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Covid-19 Pandemic's Impact on the U.S. Patent System Through November 2020[1]

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I. Introduction

The Covid-19 pandemic has had and continues to have a major impact on people and countries across the globe. The pandemic has not only affected people, it has affected many facets of life including the economy. The United States government has passed two measures in an effort to address the issues Covid has introduced. The Coronavirus Aid, Relief, and Economic Security (CARES) Act provided $2.2 trillion in economic stimulus.[3] Both the CARES Act and the United States Patent and Trademark Office (USPTO) have provided relief to stakeholders with regard to patents and applications.[4]

This essay examines patent abandonment rates and application rates to determine if they can shed light on how the Covid-19 pandemic affected innovation. While the results show temporary perturbations, the pandemic has had minimal effect on overall trends. This may suggest that abandonment rates and application rates may be surprisingly resistant to economic downturns or that the measurements are simply not good proxies for innovation. Part II of this paper will describe the data available from the

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[3] CARES Act, H.R. 748, 116th Cong. (2020).
[4] USTPO, RELIEF AVAILABLE TO PATENT AND TRADEMARK APPLICANTS, PATENTEES AND TRADEMARK OWNERS AFFECTED BY THE CORONAVIRUS OUTBREAK (2020), https://www.uspto.gov/sites/default/files/documents/coronavirus_relief_ognotice_03162020.pdf [https://perma.cc/7XLZ-9PXU].

USPTO and the methods used to work with the data.[5] Part III will examine the data as well as offer theories about the results obtained from the data.

II. USPTO Publicly Available Data and Utilized Methods of Analysis

The USPTO is offering the public access to its data in many different ways. Besides providing their newly developed application programming interfaces (APIs), the USPTO provides a web-based tool called the Patent Examination Data System (PEDS).[6] The PEDS tool is one of a small set of tools that provides current data to end users, and it gets updated with new patent related content every day. Many of the other data tools available from the USPTO only provide archival data and may not be updated often.[7] The PEDS web-based system allows users to search and download multiple USPTO records regarding publicly available patent examination data. The beta release of PEDS contains the bibliographic data, for the filing years 1981 to present, which is information found on the front page of the published document.[8] This data is the same data available through Public PAIR but presented in a searchable and downloadable format. Some data dating back to 1935 is also available.[9] The data can be easily searched using the web interface by anyone with access to the internet and a modern browser like Google Chrome or Microsoft Edge. The API requires programming knowledge and writing custom code. Users can also download the entire dataset as a single .zip file, however, the entire data set is extremely large and currently is 63.9 gigabytes (GB) in total. There are two data formats for all downloaded data available on PEDS which includes JavaScript Object Notation (JSON) and Extensible Markup Language (XML).

Additional data processing is required to organize the data into structures to make analyzing the data more accessible. Different methods of organizing the data were used incrementally to structure the large datasets. Since the datasets were large, some of the non-essential data had to be stripped to make the remaining essential data easier to work with. For

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5 Nicholas Shine, *USPTO Patent Prosecution Data Jan 2016 - Nov 2020: Filing Date and Status*, HARVARD DATAVERSE (2021), https://doi.org/10.7910/DVN/HC0ZEQ [https://perma.cc/4UHF-K8YU].

6 *Patent Examination Data System*, USPTO, https://ped.uspto.gov/peds [https://perma.cc/26S6-KFWT].

7 *USPTO APIs*, USPTO: OPEN DATA PORTAL, https://developer.uspto.gov/api-catalog [https://perma.cc/EDD4-EHHN].

8 *Patent Examination Data System, supra* note 6 (under the "User Manual" tab).

9 *Id.* (under the "User Manual" tab).

example, the 2019 datafile that includes the status update information is a 1.76 Gb compressed file and includes many status messages that are not part of this study. The large data files also include other non-essential information with regard to this study, such as inventor information. When working with files that large, most systems cannot handle the data, and the data needs to be either broken up into multiple files and/or reorganized and stripped down into files that contain only essential information related to the study. Both approaches were utilized to work with the datasets used for this paper.

The datasets were downloaded from the PEDS web interface by utilizing the filters built into the web-based tool. The PEDS web-based tool has many built-in filters that can be used to narrow the available patent examination data into specific packages of interest. Currently, there are 24 different filters available. For this essay, we used the "Status Date" filter as well as the "Filing or 371 (c) Date" filter. The Status Date filter was used to request patent examination data containing status updates within a series of target years. The Filing Date filter provides data for applications that were filed in specific years. The data requested is compressed into a single ".zip" file for each year. Once decompressed and extracted, the data was separated into ".json" files representing the year the application was submitted. For example, the 2020 status date package included 35 individual files labeled with a year ranging from 1900 to 2020 and ending with the .json file extension. The uncompressed file sizes varied for each individual file. The biggest file sizes were typically more current JSON year files. This was not surprising as a typical patent application has on average a 16-month pendency to the first action across all technology centers.[10] Additionally, there is a 23-month traditional total pendency for applications across all technology centers.[11] The earlier labeled files mostly contained data that represents patents that were expiring due to a term limit, unpaid fees, or possibly, in a very small subset, applications that took years to prosecute. The uncompressed files are very large in size. For example, a single uncompressed Status Date file containing information for updates in 2019 is 7.3 Gb and is only 1 of 35 files for that year.

The technology (tech) centers are defined by the USPTO and are organized into nine different patent technology centers that group patents

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[10] *Patents Data, at a Glance February 2021*, USPTO, https://www.uspto.gov/dashboard/patents/ [https://perma.cc/DA6R-R543].

[11] *Id.* These are the same technology centers used by Colleen Chien's group in their recent essay studying 35 U.S.C. § 101 rejections at the patent office. Colleen V. Chien, Nicholas Halkowski, Maria He & Rodney Swartz, *Parsing the Impact of Alice and the PEG*, 2020 PATENTLY-O PAT. L.J. 20.

according to the type of technology disclosed. The Deputy Commissioner for Patent Operations oversees all patent examining functions in the nine centers.[12]

The tool we chose to organize and analyze these datasets is an interpreted, high-level and general-purpose programming language called Python.[13] Python was chosen because of its ease of use, portability, implementation, and ability to open and work with large JSON files. Several python libraries, or modules, were utilized to help work with the PEDS data including the built-in comma separated values (CSV) and JSON libraries.

The first step after downloading the datasets was to remove the unnecessary data which was accomplished by filtering the JSON objects and separating the applications that contained only specific status update messages. This was only possible after we knew what messages were contained in the data. The code for discovering the status messages is found in Appendix A, and was built using an iterative process of adding newly discovered messages one by one back to the code until no new messages were found. The next step was removing everything but the applications with messages of interest from the datasets, making them easier to work with, which in-turn reduces computational time and required resources. The computer used to work with the files contains 32 Gb of RAM, which was not enough to handle these large datasets in some cases. Python stores the entire JSON dataset in memory when handling that specific type of data. At the same time, the files were reduced and the applications were organized into months by their status date. The code used to organize the data for each month is found in Appendix B. The data of interest along with their status message, status month, application numbers, and art units were sorted and stored into new JSON objects output by the Python code. The applications from the 1900.json files were discarded because they did not contain art unit information. This was a very small subset of applications. The last steps were to count the messages of interest by month and then graph them. The messages were counted and organized by tech center using the application's assigned art unit to determine its tech center. The code used to count the status messages by tech center is found in Appendix C. An extremely comprehensive plotting tool compatible with Python called Matplotlib was used to plot the data and create the graphs. This tool was created for Python

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[12] *See Patent Technology Centers Management*, USPTO (July 20, 2018, 9:49 AM), https://www.uspto.gov/patents/contact-patents/patent-technology-centers-management [https://perma.cc/ZBM7-5GY6].
[13] *See* PYTHON, https://www.python.org [https://perma.cc/DNR4-4TVN].

and meant to resemble the functionality provided by graphing tools in Matlab, another desktop environment tuned for iterative analysis.[14] The code used to plot the counted data can be found in Appendix D.

III. Analysis and Presentation of Results

Shown below in Figure 1 is the absolute number of applications and patents that were abandoned for one of seven different reasons during the time between 2016 and the third quarter of 2020. The different abandonment reasons were chosen based on the status messages discovered using the code from Appendix A discussed above. The messages are: (1) Abandoned -- Failure to Respond to an Office Action; (2) Expressly Abandoned -- During Examination; (3) Abandoned -- Incomplete Application (Pre-examination); (4) Abandoned -- Failure to Pay Issue Fee; (5) Abandonment for Failure to Correct Drawings/Oath/NonPub Request; (6) Expressly Abandoned -- During Publication Process; and (7) Abandoned -- After Examiner's Answer or Board of Appeals Decision.

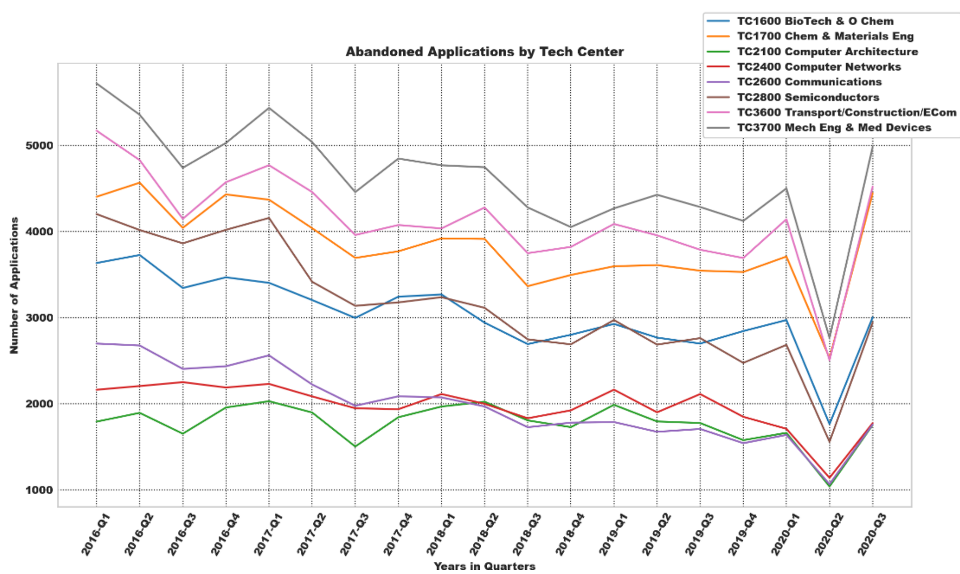


Figure 1: Abandoned Applications by Tech Centers 2016 Q1 - 2020 Q3

Figure 1 shows that, generally speaking, abandonments slowly decline from 2016 to 2020-Q1 with the only exceptions being TC2100 – Computer Architecture and TC2400 – Computer Networks, which remain relatively steady in abandonment numbers. Figure 1 shows a significant drop in

[14] John D. Hunter, *Matplotlib: A 2D Graphics Environment*, COMPUTING SCI. & ENG'G, May 2007, at 90.

abandonments for 2020-Q2, which corresponds with the start of the Covid-19 Pandemic here in the United States. This drop in abandonment numbers during 2020-Q2 is counterintuitive to the results we expected to see. Given the impact the pandemic has on the ability for people to work, coupled with state mandatory shutdown quarantine measures, and overall uncertainty, we expected to see abandonments to increase. Figure 1 shows an increase in abandonments after 2020-Q2 during 2020-Q3 with some tech centers having only a slight increase and others having a more substantial increase. For example, tech centers TC1600 (bio-tech and organic chemistry industries) with 32, TC2100 with 91, and TC2400 with 65 more abandonments show only a slight increase during 2020-Q3 as compared to 2020-Q1. In contrast, TC3700 (mechanical engineering and medical device industries) with 483 and TC3600 (transportation, construction, e-commerce industries) with 379 more abandonments in 2020-Q3 as compared to 2020-Q1.

The increase in abandonments may be a direct result of the economic impact the Covid-19 virus had on the tech center industries presented above. Although the USPTO did not shut down during 2020-Q2, the difference in abandonment from 2020-Q1 compared to 2020-Q3 may be a result of a decrease in productivity directly resulting from the onset of the pandemic and the uncertainty and upheaval that it caused. It is possible that even though the USPTO did not officially shut down, its staff may have been less productive while setting up home offices, figuring out child care, and navigating the other perils of the pandemic.

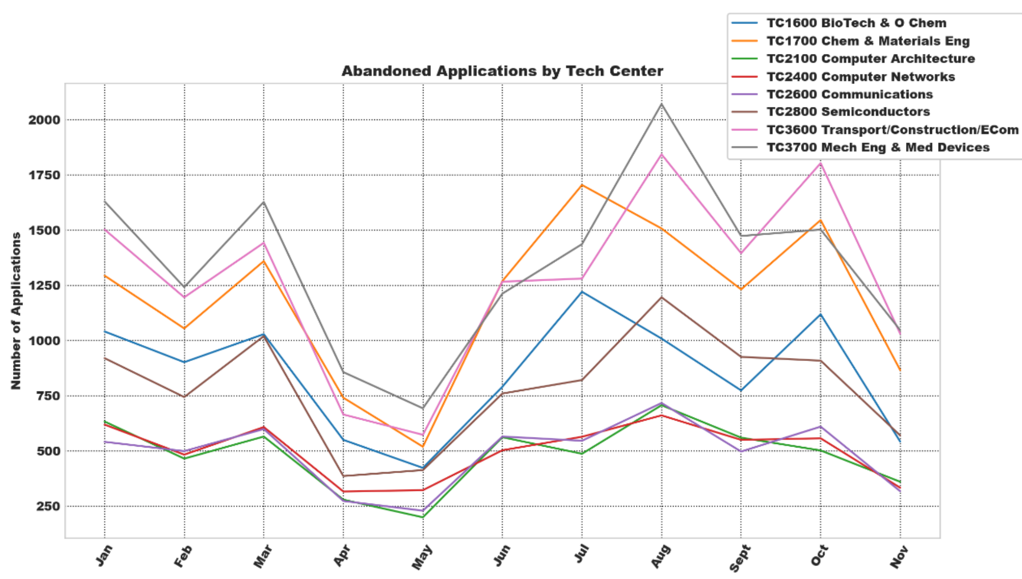
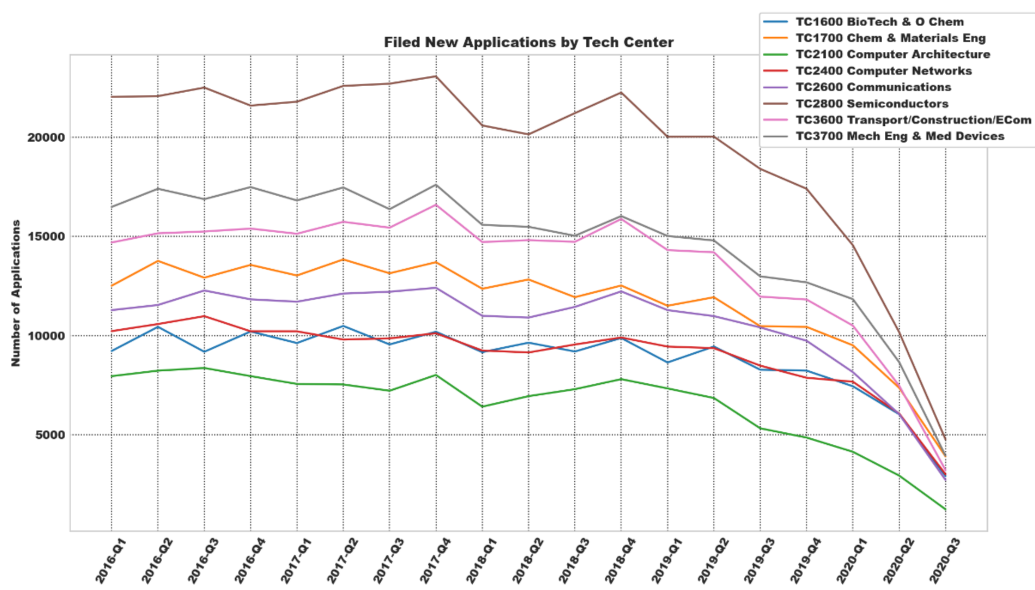


Figure 2: Abandoned Applications by Tech Centers 2020 - January

through November

This theory is further corroborated by the data in the Figure 2 graph above. In general, abandonments were declining at the beginning of 2020, again, with a counterintuitive sharp decline, starting in March and continuing until June. Abandonments picked back up with a spike in August. It would be interesting to know if the USPTO staff worked more hours or overtime in the summer of 2020 to process the applications that may have been set aside during the start of the pandemic in March, which may account for the increase in abandonments. Conversely, businesses and individuals may have also been stagnant with regard to working on applications during the beginning months of the pandemic. The applicants may have been trying to figure out the same logistical concerns mentioned above and not able to work on applications until the summer months. At this time, they may have decided to abandon the applications due to austerity measures or to focus efforts on other applications.

Another metric used in our efforts to determine how the pandemic has affected patent applications was the "Filing or 371(c) Date" which is the date that an application includes (1) a specification containing a description and, if the application is a non-provisional application, at least one claim, and (2) any required drawings.[15] Figure 3 below depicts the number of filed applications per tech center in quarters from 2016 to 2020-Q3.



[15] *See* MPEP § 506 (9th ed. Rev. 10, June 2020).

Figure 3: Filed New Applications by Tech Centers - 2016 Q1 - 2020 Q3

As shown in Figure 3, the number of new applications does not fluctuate drastically over time. The numbers across all tech centers are slightly declining over the almost 4 year period. The numbers for all tech centers drastically decline in 2020, but begin their fall in 2019-Q4. It is doubtful that this decline is a direct result of the pandemic due to the fact that it begins before the pandemic was prevalent here in the U.S. and before it was prevalent worldwide.[16] It is our conjecture that the decline starting in 2019-Q4 and progressing though 2020-Q3 results from a lag in documentation at the USPTO. It may be another year before the filing information catches up with applications recently submitted. As discussed above, there is on average a 16-month pendency to the first action across all technology centers. We believe it is reasonable to assume there is some time delay between the time an application is received, processed, and the data is made public at the USPTO.

Conclusion

Without additional information, it will be hard to decisively determine why overall patent abandonments and application filing trends do not appear to have changed significantly. We expected to see larger impact, but only saw a short-term shock. The Covid-19 pandemic did have an impact on patent prosecution and the USPTO's ability to examine patent applications, but the impact was not significant. Assuming that the pandemic did have a serious adverse economic impact, these results suggest that abandonment rates and application rates are resistant to economic downturns. That may be because these two assessments of patent activity do not measure economic innovation well.

[16] *About COVID-19,* CTRS. FOR DISEASE CONTROL & PREVENTION (Sept. 1, 2020), https://www.cdc.gov/coronavirus/2019-ncov/cdcresponse/about-COVID-19.html [https://perma.cc/H8M2-UQFS].