



# The Structure of Markets for Technology in Sweden, 1885-1914

---

DAVID E. ANDERSSON & FREDRIK TELL  
BUSINESS ADMINISTRATION  
DEPARTMENT OF MANAGEMENT AND ENGINEERING  
LINKÖPING UNIVERSITY

*Session 8.E*

*19th Annual Congress of the BHC/EBHA 2015, June 24th-27th, Miami, Florida*

# Main points

- Markets for technology are **more heterogeneous** than previous research has shown
- A **more detailed** view is needed
- **Patent quality** can vary for ex-ante and ex-post transactions

# Agenda

- Background: patenting and the emerging market for technology late 19<sup>th</sup> century
- The data: patent data and case study
- Analysis/Results: Survival analysis and patent transactions
- Conclusions/new concepts: (Sub)-Markets for technology

# Setting the stage

- Patent legislation and **emerging markets for technology**.  
Wave of new “modern” patent laws in e.g. UK (1852), Italy (1859), Germany (1877), Sweden (1884), Japan (1885), Switzerland (1888), Hungary (1894), Australia (1903)
- Stronger IP rights/protection
- **Only Sweden, Germany and the US** had a **strong examination process**.
- Effects: **Economic growth** (Khan, 2013; Burhop, 2010; North, 1990; Lamoreuax & Sokoloff, 1999), increased propensity to patent (Khan, 1995)

# Background

## **Economics of innovation/Economic History**

- Innovation and technological change main driver of economic growth (Schmookler, 1966; Solow, 1957; Nelson & Winter, 1982)
- Markets for technology contributes to economic growth through division of labor and the dissemination and transfer of knowledge (Arora & Gambardella, 2010; Lamoreaux & Sokoloff, 1999; Burhop, 2010, Serrano, 2010; Nicholas & Shimizu, 2013)

## **Strategic Management/Business History**

- Management of and strategic use of IPR by firms provide competitive advantage (Granstrand, 1999; Somaya, 2012)
- Shown in firm histories Heide (2009), Mass (1989), Guise-Richardson (2010)

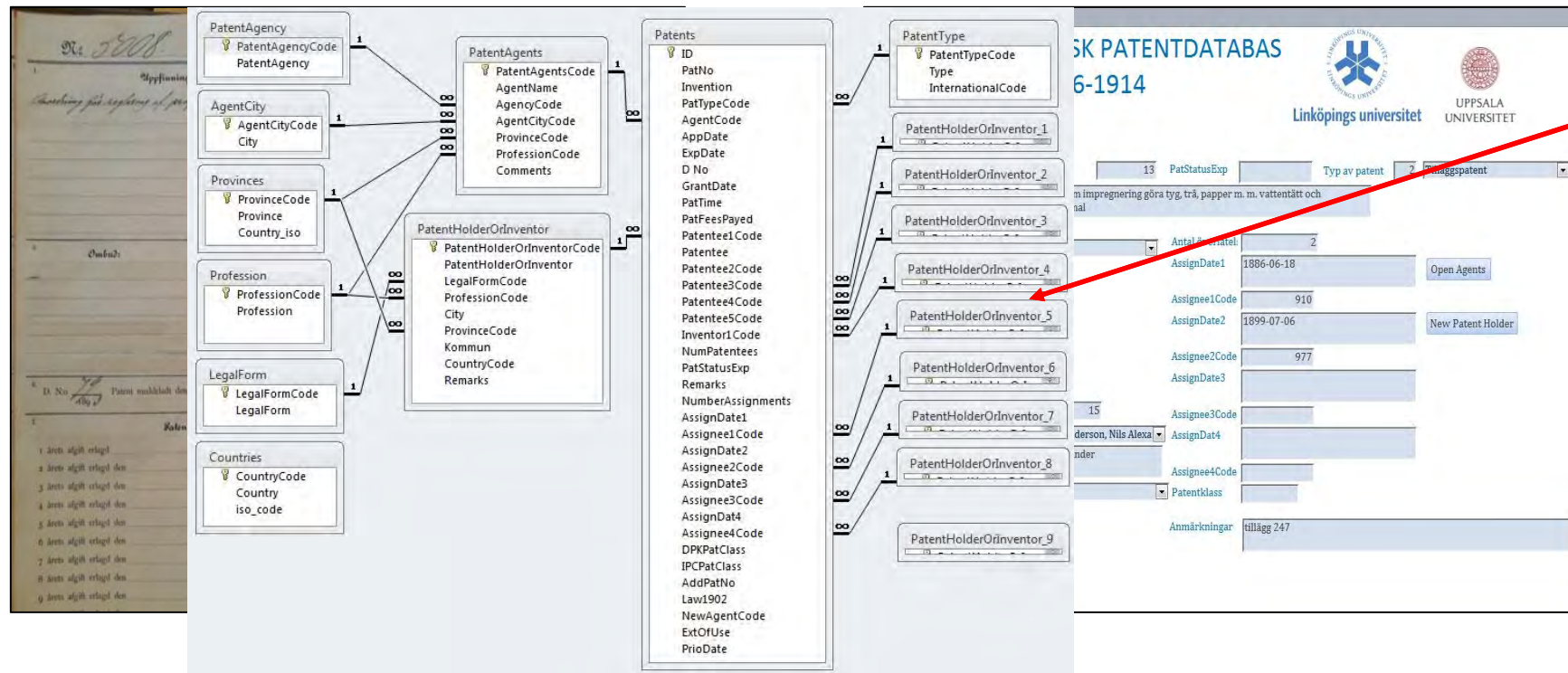
# Research problem

- Burhop (2010) Nicholas & Shimizu (2013) Lamoreaux & Sokoloff (1999, 2003), Arora et al (2001), Serrano (2010) have all shown the **existence of markets for technology**. Around **13 % of all patents**.
- Type of market? Effects on patents?
- Siebert and von Gravenitz (2010), FTC (2011), **difference between ex-ante, ex-post** transactions.
- MfTs include ideas/technology **with and without** legal protection.
- One **problem with historical patent data** and transfer/assignment data is that it fails to capture large parts of the market for technology that potentially does not show up in the patent register, for example **licensing**.

# Research questions

1. What was the size of the market for technology in Sweden?
2. What was the structure of the market?
3. How was this related to patent quality?

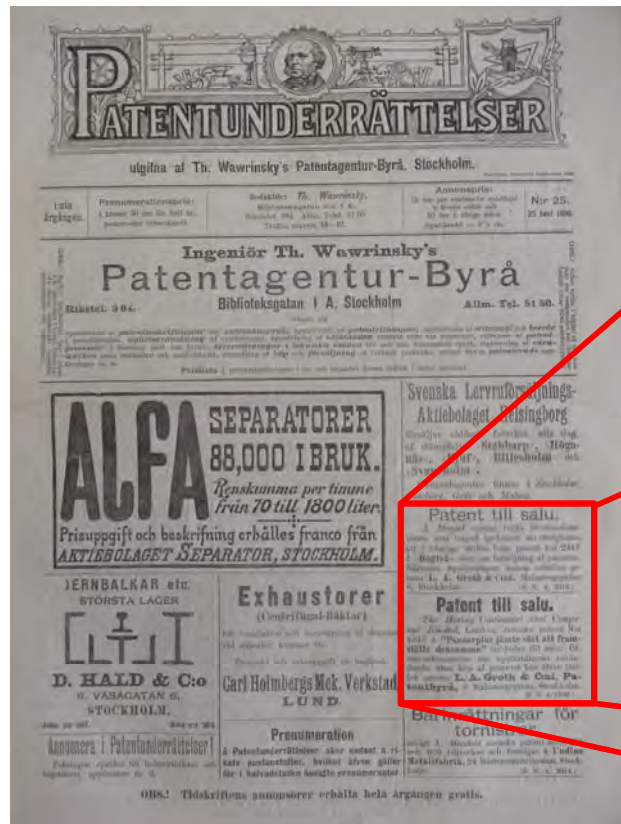
# The Data - patent statistics



- Digitalization of the original patent register of the Swedish Patent Office and **creation of a relational database** → the LiU-UU patent database
- **NO sampling!** Contains all Swedish privileges and patents 1746-1914
- 38,192 patents for 1885-1914 and ~7000 patents + privileges for 1746-1884
- Information on all **patentees, inventors, agents, transfer, patent fees, litigation,** etc.



# The Data – patent agency journals



**Patent till salu.**  
*A. Mendel* önskar träffa öfverenskom-  
melse med lugad spekulant om rättigheten  
att i Sverige utöfva hans patent n:o 2448  
å »**Bogträ**» eller om försäljning af patentet.  
Närmare upplysningar kunna erhållas ge-  
nom **L. A. Groth & C:ni**, Malm Morgsgatan  
6, Stockholm. (S. N. A. 2016.)

**Patent till salu.**  
*The Harvey Continental Steel Compa-  
nys Limited*, London, svenska patent N:o  
4242 å »**Pansarplåt jämte sätt att fram-  
ställa densamma**» utbjudes till salu. Öf-  
verenskommelse om uppfinningens använ-  
dande utan köp af patentet kan äfven träf-  
fas genom **L. A. Groth & C:ni, Pa-  
tentbyrå**, 6 Malm Morgsgatan, Stockholm.  
(S. N. A. 2109.)

The journal of Wawrinsky Patent Agency *Patent News* (Patent underrättelser). Published 1896-1899. All weekly issues digitized.

# Analysis

## Statistical

- **Logit regression**
  - What is associated the most with higher patent quality (longer patent life)?
- **Survival analysis**
  - If and how does the survival and hazard functions differ between different type of patents in regards to markets for technology transactions?

+

## Case study

- Collection of all advertised patents in *Wawrinsky Patent News* (Wawrinskys Patentunderrättelser)
  - Cross checking all patents with the patent data base to see what happened before and after advertising
- RQ:
- What type of patents (in terms of quality) was up for sale?
  - Did advertised patents get sold?

# Results - Statistical (2)

Table 1  
Dependent variable is time of expiration  
(1885-1914)

	Logit
Ex-ante transfer	0.575** (0.067)
Ex-post transfer	-0.797** (0.017)
Firm	-0.634 (0.015)
Stockholm	0.039 (0.022)
Gothenburg	-0.064 (0.047)
Malmö	0.144** (0.073)
Gävleborg	-0.065 (0.061)
Foreign	0.030 (0.016)
Constant	-0.750** (0.017)
Observations	175113
Log-likelihood	-84280.509

\*\*Significant at 1 percent level

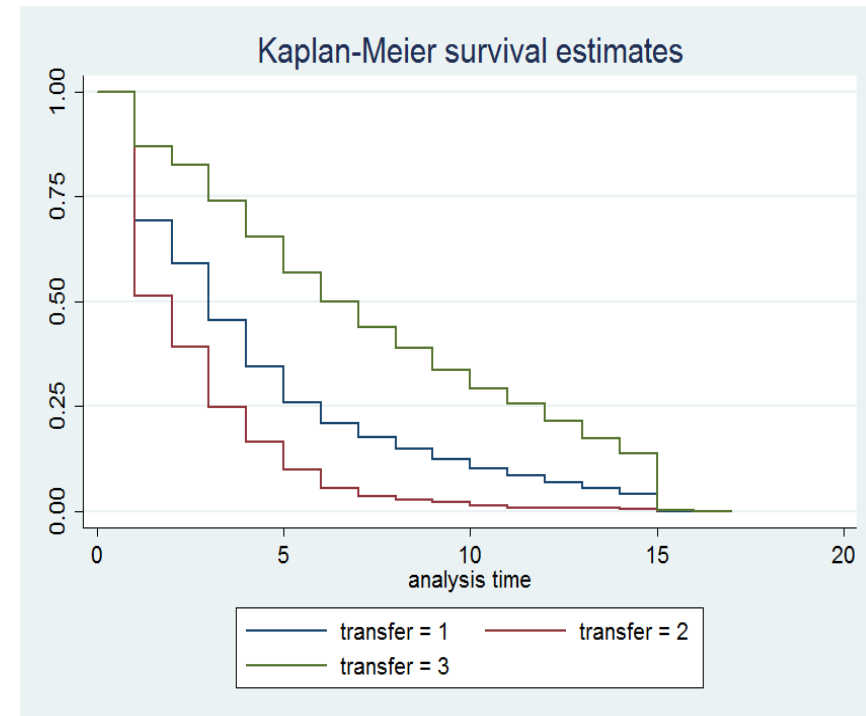
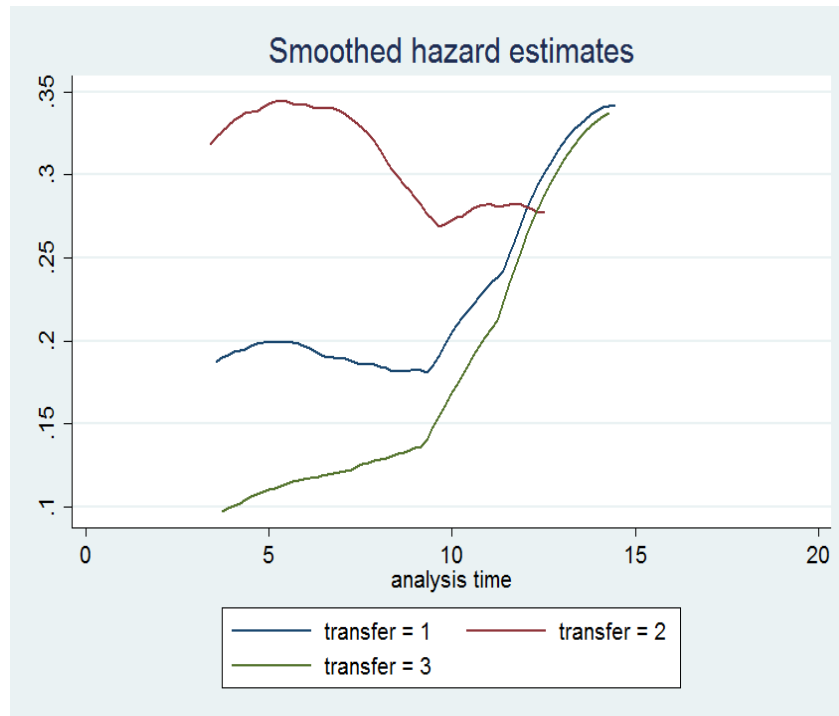
\* Significant at 5 percent level

*Note:* Benchmark patent is a patent by a non-firm Swedish patentee not residing in any of the high patenting regions and for which no kind of transaction has been registered in the patent register. Standard errors are clustered on patents.

*Source:* LiU-UU patent database

- **13,1 percent** of all 38,192 patents were transferred at least ones.
- Positive values associated with faster reach of the transition time i.e. not paying the patent fees.
- **Ex-ante, ex-post** and firm and Malmö-region significant
- Very large z-values for ex-post and firm patents (**p-value < 0.000**)

# Results – Statistical (2)



- **Only about 10% of ex-ante patents make past the five year mark when the yearly patent fees were doubled, around 60 % of ex-post patents.**
- Both a log-rank test and a Wilcoxon test rejects the hypothesis that the three functions are equal.
- The hazard function furthermore highlights **the effect of the higher fees imposed after the fifth year**
- For ex-post patents the hazard function is steadily increasing, meaning that the higher fees after the fifth year had basically no influence on these patents.

# Results – case study (1)

Table 2. A marketplace for technology

<i>Patent No.</i>	<i>Journal no.</i>	<i>Transferred before</i>	<i>Transferred after</i>	<i>Patentee</i>	<i>Profession</i>	<i>Country</i>	<i>Exploitation</i>	<i>Agency</i>	<i>Times advertised</i>	<i>Last fee</i>
2258	12-1-1896	no	yes	Samuel Edward Haskin	Factory owner	Avoca, USA	Sale or Use	Wawvrrinsky	2	15
3729	12-1-1896	no	no	Carl Kellner	Chemist/Manager	Podgora/Wien, Austria	License	Stockholms Patentbyrå		13
3667	14-1-1896	no	no	Carl Kellner	Chemist/Manager	Podgora/Wien, Austria	Sale or Use	L. A. Groth & Co.	2	12
3066	17-1-1896	no	no	Carl Kellner	Chemist/Manager	Podgora/Wien, Austria	Sale or License	Stockholms Patentbyrå		12
2997	18-1-1896	no	no	Carl Kellner	Chemist/Manager	Podgora/Wien, Austria	Sale or License	Stockholms Patentbyrå		13
4436	20-1-1896	no	no	Benno Jaffé & Darmstaedter		Berlin, Germany	Sale or Use	L. A. Groth & Co.		8
2448	23-1-1896	no	no	Alfred Mendel	Estate owner	Chemnitz, Germany	Sale or Use	L. A. Groth & Co.	3	10
4242	24-1-1896	yes	no	The Harvey Continental Steel Companys Limited		London, England	Sale or Use	L. A. Groth & Co.	2	15
427	25-1-1896	no	no	Alfred Mendel	Estate owner	Chemnitz, Germany	License	Undins Metallfabrik		13
620	25-1-1896	no	no	Alfred Mendel	Estate owner	Chemnitz, Germany	License	Undins Metallfabrik		13
2461	26-1-1896	yes	no	La compagnie Industrielle des Procédés Raoul Pictet		Frankrike	Use or Sale	L. A. Groth & Co.		13
4480	26-1-1896	no	no	Friedrich Carl Stephens	Factory owner	Crimmitschau, Germany	Use or Sale	L. A. Groth & Co.	2	15
4511	27-1-1896	yes	no	Ludwig Gottfried Dyes	Consul General	Bremen, Germany	Sale or Use	Wawvrrinsky	2	12
3152	32-1-1896	yes	no	Jean Heckhausen	Factory owner	Köln, Germany	Sale or Use	Wawvrrinsky	3	12

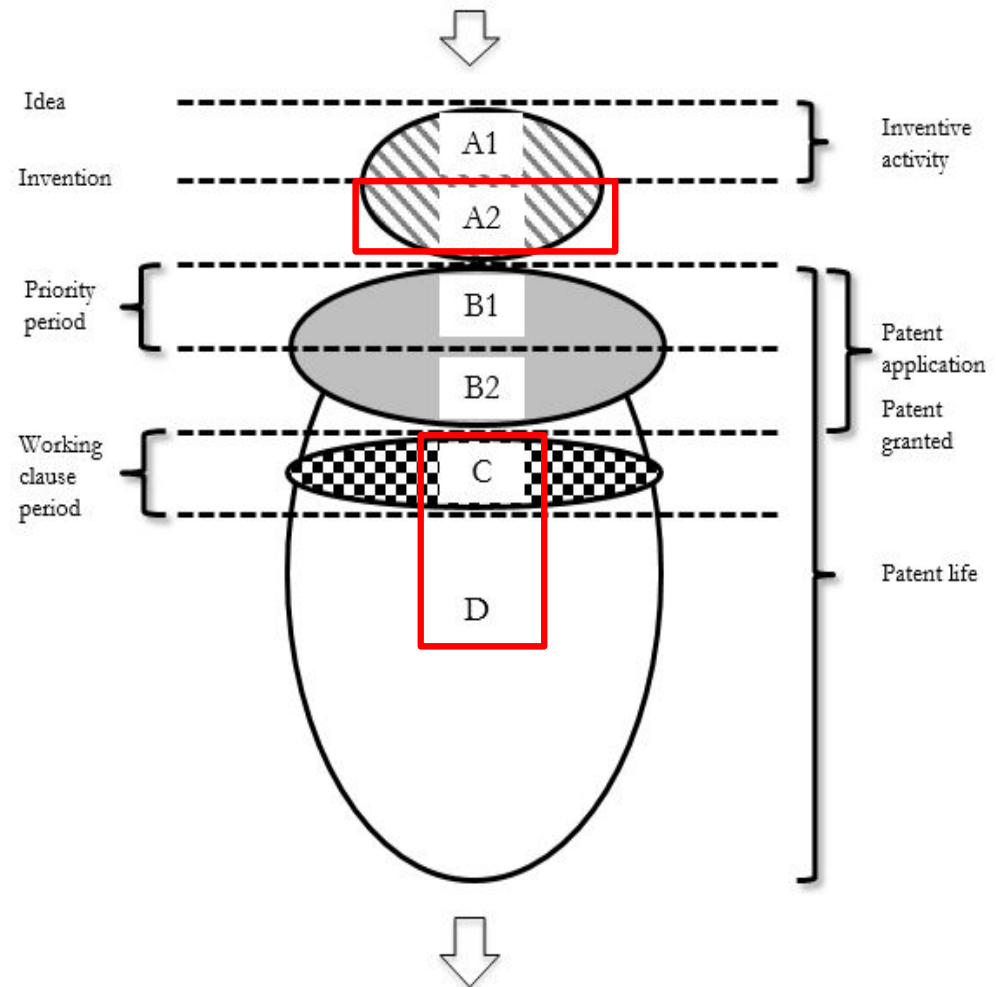
## Results – case study (2)

- **Twenty-six of forty-four** patents advertised in *Patentunderrättelser* or **59%** belongs to the cohort of none transferred patents.
- However, the **mean life time of advertised patents is 11 years**.
- As such, the above average quality patents that were for sale confirms Wawrinsky's goal to sell "***truly practical inventions***".  
Clearly **NOT a market for lemons** (Akerlof, 1970, Burhop, 2010)
- This could also be one of the possible reasons why "None transfer" patents show up with higher survival rates than the ex-ante cohort.
- For foreign patentees the prospects of **licensing the right of use** in Sweden were worth paying the extra patent fees instead of letting the patent expire.

# The structure of MfTs

We identify several possible (sub)markets encapsuled in the MfT:

- Markets for ideas (A1)
- **Markets for inventions (A2)**
- Patent application market (B1+B2)
- Working clause period (?) (C)
- **Market for patents (D)**
  
- Does patents from these (sub)markets differ?
  - **YES, it seems so..**



# Conclusions

- The size of **the market for technology in Sweden was considerable** as 13.1 percent of all patents were transferred at least ones during their lifetime.
- It can be useful to **conceptually think about markets for technology as consisting of several submarkets** where patent holders behavior possibly differs for several reasons.
- A survival analysis comparing different ex-ante transfers with ex-post transfers shows that **ex-ante transfer are associated with shorter patent life**. While patents not surviving past the first year of protection is not necessary any indication of that people and firms are patenting inventions and processes without any merit it does **show that a more heterogeneous analysis of markets for technology in general is warranted**.
- Our case study of one of the marketplaces available during the time shows **that patents not involved in any registered transfers could still be kept alive longer than average** as the possibility for **licensing national rights** were probably a lucrative opportunity especially for foreign firms.



# Main points

- Markets for technology are **more heterogeneous** than previous research has shown
- A **more detailed** view is needed
- **Patent quality** can vary for ex-ante and ex-post transactions



**Linköpings universitet**

*Thank you for your  
attention!*