Technology giants in patent wars: competition, litigations and innovation

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Background

- Patent wars involve aggressive intellectual property disputes and patent litigations.
- Substantial costs for parties involved in them: In 2012, average cost of U.S. patent litigation for cases with over $25 million at stake was close to $6 million per party through trial, and even higher for those cases with retrials or appeals (The American Intellectual Property Law Association)
- Damage to those found liable for patent infringement may be massive, examples:
  - Median damages awarded for U.S. patent holders in telecom industry 1995 – 2012: over $50 million
  - In 2012, Samsung was ordered to pay over $1 billion to Apple for its patent infringements (e.g., Iphone physical design, functions)

Background

- Large technology companies (e.g., Apple, Microsoft, Samsung) have been in the spotlight.
  - Criticized for their massive investments in patent infringement lawsuits and accumulation of patent portfolios to secure patents for litigation.
  - Also envisioned as the major originators of patent wars filing lawsuits against each other.

- Our understanding of the role of large tech companies in patent wars is, by and large, based on high profile patent litigation cases brought up by the media and case examples in the literature.
- Underlying forces of patent portfolio races and via what channels patent wars contribute to firm's accumulation of patent portfolios lack empirical evidence.

Research questions

- How large technology companies respond to

i) patent wars involving firm directly,
ii) patent wars not involving firms directly but emerging in their geographical market area,
iii) higher fragmentation of patent ownership?

- To what extent each of these elements contributes to

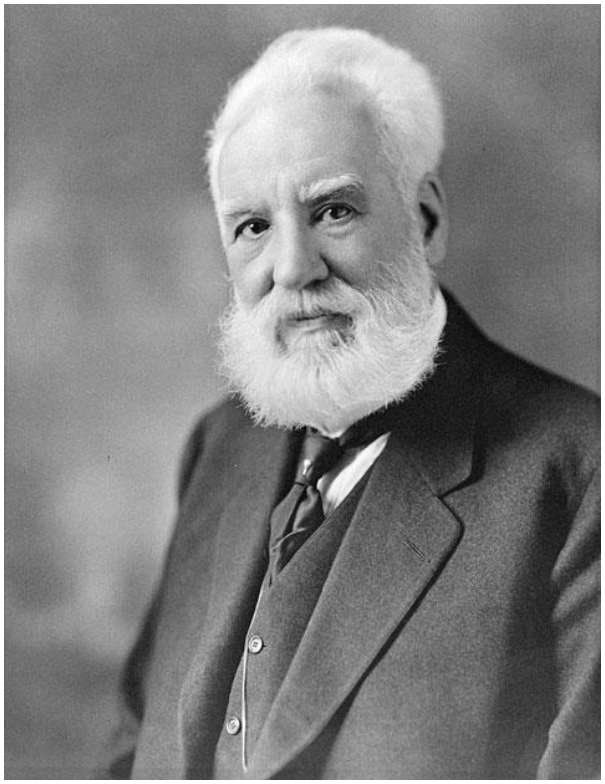
a) patent portfolio races
b) quality of their patented inventions?

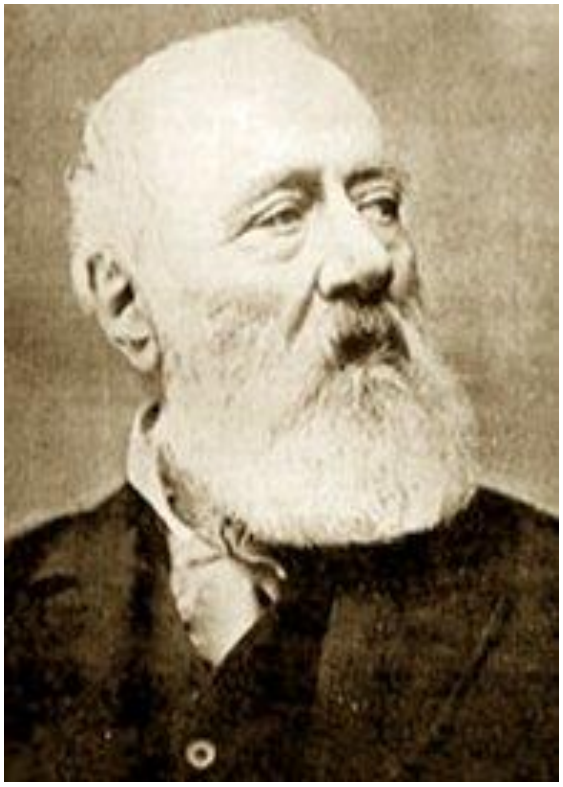
Conceptual framework

- *Patent races* have gained substantial interest in the economic literature
- Central assumption of game-theoretic models: firms compete to be the first inventors of certain technology. Winner of the race then obtains monopoly profits from its innovation via patent while the loser receives nothing.
  - Patent gives its holder right to exclude others from making, using or selling invention for a limited period of time, typically 20 years.

Famous patent race: patent for telephone (February 14, 1876)

Alexander Graham Bell vs. Elisha Grey





Conceptual framework

- Patents are also transferable assets in IP transactions; firms license, cross-license and sell patents & they file them strategically building patent portfolios to obtain bargaining power in potential patent disputes.

- More realistically and more often, firms' innovation races focus rather on *patent portfolio races* in which firms aim at accumulating vast patent portfolios that can be used as assets in intellectual property rights (IPR) disputes and negotiations.

Conceptual framework

- *Firm's involvement in patent litigation* may transfer its R&D personnel time use from innovation activities to litigation bureaucracy

  → Less/lower quality patentable inventions.

- *Intensifying patent war in firm's market area* may generate risk to get involved in costly and time consuming patent litigation.

  → Firm files more patents to secure its position in markets for technology even though it would not be directly involved in patent wars.

Conceptual framework

- *Fragmented ownership of patents*: more difficult for firm to detect all relevant patents it may potentially infringe in its products.

  → Patent portfolio races as firms defensively build up patent portfolios to forearm against infringement suits.

- OTH, threat of litigation/increased competition may-provoke tech giants to a) invest more in R&D or b) file applications to ideas they had otherwise kept secret to secure their future market shares or leading position.

  a) → More and/or more valuable patented inventions

  b) → No innovation effect, benefits society if valuable inventions (via spillovers).

Data

- Data from 20 major technology companies 2005 – 2014.
  - Involved with wireless technologies subject to patent wars (smartphone manufactures, wireless carriers, operating systems designers and app developers)
  - Among top USPTO patentees 2005 - 2014 i) in technology areas covering communications and software (i.e., IPC classes H04 and G06) and ii) comprising words “cellular” or “mobile” in the abstract, title or description of their patent application.
- Patents in IPC classes H04 and G06 as the majority of smartphone related patents covered by IPC class H04 & most software-related patents covered by ICP class G06.

Data

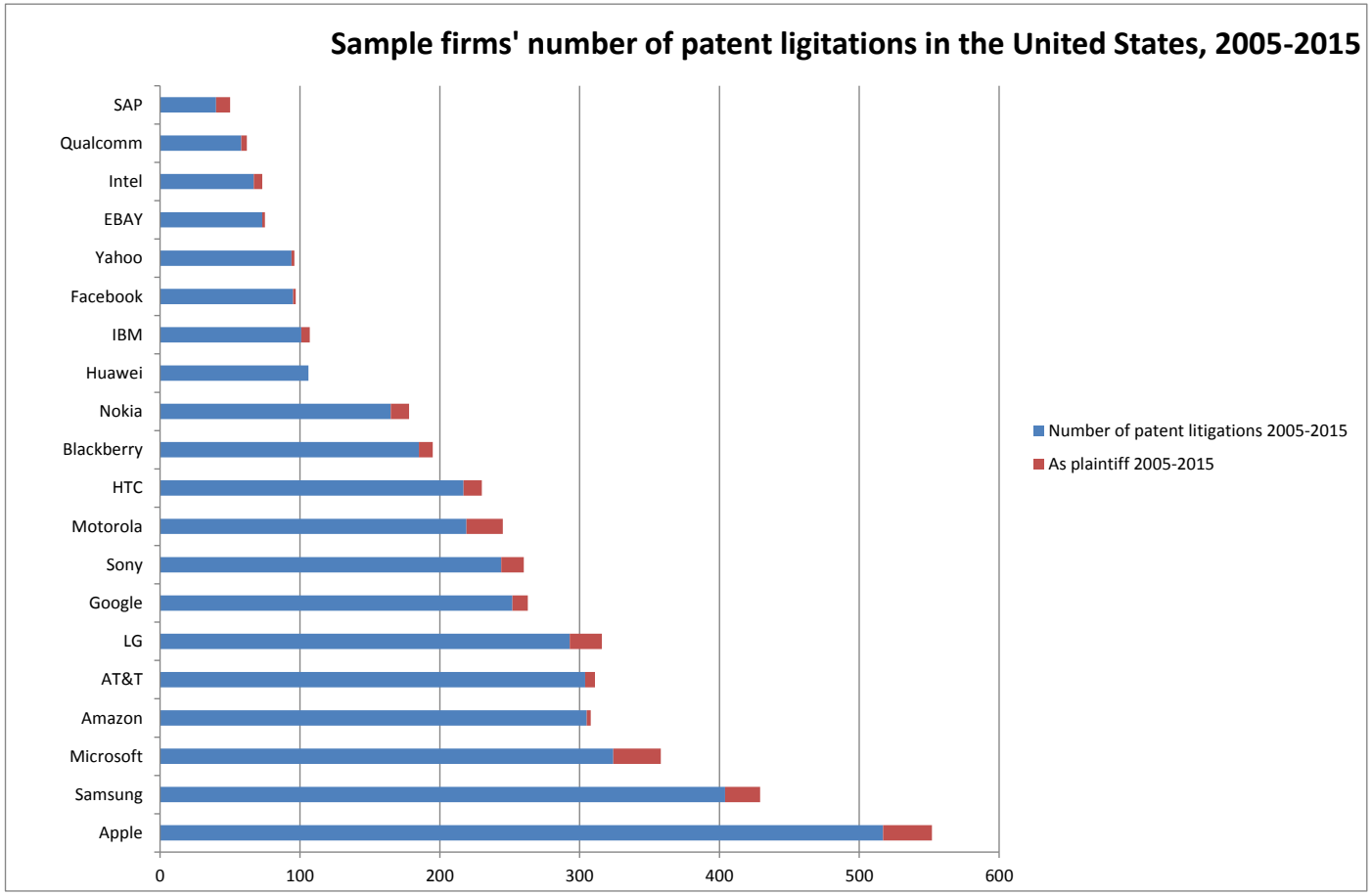
- USPTO patenting as United States among biggest market areas for smartphones & single largest software market in the world.

- US patent law enables patentability of software&algorithms

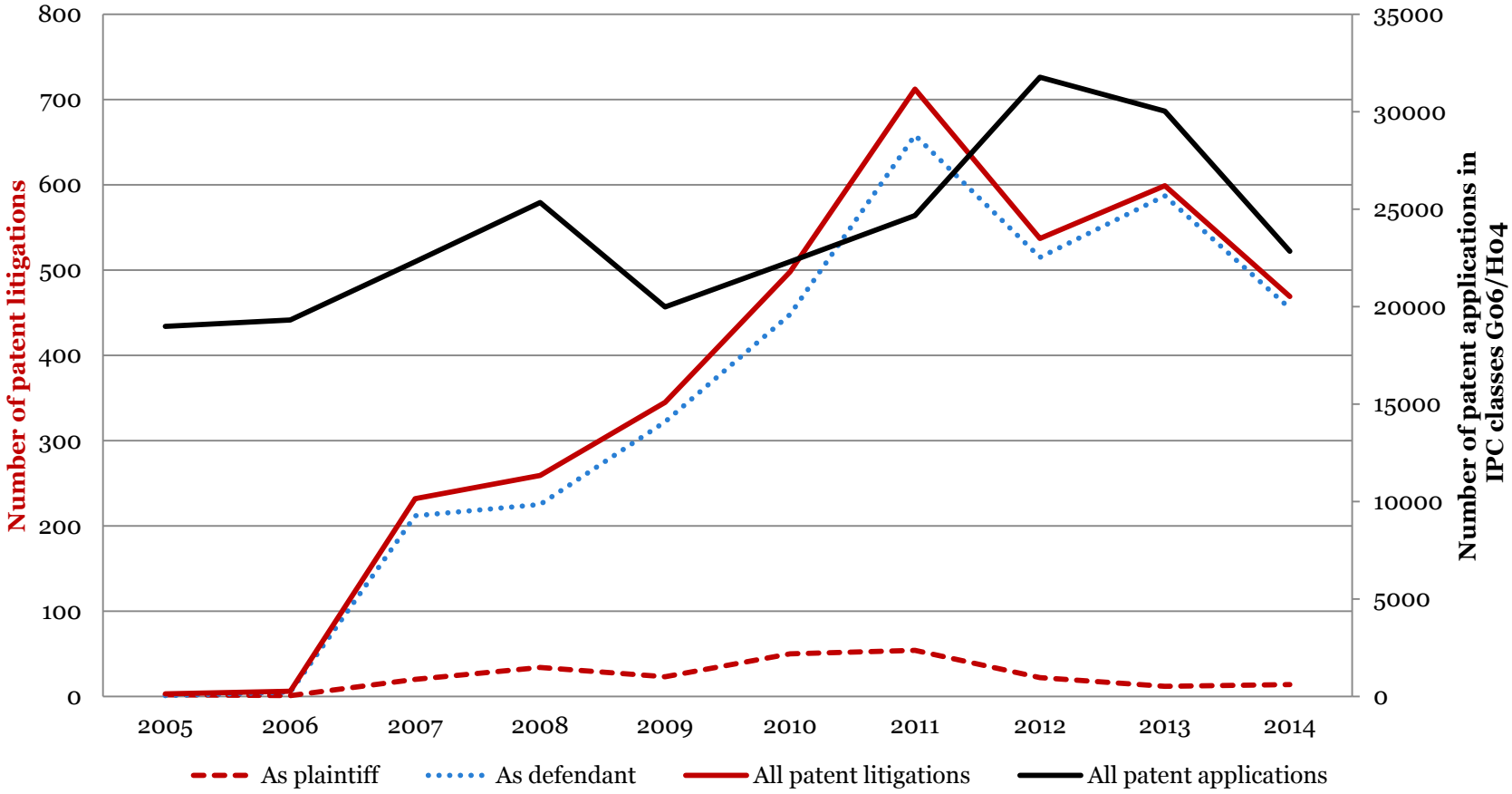
  → Broad range of innovation relevant for tech companies covered.

- Patent disputes related to telecommunications, computer hardware/electronics and software industries had higher median damages awarded than industries overall 1996-2016.
  - Median damages award for all industries < $6 million.
  - Median damages awarded for patented technology associated with computer hardware/electronics industry: $73 million, telecommunications: $34 million & software industry: $37 million.

Sample firms' patent infringement litigations in the United States, 2005-2015



Patent litigations and patent applications of sample firms in the US, 2005-2014



Econometric model: dependent variables

Variable name	Description	Data source	Mean	S.d.	N	Median
Applications	Count of patent applications filed in USPTO in IPC classes H04 and/or G06 by firm i at quarter t	Patent Inspiration – Patent analytics engine www.patentinspiration.com Accessed: 2.12.2016 (based on European Patent Office's worldwide bibliographic database)	279,04	319,87	858	166,00
AvgFwC	Average count of forward citations of patent applications filed in USPTO in IPC classes H04 and/or G06 by firm i at quarter t	Patent Inspiration	6,87	8,50	855	5,24
AvgFamsize	Average family size of patent applications filed in USPTO in IPC classes H04 and/or G06 by firm i at quarter t	Patent Inspiration	4,57	4,84	855	3,87

Econometric model: dependent variables

- Forward citations (i.e., later patents citing the subject patent) is commonly used measure of patent quality.
  - Associated to inventions with greater private returns to inventors and with greater social welfare.
  - High forward citation count = innovation is likely to be a building block for important technology area or new market with substantial growth potential.
- Patent family size that indicates the number of countries in which patent protection is sought also widely used measure of patent quality.
  - Due to relatively high costs of expanding patent protection abroad, firms tend to internationally protect only ideas of which expected value for firm is sufficient.
  - The literature also provides substantial evidence on the positive relationship between patent family size and firm value.

Econometric model

- $PAT_{it} = \alpha_0 + \beta_1 \sum_{t-1}^{t-3} Ownership\_fragmentation_{it-1} + \beta_2 \sum_{t-1}^{t-3} Litigation\_direct_{it-1} + \beta_3 \sum_{t-1}^{t-3} \sum_j Litigation\_US_{it-1} + \beta_4 RD_{iy} + \beta_5 X_{it}$

Variable name	Description	Data source	Mean	S.d.	N	Median
ln_Ownership_fragmentation	(log) Quarterly count of patentees with published U.S. patents in IPC classes H04 and/or G06 by firm i at quarter t	Patent Inspiration	8,85	0,10	858	8,84
Litigation_direct	Quarterly count of patent infringement lawsuits filed in the U.S. District Courts or U.S. Courts of Appeal in which the company i acts as defendant in the United States.	Justia Dockets - public litigation records from the federal appellate and district courts https://dockets.justia.com/ Accessed: 27.8.2016 & 12.12.2016	4,22	4,81	858	3,00
Litigation_US	Quarterly count of all other patent infringement lawsuits filed in the U.S. District Courts or U.S. Courts of Appeal.	Justia Dockets	986,05	370,16	858	776,00

How patent portfolio races are generated?

Does fragmented ownership of patents matter?

- When patent ownership is distributed among large number of parties, more difficult or expensive for firm to detect ex-ante all relevant patents it may potentially infringe in its products.

  → Firms defensively build up patent portfolios to forearm against infringement suits (this hypothesis supported by various empirical studies)

- **Our data: NO**, fragmentation of patent ownership does not generate patent portfolio races.

How patent portfolio races are generated?

Does intensity of patent war or number of patent litigations matter?

- Firm may not only react to its own patent infringement lawsuits but also intensifying patent war in its *market area* generates risk to get involved in costly and time consuming patent litigation.

  → Firms file more patents to secure their position in markets for technology and to signal their bargaining power in IPR disputes.

- **Our data: YES,** large tech companies file more patents when patent war intensifies in their market area even when not directly involved in patent litigations.

Patent wars and quality of patents?

- Patent wars reduce quality of patented innovation: Large technology companies respond to an increase in patent litigation cases by filing patent applications that have
  - smaller family size (= less countries in which patent protection is sought)
  - less forward citations (= fewer later patents citing the subject patent)

- When patent war intensifies, large technology companies tend to file more worthless or very low quality patents (measured by the share of patent applications with a) no forward citations & b) no foreign filings)

Conclusions

- In almost all US patent infringement cases, large tech companies act as defendants of patent litigations.
- Though the stock of patents filed by large tech companies due to patent wars are clearly larger than otherwise, quality of their subsequently filed patent applications is lower.
- Overall, our empirical findings hint that patent wars are socially wasteful:
  - Do not promote valuable innovation.
  - Generate substantial burden for the legal system.
  - Waste firms' resources (litigation bureaucracy, costs of patenting for signaling bargaining power in potential future patent disputes)
  - Strain patent offices with massive number of patent applications for inventions with little or no value at all.

Conclusions

- Possible that patent wars will recur in the growing markets, e.g., those related to Internet of Things (IoT).
  - Size of markets for IoT systems with connected machines, devices and vehicles is expected to surpass that of smartphones making large companies in IoT domain a lucrative target for patent litigations.
  - Integration of multiple IoT technologies exposes firms to patent infringement actions.
  - Competition among large technology companies over dominant IoT technologies and standards raises the stakes, and potentially makes patent wars between companies even fiercer.
- How to amend incentives of market players such that destructive patent portfolio races and excessive IPR disputes and patent litigations will be avoided in the future?