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w POZNANIU



Kadry dla Gospodarki
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URZĄD STATYSTYCZNY
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Innovation Patterns, Shocks and Economic Cycles

Prof. Claude Diebolt

projekt Kadry dla Gospodarki współfinansowany ze środków Unii Europejskiej w ramach Europejskiego Funduszu Społecznego



KAPITAŁ LUDZKI
NARODOWA STRATEGIA SPÓJNOŚCI

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Business Cycles Revisited: A Theoretical, Historical and Statistical Analysis

Kadry dla Gospodarki
Godz. 11.45, S. 111A

2. Innovation Patterns, Shocks and Economic Cycles

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Outline

1. Research agenda
2. ClioData
3. Cliometrics of Patents
4. Extensions

Research agenda

- Doing economic history as an economist
- Using quantitative methods (time series analysis, etc.)
- Producing new statistical datasets
- Using the counterfactual methodology
- Killing some myths

Ambition

- To provide a quantification and interpretation of the world development of patents in the long run by using a new international, comparative and historical database of patents in 40 countries from the 17th century to 1945 and in more than 150 countries from 1945 to present (Diebolt & Pellier, 2010). We distinguish between patent applications and patents granted, i.e. allocated to residents and non-residents according to the different filing routes: national, regional and/or international.
- The first part presents the organization of our database under a relational database management system. Specific information is provided on all series: status of the data, measurement unit, publication references, etc.
- The second part examines, as an original cliometric case study, the aggregate world series of patent filings in order to contribute to a central debate within new growth theories, i.e. the role of the “ideas” sector for economic growth.

- Introduction
 - ClioData
 - Shock analysis
 - Spectral analysis
 - Extensions
- Variables, periods & filters
Database interfaces
Figures

ClioData: variables, periods and filters

VARIABLE	PERIOD (may be discontinued)	FILTER BY...
Patent grants by office	1617-2009	Year, Country, Route, Residence
Patent filings by office	1883-2009	Year, Country, Route, Residence
Patent grants by origin	1951-2009	Year, Country, Route, Origin
Patent filings by origin	1951-2009	Year, Country, Route, Origin
Patent filings (USA)	1840-2010	Year
Patent grants (USA)	1790-2010	Year, Residence
Patents in force (by origin)	2004-2009	Year, Country, Route, Origin
Patents in force (by year of filing)	1983-2009	Year, Country, Route
Patent grants by fields of technology (Germany)	1878-1959	Year, Field
GDP	1820-2008	Year, Country
Population	1820-2009	Year, Country

- Introduction
- ClioData
- Shock analysis
- Spectral analysis
- Extensions

Variables, periods & filters
Database interfaces
Figures

ClioData interface: general menu

CLIODATA

Base de données statistiques pour la cliométrie
Quitter

Brevets par office	Brevets par origine	Brevets USPTO	Brevets en vigueur	Brevets par secteur
Informations	Les variables	Les pays	Les espaces	Population, PIB

CLIODATA. Base de données statistiques pour la Cliométrie
C. Diebolt & K. Pellier (2010) Maj 01/ 2010

ClioData rassemble des données relatives aux brevets, à la population et au PIB pour la quasi-totalité des Etats du monde. La navigation dans la base s'effectue à partir d'un menu sous forme d'onglets, dont l'activation fait apparaître soit des informations détaillées sur les variables, pays ou groupes contenus dans la base, soit de multiples filtres permettant l'organisation, la visualisation et l'extraction des données sélectionnées.

[Les variables](#)
Affiche la liste des variables contenues dans la base, des informations complémentaires ainsi que les sources associées.

[Les pays](#)
Affiche la liste des pays et des offices (nationaux et régionaux) de brevets.

[Les espaces](#)
Assure la gestion des espaces : création ou suppression de groupes de pays ou d'offices.

[Population, PIB](#)
Permet la visualisation des données sur la population ou le PIB concernant soit un groupe de pays préalablement défini dans l'onglet des espaces, soit des pays individuels pour une période déterminée par l'utilisateur. L'option « vue personnalisée et graphique » permet à l'utilisateur de créer des tableaux ou des graphiques croisés dynamiques adaptés à ses besoins. Une fois filtrées, les données peuvent être exportées au format du tableur Excel.

Les indicateurs des brevets étant variés, cinq onglets distincts ([Brevets par offices](#), [Brevets par origines](#), [Brevets USPTO](#), [Brevets en vigueur](#) et [Brevets par secteurs](#)) visent à faciliter l'exploitation des données. Ces dernières peuvent être filtrées selon le type de brevet (déposé ou délivré), le type de déposant (résident ou non), la voie du dépôt de la demande (nationale, régionale ou internationale), le pays d'origine du demandeur et l'office récepteur. Comme pour les variables Population et PIB, les fonctionnalités associées à l'option « vue personnalisée et graphique » offrent la possibilité d'organiser les données filtrées en tableaux ou graphiques croisés dynamiques. Les extractions se font également vers le tableur Excel.

- Introduction
 - ClioData
 - Shock analysis
 - Spectral analysis
 - Extensions
- Variables, periods & filters
 - Database interfaces
 - Figures

ClioData interface: query

CLIODATA
Base de données statistiques pour la cliométrie Quitter

Informations	Les variables	Les pays	Les espaces	Population, PIB
Brevets par office	Brevets par origine	Brevets USPTO	Brevets en vigueur	Brevets par secteur

Brevets demandés ou délivrés par office, pays d'origine et voie de dépôt

Série de brevets

demandés délivrés

Période

années de à

Espace aucun tous 1

OEB	<input type="checkbox"/>
OFFREG	<input type="checkbox"/>
OAPI	<input type="checkbox"/>
OCDE	<input checked="" type="checkbox"/>
OEAB	<input type="checkbox"/>

Voie de dépôt aucun tous 1

Nationale-Directe (NAT)	<input checked="" type="checkbox"/>
PCT Nationale (PCTNAT)	<input type="checkbox"/>
Régionale (REG)	<input type="checkbox"/>
PCT Regionale (PCTREG)	<input type="checkbox"/>
Toutes voies (TV)	<input type="checkbox"/>

Actualiser en fonction des espaces sélectionnés

Office récepteur/délivreur aucun tous 30

AR ARGENTINA	<input type="checkbox"/>
AS AMERICAN SAMOA	<input type="checkbox"/>
AT AUSTRIA	<input checked="" type="checkbox"/>
AU AUSTRALIA	<input checked="" type="checkbox"/>
AW ARUBA	<input type="checkbox"/>
AZ AZERBAIJAN	<input type="checkbox"/>
BA BOSNIA AND HERZEGOVINA	<input type="checkbox"/>
BB BARBADOS	<input type="checkbox"/>
BD BANGLADESH	<input type="checkbox"/>
BE BELGIUM	<input checked="" type="checkbox"/>
BF BURKINA FASO	<input type="checkbox"/>
BG BULGARIA	<input type="checkbox"/>
BH SAUDI ARABIA	<input type="checkbox"/>
BI BURUNDI	<input type="checkbox"/>
BJ BENIN	<input type="checkbox"/>

Actualiser en fonction des espaces sélectionnés

Pays ou office d'origine aucun tous 237

AI ANGUILLA	<input checked="" type="checkbox"/>
AL ALBANIA	<input checked="" type="checkbox"/>
AM ARMENIA	<input checked="" type="checkbox"/>
AN NETHERLANDS ANTILLES	<input checked="" type="checkbox"/>
AO ANGOLA	<input checked="" type="checkbox"/>
AR ARGENTINA	<input checked="" type="checkbox"/>
AS AMERICAN SAMOA	<input checked="" type="checkbox"/>
AT AUSTRIA	<input checked="" type="checkbox"/>
AU AUSTRALIA	<input checked="" type="checkbox"/>
AW ARUBA	<input checked="" type="checkbox"/>
AZ AZERBAIJAN	<input checked="" type="checkbox"/>
BA BOSNIA AND HERZEGOVINA	<input checked="" type="checkbox"/>
BB BARBADOS	<input checked="" type="checkbox"/>
BD BANGLADESH	<input checked="" type="checkbox"/>
BE BELGIUM	<input checked="" type="checkbox"/>

Sources des données Visualiser les données

Vue personnalisée et graphiques Exporter vers Excel

- Introduction Variables, periods & filters
- ClioData Database interfaces
- Shock analysis Figures
- Spectral analysis
- Extensions

ClioData interface: view

CLIODATA - [RV18tcd : Requête Sélection]

Fichier Edition Affichage Tableau croisé dynamique Outils Fenêtre ? Adobe PDF

variable ▼
Tous

pays-resid ▼ voie ▼

année ▼	AT-N		AT-R		AU-N		AU-R		BE-N		BE-R		CA-N		CA-R		CH-N		CH-R	
	NAT		NAT		NAT		NAT		NAT		NAT		NAT		NAT		NAT		NAT	
	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼	Nb_Brevets ▼
1974	6775	1217	11898	930	13559	1093	19644	1200	9323	3647										
1975	5840	1178	11236	925	12110	1034	19352	1336	9906	3794										
1976	5235	1177	10164	910	11706	1020	20147	1293	8818	3482										
1977	5344	1297	8868	768	11386	1060	19870	1260	16235	6320										
1978	5307	1180	8337	701	9619	975	19643	1352	475	229										
1979	5337	1163	6012	467	6836	833	21427	1369	4976	1638										
1980	4678	1151	7805	620	5081	811	21444	1450	4486	1475										
1981	4018	1120	5929	505	3902	788	22639	1526	4765	1737										
1982	2903	1128	5248	483	2930	785	21061	1386	4659	1787										
1983	2699	1116	6690	557	2249	782	19640	1359	4553	1836										
1984	2096	1080	6526	726	1930	1427	4447	1886												
1985	1493	1045	6379	609	1280	1355	4341	1936												
1986	1414	1115	6345	527	1430	1377	3422	2077												
1987	1367	1233	8862	708	360	1082	2617	1759												
1988	1261	1260	8963	748	300	1184	2506	2163												
1989	1080	1187	9098	810	580	1069	2163	2076												
1990	952	1176	9702	822	480	1109	1575	1809												
1991	856	1063	9565	748	440	1108	1240	1565												
1992	751	961	9404	657	800	1305	722	1110												
1993	551	934	8439	696	560	1053	742	1236												
1994	552	1136	6754	734	550	846	548	1175												
1995	571	1192	4978	593	580	722	373	909												
1996	388	1076	4104	530	440	651		1027												
1997	276	994	3336	444	250	583	396	695												
1998	320	1026	4528	600	170	839	208	371												
1999	275	1034	4063	532	239	783	8878	1151	247	391										
2000	236	955	3775	588	289	533	7529	938	321	534										

Liste de champs de tableau cr...
Déplacez les éléments vers la liste ...
RV18tcd
variable
année
pays-resid
voie
Nb_Brevets
statut
source
collecteur
Ajouter à Zone de lignes ▼


- Introduction
 - ClioData
 - Shock analysis
 - Spectral analysis
 - Extensions
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ClioData interface: area selection



CLIODATA
Base de données statistiques pour la cliométrie Quitter

Brevets par office	Brevets par origine	Brevets USPTO	Brevets en vigueur	Brevets par secteur
Informations	Les variables	Les pays	Les espaces	Population, PIB

Groupes de pays ou d'offices (9)






EU27


 Europe (27)

0 aucun Pays ou office à inclure dans l'espace

- AP African Regional Intellectual Property Organization (ARIPO)
- BX Office Benelux de la Propriété intellectuelle (OBPI)
- EA Eurasian Patent Organization (EAPO)
- EP European Patent Office (EPO)
- OA African Intellectual Property Organization (OAPI)
- QZ Community Plant Variety Office (CPVO)
- AD ANDORRA
- AE UNITED ARAB EMIRATES
- AF AFGHANISTAN
- AG ANTIGUA & BARBADA
- AI ANGUILLA
- AL ALBANIA
- AM ARMENIA

Enr : 1 sur 218

>>

<<

0 aucun Pays ou office à exclure de l'espace

- AT AUSTRIA
- BE BELGIUM
- BG BULGARIA
- CY CYPRUS
- CZ CZECH REPUBLIC
- DE GERMANY
- DK DENMARK
- EE ESTONIA
- ES SPAIN
- FI FINLAND
- FR FRANCE

Enr : 1 sur 27

Figure 1: Number of countries available (1826-2007)

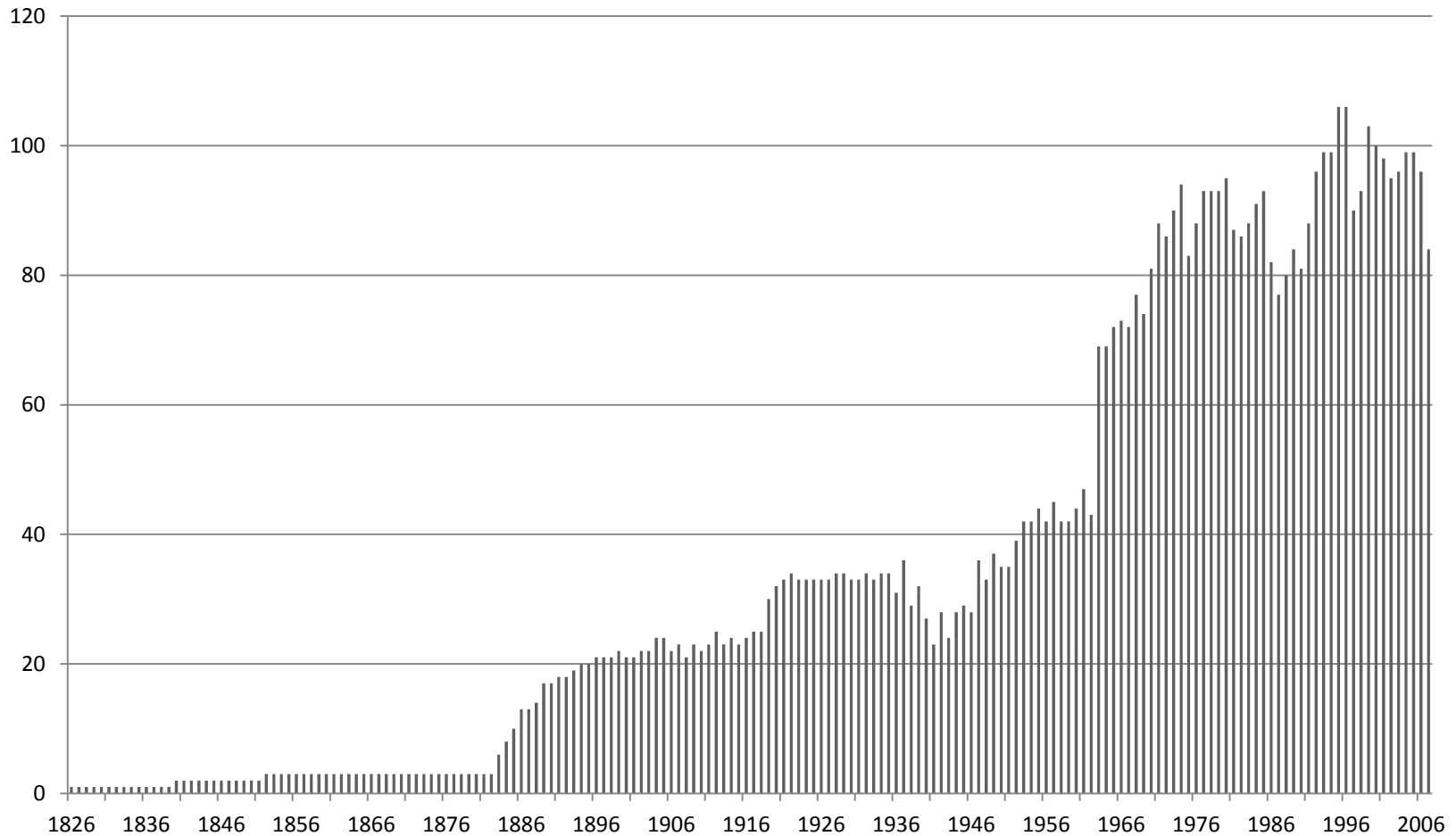
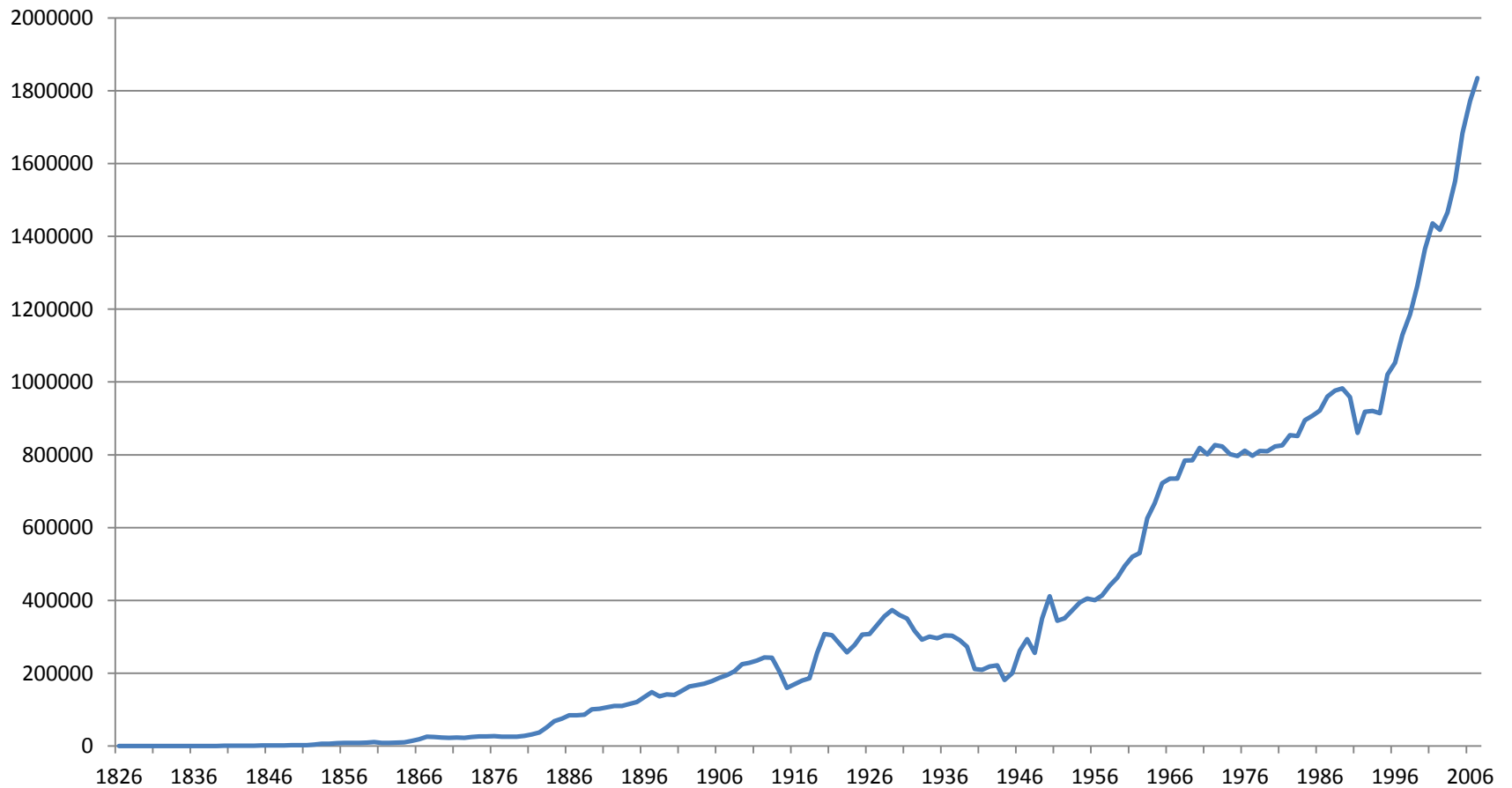
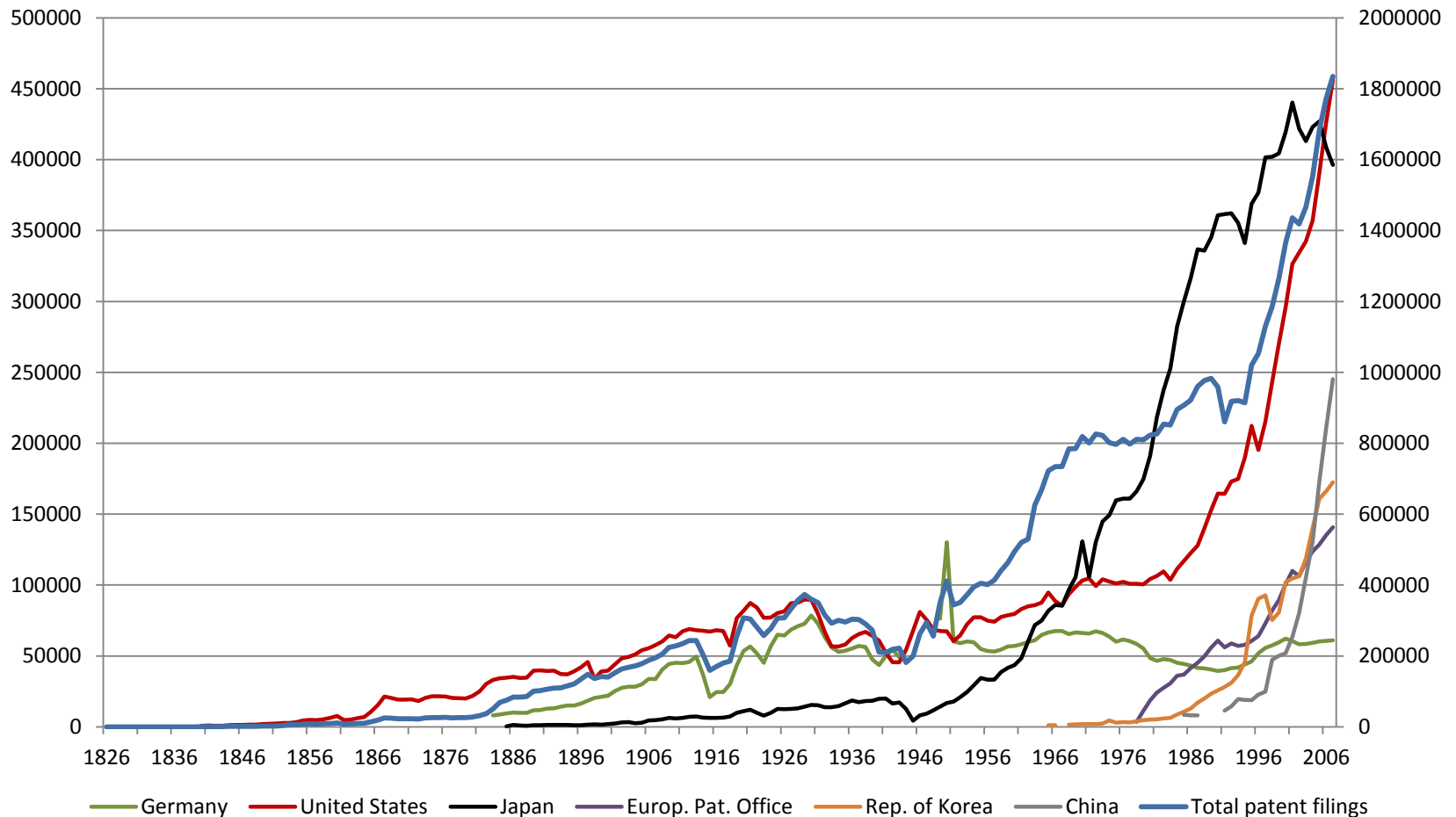


Figure 2: Total patent filings (1826-2007)



- Introduction
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 - Shock analysis
 - Spectral analysis
 - Extensions
- Variables, periods & filters
 - Database interfaces
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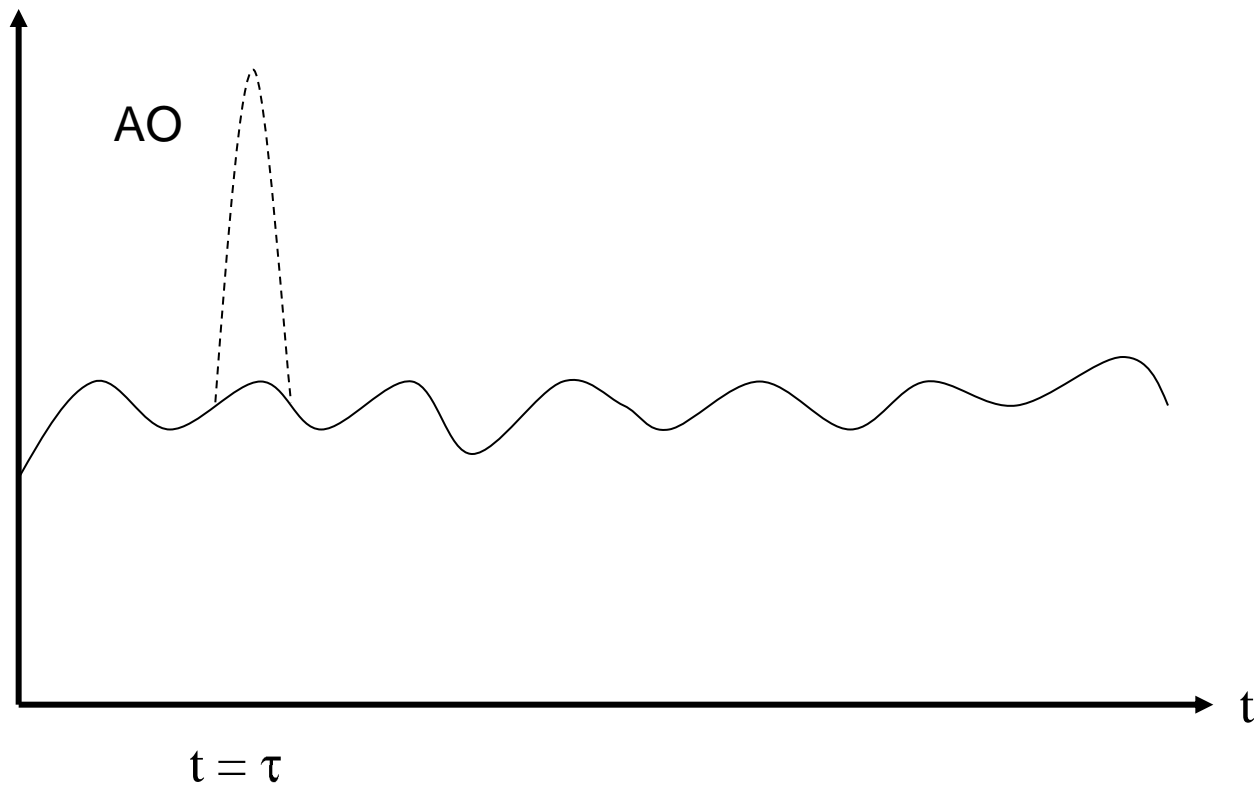
Figure 3: Trends in patent filings by leading offices (1826-2007)



Shock analysis

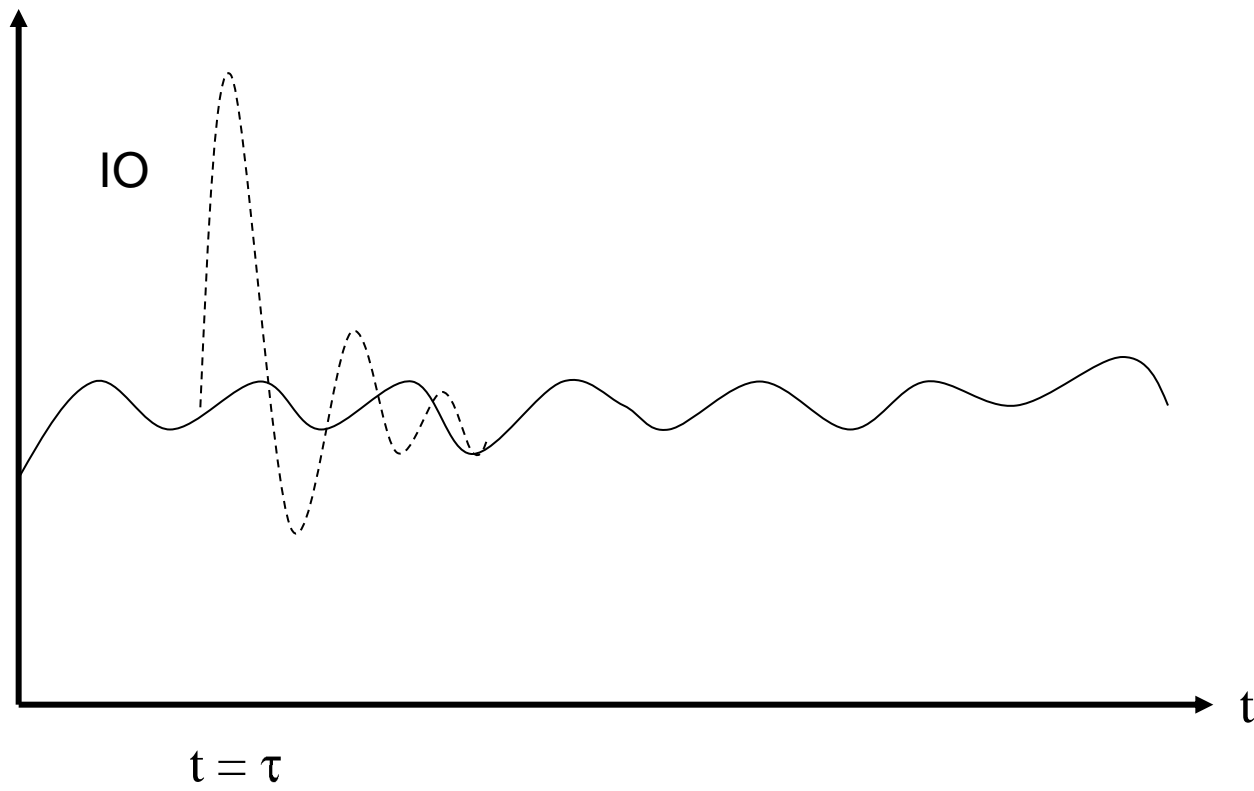
- Assumptions:
 - regular shocks are superposed by irregular shocks (outliers) which appear rarely (infrequent large shocks) ⇒ includes the question whether the long-term development of patents is caused (or not) by such extraordinary shocks such as wars, political measures and institutional changes.
 - If this was the case, patent development could probably not be explained as a systematic endogenous process but would have to be traced back to specific historical events.
- Shocks as counterfactuals: a hidden economic, market or cyclical dynamic?

Additive Outliers



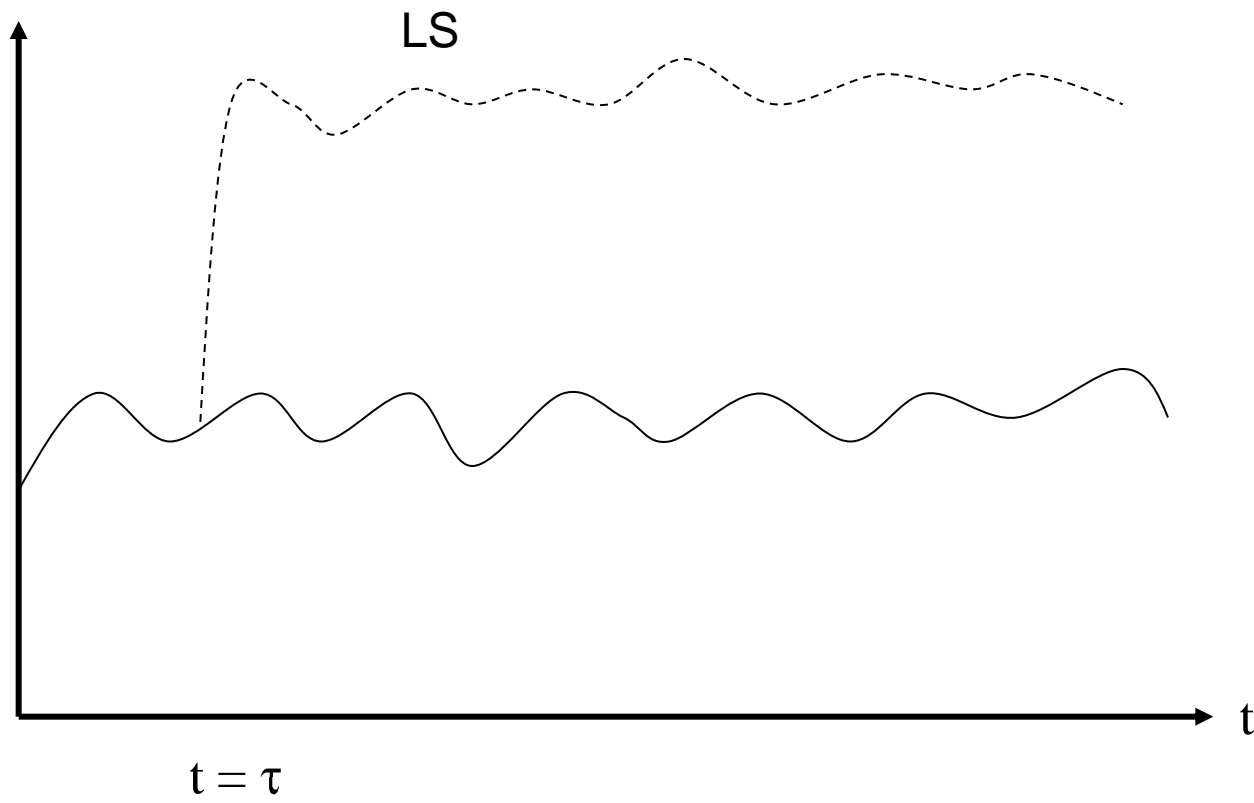
- Introduction
 - ClioData
 - Shock analysis
 - Spectral analysis
 - Extensions
- Assumptions
 - Outliers classification
 - Figures
 - Results

Innovational Outliers

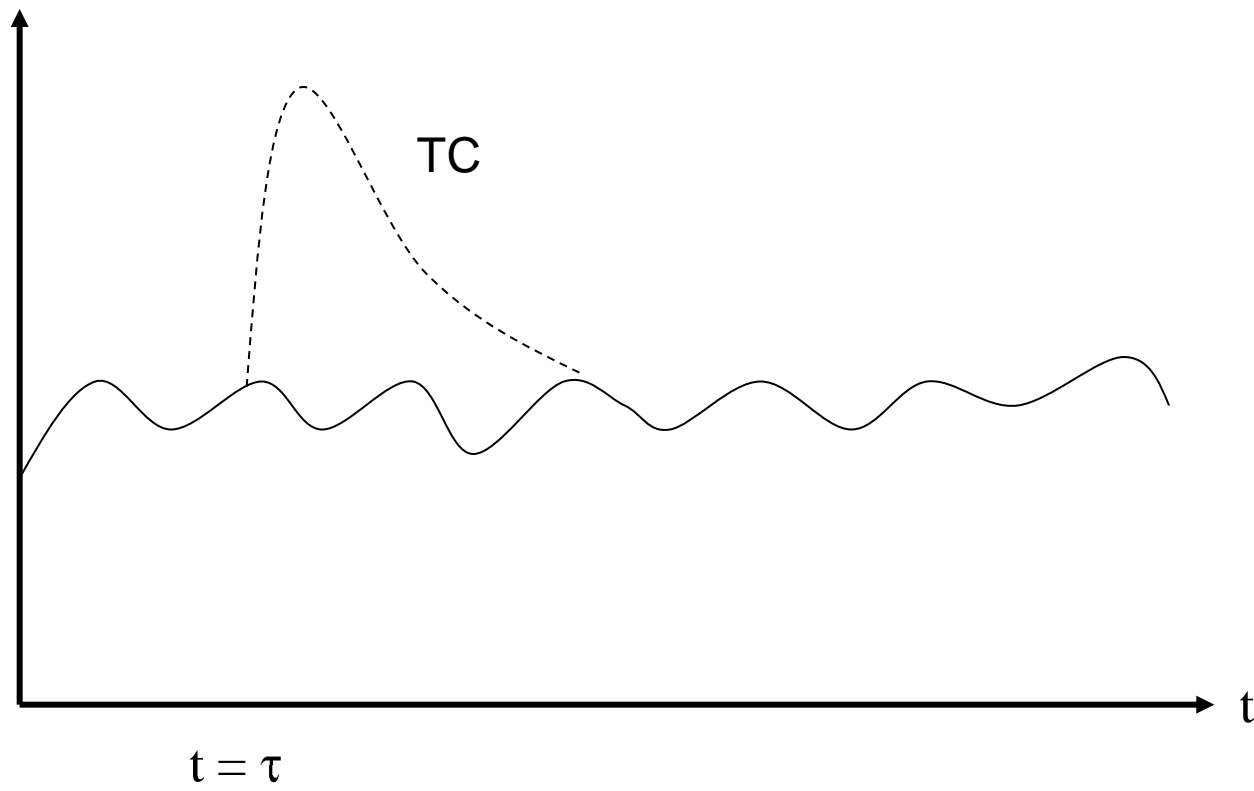


- Introduction
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- Assumptions
- Outliers classification
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Level Shifts

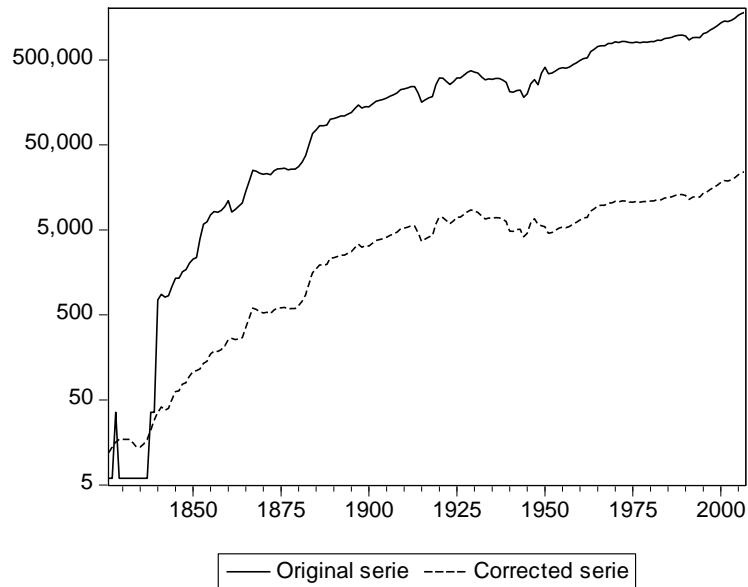


Temporary Changes

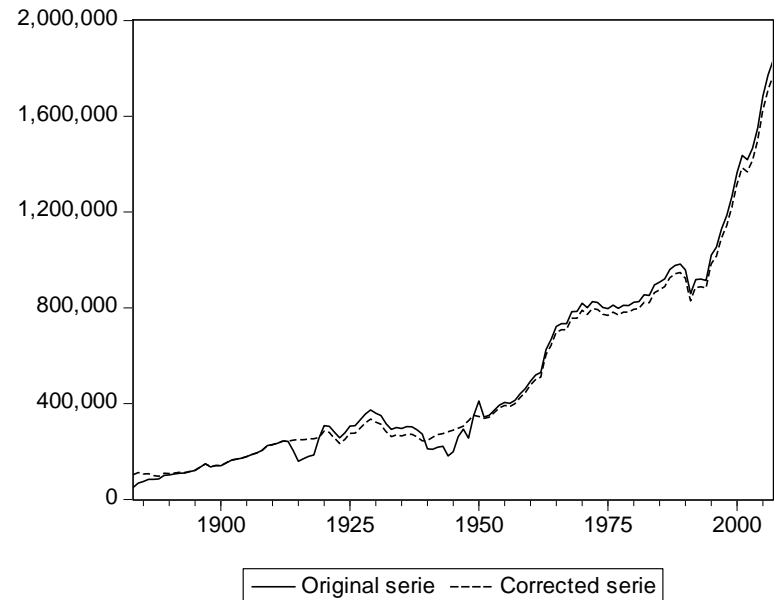


- Introduction
- ClioData
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Outliers: 1826-2007 and 1883-2007



1826-2007



1883-2007

Shock analysis: results

1826-2007:	1828 (AO, +), 1831 (AO, -), 1833 (AO, -), 1835 (AO, +), 1840 (LS, +), 1852 (IO, +), 1861 (TC, -), 1949 (IO, +).
1883-2007:	1883 (TC, -), 1914 (IO, -), 1915 (TC, -), 1919 (IO, +), 1940 (IO, -), 1944 (TC, -), 1946 (IO, +), 1948 (AO, -), 1950 (AO, +).

- Strong proof of infrequent large shocks resulting essentially from major economic and political events. These results question the autonomous process, i.e. the internal dynamic of the patent systems. Wars seem to push innovation and finally the economic growth process itself.

▪ Introduction	Definition
▪ ClioData	Cycles
▪ Shock analysis	Spectral density with outliers
▪ Spectral analysis	Spectral density without outliers
▪ Extensions	

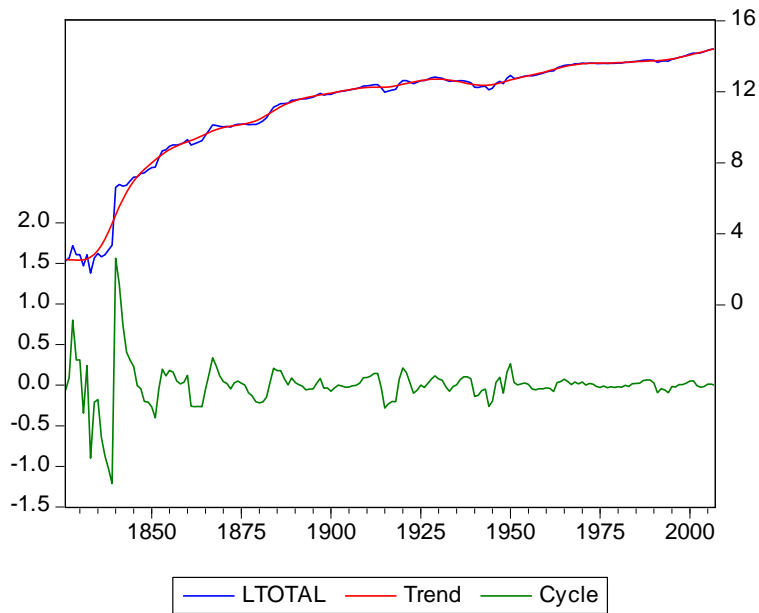
Spectral analysis

- Spectral analysis \Rightarrow often presented as the most valuable method for seeking dependences expressed as lags between different magnitudes. Its use is determined by the search for maximum objectivity in the observation of time series and the possibility of applying it to a large number of series.
- The core hypothesis \Rightarrow a given time series consists of a large number of sinusoidal components with different frequencies (univariate spectral analysis).
- The spectral density function shows the leading cyclical movement.

- Introduction
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- Spectral analysis
- Extensions
- Definition
- Cycles
- Spectral density with outliers
- Spectral density without outliers

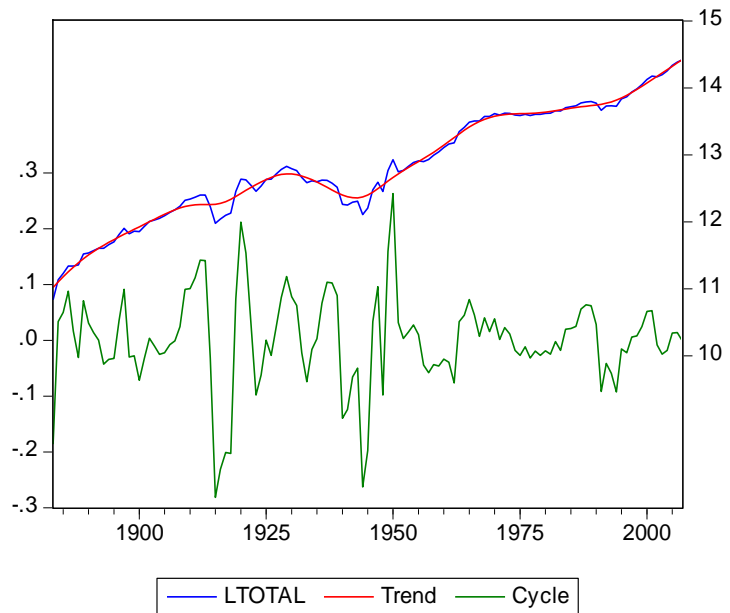
Cycles: 1826-2007 and 1883-2007

Hodrick-Prescott Filter (lambda=100)



1826-2007

Hodrick-Prescott Filter (lambda=100)

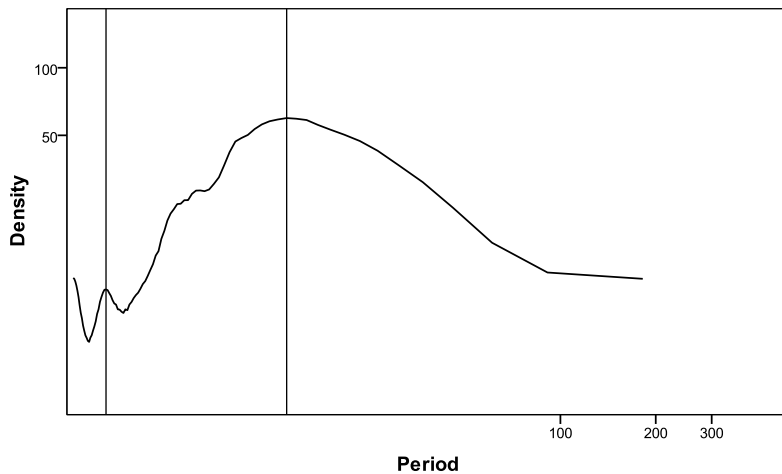


1883-2007

- Introduction
 - ClioData
 - Shock analysis
 - Spectral analysis
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- Definition
 - Cycles
 - Spectral density with outliers
 - Spectral density without outliers

Spectral density (with the outliers): results

Spectral Density of TOTALP1 by Period

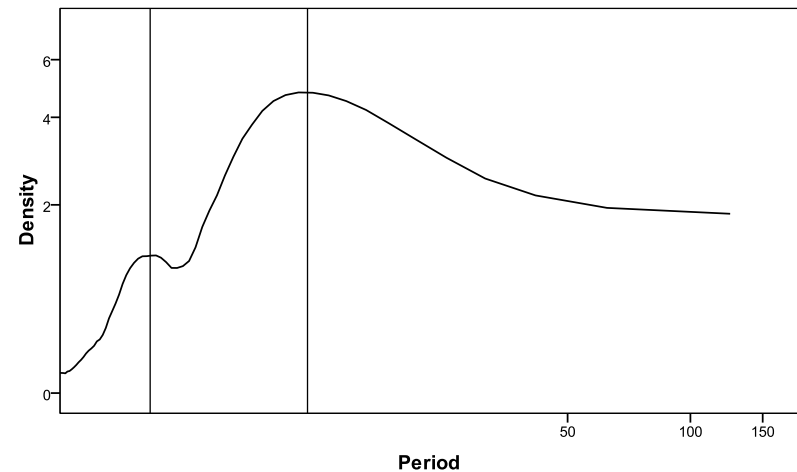


Window: Tukey-Hamming (19)

1826-2007

Cycles: 2.8 and 13 years

Spectral Density of TotalP2 by Period



Window: Tukey-Hamming (19)

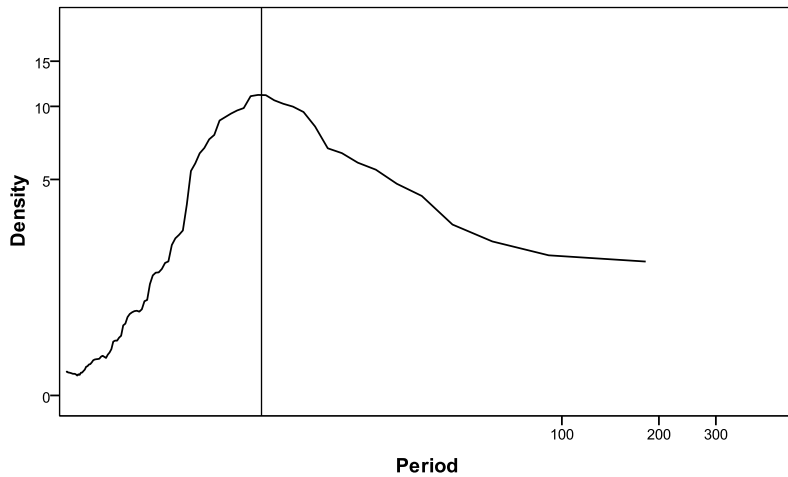
1883-2007

Cycles: 4 and 11 years

- Introduction
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- Definition
 - Cycles
 - Spectral density with outliers
 - Spectral density without outliers

Spectral density (without the outliers): results

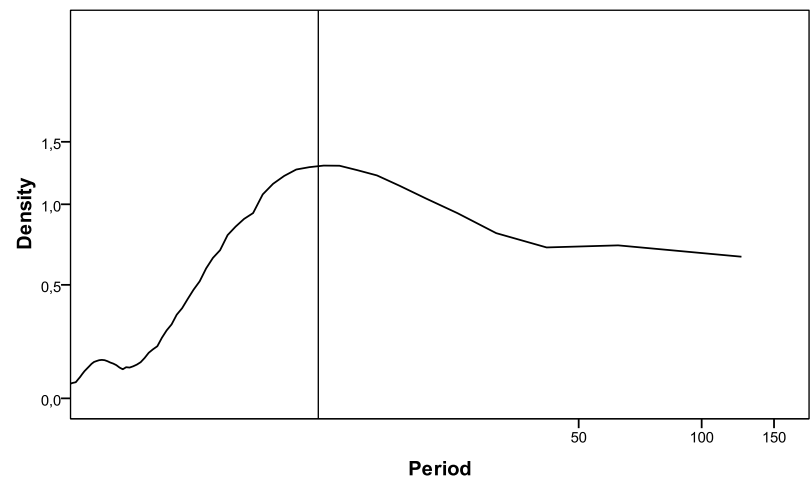
Spectral Density of totalcP1 by Period



Window: Tukey-Hamming (19)

1826-2007
Cycles: 11 years

Spectral Density of TotalcP2 by Period



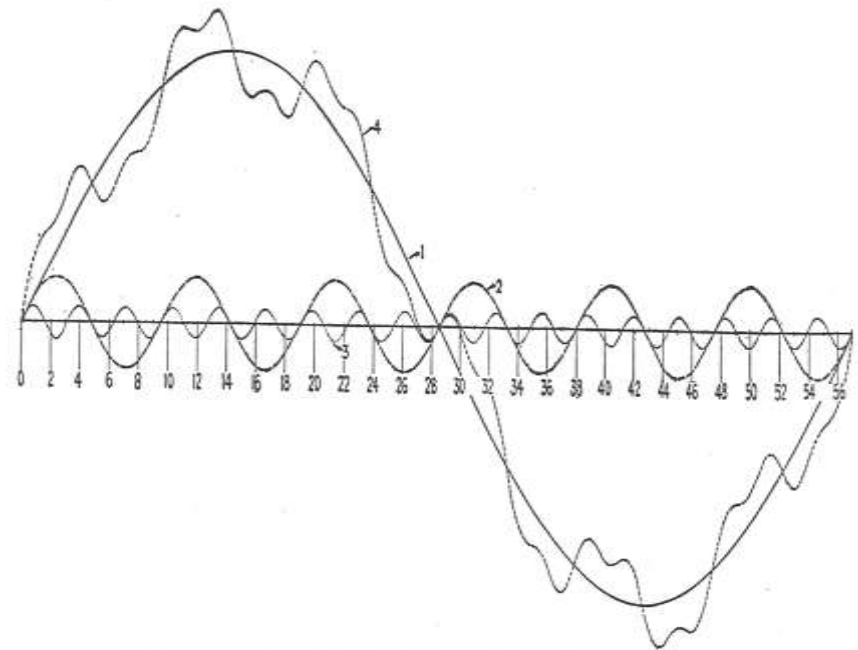
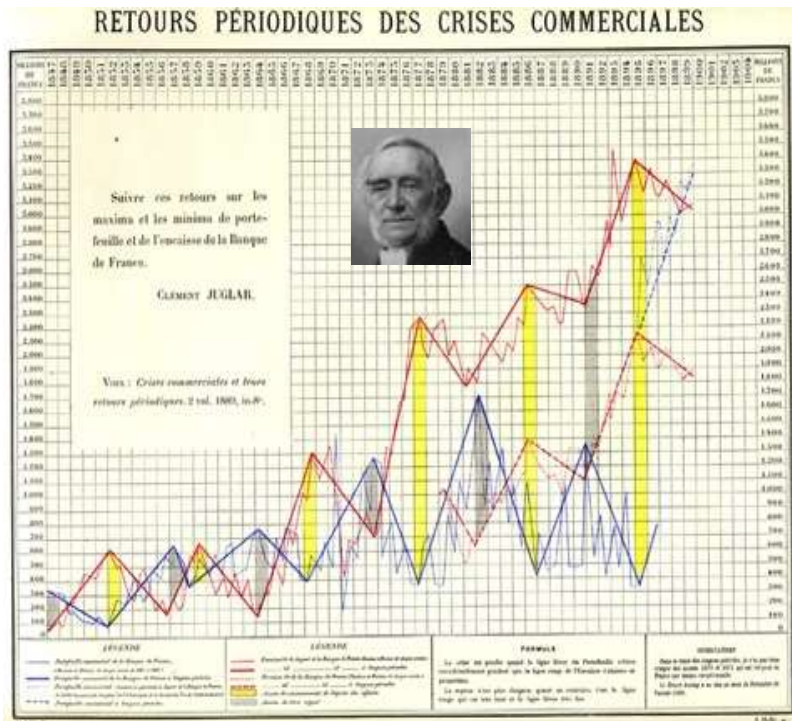
Window: Tukey-Hamming (19)

1883-2007
Cycles: 11 years

Extensions

- To develop a general theory so good that it could serve as a code or handbook translating the meaning of past and current economic situations into terms of future movements. A dream?
- The best we can do is to synthesise existing theories of why the circular flow of patent filings moves in the rhythms that the discourse calls Juglar cycles!

Thanks for your attention!

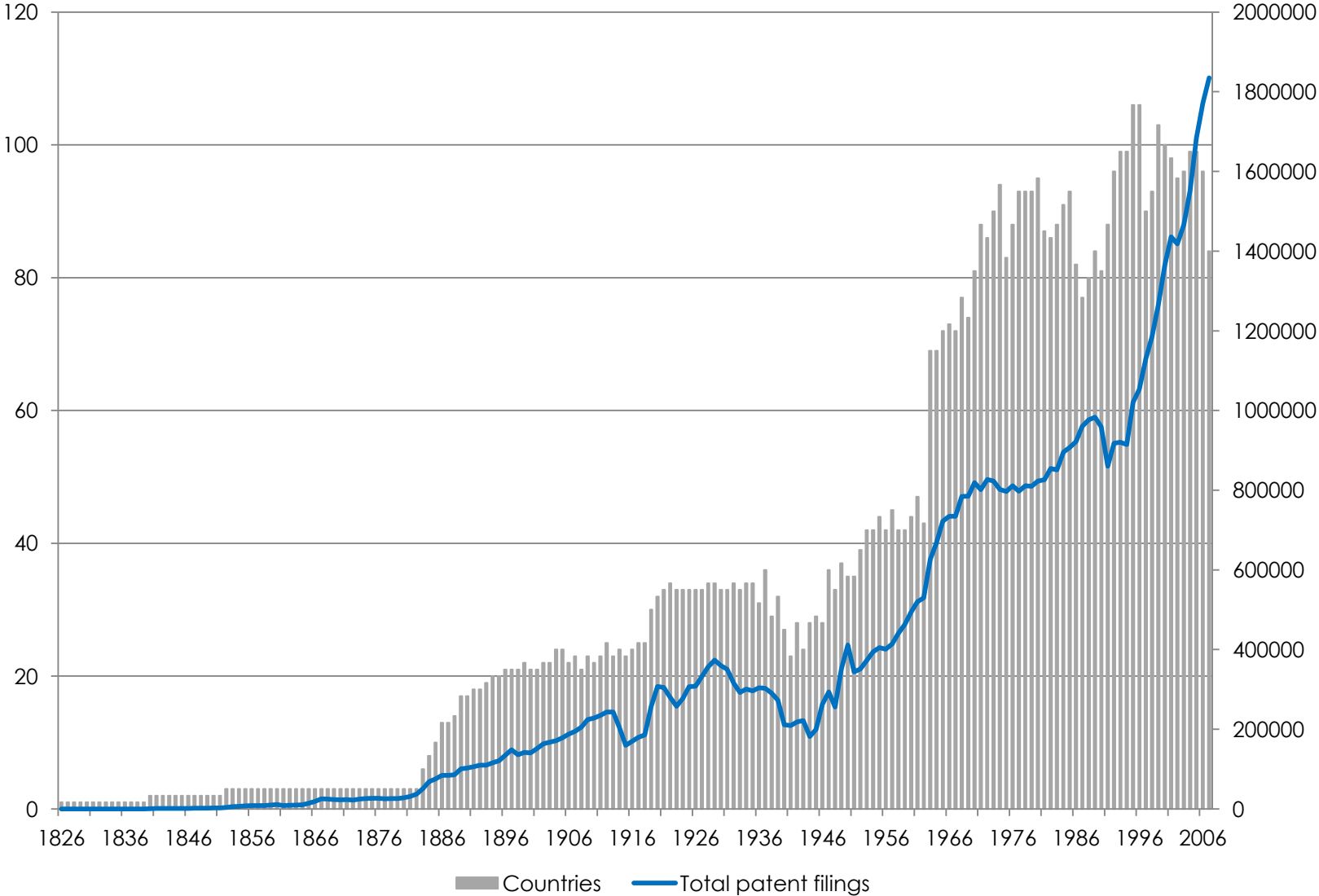


—Curve 1, long cycle; curve 2, intermediate cycle; curve 3, short cycle; curve 4, sum of 1-3

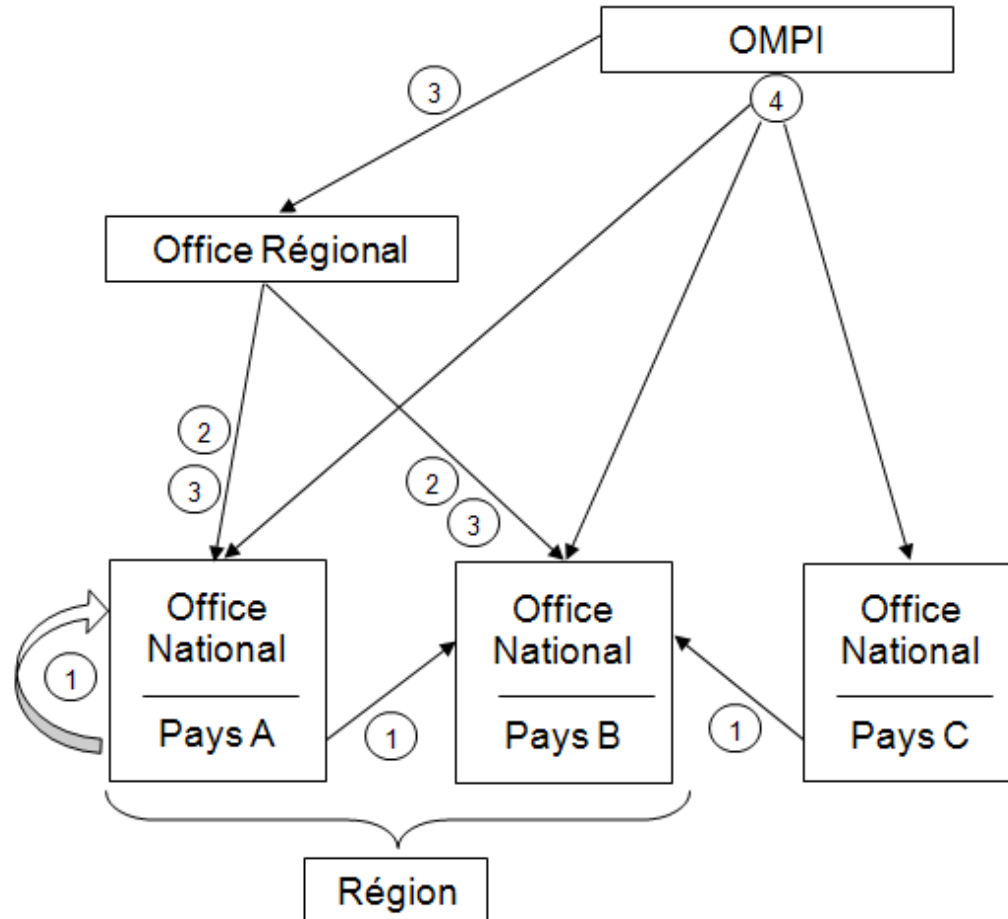


Annexes

Total patent filings and number of countries available (1826-2007)



Routes of patent filings



Others patent statistical databases

- **PATSTAT** (EPO, 2005): world patent database
- **REGPAT** (OECD, 2008): regional patent database
- **NBER Patent Citation Data File** (Hall & co, 2001): US patent database
- **IIP Patent Database** (Goto & Motohashi, 2006): patent applications filed with the JPO
- ...

Organization of ClioData database

- Principles of modelling: Merise method (1978)
- Steps:
 1. Conceptual data model (Entity-Relationship model)
 2. Logical data model: Relational model (Codd, 1970)
 3. Physical data model \Rightarrow Implementation with a relational database management system (RDBMS) (Access)
- Once the structure of the database is finalized, data are checked and then entered or imported into tables.

Conceptual data model

1. Data dictionary: list of relevant information (attributes) that has to be stored in the database
2. Attributes are organized in groups called 'entities':

VARIABLE (ID_var, name_var, unit, y_min, y_max, infos_var)

AREA (ID_area, type, name_area, infos_area)

ROUTE OF FILING (ID_route, name_route)

RESIDENCE (ID_resid, name_resid, rmq)

FIELD OF TECHNOLOGY (ID_field, field)

SOURCE (ID_source, Nom_source)

STATUS (ID_status, status)

GEO. GROUP (ID_group, name_goup)

TECHNICAL CLASSIFICATION (ID_class, class.)

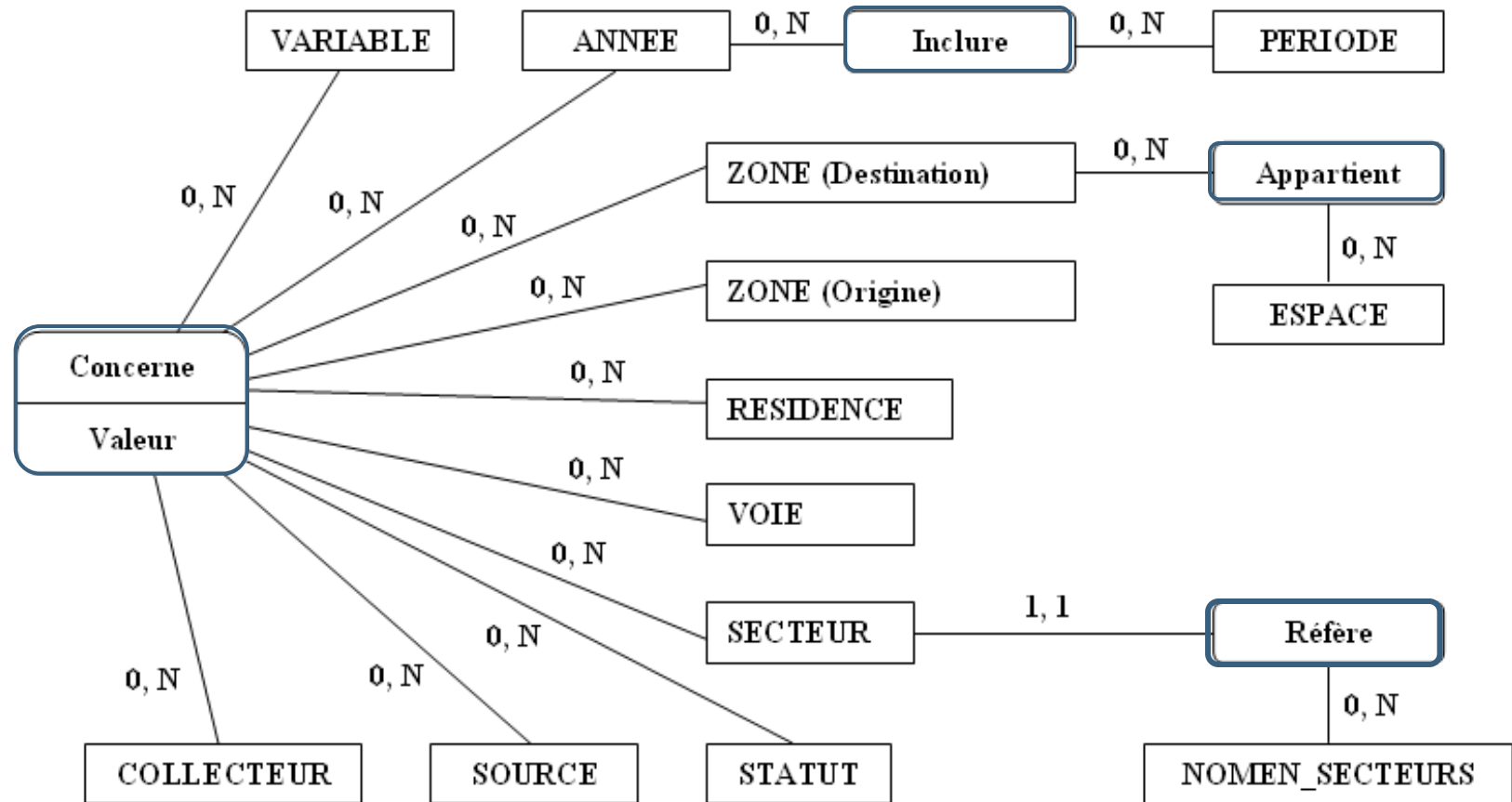
DATA PROVIDER (ID_provider, name_provider)

YEAR (year)

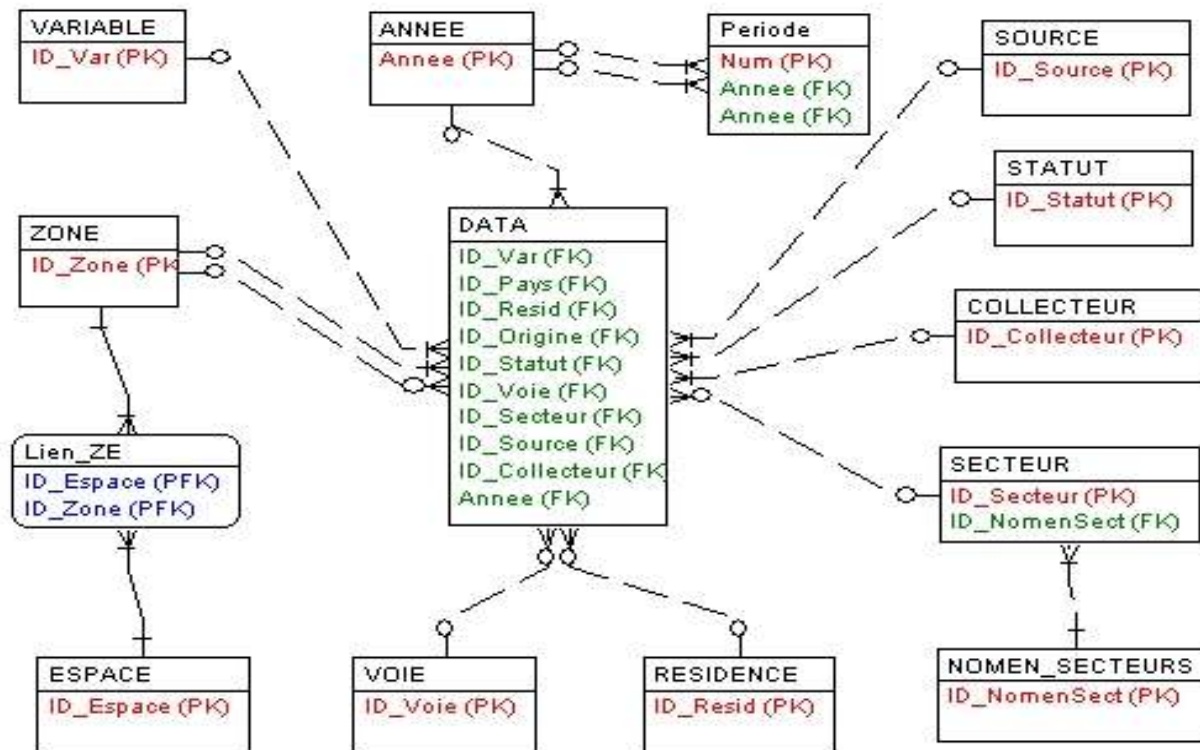
PERIOD (num, y_beg, y_end)

3. Relationships between entities are specified: Entity-Relationship diagram

Entity-Relationship diagram



Logical data model



➤ Physical data model: implementation with a RDBMS (Access)



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