The Effect of the USPTO's Quality-Improving Initiatives in 2000 on the Claim Scope of Business Method Patents

Teruki Amano†

Table of Contents

Introduction

Patent quality and value has concerned society for over two decades while the U.S. patent system has undergone significant changes in many ways. After the patentability of software patents was judicially confirmed in the *State Street Bank* decision,[1] the granting of some arguably overly broad business method or software-related patents, and subsequent litigation based on those patents have caused

† Deputy director of policy planning and research division, Japan Patent Office. The author conducted this research as a visiting scholar at Northwestern University Pritzker School of Law. The opinions in this article are the author's independent academic views and are not attributable to any of his organization or affiliations. The author is grateful for Prof. David L. Schwartz for helpful comments and suggestions.

1 State Street Bank & Trust Co. v. Signature Fin. Grp., Inc., 149 F.3d 1368, 1375 (Fed. Cir. 1998), abrogated by In re Bilski, 545 F.3d 943, 959 (Fed. Cir. 2008) (holding that the "machine-or-transformation" test should be used to determine patent eligibility of a process claim instead of the "useful, concrete, and tangible result" test).

concerns.[2] The most recent debate on patent subject matter eligibility under 35 U.S.C. § 101 is also within the scope of the issue of patent quality and value in the broadest sense.

Although there was a time when the U.S. Patent and Trademark Office (USPTO) was said to be regularly issuing bad patents,[3] the agency had also shared concerns and adopted many initiatives to improve patent quality.[4] Following these initiatives, why is the discussion on patent quality still ongoing? It may be that the USPTO's attempts were not enough, or it may be that the initial problems were adequately addressed, but new challenges have surfaced. Either way, knowing the effectiveness of each of the USPTO's initiatives is essential to an informed debate on these issues.

One difficulty in assessing the effectiveness of the initiatives is that there are no definitive measures for patent quality. Various measures have been developed and used in literature, including patent scope, patent family size, backward/forward citations, patent renewal, and so on.[5] Each measure naturally has its advantages and disadvantages, but among them, there is a strong legal basis for using patent (claim) scope or breadth to determine patent quality. This is simply because patent claims determine what is protected against competitors.[6] Furthermore, given that every element of a claim must be present in another's product or process to show patent infringement, a claim with fewer elements or words should, theoretically, mean that it is broader in the same or similar technical field. This indicates that the claim length can represent the claim scope and be an important indicator of the quality and value of the patent. Despite its logical clarity and simplicity, the use of claim length as a measure of patent quality has not made much progress until recent large-scale analyses.

Recently, one study by Alan Marco, Joshua Sarnoff, and Charles DeGrazia analyzed the word count of the shortest independent claims in U.S. patents.[7] This study confirmed that the length of independent claims increased during the examination process, and also showed the independent claim length had explanatory power for other common indicators that had been used in literatures.[8] Kuhn and Thompson also analyzed the word count of the first claim and advocated the usefulness of the claim length by showing the explanatory power for patent renewal

---

2 *See, e.g.*, Mark A. Lemley & Bhaven Sampat, *Is the Patent Office a Rubber Stamp?*, 58 EMORY LAW J. 181, 181–82 (2008); Executive Office of the President, *Patent Assertion and U.S. Innovation* 1, 2–4 (June 2013), https://obamawhitehouse.archives.gov/sites/default/files/docs/patent_report.pdf.

3 Lemley & Sampat, *supra* note 2.

4 *E.g.*, USPTO, *2010–2015 Strategic Plan* 1, 8–9 (2010), http://www.uspto.gov/about/stratplan/USPTO_2010-2015_Strategic_Plan.pdf; USPTO, *The 21st Century Strategic Plan* 1, 7 (updated on Feb. 3, 2003).

5 *See generally* Mariagrazia Squicciarini, Hélène Dernis & Chiara Criscuolo, *Measuring Patent Quality: Indicators of Technological and Economic Value*, OECD SCI. TECH. & IND. WORKING. PAPERS. 70 (June 6, 2013).

6 *See* 35 U.S.C. § 271(a); 35 U.S.C. § 112(b) or pre-AIA 35 U.S.C. § 112.

7 Alan C. Marco, Joshua D. Sarnoff & Charles A.W. DeGrazia, *Patent Claims and Patent Scope*, 48 RES. POL'Y., no. 103790, 2019.

8 *See*, *e.g.*, *Id.* at 1, 10–12.

rates and the correspondence with evaluations by patent attorneys.[9] Similarly, Okada et al. analyzed the number of characters in the first claim of Japanese patents and found the claim length increased through the patent examination process.[10] These prior studies show the potential of using claim length as an indicator of the stringency of patent examination process and the quality of patents granted.

On the other hand, empirical analysis using claim length has just begun, and its usefulness will be established through further research. For example, as the Marco study pointed out, such analysis assumes that similar technical terms are used, and it is important to note that it may or may not be useful in all fields of technology.[11] Therefore, a series of case studies that apply claim length to specific events and technologies are needed to examine and improve the utility of this indicator in empirical research and policy considerations.

This study uses claim length to examine the effectiveness of the USPTO's quality-improving initiatives implemented in 2000 for business method patents. I chose this event because the quality of business method patents remains an often-debated issue[12] and, more importantly, because the event was aimed at a specific group of patents—business method patents—which allows for the use of quasi-natural experimental methods. Specifically, Difference-in-Differences (DID) study design was used to compare between a treated group of patents that were subject to the treatment, and a control group of patents that were untreated but technologically related, across the pre-treatment and treatment period. This comparison is to control possible confounding factors such as the terminological changes as well as the impact of other systemic changes existing in common in the technical field like the introduction of pre-grant publication scheme[13] in 2000 by the American Inventors Protection Act (AIPA).

This article is organized as follows. Section I outlines the event to be studied and relevant prior studies. Section II details the methodology for comparing treated and control group in the Difference-in-Differences (DID) study design. Section III provides the results of the comparison and estimations of the effects by the DID analysis. Concluding remarks follow.

I. The USPTO's Quality-Improving Initiatives in 2000 for Business Method Patents

In the late 90's, patent filings for business-related data processing methods and technologies increased as the electronic commerce business industry grew. The USPTO established a new class of United States Patent Classification (USPC), Class

---

9 Jeffrey M. Kuhn & Neil C. Thompson, *How to Measure and Draw Causal Inferences with Patent Scope*, 26 INT. J. ECON. BUS. 5 (2019).

10 Yoshimi Okada, Yusuke Naito & Sadao Nagaoka, *Making the Patent Scope Consistent with the Invention: Evidence from Japan*, 27 J. ECON. MGMT. STRATEGY 607 (2018).

11 Marco, Sarnoff, & DeGrazia, *supra* note 7, at 10–12.

12 *See* Exec. Office of the President, *supra* note 2.

13 American Inventors Protection Act of 1999, Pub. L. No. 106–113 (1999).

705 for the business method patents in September 1997.[14] The Class 705 covers variety of financial and management data processing areas defined as "Data Processing: Financial, Business practice, Management, or Cost/Price determination",[15] i.e., a prominent portion of business method patents. After the patentability of software was judicially confirmed in the *State Street Bank* decision,[16] the number of patent applications in the Class 705 reached 2658 in FY 1999 (Oct. 1998 – Sept. 1999). That number is double the number of applications from FY 1998. In FY 1999, business method patent applications corresponded to 1% of patent applications and less than 5% of patent applications filed in the communications and information technology area.[17]

In response to an increasing concern for its quality, the USPTO announced several initiatives to improve the examination process of the business method patents in March 2000.[18] Those include a mandatory non-patent literature (NPL) search, a new second-level review (Second Pair of Eyes Review: SPER), and a quality review with larger sampling size for patent applications in the Class 705, in addition to other initiatives already in place.[19] The mandatory NPL search initiative required patent examiners search core and subject-specific NPL databases as well as U.S. and foreign patent documents in examining the Class 705 patent applications.[20] The SPER of all allowed patent applications in the Class 705 was carried out by the other examiner(s) in order to ensure the compliance with the mandatory NPL search requirement and the adequacy of the examination.[21]

Regarding the effectiveness of the initiatives, Allison and Hunter found that, in 2001-2002, the USPTO observed a dramatic decrease in the number of defective patents reopened by the office of patent quality review after the implementation.[22] They also found the number of patent and NPL documents referenced (by examiners and /or applicants) per a Class 705 patent granted, and the number of Class 705 patent granted with at least one reference of foreign patents or NPL increased after the

---

14 USPTO, *USPTO's classification order 1659* (issued on September 2, 1997), https://www.uspto.gov/sites/default/files/documents/archiverpt.pdf.

15 USPTO, *Classification Resources*, https://www.uspto.gov/web/patents/classification/uspc705/defs705.htm; *see also* John R Allison & Starling David Hunter, *On the Feasibility of Improving Patent Quality One Technology at a Time: The Case of Business Methods*, BERKELEY TECH. L. J., 21(2), 729, 734 n.15 (2006).

16 *See State Street Bank,* 149 F.3d 1368.

17 USPTO, *A USPTO white paper: Automated financial or management data processing methods (business methods)*, https://www.uspto.gov/sites/default/files/web/menu/busmethp/whitepaper.pdf [hereinafter *USPTO White Paper*].

18 *Id.*

19 *Id. (*noting the other initiatives in place prior to March 2000 include the hiring of more and experienced examiners, training efforts/partnerships with industry associations and companies, and customer partnerships).

20 *Id.*

21 *Id.* (noting the SPER was required "to ensure compliance with the mandatory search requirements, clarity and completeness of reasons for allowance, and to determine whether the scope of the claims should be reconsidered.").

22 Allison & Hunter, *supra* note 15, at 737.

implementation even in comparison to those of technologically related patents.[23] Several scholars have cited the USPTO's statement addressing the effectiveness of the SPER. For example, Lois Matelan noted that the allowance rate of the Class 705 patents dropped from 57% before the SPER to 47% at the end of the first quarter of the FY 2001 (i.e., at the end of 2000), and continued to drop to 11% in FY 2004 and 19% in 2005-2006.[24] Allison and Tiller also mentioned the allowance rate decreased from 56% to 36% in a year from March 2000 to March 2001 and was stable around 35% by October 2002.[25]

Whereas these prior studies suggest the initiatives worked, no studies investigated the effects on claim length or claim scope itself. Furthermore, more statistically robust results can be obtained by using a Difference-in-Differences (DID) analysis. Given that a claim amendment to avoid prior arts or to make the claim clearer would be usually done by adding words to the claim, I hypothesized that claim length of Class 705 patents (treated group) should have increased after the initiatives. More precisely, every patent application needs to pass the examination by patent examiners before granted a patent. The patent applicants can narrow the scope of the claim for example by adding other elements to avoid prior art or to correct deficiencies. Considering that words describe the elements, one can reasonably expect the examination process to generally increase the claim word counts. In that sense, the claim length added during the examination would reflect the quality of the examination process.

II. Methodology

A. Definitions

1. Treated Group and Control Group

This study used a Difference-in-Differences (DID) study design to control the impact of other systemic changes that could have been caused by patent law amendment or judicial decisions. First, I defined the treated group. Second, the control group is defined as the group which is affected similarly to the treated group but does not experience the treatment.

With respect to the treated group, the quality-improving initiatives implemented in 2000 seems to be applied only to patents classified into the United States Patent Classification (USPC) Class 705 as a main classification.[26] Therefore, the treated

---

[23] *Id.* at 748–57, 758–64 (at the same time, pointing out the SPER was not sufficient to cover all range of business method patents that could be classified into other main classification than Class 705, questioning the effectiveness of these patent classification-based approach to improve overall patent quality.).

[24] Lois Matelan, *The Continuing Controversy over Business Methods* , 18 FORDHAM INTELL. PROP. MEDIA ENT. L.J. 189, 207–08 (2007).

[25] John R. Allison & Emerson H. Tiller, *The Business Method Patent Myth*, 18 BERKELEY TECH. L.J. 987, 1026 (2003).

[26] *See* USPTO, *White Paper*, *supra* note 17; Allison & Hunter, *supra* note 15, at 734 n.14 ("The program, referred to as the Second Pair of Eyes Review (SPER) because of the second-level examination, applies only to allowed applications with a main classification of 705.").

group was defined as regular utility patents assigned into Class 705 (Class 705 patents) in the "Patent Examination Research Dataset (Public PAIR)".[27]

Next, regarding the control group, I referred to prior studies showing that business method patents were classified not only into Class 705 but also into other classes, such as Class 235, 340, 700, 707, 709, and 713.[28] I further extracted those with the secondary classification of Class 705 to choose technologically closer patents. In other words, the control group was defined as patents assigned into any of Class 235, 340, 700, 707, 709 or 713 in the Public PAIR[29] and also having classification of Class 705 (not as the main classification) at patent issue date in the PatentsView dataset.[30] Table 1 shows the technological definitions of the classes.

---

[27] USPTO, *Patent Examination Research Dataset (Public PAIR)*, https://www.uspto.gov/learning-and-resources/electronic-data-products/patent-examination-research-dataset-public-pair [hereinafter Public PAIR] (the variable "uspc_class" in the APPLICATION_DATA file denotes "Invention U.S. Classification"); *see also* Stuart J.H. Graham, Alan C. Marco & Richard Miller, *The USPTO Patent Examination Research Dataset: A window on patent processing*, 27 J. ECON. MANAG. STRATEG. 554–78 (2018).

[28] Allison & Tiller, *supra* note 25, at 1035 n.161; Allison & Hunter, *supra* note 15, at 758–764.

[29] USPTO, *Public PAIR*, *supra* note 27.

[30] The PatentsView, http://data.patentsview.org/20200630/download/uspc.tsv.zip (the table "uspc" contains USPC classification data for patents at patent issue date).

Table 1. Technological definitions[31] of the USPC classes relevant to the treated and control group

Group	USPC class	Technological Definition
Treated	705	Data Processing: Financial, Business practice, Management, or Cost/Price determination
Control	235	Registers
	340	Communication: Electrical
	700	Data Processing: Generic control systems or Specific applications
	707	Data Processing: Database, Data mining, and File management or Data structures, Appropriate subclasses for database structure, Database and file management
	709	Electrical computers and digital processing systems: Multicomputer data transferring
	713	Electrical computers and digital processing systems: Support

2. Pre-treatment and Treatment Period

The Class 705 was established in September 1997,[32] and the initiatives to be studied were announced in March 2000.[33] Although the exact initiation date of the mandatory NPL search is unclear, a preliminary analysis revealed the percentage of Class 705 patents with at least one NPL documents referenced by examiners and /or applicants increased from 2000 (data not shown). The SPER was initiated practically around mid-2000, according to the USPTO.[34] It should be also noted that other

31 USPTO, *Classification Resources*, *supra* note 15.
32 USPTO, *Classification Order 1659*, *supra* note 14.
33 USPTO, *White Paper*, *supra* note 17.
34 E-mail from Associate Counsel of the Office of General Law, USPTO (October 16, 2019). ("I found out that all Class 705 applications that were "pending" when the program was initiated (around mid-

USPTO-wide quality initiatives were also implemented afterward. The USPTO's 21st century strategic action plan that was updated in 2003 included such initiatives as examiner trainings, in-process review, and the expansion of the SPER.[35] These initiatives were mainly implemented in FY 2004 (Oct 2003 – Sep 2004).[36] The SPER was proposed to expand to some advanced field of technologies such as semiconductors, telecommunications, and biotechnology.[37] The expansion appears to be done on a trial basis in 2004,[38] although the exact target is unclear. Then, the SPER was finally expanded to all classes in May 2005.[39] The USPTO mentioned these general (not specific to Class 705 patents) quality initiatives improved the overall error rate of patent allowance in the second half of FY 2005 (Apr. – Sept. 2005).[40] This information is summarized in Figure 1 below. In a strict sense, the treatment period would be from mid-2000 to before FY 2004, and it would be also possible to include 2004 if some underestimation is allowed. The treatment period was defined as (a) 2001-2003 or (b) 2001-2004, and the pre-treatment period was defined as 1998-1999 to exclude 2000 to simplify the analysis.

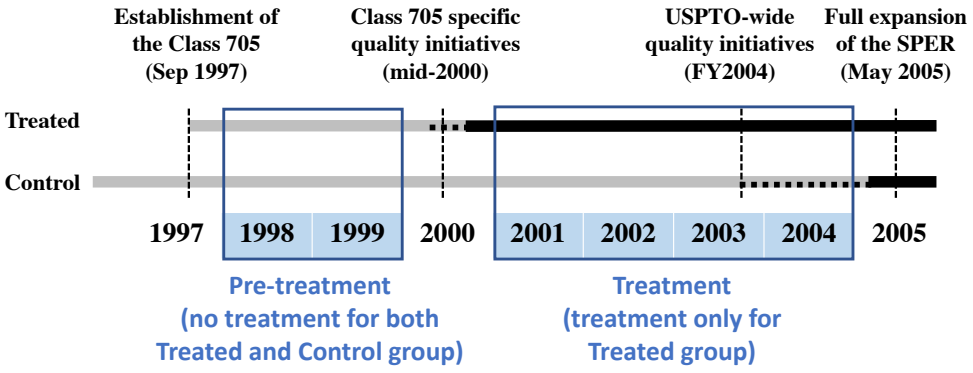

Figure 1. A diagram showing pre-treatment and treatment period

---

2000) were subject to review.").

35 USPTO, *2010–2015 Strategic Plan*, *supra* note 4.

36 USPTO, *FY 2004 Performance and Accountability Report*, https://www.uspto.gov/sites/default/files/about/stratplan/ar/USPTOFY2004PAR.pdf.

37 USPTO, *2010–2015 Strategic Plan*, *supra* note 4.

38 *See* NATIONAL ACADEMY OF PUBLIC ADMINISTRATION, *US Patent and Trademark Office: Transforming to Meet the Challenges of the 21st Century.* (2005), https://www.napawash.org/uploads/Academy_Studies/05USPatentandTrademarkOffice.pdf ("This was begun in the business methods areas in March 2000 and has been expanded to other areas on a trial basis to determine best practices." As of April 30, 2005, "[s]ome of the TC directors and supervisory PEs indicated that the second-pair-of-eyes reviews had been very helpful in improving the patent quality. For example, some art unit directors credited the reviews with reducing their error rates by half during the last two quarters of FY 2004.").

39 *See* Gene Quinn, *An Interview with the Acting Commissioner for Patents*, IPWATCHDOG (May 12, 2009), https://www.ipwatchdog.com/2009/05/12/an-interview-with-the-acting-commissioner-for-patents/id=3381/ (""Second Pair of Eyes" enhanced reviews were implemented in all areas of technology in May of 2005."); *see also* USPTO, *FY 2006 Performance and Accountability Report*, https://www.uspto.gov/sites/default/files/about/stratplan/ar/USPTOFY2006PAR.pdf.

40 USPTO, *FY 2005 Performance and Accountability Report*, https://www.uspto.gov/sites/default/files/about/stratplan/ar/USPTOFY2005PAR.pdf.

B. DID Models

A simple DID model can be expressed as the following equation:[41]

$$estimated\ independent\ claim\ length_i = \beta_0 + \beta_1 \cdot period_i + \beta_2 \cdot treated_i + \beta_3 \cdot period_i \cdot treated_i + e_i$$

Here, *period* and *treated* is a dummy variable for period (pre-treatment period/ treatment period = 0/1) and treatment (control group/treated group = 0/1). Then, β_1 captures a time trend (difference between pre-treatment and treatment period in control group) and β_2 captures a group effect (difference between treated and control group in pre-treatment period). Finally, the coefficient of the interaction term β_3 is the estimator of the treatment effect. The DID analysis requires a parallel trend assumption that the treated and control groups show a similar trend besides the effect of the treatment.[42] We further incorporated other covariates into the equation to compare DID estimations. The covariates should work to adjust for the factors that might violate the parallel trend assumption. If the DID estimation is not sensitive, the results would be considered more credible.[43] Some characteristics that could affect the independent claim length[44] were selected (Table 2).

---

41 *See generally* Coady Wing, Kosali Simon & Ricardo A. Bello-Gomez, *Designing Difference in Difference Studies: Best Practices for Public Health Policy Research*, 39 ANNU. REV. PUBLIC HEALTH 453, 456 (2018).

42 *See generally id.* at 455–57.

43 *See generally id.* at 459.

44 *See, e.g.,* Marco, Sarnoff, and DeGrazia, *supra* note 7; Kuhn and Thompson, *supra* note 9; Okada, Naito, and Nagaoka, *supra* note 10.

Table 2. Covariates used in the DID estimation

Covariate	Description
foreign_application dummy	Dummy variable for claiming priority to foreign (non-US) patent(s) (yes = 1, no = 0)
continuation_in_part dummy	Dummy variable for continuation in part application (yes = 1, no = 0)
continuation dummy	Dummy variable for continuation application (yes = 1, no = 0)
divisional_continuation dummy	Dummy variable for divisional continuation application (yes = 1, no = 0)
provisional_application dummy	Dummy variable for claiming the benefit of us-provisional application (yes = 1, no = 0)
small-entity dummy	Dummy variable for applicants being an individual inventor, a collaboration of individual inventors, a nonprofit organization, or a company with fewer than 500 employees[45] (yes = 1, no = 0)
post_implementation_filing dummy	Dummy variable for applications filed after the initiatives were implemented (filed in/after 2001 = 1, filed in/before 1999 = 0)

[45] Graham, Marco, and Miller, *supra* note 27.

C. Dataset

Claim length data of U.S. utility patents was retrieved from "Patent Claims Research Dataset"[46] provided by the USPTO. The "patent_document_stats" file in the dataset contains minimum and average word count of independent claims at grant of each patent from 1976 to middle of 2014. In this study, the minimum word count of independent claims in each patent was analyzed as the "independent claim length." This is because theoretically it should represent the broadest scope of the patent. I also confirmed that both minimum and average word count of independent claims show a similar trend over time (data not shown).[47] Although the independent claim length added (or deleted) during the examination was my primary interest, the data was not available for most of the Class 705 patents studied in this study. This is because these patents were filed before the pre-grant publication scheme[48] was introduced, and only the granted claims had been published. Therefore, I analyzed the independent claim length at patent grant. The introductory claiming language such as "I claim" or "What is claimed is" and numeric formulas are not included in the counts. Whereas US6506748 that is about drug compounds (USPC Class 514) and apparently wrongly assigned into the Class 705 was excluded, it was impossible to check all the other patents manually. Therefore, the classification used in the dataset was relied upon generally.

The Public PAIR dataset[49] was used to retrieve other basic information. I used the allowance date showing that one or more claims in the application have been allowed,[50] instead of the patent issue date which generally appeared several months later. Few (less than 5% of) patents had multiple allowance dates due to several reasons such as requests for continued examination. I used the latest allowance date among the multiple dates to reflect the possible amendment because the independent claim length was recorded based on the latest, issued patent. I also retrieved and calculated from the database the number of Non-Final and Final Rejections issued.[51] Some patents did not contain transactions-related data such as the allowance date, which is presumably due to the errors in data entry into the USPTO's datasets used or the original database. These observations were also excluded, and there was

---

46 USPTO, *Patent Claims Research Dataset*, https://www.uspto.gov/learning-and-resources/electronic-data-products/patent-claims-research-dataset; *see also* Marco, Sarnoff, and DeGrazia, *supra* note 7.

47 USPTO, *Patent Claims Research Dataset*, *supra* note 46.

48 *See* American Inventors Protection Act of 1999, Pub. L. No. 106-113; *see also* USPTO, *USPTO Will Begin Publishing Patent Applications* (November 27, 2000), https://www.uspto.gov/about-us/news-updates/uspto-will-begin-publishing-patent-applications (noting patent applications filed on or after November 29, 2000 is published eighteen months after the effective filing date of the application. The claim length at the filing, precisely speaking, at the publication is available only for those patent applications.).

49 USPTO, *Public PAIR*, *supra* note 27.

50 *Id.* (the event code of "N/=." in the TRANSACTIONS file denotes "Notice of Allowance Data Verification Completed").

51 *Id.* (the event code of "CTNF" and "CTFR" in the TRANSACTIONS file denotes "Non-Final Rejection" and "Final Rejection", respectively).

eventually on average 6%, at most 17% difference in the number of Class 705 patents granted in a year between USPTO's statistics[52] and our dataset.

III. Results and Discussion

A. Comparison of Independent Claim Length Between Treated and Control Groups Across the Pre-treatment and Treatment Period

Given that a claim amendment to avoid prior arts or to make the claim clearer would be usually done by adding words to the claim, I hypothesized that claim length of the treated group should have increased after the initiatives.

Figure 2 shows yearly averages of independent claim length of Class 705 patents between 1998 and 2005, across the implementation of the initiatives in middle of 2000. The duration covers most of the period from the establishment of the Class 705 to the implementation of other USPTO-wide quality initiatives. The control group that was not subject to the initiatives but is technologically related is used to represent a general trend in the field. As assumed, both groups similarly show decreasing trend in the pre-treatment period. From 1998 to 2000, Class 705 patents showed a decrease by 21.0 words (from 161.8 words to 140.8 words) and the control group by 17.6 words (from 156.8 words to 139.2 words). This result further supports the assumption that the control group reflects a general trend that could include changes in terminology at the filing or other general policy changes not specific to the Class 705. In contrast to the decreasing trend in the pre-treatment period, the independent claim length of the Class 705 patents increased from 138.5 words in 2000 to 190.9 words in 2005, whereas that of the control group remained in almost the same level. As a result, the difference between the two groups which would have reflected the effects of the initiatives increased, reaching around 40 words in 2003-2005.

[52] USPTO, *Class 705 Application Filing and Patents Issued Data* (as of December 14, 2016), https://www.uspto.gov/patents-getting-started/patent-basics/types-patent-applications/utility-patent/business-methods-18.

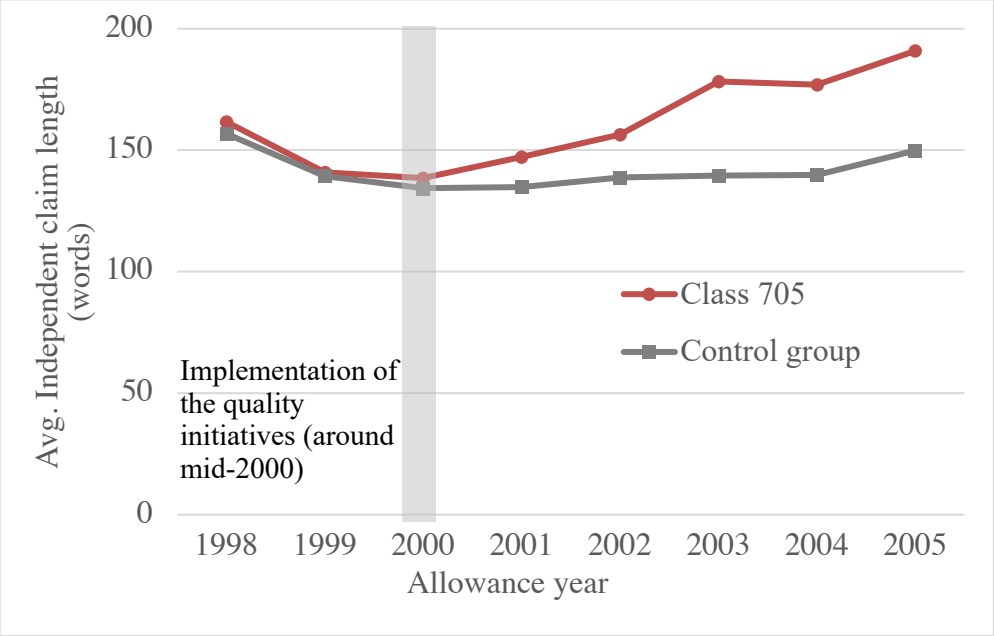

Figure 2. Changes in independent claim length of Class 705 patents between 1998 and 2005, in comparison with the control group[53]

Interestingly, contrary to the intuition that a certain effect might emerge immediately in the treatment period, the difference between the two groups was found to be increasing gradually. The most straightforward interpretation would be that it took time for the effect to show. The reasons for this are not entirely clear, but the analysis of the office actions issued against these patents during the examination process provides one of interpretation.

Figure 3 shows changes in percentage over time between the control group and Class 705 patents which have received at least one Non-Final Rejection or Final Rejection (in addition to Non-Final Rejection). Interestingly, over 70% of Class 705 patents had received at least one Non-Final Rejection even in the pre-treatment period, as had the control group. On the other hand, the percentage of having received at least one Final Rejection drastically increased after the initiatives in the Class 705 patents, and the difference between the control group gradually increased as time passed since the initiatives.

[53] Note the allowance year of 1997 was omitted due to limited number of observations for the control group.

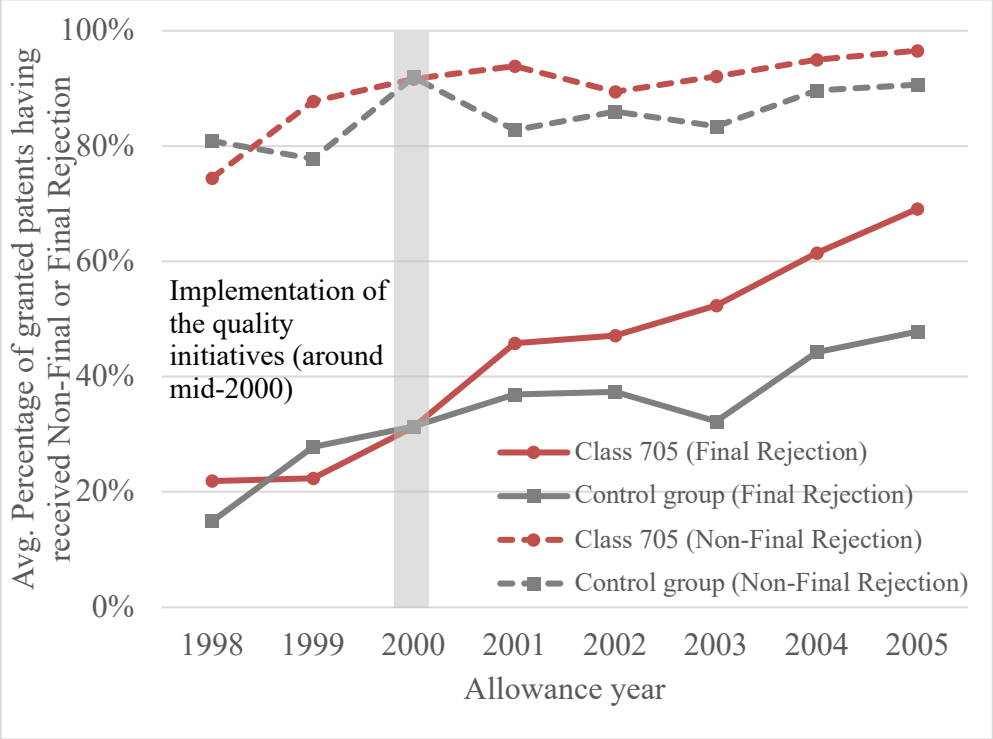

Figure 3. Changes in percentage of Class 705 patents granted having received at least one Non-Final or Final Rejection, in comparison with the control group

Given the nature of the Final Rejection as a second or any subsequent office action from the patent examiner,[54] the gradual increase of them indicates that the patent examiners became more cautious to grant a patent as time passed. This suggests a scenario that patent examiners or reviewers for the SPER, or other quality reviews, needed time to catch up with the new or higher internal rules or standards required by the initiatives. This scenario is not contradictory to the fact that the allowance rate of Class 705 patents gradually increased after the initiatives were implemented.[55] Future research on changes in the grounds of rejection (e.g., patent eligibility, novelty, non-obviousness etc.) may further clarify the mechanisms in

[54] USPTO, *706.07(a) Final Rejection, When Proper on Second Action*, MANUAL OF PATENT EXAMINING PROCEDURE (MPEP), 7th Ed., (Jul. 1998), https://www.uspto.gov/web/offices/pac/mpep/old/E7R0_700.pdf; USPTO, *706.07(a) Final Rejection, When Proper on Second Action*, MANUAL OF PATENT EXAMINING PROCEDURE (MPEP), 8th Ed., (Aug. 2001), https://www.uspto.gov/web/offices/pac/mpep/old/E8R0_700.pdf. (Any edition during 1998–2005 describes Final Rejection as follows: "Under present practice, second or any subsequent actions on the merits shall be final, except where the examiner introduces a new ground of rejection that is neither necessitated by applicant's amendment of the claims nor based on information submitted in an information disclosure statement filed during the period set forth in 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p).").

[55] *See* Matelan, *supra* note 24, at 207–208; Allison & Tiller, *supra* note 25, at 1026 (Taken together, the allowance rate was around 55% before the initiatives and decreased to around 35% in 2001–2002 and then to around 10–20% in 2004–2005.).

detail.

Some might think of a possibility that applicants changed their filing behavior in response to the initiatives to increase the claim length at the filing of the Class 705 patents aiming to avoid prior arts etc. This possibility cannot be directly examined because the claim length at the filing is not available for the majority of the Class 705 patents studied.[56] Nevertheless, Class 705 patents filed in/after 2001 constituted only 5.1%, 12.0%, and 5.7% of those allowed in 2002, 2003, and 2004, respectively. In other words, of the Class 705 patents analyzed in this study were filed before the implementation of the initiatives, indicating this scenario is unlikely to have contributed significantly. Preliminary analysis with limited data to those filed before the initiatives gave almost the same results with Figure 2 (data not shown).

Taken together, it is strongly suggested that the initiatives actually increased the independent claim length at grant of the Class 705 patents, and that independent claim length may be useful indicator of the stringency of patent examination process and the claim scope in this area of technology as well.

B. Statistical Estimation of the Effects

Finally, the effects of the initiatives were statistically verified and estimated by the Difference-in-Differences (DID) analysis. Estimating the effects in each year might be desirable given that the effects seem to have appeared gradually. However, meaningful estimates could not be obtained due to high standard errors (data not shown). Instead, a two-group, two-period DID design was used to compare the independent claim length between the treated and control groups before and after the initiatives.[57] The similar trend between the two groups in the pre-treatment period shown in Figure 2 supports the parallel trend assumption required in the DID analysis, although it is not strictly testable without additional time periods.[58]

Table 3 summarizes the results of simple Ordinary Least Squares (OLS) regressions of the DID models. First, in the models (1)-(3), the average treatment effect was estimated for the treatment period of 2001-2003 (Table 3(a)). The estimated effects were positive and statistically significant with $p<0.05$ in every model. The most basic model (1) estimated 18.5 words increase, indicating the initiatives increased the independent claim length at grant of the Class 705 patents by 18.5 words in average. The models (2) and (3) with covariates set-1 and set-2 respectively gave similar estimations of 17.0 and 18.2 words increase, which shows the covariates did not affect the results significantly. Furthermore, the result from model (3) in which *post_implementation_filing* dummy variable was included, confirmed that the application filed after the initiatives did not affect the results significantly and supported the view that the filing-behavior-change scenario is

---

[56] American Inventors Protection Act of 1999, Pub. L. No. 106-113; USPTO, *USPTO Will Begin Publishing Patent Applications*, *supra* note 48 and accompanying text.

[57] *See supra* section II. A, B.

[58] *See supra* section II. B.

unlikely to have contributed.[59]

Next, in the models (4)-(6), the treatment period was expanded to include the year of 2004 when the other USPTO-wide quality initiatives were also implemented. The inclusion of 2004 in the treatment period should theoretically lead to an underestimation of the effects, because the control group should also be affected by (other) quality-improving initiatives. Nevertheless, the models (4)-(6) estimated 22.7 to 23.8 words increase, being higher than those of corresponding models (1)-(3) (Table 3(b)). This is probably due to the gradual increase of the effects already discussed above.[60]

Table 3. The average treatment effect of the initiatives estimated for the treatment period of (a)2001-2003 and (b)2001-2004.[61]

(a)	(1)	(2)	(3)
Estimated average treatment effect (β_3)**(i)**	18.5473****(ii)** (8.548966)	17.01441** (8.47422)	18.2062** (8.807039)
Pre-treatment period	1998-1999		
Treatment period	2001-2003		
Covariates	No	set-1**(iii)**	set-2**(iv)**
Number of observations	3627		3176**(v)**

[59] *See supra* section III. A.

[60] *See supra* section III. A.

[61] (i) The coefficient in each model was estimated by simple OLS regression. Standard errors in parentheses.

(ii) Inference: *** p<0.01; ** p<0.05

(iii) Covariates set-1 includes all the foreign_application, continuation_in_part, continuation, divisional_continuation, provisional_application, and small-entity dummy variables to further control patent and applicant characteristics (See Table 2 in section II. B.).

(iv) Covariates set-2 includes post_implementation filing dummy variable in addition to the variables of Covariates set-1.

(v) The difference in the number of observations between models (1)-(2) and (3), (4)-(5) and (6) comes from the applications filed in 2000. The post_implementation_filing dummy variable was assigned for patents filed before and after 2000, excluding 2000 (See Table 2 in section II. B.).

(b)	(4)	(5)	(6)
Estimated average treatment effect (β_3)	23.79674*** (8.870706)	22.68979*** (8.163467)	23.46318*** (8.409304)
Pre-treatment period	1998-1999		
Treatment period	2001-2004		
Covariates	No	set-1	set-2
Number of observations	4747		3879

Models (5) and (6) gave similar results as model (4), as did models (2) and (3) compared to model (1). These results indicate that the selection of the control group is appropriate and that this DID analysis is reliable. Although it was difficult to make a precise estimation due to the above reasons, DID analysis confirmed that the quality-improving initiatives implemented in 2000 increased the independent claim length at grant of the Class 705 patents statistically significantly, suggesting that the initiatives contributed to narrow the claim scope of the Class 705 patents. The estimated average treatment effects were in a range of 17.0 to 23.8 words increase, as the independent claim length at patent grant. Given that the examination process typically increases the independent claim length by a few dozen words,[62] it seems quite significant that the initiatives increased the length by 17.0 to 23.8 words. Future studies may further clarify the relationship between the independent claim length, claim scope, and the fate and value of the patent.

Conclusion

The purpose of this article was to see and improve the practical usefulness of claim length as an indicator of patent quality through a case study.

In this study, the effectiveness of USPTO's quality-improving initiatives implemented in 2000 for business method patents was examined by using claim length in a Difference-in-Differences (DID) study design. The DID analysis revealed that independent claim length of the Class 705 patents increased, whereas that of the control group remained in the almost same level. As a result, the difference between the two groups which would have reflected the effects of the initiatives increased, reaching around 40 words in 2003-2005. Taken together with the changes in percentage of Class 705 patents granted having received at least one Final Rejection, it was suggested that patent examiners or reviewers for the SPER or other quality reviews needed time to catch up with the new or higher internal rules or standards required by the initiatives. Finally, the effects of the initiatives were statistically verified and estimated by simple OLS regressions of DID models. The estimated average treatment effects were positive and statistically significant with $p<0.05$ in

[62] Marco, Sarnoff, and DeGrazia, *supra* note 7 ("The examination process increases the mean ICL from 106 words at publication to 156 words at issuance for application years 2001–2014.").

every model, being in a range of 17.0 to 23.8 words increase, as the independent claim length at patent grant. These effects appeared quite significant considering the typical increase by the examination process.

This article provides an empirical basis regarding the effects of USPTO's quality-improving initiatives in 2000 on the claim scope of business method patents, and at the same time, shows the practical usefulness of the independent claim length as an indicator of the stringency of patent examination process and the claim scope in this area of technology.