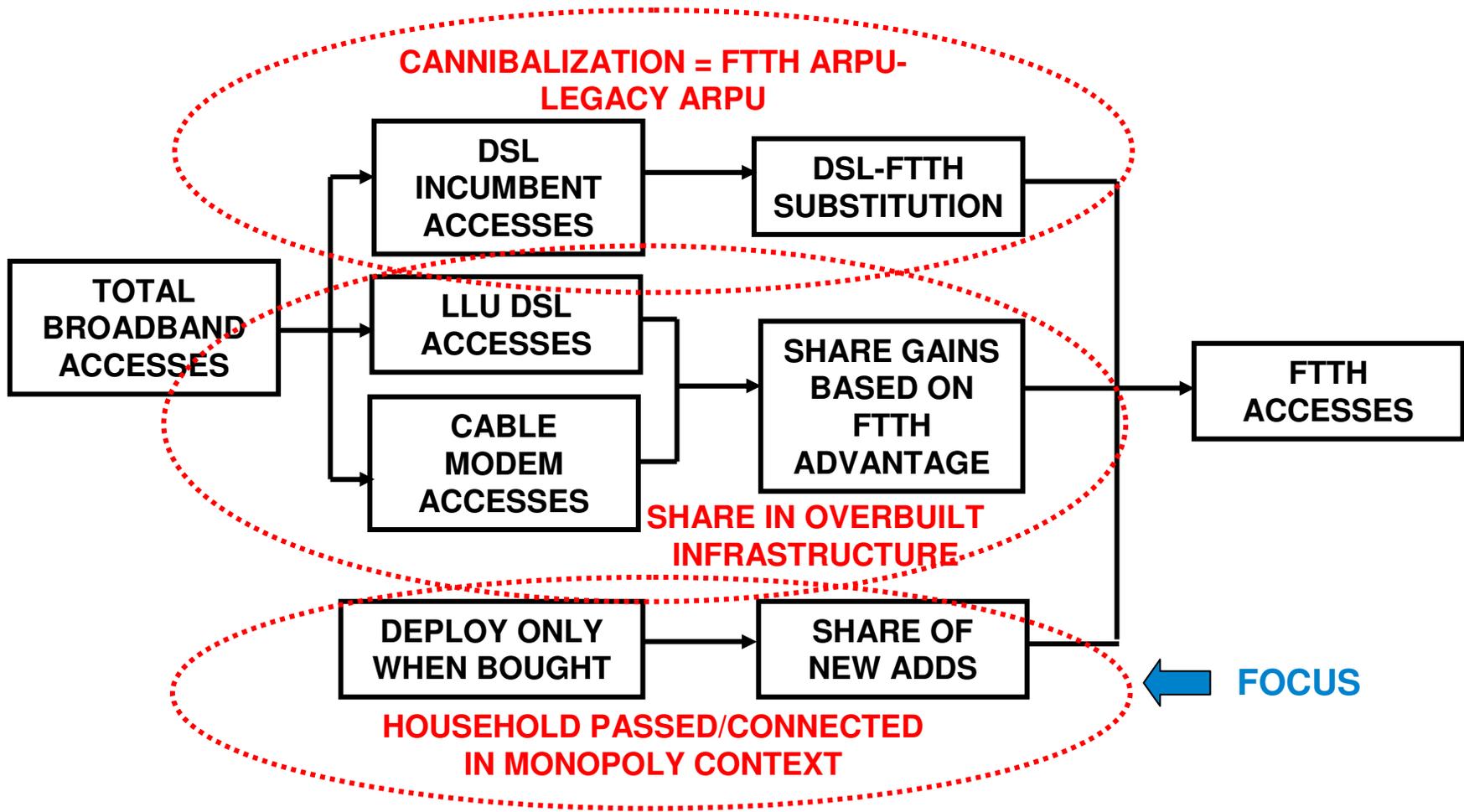
Tiered pricing attempts to reduce cannibalization with DSL service

VERIZON FIOS SERVICE PLAN AND SPEEDS

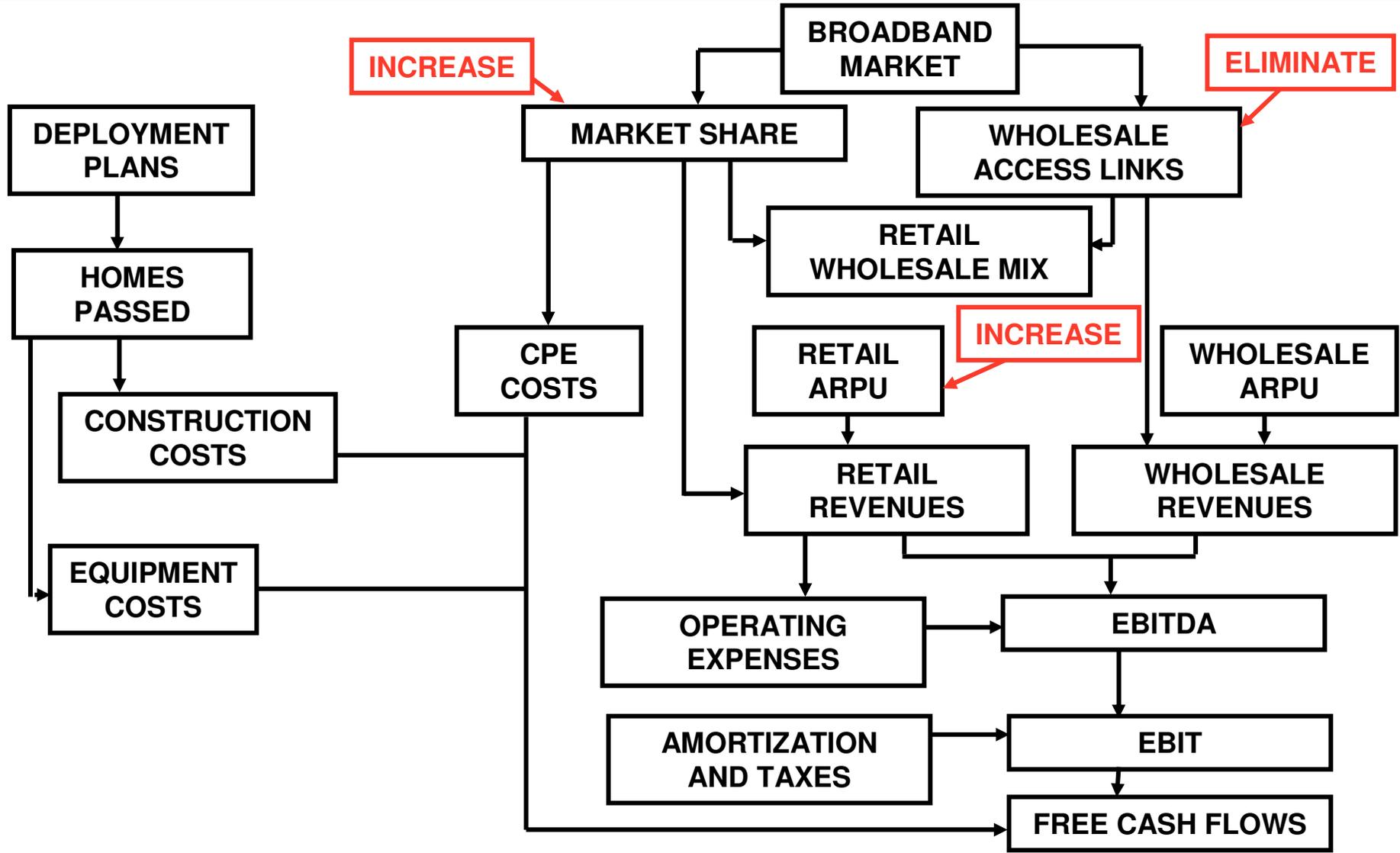
TYPE OF SERVICE	MAXIMUM CONNECTION SPEED	PRICE
Fast	<ul style="list-style-type: none">•5 Mbps download•2 Mbps upload	\$ 42.99/month
Faster	<ul style="list-style-type: none">•15 Mbps download•2 Mbps upload	\$ 52.99/month
Faster Plus	<ul style="list-style-type: none">•15 Mbps download•15 Mbps upload	\$ 64.99/month
Fastest	<ul style="list-style-type: none">•30 Mbps download•15 Mbps upload	\$ 139.95/month

Source: Company website

An emphasis on “Success based deployment” reduces uncertainty regarding market share gains



Therefore, carriers operating under intermodal competition affect three variables of the investment model



Is Verizon FTTH investment case making money? No

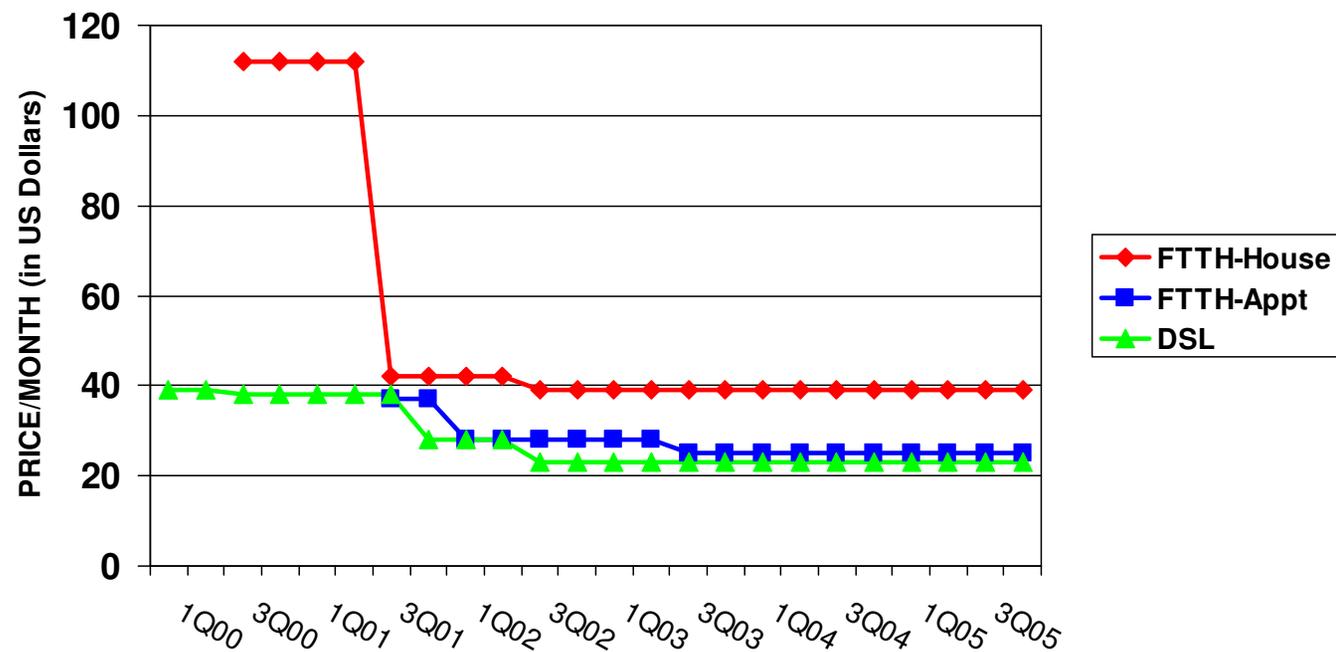
- Variables as of December 2007
 - Houses passed: 9 million (reaching 18 million by 2010)
 - Broadband subscribers: 1,500,000 (17%) (projected to reach 20% in two years)
 - Triple play subscribers: 1,000,000 (11%)
 - ARPU for triple play: \$ 94.99/month (declining @ 3% p.a.)

NET PRESENT VALUE (W/O terminal value)	€ (569) MM
NET PRESENT VALUE (W/terminal value)	€ 826 MM

Unable to price discriminate and forced to unbundle access, the Japanese incumbent needs to affect other variables of the FTTH investment model

- Service available to 84% of population, projected to 90% by 2010
- The incumbent (NTT) controls 79% of all FTTH accesses
- Severe price competition in fiber and loss of DSL share leads to drastic reduction in FTTH pricing, with limited introduction of additional services with exception of IP telephony and video

BROADBAND PRICING IN JAPAN



Source: NTT

A drop of 63% in retail ARPU in year 2 of deployment should severely affect the attractiveness of fiber

Pricing scenarios	RETAIL ARPU (average over five years)	NET PRESENT VALUE (W/O terminal value)	NET PRESENT VALUE (W/terminal value)
Broadband prices fall at ~8% p.a.	€ 47.1	€ (166) MM	€ 1,696 MM
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Fiber prices align with copper	€ 54.0	€ (83) MM	€ 2,212 MM
Baseline case (price tiering)	€ 63.0	€ 105 MM	€ 2,212 MM
Drop in FTTH pricing by 63% in Year 2	€ 33.70	€ (700) MM	€ (1,288) MM

Even a reduction in capex to account for Japan's aerial deployment and urban density does not help rendering the NPV positive

Is NTT making money on FTTH? No

- A published ARPU of 5,085 yen (\$ 49.8 or 33 Euros) (Source: NTT Annual report) does not appear to be enough to generate a positive NPV
- In fact, although NTT is not disclosing the segmented profit/loss figure of FTTH and FTTN; however, the item “Designated Telecommunications Services” in the NTT-East report comprises only FTTH, FTTN, ISDN and “Off-Talk”, which incurred a loss of 103,099 million yen (\$ 1 billion) in 2007
- Considering the number of users of each service is 3,339,000 for fiber service and only 258,000 are for ISDN and 60,000 for “off-talk”, it is safe to conclude that the majority of the loss comes from FTTH and FTTN
- In addition, the President of NTT-East has made two statements confirming the service is losing money:
 - In order to stop the deteriorating overall financial situation, it is important for us to increase FTTH&FTTN revenue through providing new services, such as video and, on top of this, to decrease its cost per subscribers by increasing sales” (Aug. 2, 2007)
 - “I think it is a great problem if we still continue generating significant loss in our FTTH business in 2010 when FTTH/FTTN is estimated to have 20 million users. I think that an increase in subscribers allows us to capture economies of scale and that sales expense will also become relatively cheap in the future. Also, I can see the operating cost will also come down. I hope additional revenue which comes from several value-added services, such as video distribution, will contribute its bottom line. I hope additional revenue which comes from several value-added services, such as video distribution, will contribute to its bottom-line and make it a healthy business” (Nov. 9, 2007)

Therefore, the government has intervened by easing some of the investment variables

- Industrial policy incentives
 - Loans with interest rates lower than market rate available to any carrier with a fiber deployment plan
 - Tax deductions to stimulate fiber investment
- In addition, while unbundling is a key feature of Japanese regulation, the government has shown flexibility in setting up wholesale rates, although it is difficult to visualize what the net impact of this move would be
 - The incumbent requested a review of the method for calculating wholesale charges with an allowance to increase FTM and reduce the depreciation schedule

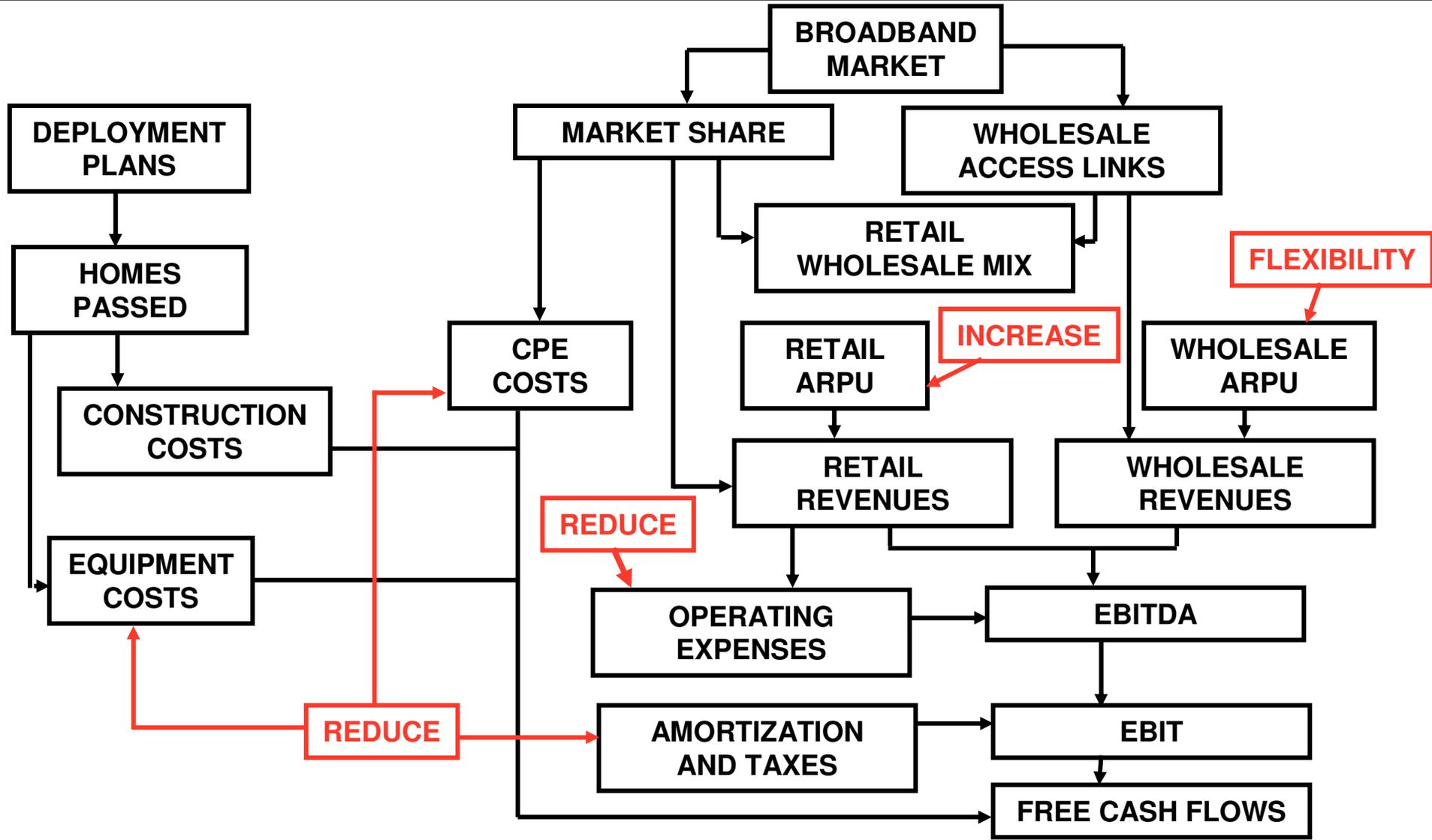
FIBER ACCESS CHARGES (Single Star)

	CURRENT	PROPOSED	
		NTT EAST	NTT WEST
Dark Fiber	4,527 Yen	4,359 Yen	4,761 Yen
Fiber Termination Module (*)	76 Yen	183 Yen	122 Yen
Overhead	471 Yen	171 Yen	165 Yen
Total	5,074 Yen	4,713 Yen	5,048 Yen

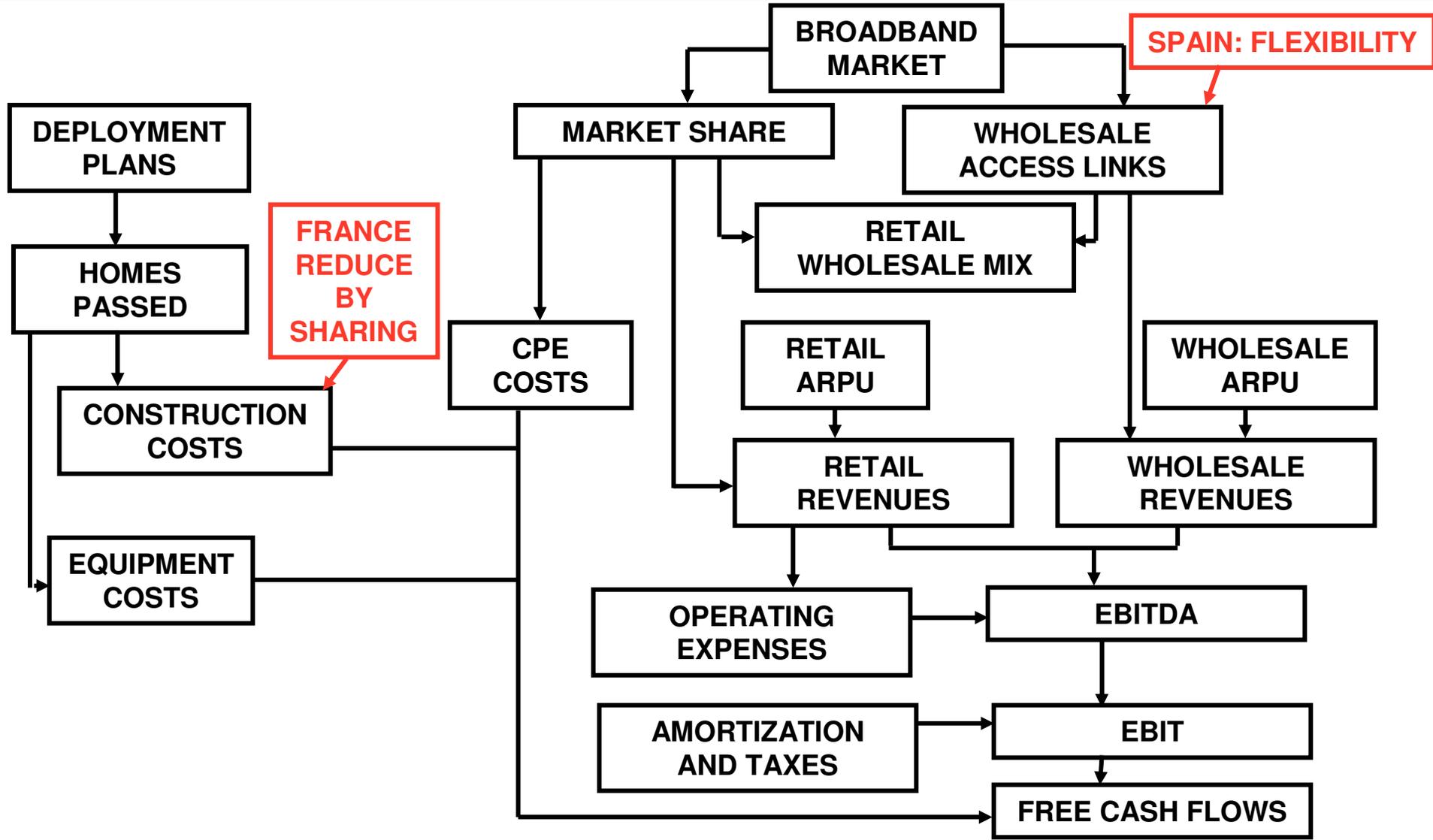
(*) Located in Central Office

Source: Toshiya Jitsuzumi

In sum, the Japanese investment model features a combination of strategic moves and some government-induced financial stimuli



No single European model: France promotes sharing of passive infrastructure to lower costs of fiber deployment while Spain distinguishes between legacy and fiber in terms of access obligations



In conclusion,

- No uniform investment model around the world
- Intermodal competition: eliminates wholesale obligations, and shifts responsibility to deploying carrier that makes strategic decisions
- Japanese model: provides investment incentives and flexibility in wholesale access rates
- European model: no single model

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Is anyone making money?

- The CAPEX problem: fiber builds tend to reduce FCF by 20-30%
- Demand for new services remains speculative so far
- Consumers balk at seeing prices for enhancing throughput rise
- In response to these issues, the “strategic imperative” is being raised as an investment rationale
 - The transformational argument: reduce network O&M by virtue of massive fiber deployment (FTTH is less opex intensive since most active equipment is managed at CO, and a fiber sub-loop costs less to maintain than copper)
 - The defensive retaliation argument: we will not make money but we have to respond to the cable threat
 - The arms race argument: let us raise the stakes and see whether they can follow us
 - We buy market share
- The regulatory and industrial policy variable is the only one that can provide some flexibility
 - Uphaul the ULL regime and have ULL players to become resellers, which would allow incumbents to raise wholesale access prices
 - Consider ultrabroadband a new highway system and therefore subject to government investment
- From a revenue standpoint, need to think at two-sided market business models

Incumbents are confronted with a set of strategic decisions

- Need to invest in FTTH to respond to cable threat of introduction of 100 Mbps service (US, Japan, Korea, Belgium, Switzerland, Portugal, Austria)
- If FTTH is not profitable, need to push the regulator to change access obligations (pricing) and conduit sharing
- If ULL and pricing continue to put pressure on the FTTH investment case, the incumbent needs to argue for industrial policy incentives (tax, advantageous loans)
- If government is unwilling to provide any of these, incumbent is confronted with the following options:
 - Invest in FTTH and take 20-30% of FCF forecasts with consequent impact on stock
 - Do not invest in FTTH and allocate CAPEX to more certain areas of the portfolio (spectrum, overseas subsidiaries if incumbent is global)
 - Short term, this option is more attractive but incumbent might lose innovation initiative to domestic cable
- Therefore:
 - If low cable threat, low willingness from the government to change access rules, and large overseas portfolio, FTTH will not materialize (Telefónica? Which explains last change in NGAN rules by Spanish regulator)
 - If high cable threat, willingness by regulator to reduce access obligations and no overseas portfolio, incumbent invests (Verizon)
 - If high competitive threat, industrial policy incentives and limited overseas portfolio, incumbent invests (NTT)

