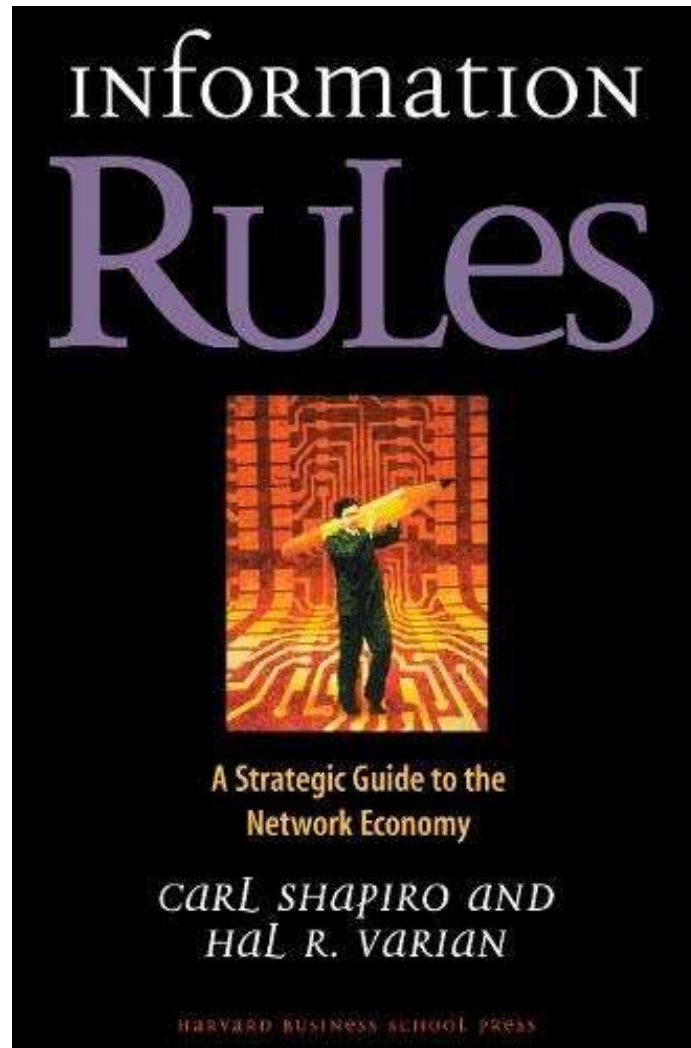


# Strategies in digital industries

## Part II. Cost structures

Business and Project Management

Prof. Andrea Bonaccorsi

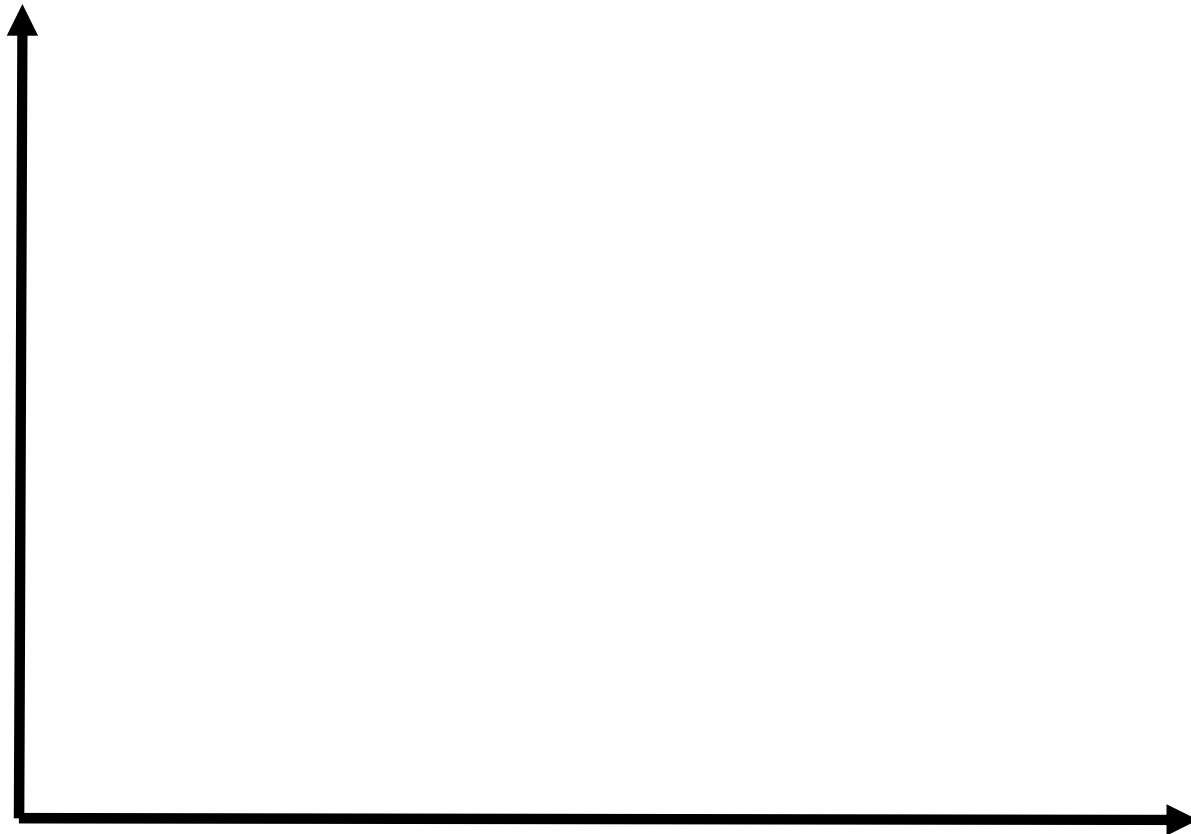


The cost structure of digital companies is structurally different from manufacturing firms

- large portion of total costs is formed by fixed costs (e.g. indivisibility in software design, for example Operation systems, large applications, platform, infrastructure)
- marginal costs are approximately constant (hence constant unit variable costs)
- marginal costs are close to zero (e.g. reproduction of digital products)

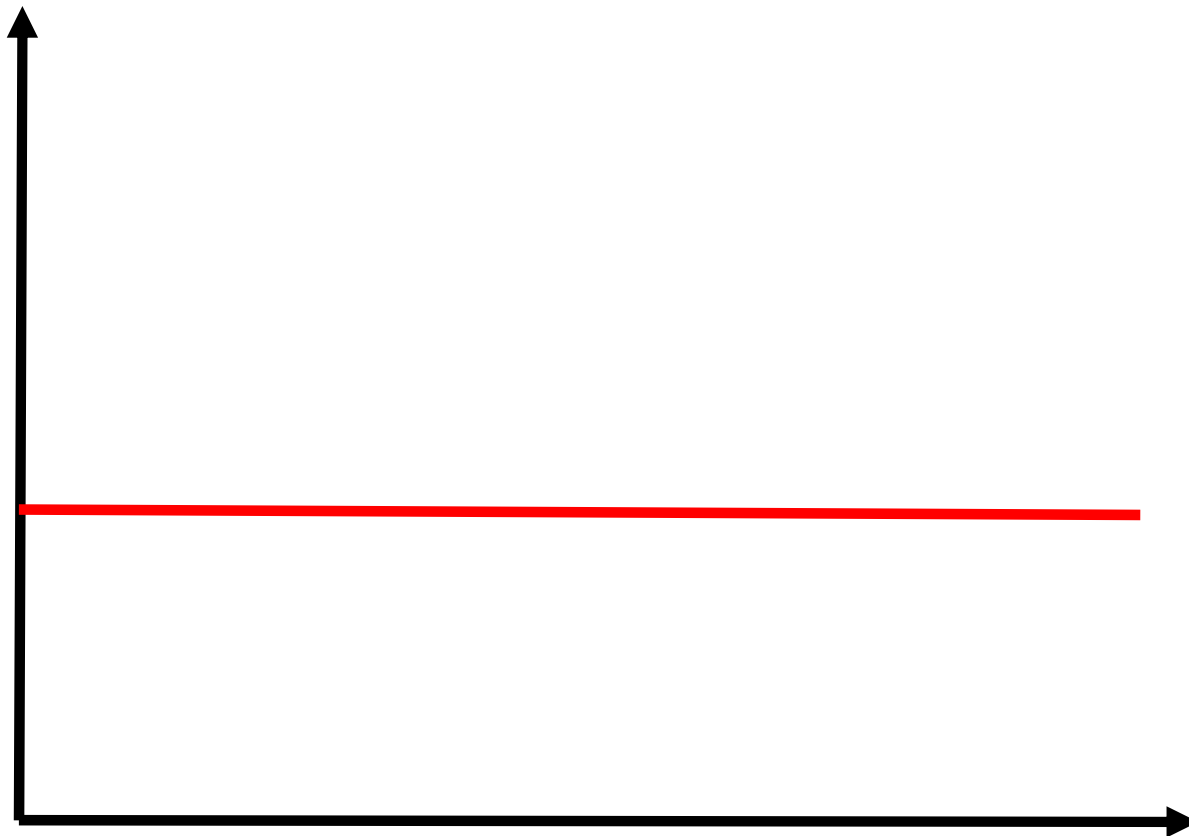
This peculiar cost structure has deep implications for the strategy of digital firms.

Short run total cost



Quantity

Short run total cost



Fixed cost

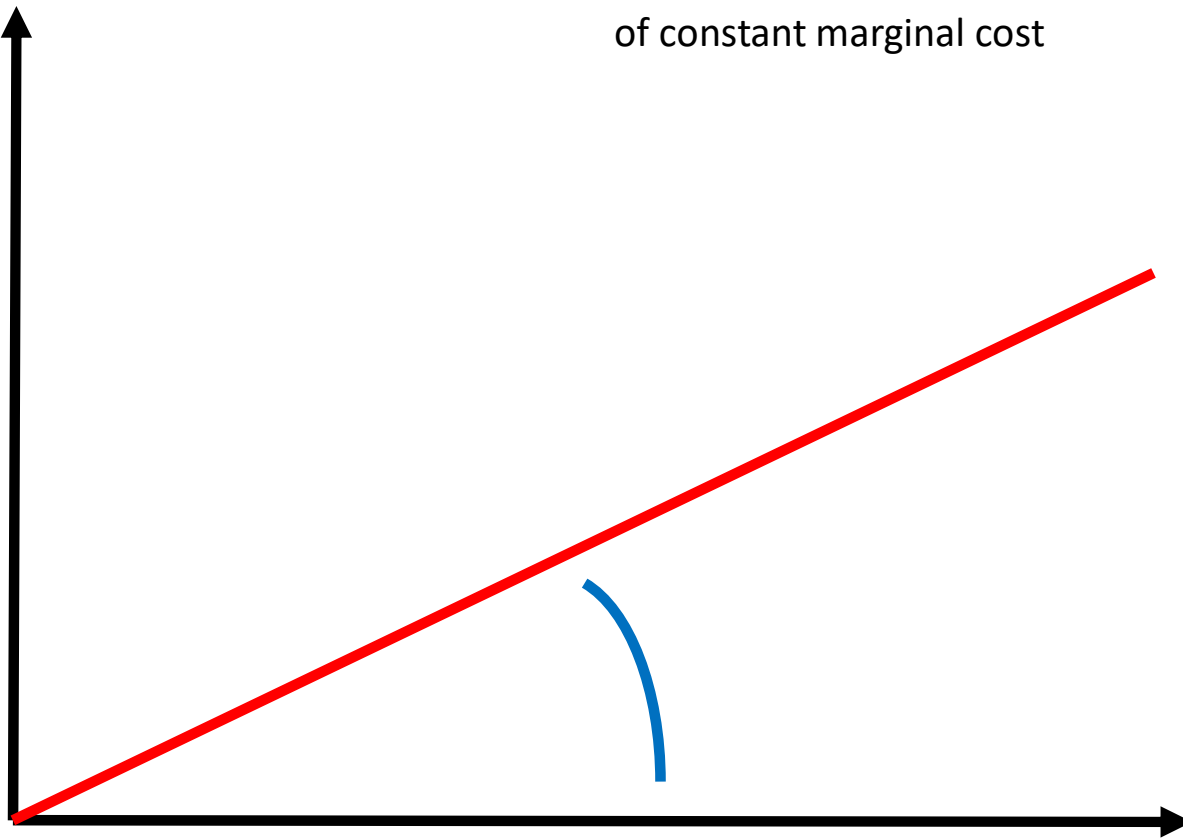
Quantity

Short run total cost

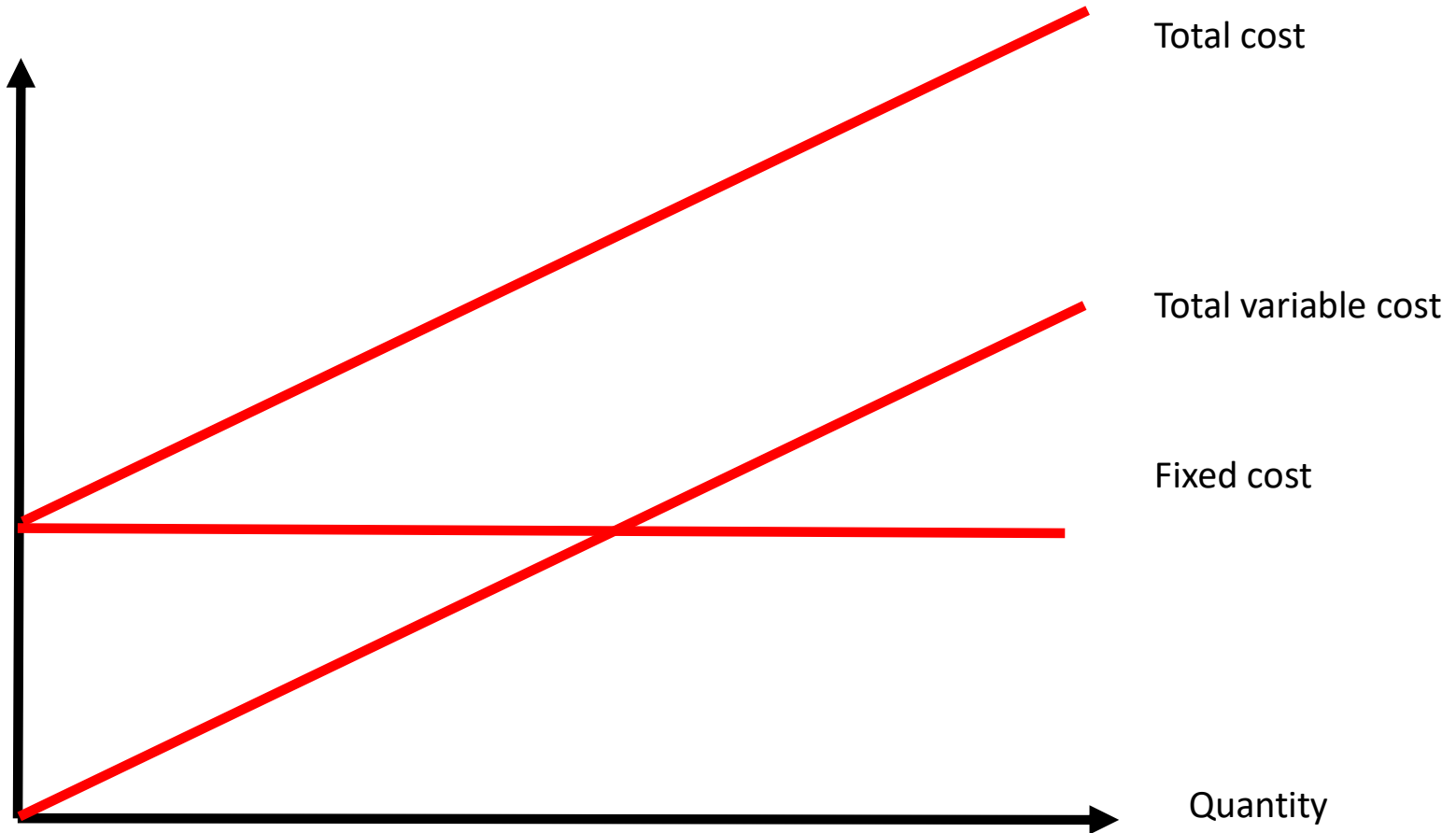
Total variable costs under the assumption  
of constant marginal cost

Total variable cost

Quantity



Short run total cost



- Constant returns can be assumed only for small intervals
- Cost minimization implies that firms try to achieve the largest volume = full use of total capacity

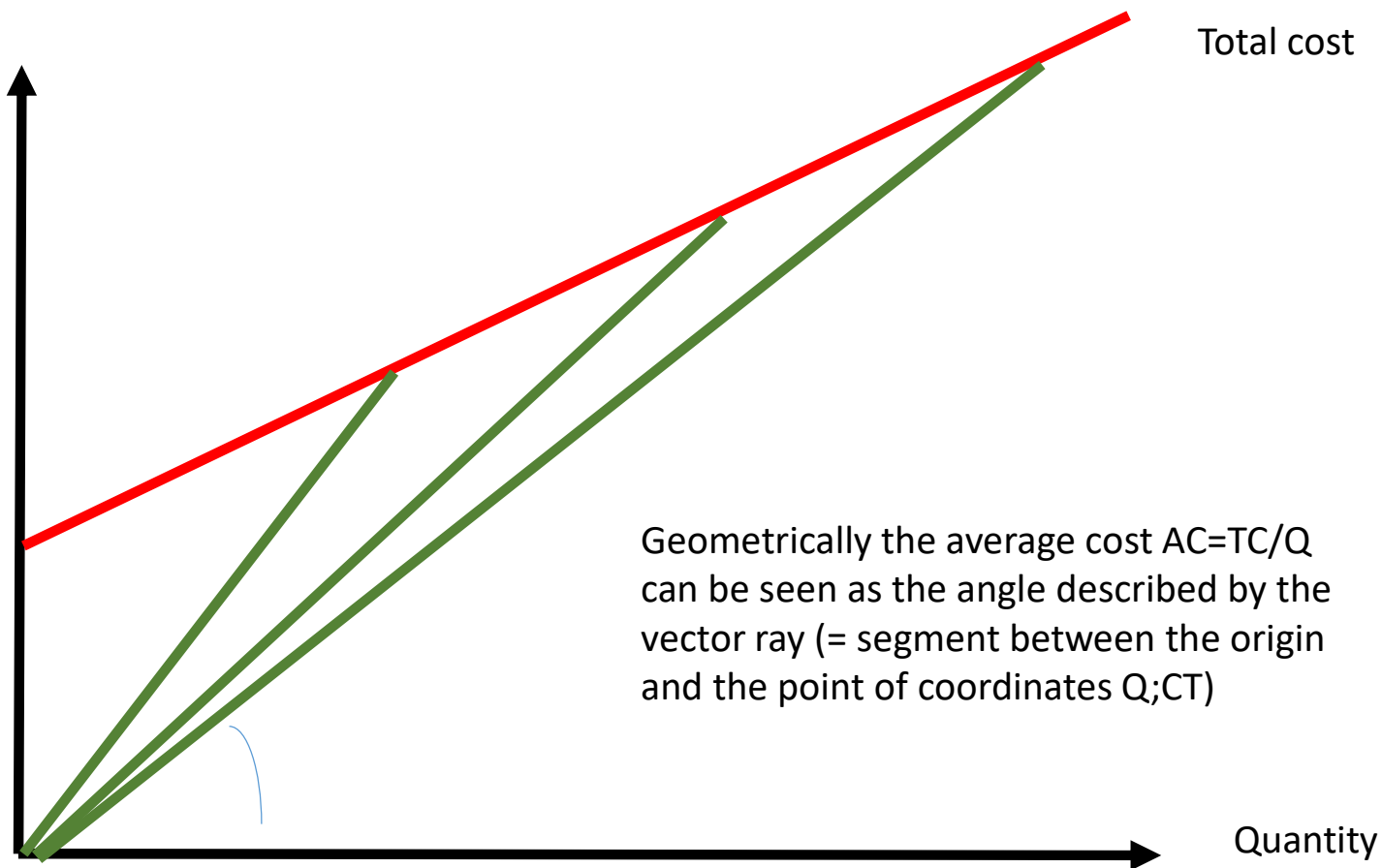
$TC = FC + VC$  (total cost = fixed cost + total variable cost)

$AC = TC/Q$  (average cost = total cost/quantity)

$AC = FC/Q + VC/Q = FC/Q + v$

Since  $FC/Q$  decreases asymptotically, if  $v$  is constant (= constant marginal cost), then the average cost  $A$  decreases monotonically over the quantity.

Short run total cost





- How do companies maximize the profit?
- Let us assume constant prices

$TR = p * Q$  (ricavi totali = prezzo unitario \* quantità)

$$\pi = TR - TC = p * Q - TC$$

$$\pi = TR - TC = p * Q - FC - VC$$

$$\pi = TR - TC = p * Q - FC - v * Q$$

That is

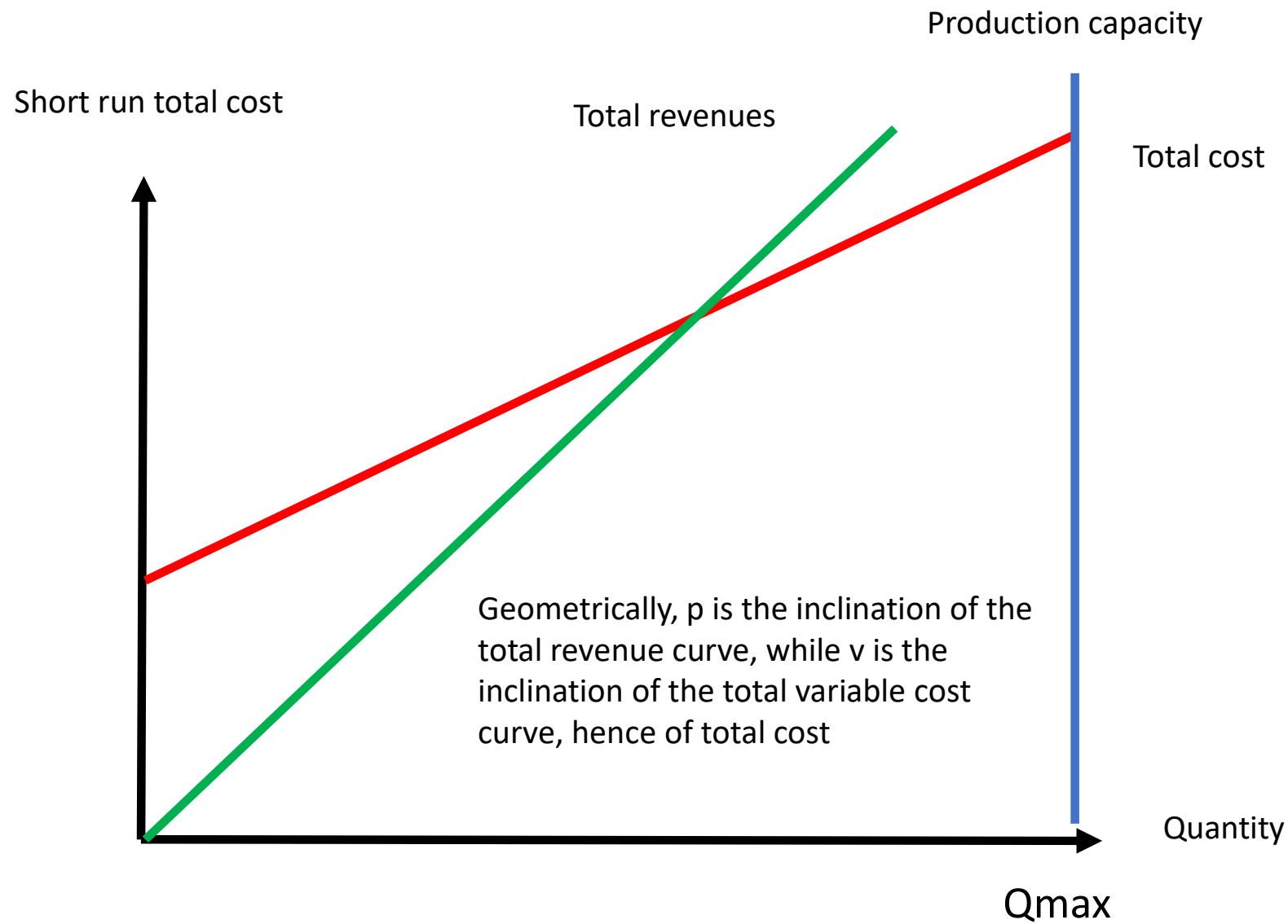
$$\pi = Q (p - v) - FC$$

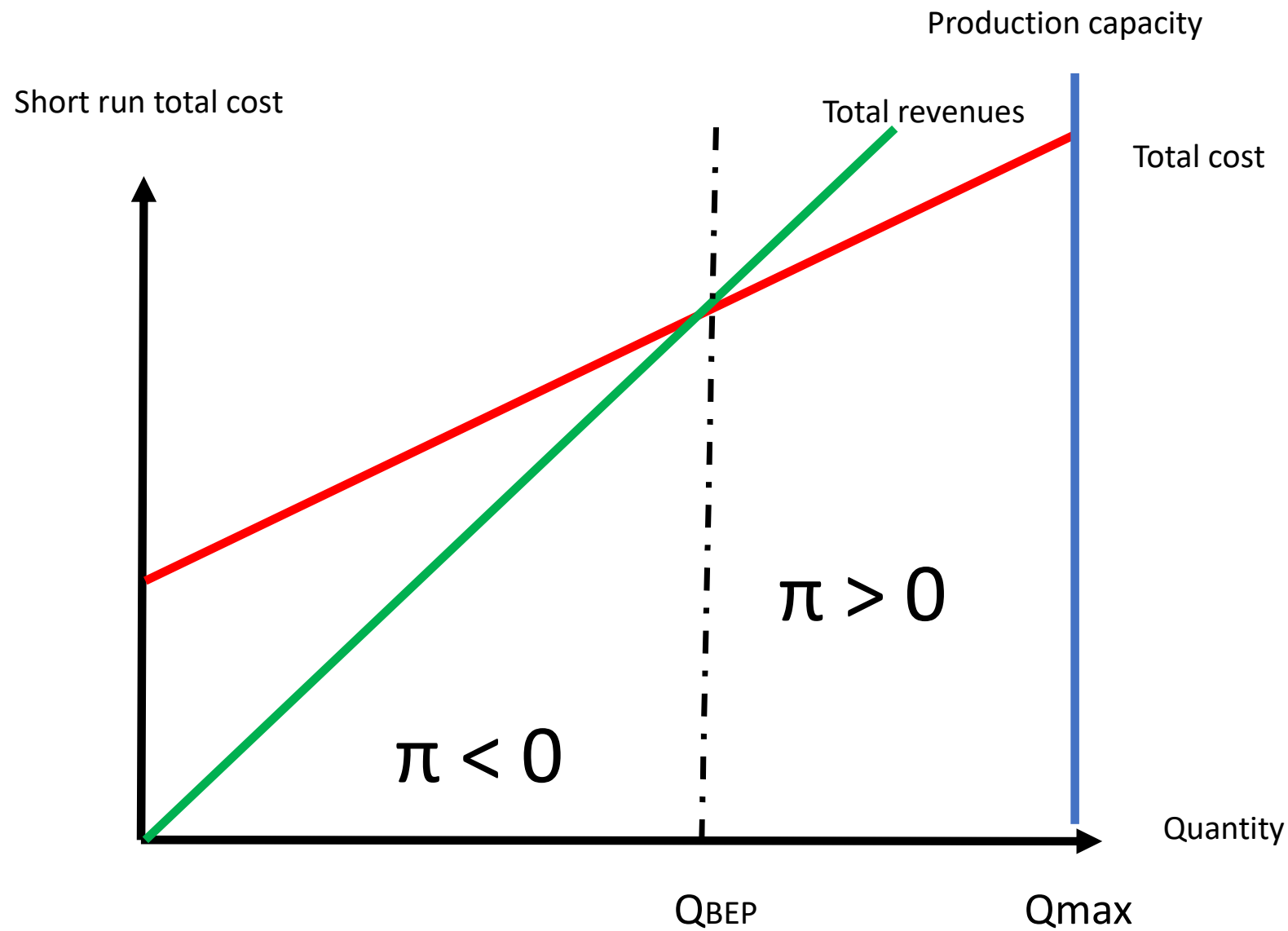
That is  $\pi = Q (p-v) - CF$

The expression  $(p-v)$  is called «contribution margin». It shows to what extent each sold additional unit «contributes»

- first to the coverage of fixed costs (if  $FC$  is larger than  $Q(p-v)$  the firm has negative profits)
- then to the progressive formation of total profits.

Remark: if  $p < v$  the firms will never make profits.





How to compute the BEP?

At the BEP profits are equal to zero.

Therefore  $\pi = Q (p-v) - CF = 0$  implies that

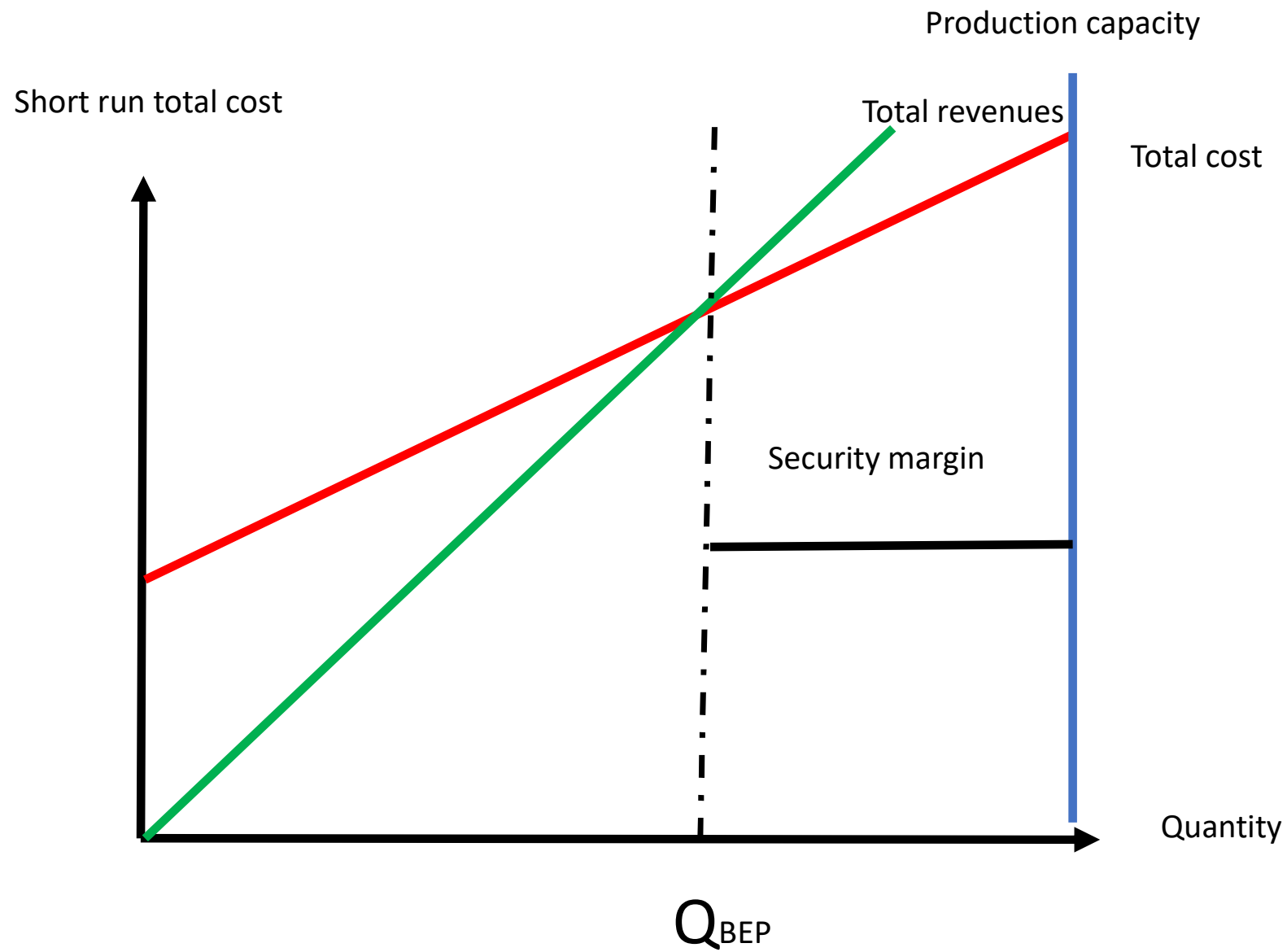
$$Q(p-v) = FC$$

$$Q = FC / (p-v)$$

Hence  $Q_{BEP}$

- Increases when fixed cost increases
- Increases when unit variable cost increases
- Decreases when the unit price increases

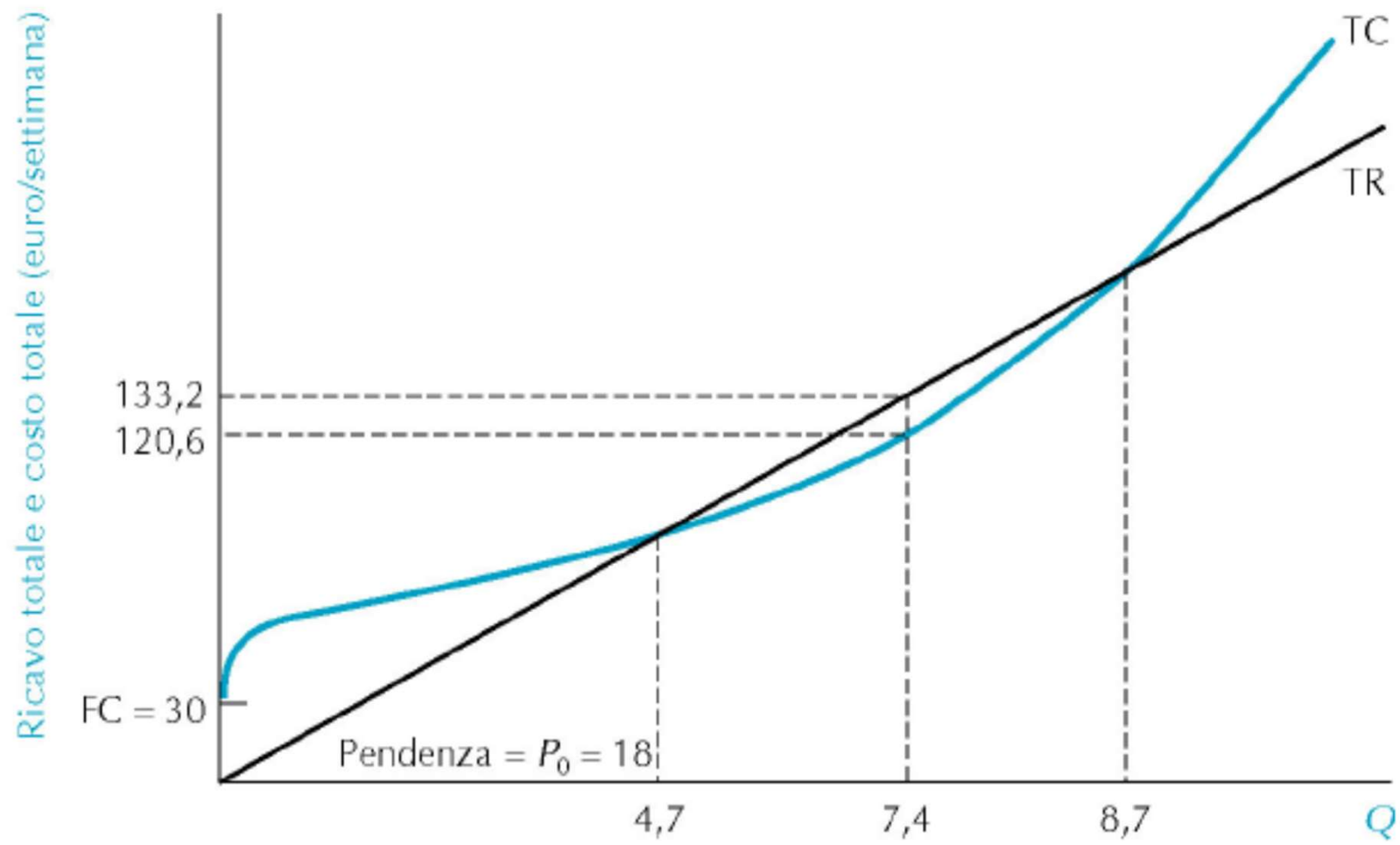
$$\text{Security margin (\%)} = (Q_{\max} - Q_{BPE}) / Q_{\max}$$



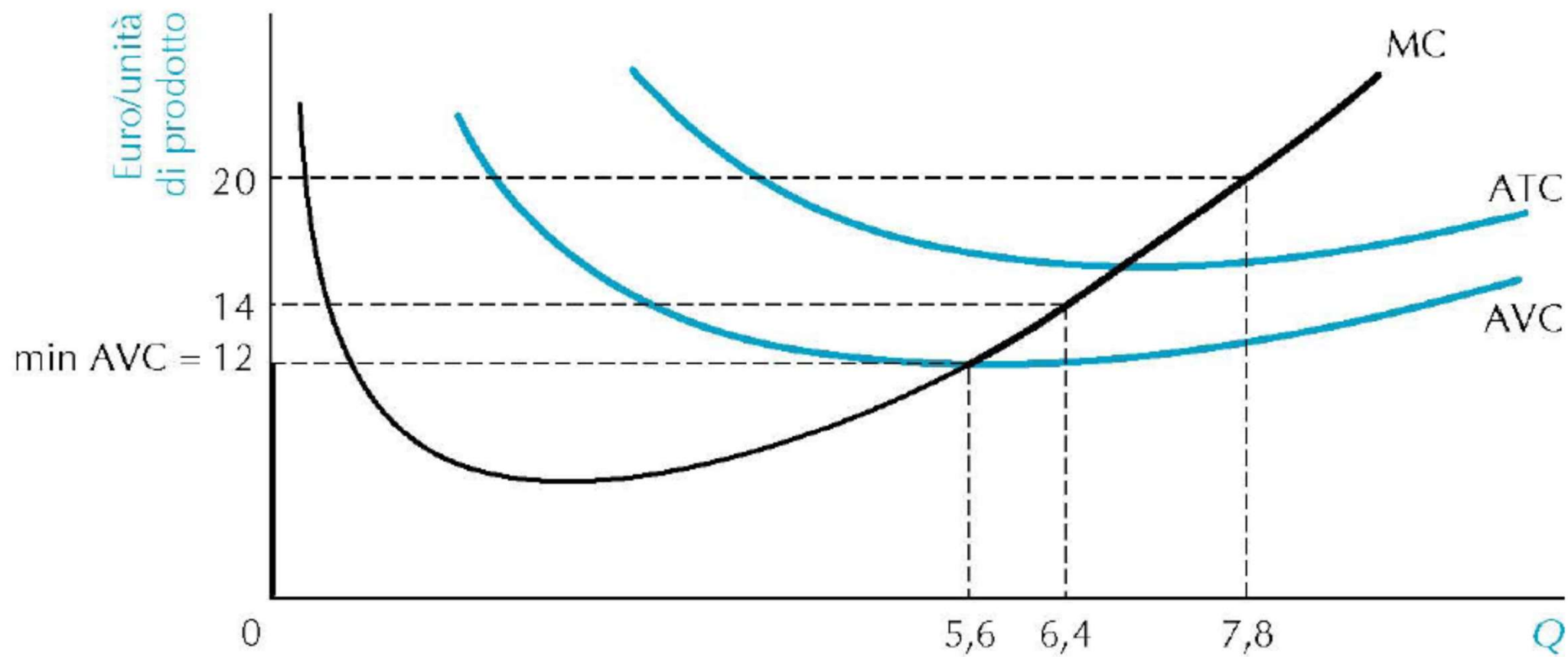
A strong implication of the constant marginal cost assumption is that companies try to grow until they saturate their capacity.

If production capacity is as large as the total market, companies will try to become monopolists.

We might expect digital companies to grow until they reach the total size of the market. In general, there will be room for a number of competitors consistent with the size of the fixed cost (i.e. proportional to the inverse of the ratio between production capacity and total market size).







<b>Companies</b>	<b>Sales</b>	<b>Core business</b>	<b>R&amp;D</b>	<b>Share R&amp;D in sales</b>	<b>Employees</b>	<b>Of that: In R&amp;D</b>
fiscal year end	in billion US\$	in billion US\$	in Mrd. US\$	in %	in thousands	in thousands
<b>Apple</b> (9/2016)	215.6	180.1 Hardware <sup>a</sup> (84%)	10.0	4.6	116.000	n/a
<b>Amazon</b> (12/2015)	107.0	99.1 Retail (93%)	12.5 <sup>b</sup>	11.7	238.000	n/a
<b>Microsoft</b> (6/2016)	85.3	71.3 <sup>c</sup> Software / Services (84%)	12.0	14.1	114.000	37.000 (32%)
<b>Google<sup>d</sup></b> (12/2015)	75.0	67.4 Advertising (90%)	12.3	16.4	61.814	23.336 (38%)
<b>Facebook</b> (12/2015)	18.0	17.1 Advertising (95%)	4.8	26.7	12.691	n/a
<b>Twitter</b> (12/2015)	2.2	2.0 Advertising (91%)	0.8	36.4	3.898	n/a

a iPhone, iPad, iPod and Mac.

b Amazon conducts its R&D under the "Technology and Content" label, which is much more than just research and development: "Technology costs consist principally of research and development activities, including payroll and related expenses for employees involved in application, production, maintenance, operation and platform development for new and existing products and services, as well as AWS and other technology infrastructure expenses. Content costs consist principally of payroll and related expenses for employees involved in category expansion, editorial content, buying and merchandising selection." (Amazon Annual Report 2013: 42, 27)

c Rough estimation: Total sales less sales with devices (computing, gaming and phone hardware).

d Alphabet Inc. since 2015 (including Google).

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## Apple, Amazon, Google, Facebook, Microsoft

Market Concentration – Competition – Innovation Strategies

Ulrich Dolata

*Source: 2015/16 Annual Reports (Form 10-K) of the companies*

<b>Stock market value</b> <i>in billion US\$</i>	
Google	551.4
Facebook	392.8
Amazon	392.2
Apple	675.4
Microsoft	487.7

*Source: NASDAQ: Market Cap on February 1, 2017.*

Year Company		Purchase price in billion US\$
Google	2004 Picasa (photo service)	0.01
	2004 Where 2 Technology (mapping service)	n/a
	2005 Android (mobile software)	0.05
	2006 YouTube (videos, media)	1.65
	2008 Doubleclick (internet advertising)	3.10
	2009 Admob (mobile advertising)	0.75
	2011 Motorola Mobility (mobile devices; 2014 sale to Lenovo for US\$ 2.9 billion)	12.50
	2013 Waze (GPS navigation software)	0.97
	2013 Boston Dynamics (military robots)	n/a
	2014 Nest Labs (thermostats; fire alarms)	3.20
	2014 Skybox Imaging (satellite technology)	0.50
	2014 Deep Mind Techn. (artificial intelligence)	0.80
	2016 Apigee (predictive analytics)	0.63

*Source: Annual reports of the companies; media content analysis; own compilation.*

Year		Company	Purchase price in billion US\$
Facebook	2009	FriendFeed (social networking aggregator)	0.05
	2010	Hot Potato (social media platform)	0.01
	2011	Beluga (messaging)	0.01
	2011	Gowalla (social network)	n/a
	2011	Snaptu (app developer)	0.07
	2012	Instagram (photo and video portal)	1.00
	2013	Parse (app platform)	0.09
	2014	WhatsApp (messaging service)	19.00
	2014	Oculus VR (virtual reality)	2.00
	2015	Surreal Vision (augmented reality)	n/a
	2015	Pebbles (augmented reality)	0.06

*Source: Annual reports of the companies; media content analysis; own compilation.*

Year Company		Purchase price in billion US\$
Amazon	1999 Junglee (online shop; electronics, clothing, books)	0.19
	1999 Alexa Internet (server; website rankings)	0.25
	2008 Audible (audio book download provider)	0.22
	2009 Zappos.com (online shop; shoes, clothing)	0.82
	2010 Quisidi (online shop; drug store, pet food)	0.55
	2011 Living Social (special offers; gift cards)	0.40
	2011 Lovefilm (video rental)	0.30
	2012 Kiva Systems (automatic ordering systems)	0.78
	2013 Goodreads (book community)	0.20
	2014 Double Helix Games (video games)	n/a
	2014 Twitch (video game platform)	0.97
	2016 Curse (game portal)	n/a

Source: Annual reports of the companies; media content analysis; own compilation.



Year	Company	Purchase price in billion US\$	
Apple	1996	Next Computer (software; operating systems)	0.40
	1997	Power Computing (computer manufacturer)	0.11
	2010	Siri (voice assistant software)	0.20
	2012	AuthenTec (biometrics hardware)	0.36
	2013	Topsy Labs (media research)	0.20
	2013	PrimeSense (3D sensor manufacturer)	0.35
	2014	Beats Electronics (headsets; music streaming)	3.00
	2016	Turi (machine learning)	0.20

*Source: Annual reports of the companies; media content analysis; own compilation.*

Year	Company	Purchase price in billion US\$	
Microsoft	1997	Hotmail (internet software)	0.50
	2000	Visio Corp. (software)	1.38
	2002	Navision (software)	1.33
	2007	aQuantive (advertising)	6.33
	2008	Fast Search & Transfer (search software for companies)	1.19
	2011	Skype Technologies (voice over IP)	8.50
	2013	Nokia Devices (mobile devices)	7.20
	2014	Mojang (video games)	2.50
	2016	LinkedIn (social network)	26.20

*Source: Annual reports of the companies; media content analysis; own compilation.*



Domain	Expansion	Main competitors
Google	<p>Search engine / Advertising</p> <p><i>Media</i> YouTube (video/film), Google Play (media-/app store), All Access (music), Google Books</p> <p><i>Mobile soft- and hardware</i> Android, Chrome Browser, Chromecast, Nexus (smartphone and tablet), set-top box running Google TV)</p> <p><i>Social networks</i> Google+</p> <p><i>Internet of Things</i> Smart home, connected car: Open Automotive Alliance, alliance between Google and car manufacturers, special drones</p>	<p><i>Advertising</i> Facebook, Yahoo, advertising firms</p> <p><i>Media</i> Apple, Amazon, Netflix, Hulu, media companies</p> <p><i>Social Networks</i> Facebook, Twitter, Flickr</p> <p><i>Mobile soft- and hardware</i> Apple, Amazon, Microsoft</p> <p><i>Connected car</i> Apple; car manufacturers</p> <p><i>Smart home</i> Microsoft, Cisco, appliance manufacturers</p>

*Source: Annual Reports of the companies; media content analysis; own compilation.*

Domain		Expansion	Main competitors
Facebook	Social network / Advertising	Media Instagram (photos), WhatsApp (messaging)	Advertising Google, Yahoo, advertising firms
		Software Oculus (virtual reality headsets)	Social networks Google+; YouTube; Twitter, Flickr
			Apps Google, Apple

*Source: Annual Reports of the companies; media content analysis; own compilation.*

Domain	Expansion	Main competitors
<b>Amazon</b>	Retail	<div data-bbox="761 502 1355 726"> <i>Media</i>  Amazon Game Studios, Lovefilm, Prime Instant Video, Fire TV, Amazon MP3, Amazon Publishing, Amazon App Store </div> <div data-bbox="761 782 1355 949"> <i>Mobile soft- and hardware</i>  Kindle e-book reader; Kindle Fire tablet, Fire Phone, Amazon Fire set-top box (TV) </div> <div data-bbox="761 1005 1355 1109"> <i>Cloud / IT Leasing</i>  Amazon Web Services </div> <div data-bbox="1377 502 1937 1181"> <i>Trade</i>  Retail companies, specialized online dealers   <i>Media</i>  Google, Apple, Microsoft, Netflix, Spotify, game manufacturers, media companies   <i>Mobile hardware</i>  Apple, mobile device manufacturers   <i>IT Services</i>  Microsoft, Apple, Google </div>

*Source: Annual Reports of the companies; media content analysis; own compilation.*

	Domain	Expansion	Main competitors
Apple	Consumer / communications-electronics	<p><i>Media</i> iTunes Store, App Store, iBooks Store, Apple TV set-top box, music-streaming</p> <p><i>Mobile hard- and software</i> iPhone, iPad, iPod, iWatch, iOS operating system, Safari browser</p> <p><i>Mobile soft- and hardware for corporate clients</i> Strategic alliance Apple-IBM</p> <p><i>Cloud</i> iCloud</p> <p><i>Internet of Things</i> Wearables; health and fitness; connected car: iOS in the car - alliance between Apple and car manufacturers</p>	<p><i>Mobile hard- and software</i> Smartphone/tablet manufacturers; Amazon, Google (Android), Microsoft</p> <p><i>Media</i> Google, Amazon, Netflix, Hulu, Spotify, media companies</p> <p><i>Connected car</i> Google; car manufacturers</p>

*Source: Annual Reports of the companies; media content analysis; own compilation.*

Domain	Expansion	Main competitors	
Microsoft	Computer software / IT services	<i>Media</i> Games – Microsoft Studios, Xbox game console, MSN TV	<i>Mobile software</i> Google (Android); Apple (macOS, iOS); Apple-IBM
		<i>Mobile soft- and hardware</i> Skype, Bing, MSN, Surface (tablet), Windows Phone,	<i>Media</i> Amazon, Google, Apple, game developers
		<i>Social Networks</i> LinkedIn	<i>IT services</i> Google, Apple, Amazon, IBM
			<i>Social networks</i> Facebook; Google+

*Source: Annual Reports of the companies; media content analysis; own compilation.*