U.S. Patent and Trademark Office
OFFICE OF THE CHIEF ECONOMIST
IP DATA HIGHLIGHTS NO. 3

Supplementary Material

Adjusting to *Alice*: USPTO patent examination outcomes after *Alice Corp. v. CLS Bank International*

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April 2020

UNITED STATES
PATENT AND TRADEMARK OFFICE
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Introduction

This supplement describes the data and research methods used in "Adjusting to Alice: USPTO patent examination outcomes after *Alice Corp. v. CLS Bank International*" published in April 2020.

Data construction and description

Database construction started with information on USPTO patent applications. That information was augmented in several ways to complete the datasets used in the empirical analysis. To evaluate our first examination outcome of interest – the likelihood of receiving a first office action with a rejection for patent-ineligible subject matter – we estimated models using patent application-level datasets. For our second examination outcome – uncertainty in patent examination – we aggregated the application-level datasets to the technology class level.

Datasets on patent applications: public and proprietary versions

Two patent application-level datasets were constructed for the empirical analysis. A public data version, which was used to estimate models evaluating the U.S. Supreme Court decision in *Alice Corp. v. CLS Bank International* (*Alice*), and a proprietary data version, which was used to evaluate the USPTO's Berkheimer Memorandum and the January 2019 Revised Patent Subject Matter Eligibility Guidance (2019 PEG). The proprietary dataset was required for the examiner guidance analysis to avoid problems with missing public data. Patent application information is not publicly available until about 18 months after initial filing and the time dimension for the analysis extends through the end of January 2020.

The public application datasets started with the Patent Examination Research Dataset (PatEx) described in Graham et al. 2018 (PatEx data are available at https://www.uspto.gov/learning-and-resources/electronic-data-products/patent-examination-research-dataset-public-pair), and the proprietary application dataset with the internal USPTO version of PatEx (PALM) that contains information on non-public applications. From these datasets, we extracted all the applications, granted or pending, with examiner office actions of the following types: non-final rejection, final rejection, ex parte quayle, and notice of allowance. The earliest mailing date shown in PatEx for an application was defined as the "first office action."

The next step for the public dataset was to merge the patent applications from PatEx with the USPTO Office Action Research Dataset for Patents (OADP) described in Lu et al. 2017 (available at https://www.uspto.gov/learning-and-resources/electronic-data-products/office-action-research-dataset-patents). OADP provides comprehensive information on examiner issued rejections at all stages of prosecution. It covers office actions mailed during the period 2008 to mid-2017 and indicates whether the examiners' office actions contain a non-final or final rejection along with a description of the rejection types. The rejection type of interest is 35 USC §101 (Section 101) as it indicates a rejection for patent-ineligible subject matter. Note that each office action may have multiple rejections and rejection types. OADP was merged with PatEx using the patent application numbers and the office action mailing dates.

For the proprietary dataset, we merged a proprietary version of the OADP to obtain information on office actions for non-public applications. For both public and private applications, PALM identified the examiner who issued the first office action. PatEx only identifies the last examiner associated with the patent application and, in many cases, that person is not the one who issued the first office action.

Description of patent application characteristics

We added several characteristics to the application-level dataset. For each application, when available, we added the U.S. Patent Classification (USPC) listed on the pre-grant publication (PGPub). The classification listed on the PGPub is most likely the classification at the time of the examiner's first office action. For granted patents without a PGPub, we used the USPC listed on the granted patents. For a small number of applications that were published after USPTO discontinued the USPC system in 2015, we had to use the most recent USPC from PatEx. Lastly, for unpublished applications, we used the latest classification as listed in the PALM system.

For the public dataset, we augmented the application information with text-based data elements computed from published and granted patents. From the Patent Claims Research Dataset described in Marco et al. 2019 we added a variable to capture claim scope (the "breadth" of a claimed invention) by using the independent claim count (ICC) and shortest independent claim (ICL). (That dataset is available at https://www.uspto.gov/learning-and-resources/electronic-data-products/patent-claims-research-dataset.) Next, we developed a text-based measure of abstract language in patent claims (details available upon request). The source for patent application claims text is the USPTO bulk XML data (https://bulkdata.uspto.gov/). For each patent application, we used the text in the PGPub (when available) or the text in the granted patent. Because these text-based data elements rely on publicly available information, they are not available for our proprietary dataset used to evaluate the Berkheimer Memorandum and the 2019 PEG.

The public and proprietary patent application-level datasets are pooled cross-sections of applications grouped into one month cohorts by filing date (i.e., application-filing month observations). These datasets were used to estimate the models for the likelihood of receiving a first office action with a rejection for patent-ineligible subject matter.

Datasets at the technology class level

To evaluate the degree of uncertainty in the patent examination process, we constructed two new datasets. In these datasets, the application-level observations were aggregated to broader technology classes (3-digit USPCs) and the time dimension was expanded to cover six month intervals (i.e., technology-half year observations). These adjustments were necessary in order to measure the degree of variation across examiners in their decision-making outcomes. The decision outcomes, which are described in detail in the next section, are each examiner's proportion of first office actions with rejections for patent-ineligible subject matter. We calculated the variance across examiners in their decision outcomes within a technology area and time period (i.e., the variance across examiners within technology-half year cells).

For the other data elements, when those are available in the public and private application datasets, we used aggregated values calculated by taking their average for the technology-half year cells. For instance, for counts of independent claims in the applications, the values are the average number of independent claims among applications filed in a particular 3-digit USPC and specific half-year time period. We also added a new data element: the average of the variance across examiners in their decision outcomes. When included in the models, this "level of variance" in the technology-half year cells helps to identify that portion of changes in uncertainty attributable to examiner decisions about the event under study such as the *Alice* decision. Changes in uncertainty within USPC 3-digit technology areas might reflect examiner compositional changes such as the adding of new examiners with less experience or changes in how applications are assigned to examiners. It would be wrong to attribute this type of influence to the event under study. Some other new data elements include the number of examiners and the number of applications per technology-half year.

The public and proprietary technology-half year datasets are panels with multiple observations for each technology class. These datasets were used to estimate the models for examination uncertainty in the first office action stage of patent examination.

Restrict to applications filed before *Alice*, Berkheimer memorandum and USPTO 2019 PEG

A potential source of endogeneity for identifying the impact of *Alice* and subsequent guidance documents on examiner outcomes is applicant behavior. In particular, applicants may react to the *Alice* decision and guidance documents by submitting redrafted applications, or prosecuting applications differently after the events. To alleviate these endogeneity concerns, we restricted our datasets to applications filed before the relevant event. This restriction mitigates the influence of applicant drafting strategies on our results. In a robustness check, we explored the implications of this restriction.

Additionally, our outcomes of interest are at the first office action stage of patent examination. Subsequent examination stages involve additional decision makers such as attorneys, agents, supervisors, and so forth. Thus, using a later stage of patent examination would confound the decisions of examiners with many others. Further, the first office action describes the initial patentability decision by the examiner and is performed with minimal interaction with applicants, which further reduces the influence of applicant behavior on the examination outcomes in this study.

Restriction to adjust for the Supreme Court Case *Bilski v. Kappos*

In 2010, the U.S. Supreme Court decided *Bilski v. Kappos* (*Bilski*), which was another case involving a business method patent. The Court found the claims to be patent-ineligible because they were directed toward an abstract idea. For this analysis, the *Bilski* decision may affect the pre-event trends (e.g., the trends before the *Alice* decision) in the *Alice*-affected technologies and other technologies. As discusses below, the empirical design of this study requires a statistically indistinguishable pre-event trend in *Alice*-affected and other technologies. To address this potential issue, the regression dataset starts in 2013 instead of 2011, thereby minimizing any impact from the *Bilski* decision. In a robustness check of the results, we relaxed this restriction and used the data from 2011. The results are quantitatively very similar and qualitatively the same.

Definition of "*Alice*-affected" and other technology groups

To identify the technologies affected by *Alice* (called *Alice*-affected technologies), we drew on patent litigation cases where validity was challenged under the "abstract idea" judicial exception. The USPTO's Office of Patent Legal Administration (OPLA) maintains a public and comprehensive list of cases from the U.S. Court of Appeals for the Federal Circuit (CAFC) and the U.S. Supreme Court. A team of lawyers monitors these cases and identifies patents litigated for subject matter eligibility. One of the fields recorded for each case is the "Exception Type." This refers to the relevant judicial exception type (i.e. laws of nature, products of nature, natural phenomena, or abstract ideas).

For this analysis, we defined *Alice*-affected technologies as USPCs appearing in cases involving the abstract ideas judicial exception. This group of technologies has 33 USPCs and comprises 33% of the patent applications in our dataset. The group of other technologies includes all USPCs that were not involved in any decision from the cases considered by OPLA and contains applications from 382 different USPCs.

Outcome variable definitions

Percentage of first office action Section 101 rejections

Our first outcome of interest is the likelihood of receiving a first office action with a rejection for patent-ineligible subject matter (also referred to as a Section 101 rejection). This is a binary indicator that takes the value of 1 when the first office action includes a rejection for patent-ineligible subject matter, 0 otherwise. The binary indicator is the dependent variable in the regression models, but the descriptive figures shown in the *Adjusting to Alice* report aggregated this indicator by technology and month. Specifically, those figures show the percentage of first office action Section 101 rejections among all first office actions in the technology groups of interest, *Alice*-affected and other technologies, for a given month.

Section 101 first action examination uncertainty

The second outcome measure captures one source of uncertainty in the patent examination process. As described above, the analysis focused on uncertainty surrounding examiners' decisions in the first action stage of patent examination. The uncertainty metric was computed in two steps. First, within technology-half year cells, the first office actions for each application were aggregated to the examiner-level. This allowed us to calculate the share of first office action Section 101 rejections for each examiner. Next, the variance across the examiners' shares was used to capture uncertainty. This metric will increase when examiners' determinations on subject matter eligibility are more uneven within a technology-half year.

For our descriptive analysis in the *Adjusting to Alice* report, Section 101 first office action examination uncertainty is the average of the variance observed in each technology-half year for the groups of interest, *Alice*-affected and other technologies.

Methodology

Alice effect on the probability of first office action Section 101 rejections

To identify the impact of *Alice* on the likelihood of receiving a first office action with a rejection for patent-ineligible subject matter, we used a difference-in-differences methodology with a linear probability model. The baseline estimating equation (see Table 2 in the Findings Section) is:

$$pr(101)_{it} = \beta_0 + \beta_1(PatGrp_{it} * Alice_t) + \delta_k + \theta_j + \gamma_t + \boldsymbol{\alpha X}_{it} + \epsilon_{it} \quad (1)$$

where i indicates the patent application, j is the examiner, k is the technology area (3-digit USPC), t is time, $pr(101)_{it}$ is a binary variable that indicates whether the application received a Section 101 rejection on the first action, δ_k is a technology fixed effect, γ_t is a time fixed effect,

θ_j is an examiner fixed effect, and $\boldsymbol{X}_{it}$ is a vector of patent characteristics. *Alice*-affected technologies are represented by the variable, $PatGrp_{it}$, and the event indicator for the *Alice* decision is captured by $Alice_t$. The event indicator takes the value of 0 before June 2014 and the value 1 thereafter. We used robust standard errors to account for heteroskedasticity. The coefficient, β_1, is the "treatment" effect. The magnitude and statistical significance of this coefficient reveals how the *Alice* decision changed the probability of receiving a first office action with a Section 101 rejection. The impact of the *Alice* decision is evaluated for those technologies exposed to the *Alice* standard (i.e., *Alice*-affected technologies in $PatGrp_{it}$) relative to the other technologies. This relative comparison eliminates common influences affecting all technologies such as an increase in Section 101 rejections due to utility and statutory double patenting.

Additional co-variates for non-random assignment

Even though the *Alice* decision is plausibly exogenous to the USPTO and its examiners, the assignment of patent applications to the *Alice*-affected group is not random because it relies on litigation events and the technologies of the patents involved. The use of OPLA's information on litigation cases resulted in a broad definition of technologies potentially impacted by *Alice*. This is a conservative way to define the "treatment" group for the analysis. However, the model specifications also include a variety of patent application characteristics, $\boldsymbol{X}_{it}$, such as claim scope to help alleviate concerns of possible omitted co-variates. Due to the nature of the *Alice* decision, we also explored whether the degree of abstractness contained in the language of the patent application was a confounding influence. We estimated a specification that includes the abstractness variable $Abst_i$ for application i as follows (see Table 2 in the Findings Section):

$$pr(101)_{it} = \beta_0 + \beta_1(PatGrp_{it} * Alice_t) + \beta_2 Abst_i + \delta_k + \theta_j + \gamma_t + \boldsymbol{\alpha X}_{it} + \epsilon_{it} \tag{2}$$

Differential *Alice* impact due to abstract language

We also explored the possibility that the *Alice* decision impacted *Alice*-affected technologies differentially according to the degree of abstract language contained in the patent applications. To do this we added the following interaction term to the model: $(PatGrp_{it} * Abst_i * Alice_t)$. The empirical specification becomes (see Table 2 in the Findings Section):

$$\begin{aligned} pr(101)_{it} = {} & \beta_0 + \beta_1(PatGrp_{it} * Alice_t) + \beta_2 Abst_i + \beta_3(PatGrp_{it} * Abst_i * Alice_t) + \delta_k \\ & + \theta_j + \gamma_t + \boldsymbol{X}_{it}\alpha + \epsilon_{it} \end{aligned} \tag{3}$$

With this model, the impact of the *Alice* decision or "treatment effect" is: $\beta_1 + \beta_3 * Abst_i$. If β_3 is positive and statistically significant, then the *Alice* decision caused an additional increase in the likelihood of receiving Section 101 for those applications containing more abstract language in the group of *Alice*-affected technologies.

Assessment of pre-trends

One of the key assumptions required for identifying causal effects with a difference-in-difference research design is that the pre-event trends in *Alice*-affected and other technologies are the same (or at least statistically indistinguishable). To verify this assumption, we estimated a model that interacts an indicator variable for *Alice*-affected technologies, $PatGrp_{it}$, and a monthly time indicator, $Month_t$, that begins in January 2013 and runs through December of 2016. For the pre-event trends assumption to hold, the coefficient estimates on the interaction terms should not be statistically different from zero before the *Alice* decision and should be statistically different after the *Alice* decision. The estimation equation is given by (see Figure 1 in the Findings Section):

$$pr(101)_{it} = \beta_0 + \sum_{t}^{2013-2016} \beta_t (PatGrp_{it} * Month_t) + \psi_1 Abst_i + \delta_k + \theta_j + \boldsymbol{X}_{it}\alpha + \epsilon_{it} \quad \textbf{(4)}$$

Berkheimer memo and 2019 PEG effects on the probability of first office action Section 101 rejections

To assess the effects of the Berkheimer memorandum and the 2019 PEG on the likelihood of receiving a first office action with a rejection for patent-ineligible subject matter, we used the same modeling approach described for the *Alice* decision. The event indicator for the Berkheimer memorandum takes the value of 0 before April 2018, and 1 thereafter. For the 2019 PEG, the event indicator takes the value of 0 before January 2019, and 1 thereafter. These event indicators are interacted with the *Alice*-affected technologies. However, the model specifications for these two events are more parsimonious. Due to the limitations of the proprietary patent application dataset, the specifications did not include application-level co-variates such as claim scope and application language abstractness.

Alice effect on first action examination uncertainty

To identify the impact of *Alice* on first action examination uncertainty, we use the difference-in-difference model given by (see Table 3 in the Findings Section):

$$Var_{kt} = \beta_0 + \beta_1 (PatGrp_{kt} * Alice_t) + \delta_k + \gamma_m + \boldsymbol{X}_{kt}\alpha + \epsilon_{kt} \quad \textbf{(5)}$$

where k indicates the technology area, t is time in half-year intervals, δ_k is a technology (USPC) fixed effect, γ_t is a half-year fixed effect, $Alice_t$ is an event indicator variable taking a value of 1 after the *Alice* decision, and $\boldsymbol{X}_{kt}$ is a vector of USPC-level by time period co-variates. $PatGrp_{it}$ indicates whether the application is part of the *Alice*-affected technologies treatment group. The dependent variable Var_{kt} is the variance of Section 101 rejection rates across examiners in technology k in period t. That variable measures the decision-making spread in the determinations of Section 101 rejections by examiners and, all else equal, greater variation reflects greater uncertainty about whether the patent application will receive a rejection for patent-ineligible subject matter in the first action stage of examination.

In the specification shown in eq. (5), we included a variety of patent application characteristics $\boldsymbol{X}_{it}$ averaged across the applications within each technology-half year cell. Besides the patent claim scope co-variates used in the models for Section 101 rejections, we added the variance in the abstractness of the language in the applications that examiners' received within each technology-half year cell. If examiners were assigned applications with varying degrees of abstract language after the *Alice* decision, Section 101 rejection decision variance may increase mechanically rather than reflect decision-making uncertainty from *Alice*. The abstractness co-variate addresses this potential issue.

We added several more co-variates to capture other sources of increased variance that may not be attributable to the *Alice* decision. These include within-examiner Section 101 rejection rate variances (the standard errors of each examiner's Section 101 rejection rate affects the variance across examiners), the number of examiners, and applications per examiner within each USPC at time t (because the number of examiners and applications affects the variance across examiners). These controls may be important as our dataset restricts the applications to those filed before *Alice*, which was done as a way to mitigate any influence from applicant behavior. This dataset restriction means that the number of first office actions will decrease as time passes because more and more of those applications have received a first office action decision. Such a mechanistic decrease could lead to an increase in the variance across examiners that does not reflect *Alice*.

Additional co-variates for non-random assignment

Similar to the specification for Section 101 rejections, we estimated a second model that includes the average abstractness measure, Avg_Abst_i. This co-variate is the average abstractness of the patent applications receiving a first office action in the USPC at time t. The coefficient will capture any direct effect of abstract language on examination uncertainty.

Differential *Alice* impact due to abstract language

We also explored the possibility that the *Alice* decision impacted first action examination uncertainty differentially according to the degree of abstract language contained in the patent applications. The approach is the same as discussed above for Section 101 rejections. Specifically, in a third model, we added a triple interaction term.

Assessment of pre-trends

To verify that the pre-event trends in examination uncertainty for *Alice*-affected and other technologies are statistically indistinguishable, we estimated a model that interacts an indicator variable for *Alice*-affected technologies, $PatGrp_{it}$, with a half-year time indicator, $HalfYear_t$, that begins in January 2013 and runs through December of 2016. For the pre-event trends assumption to hold, the coefficient estimates on the interaction terms should not be statistically different from zero before the *Alice* decision. The estimation equation is given by (see Figure 2 in the Findings Section):

$$Var_{kt} = \beta_0 + \sum_{t}^{2013-2016} \beta_t (PatGrp_{it} * HalfYear_t) + \psi_1 Avg\_Abst_i + \delta_k + \theta_j + \boldsymbol{X}_{it}\alpha + \epsilon_{it} \quad (6)$$

Berkheimer memo and 2019 PEG effects on first action examination uncertainty

Once again, we used a similar approach to estimate the effects of the Berkheimer memorandum and the 2019 PEG on first action examination uncertainty. The event indicators are defined as before and included in the regression models. There are data limitations from using the proprietary dataset. For instance, we could not include several application characteristics such as average abstractness, average claim scope (both ICL and ICC), and the variance in abstractness across examiners. Despite this, we were able to include fixed effects, the number of applications, and the number of applications per examiner to alleviate concerns related to our identifying assumptions.

Findings

Descriptive analysis

The figures that descriptively illustrate the findings are presented the *Adjusting to Alice* report. Table 1 provides the mean values and standard deviations for three groups – other technologies, *Alice*-affected technologies, and combined – for the public dataset, before and after the *Alice* decision. *Alice*-affected technologies have a higher degree of abstractness compared to other technologies, but the *Alice* decision did not change the degree of abstractness. For instance, abstractness for *Alice*-affected technologies did not change much after *Alice* (0.02416 to 0.02419). This is desired and reflects the dataset restriction to only those applications filed before the *Alice* decision. The outcomes of interest – the percentage of first office actions with a Section 101 rejection and uncertainty in first action examination – both increased for *Alice*-affected and other technologies; however, the increase in the *Alice*-affected technologies is substantially larger. These differences anticipate the regression findings presented below.

Table 1: Summary Statistics

	Other technologies		*Alice*-affected technologies		Combined	
	mean	*std dev*	*mean*	*std dev*	*mean*	*std dev*
Application Abstractness	0.01679	0.0093403	0.02418	0.012319	0.01923	0.01098
Application Abstractness [before *Alice*]	0.01682	0.0093729	0.02416	0.012343	0.01918	0.01097
Application Abstractness [after Alice]	0.01676	0.0093095	0.02419	0.0123	0.01927	0.011
Percent of § 101 Rejections [before *Alice*]	5.42%	22.63%	21.11%	40.81%	10.45%	30.60%
Percent of § 101 Rejections [after *Alice*]	6.18%	24.08%	28.34%	45.07%	13.68%	34.37%
§ 101 Examination Variance [before *Alice]*	0.02665	0.0454264	0.09105	0.044542	0.03204	0.04872
§ 101 Examination Variance [after *Alice]*	0.02984	0.0547089	0.12266	0.065881	0.03808	0.06171

Regression results

Alice effect on first office action Section 101 rejections

Table 2 presents the main regression findings for the impact of the *Alice* decision on the likelihood of receiving a first office action with a rejection for patent-ineligible subject matter. Model 1 shows the coefficient estimates for the baseline specification (eq. 1). The coefficient, β_1, on the interaction term ($Alice * PatGrp_{it}$) is 0.0466, and is statistically significant at the 1% level. The result shows that the *Alice* decision increased the probability of receiving a Section 101 rejection in the first office action by 4.66 percentage points for a patent application in *Alice*-affected technologies.

Table 2: Regression Results for the Alice Decision on Section 101 Rejections

VARIABLES	Model 1	Model 2	Model 3
Abst		0.528***	0.186***
		(0.0341)	(0.0362)
Alice x PatGrp	0.0466***	0.0467***	0.0140***
	(0.00148)	(0.00148)	(0.00236)
Alice x PatGrp x Abst			1.364***
			(0.0837)
ICC	0.00927***	0.00915***	0.00918***
	(0.000284)	(0.000283)	(0.000284)
ICL	-7.18e-05***	-7.77e-05***	-7.57e-05***
	(3.73e-06)	(3.83e-06)	(3.82e-06)
Constant	0.0909***	0.0830***	0.0879***
	(0.00835)	(0.00836)	(0.00836)
Observations	1,027,924	1,027,924	1,027,924
R-squared	0.308	0.309	0.309
Time FE	Month x Year	Month x Year	Month x Year
Technology FE	USPC	USPC	USPC
Examiner FE	Yes	Yes	Yes

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Model 2 contains the application-level abstractness measure as in eq. (2). The coefficient on our main variable of interest, (*Alice* x PatGrp), remains unchanged. The estimate for the abstractness term is 0.528, indicating that a one standard deviation increase in the abstractness measure leads to a .58 percentage point increase in the probability of receiving a § 101 rejection.[1]

Model 3 reports the results from the specification that contains the triple interaction term between the treatment group, the abstractness measure, and the *Alice* event indicator (eq. 3). The triple interaction term is statistically significant with a coefficient of 1.364. Using the standard deviation from the after-*Alice* abstractness for applications in *Alice*-affected technologies from Table 1 (i.e., 0.0123), the estimate indicates that the *Alice* decision had a

[1] This is calculated using the coefficient estimate from Table 2 and the standard deviation of the abstractness measure for all USPCs in Table 1, (0.01098*0.528).

stronger effect on applications with more abstract language. The probability of receiving a first office action with a rejection for patent-ineligible subject matter increased by 1.7 percentage points (i.e., 1.364*0.0123) for an application with one standard deviation higher degree of abstract language.

Note that the coefficient on (*Alice* x PatGrp) remains statistically significant at the 1% level with a coefficient estimate of 0.014. With both interaction terms positive and significant, the evidence suggests that the *Alice* decision had its impact on *Alice*-affected technologies through two channels, a direct effect on the *Alice*-affected technologies and a further effect when these patent applications contained more abstract language. The combined effect from the Alice decision, when evaluated at the mean abstraction in the *Alice*-affected group, is 4.7 percentage points ($\beta_1 + \beta * .0241896$) and is significant at the 1% level.

Figure 1 displays the point estimates for the interactions terms between *Alice*-affected technologies and the monthly time indicators,($PatGrp_{it} * Month_t$). The base is the month immediately before the *Alice* decision, May 2014. An F-test for the null hypotheses that all the pre-*Alice* interaction terms are significantly different from zero is rejected at the 1% level. Two months, September and October 2013, differ slightly while all the other months are not statistically different from zero using 95% confidence interval. This evidence supports the pre-trends assumption for the difference-in-difference design. Also apparent is a sharp increase in the probability of a Section 101 rejection in the period immediately following *Alice* (July 2014). Using this model, relative to the other technologies, the probability of receiving a first office action with a Section 101 rejection increased by 31% through December 2015.[2]

[2] This is computed in the following way. Let t_1 be the average probability of receiving a Section 101 rejection in the treatment group in May 2014, and t_2 be the average probability of receiving a Section 101 rejection in the treatment group in December 2015. c_1 and c_2 are the averages for the control group in these two periods. Then, 31 percent is $\frac{(t_2-t_1)-(c_2-c_1)}{t_1} * 100$.

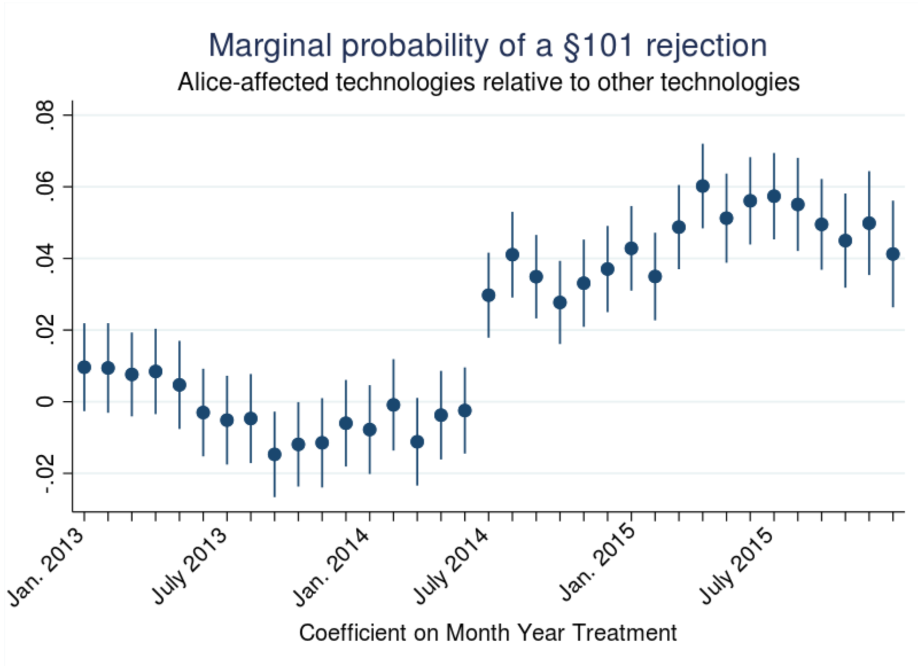


Figure 1: Monthly estimates for the marginal increase in Section101 rejection rates in *Alice*-affected technologies relative to the control technologies (the base period is May 2014). The figure shows a clear change post-*Alice*, and that the pre-trend assumption of constant pre-trends is satisfied for one and a half years before *Alice*.

Berkheimer memo and 2019 PEG effects on first office action Section 101 rejections

Table 3 shows the regression results for the effects of the Berkheimer memorandum and the 2019 PEG on the likelihood of receiving a first office action with a rejection for patent-ineligible subject matter. For comparison, Model 1 in column (2) presents the results previously discussed in Table 2 for the Alice decision. In the next column, Model 5 shows that the Berkheimer memorandum reduced the likelihood of receiving a first office action Section 101 rejection for *Alice*-affected technologies. The estimate is -0.0157 and is statistically significant at the 1% level. It indicates the Berkheimer memo reduced the probability by 1.57 percentage points.

Model 6 shows that the 2019 PEG is associated with a larger decrease in the probability of receiving a first office action with a rejection for patent-ineligible subject matter. The coefficient estimate is over seven times larger at -0.116 and is significant at the 1% level. Using a model similar to eq. 4, the 2019 PEG reduced the likelihood of receiving a first office action with a Section 101 rejection by 25% for Alice-affected technologies between Dec. 2019 and Jan. 2020.[3]

[3] Although equation (4) contains application level co-variates, for reasons described earlier, we do not use these independent variables for this estimate.

Table 3: Regression Results for the Berkheimer Memo and 2019 PEG on Section 101 Rejections

VARIABLES	Model 1	Model 4	Model 5
Alice x PatGrp	0.0466***		
	(0.00148)		
Berkheimer x PatGrp		-0.0157***	
		(0.00179)	
2019 PEG x PatGrp			-0.116***
			(0.00144)
ICC	0.00927***		
	(0.000284)		
ICL	-7.18e-05***		
	(3.73e-06)		
Constant	0.0909***	0.137***	0.137***
	(0.00835)	(0.0117)	(0.00992)
Observations	1,027,924	703,222	1,047,734
R-squared	0.308	0.439	0.387
Time FE	Month x Year	Month x Year	Month x Year
Technology FE	USPC	USPC	USPC
Examiner FE	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Alice effect on first action examination uncertainty

Table 4 presents the results for the effect of the *Alice* decision on first action examination uncertainty. In Model 6 the variable of interest is the interaction term between the *Alice* decision indicator and the group of *Alice*-affected technologies from eq. 5, *Alice* x PatGrp. The coefficient estimate is positive and statistically significant at the 1% level. For *Alice*-affected technologies, the size of the estimate indicates that the variance across examiners in Section 101 determinations increased by roughly 61% using the standard deviation observed before the Alice decision (information from Table 1, 61%=0.0272/0.044542*100).

Table 4: Regression Results for the Alice Decision on Examination Uncertainty

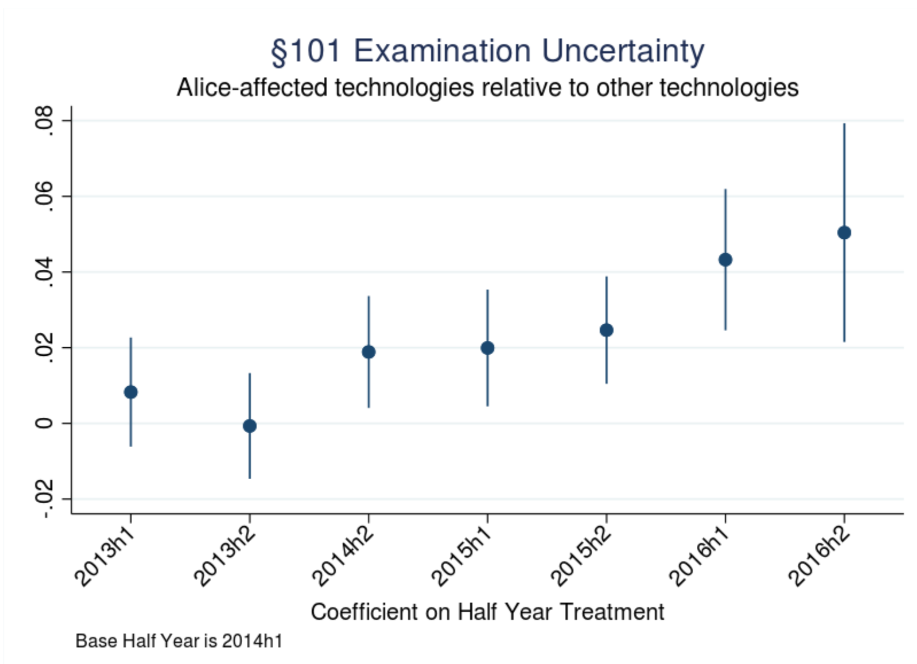
VARIABLES	Model 6	Model 7	Model 8
Avg. abstractness		-1.446	-1.458
		(0.946)	(0.894)
Alice x PatGrp	0.0272***	0.0272***	0.0218
	(0.00453)	(0.00447)	(0.0473)
Alice x PatGrp x Avg. abstractness			0.230
			(1.947)
Avg. number of independent claims	-0.00409	-0.00329	-0.00325
	(0.00465)	(0.00450)	(0.00438)
Avg. word count in claims	-9.23e-05	-7.50e-05	-7.45e-05
	(8.29e-05)	(8.47e-05)	(8.39e-05)
Avg. examiner variance	0.144*	0.148*	0.150*
	(0.0826)	(0.0809)	(0.0837)
Number of examiners	-0.000105***	-0.000105***	-0.000105***
	(3.32e-05)	(3.29e-05)	(3.32e-05)
Number of applications	8.36e-06**	8.45e-06**	8.48e-06**
	(3.77e-06)	(3.77e-06)	(3.76e-06)
Avg. applications per examiner	-0.00350***	-0.00348***	-0.00347***
	(0.000780)	(0.000775)	(0.000776)
Variance in abstractness	-43.60	-20.96	-21.08
	(54.07)	(49.25)	(49.18)
Constant	0.0791***	0.0977***	0.0978***
	(0.0179)	(0.0206)	(0.0206)
Observations	3,030	3,030	3,030
R-squared	0.551	0.552	0.552
Time FE	Half Year	Half Year	Half Year
Technology FE	USPC	USPC	USPC

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

In Model 7, the average abstractness of the patent applications in the technology-half years is added as a co-variate. It is not statistically significant and does not have a direct effect on first action examination uncertainty. Note that the main variable of interest does not change in magnitude or significance. Looking at Model 8 with the triple interaction term, the coefficient estimate is not significant. Note that including the triple interaction term dramatically increased the standard error for *Alice* x PatGrp and produced a statistically insignificant result. That does not mean that our main variable no longer holds, rather it reflects multicollinearity and indicates that Model 3 is not appropriate. We tested the significance of the overall effect using the mean of the abstractness co-variate, $(\beta_1 + \beta_3 * .0234711)$. It is significant and the main effect remains at 0.0272.

Also of interest are the variance controls in the regressions. As expected, the average number of applications per examiner reduced the variation in Section 101 determinations across examiners. Also as expected, average examiner variance for their own Section 101 determinations (i.e., within-examiner) is associated with greater first action examination uncertainty. The variance of abstractness from incoming applications is insignificant, which is consistent with the findings for the other application language abstractness co-variates.

Figure 2 is a coefficient plot from eq. (6) that shows the interactions between the *Alice*-affected technologies group and the half-year time indicators. The base period is the half year directly preceding *Alice* (the first half of 2014). There is a substantial and persistent increase immediately after *Alice*. Further, the pre-trend assumption is satisfied throughout the pre-event period (none of the pre-*Alice* coefficients are statistically different from zero). Using this model and relative to the other technologies, first action examination uncertainty for Alice-affected technologies increased by 26% by December 2015.[4]



[4] This computation is identical to that described in the percentage change footnote in the previous section.

Figure 2: Examination uncertainty in *Alice*-affected technologies relative to other technologies. This figure shows the coefficients for the treatment group interacted with each half year time period in model (8). Importantly, the pre-trend is statistically indistinguishable from zero, where the base period is the first half of 2014. Further, examiner uncertainty increases in the *Alice*-affected technologies post *Alice*.

Berkheimer memo and 2019 PEG effects on first action examination uncertainty

Table 5 shows the regression results for the effects of the Berkheimer memorandum and the 2019 PEG on first action examination uncertainty. For comparison, Model 6 in column (2) presents the results previously discussed for the Alice decision from Table 4. Model 9, in the next column, shows that the Berkheimer memorandum had a negative, but statistically insignificant effect on first action examination uncertainty. This means that Berkheimer memorandum did not have a statistically distinct effect on *Alice*-affected technologies relative to other technologies.

Model 10 in Table 5 shows that the 2019 PEG reduced first action examination uncertainty. The coefficient is negative and significant at the 1% level. Using a model with time period interactions with the Alice-affected technologies (similar to the model in equation (6)), relative to the other technologies, first action examination uncertainty decreased by 44% in the 12 months following the issuance of the 2019 PEG.

Table 5: Regression Results for the Berkheimer memo and 2019 PEG on Examination Uncertainty

VARIABLES	Model 6	Model 9	Model 10
Alice x PatGrp	0.0272***		
	(0.00453)		
Berkheimer x PatGrp		-0.00742	
		(0.00521)	
2019 PEG x PatGrp			-0.0369***
			(0.00473)
Avg. number of independent claims	-0.00409		
	(0.00465)		
Avg. word count in claims	-9.23e-05		
	(8.29e-05)		
Avg. examiner variance	0.144*	0.0995	0.139**
	(0.0826)	(0.0710)	(0.0686)
Number of examiners	-0.000105***	-7.45e-05**	-7.28e-05***
	(3.32e-05)	(3.25e-05)	(2.23e-05)
Number of applications	8.36e-06**	7.40e-06	1.08e-06
	(3.77e-06)	(6.01e-06)	(3.49e-06)
Avg. applications per examiner	-0.00350***	-0.00185***	-0.000616**
	(0.000780)	(0.000596)	(0.000287)
Variance in abstractness	-43.60		
	(54.07)		
Constant	0.0791***	0.0509***	0.0368***
	(0.0179)	(0.00425)	(0.00301)
Observations	3,030	2,361	2,747
R-squared	0.551	0.645	0.605
Time FE	Half Year	Half Year	Half Year
Technology FE	USPC	USPC	USPC

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Robustness checks for the impact of *Alice*

Assessing dataset restrictions

The analysis focused on the first action stage of patent examination and restricted the datasets to only those patent applications filed before the events of interest in order to minimize the influence of other decision makers on our results. By limiting the datasets to applications filed before the *Alice* decision, we induced a mechanical drop in the number of observations over time – as examiners completed first office actions the remaining pool of applications awaiting a first office action shrinks. This is potentially problematic for our estimates of first action examination uncertainty since fewer applications with first actions will artificially increase the variance across examiners in a way that does not reflect variation in decision-making. We added several co-variates to help capture part of this effect such as the number of applications, the number of applications per examiner, and a flexible time trend using indicator variables.

Figure 3 illustrates the implications of the dataset restriction. It shows the percentage of first office action non-final and final rejections in our dataset relative to the total number of first action rejections in each period. The left censoring reflects the construction of the USPTO Office Action Research Dataset for Patents dataset. It includes patent applications with series numbers that start with 12, 13, 14 and 15, rather including all applications in a fixed period time (see https://www.uspto.gov/patents-application-process/checking-application-status/search-application). In figure 3, the vertical bar shows the month of the *Alice* decision, June 2014. As expected, the percentage of first action rejections in our dataset starts to decrease immediately. By December 2015, the percentage had decreased to approximately 45%.

To test the sensitivity of our results on examination uncertainty shown in Table 4, we re-estimated the regression models using the time window of 2013 through 2015. Table 6, Models 11 and 12, shows that the effect of the *Alice* decision on first action examination uncertainty is slightly smaller in magnitude, but statistically significant at the 1% level. Unlike in Table 4, the triple interaction term in Model 13 is positive and statistically significant at the 5% level. This result suggests that the abstract language content of patent applications further increased first action examination uncertainty. The total treatment effect is .018 ($\beta_1 + \beta_3 * .0234302$) and is significant at the 1% level.

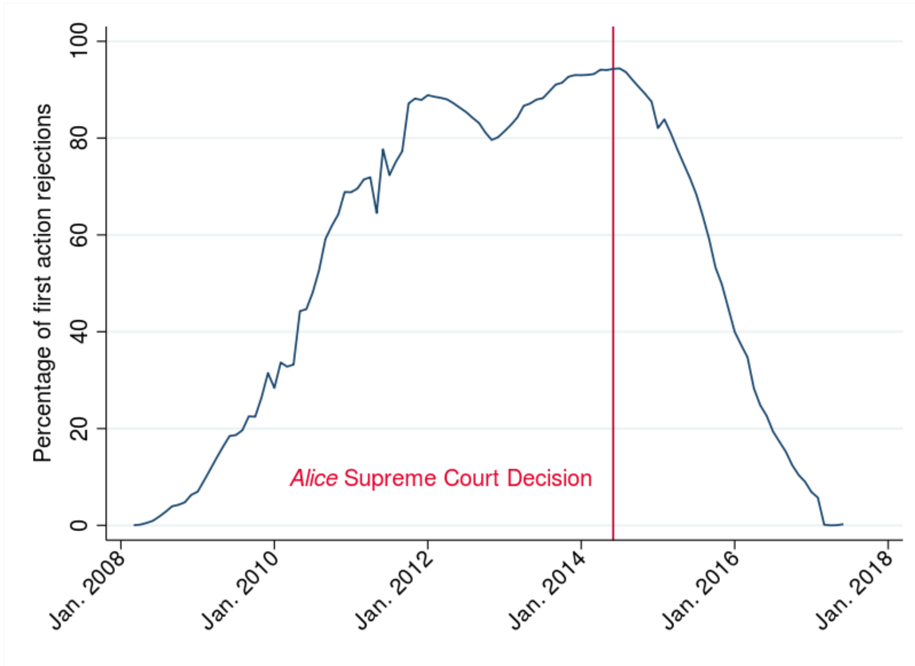


Figure 3: Percentage of first office action rejections in dataset

Table 6: Regression Results for the Test of Dataset Restriction on Applications

VARIABLES	Model 11	Model 12	Model 13
Avg. abstractness		**-0.904**	**-0.907**
		(0.869)	**(0.870)**
Alice x PatGrp	**0.0185*** **	**0.0185*** **	**-0.0165**
	(0.00363)	**(0.00364)**	**(0.0154)**
Alice x PatGrp x Avg. abstractness			**1.488** **
			(0.629)
Avg. number of independent claims	-0.00509	-0.00483	-0.00478
	(0.00584)	(0.00575)	(0.00575)
Avg. word count in claims	-4.23e-05	-3.15e-05	-2.89e-05
	(9.40e-05)	(9.42e-05)	(9.43e-05)
Avg. examiner variance	0.347***	0.351***	0.358***
	(0.0664)	(0.0667)	(0.0667)
Number of examiners	7.86e-05**	7.87e-05**	7.06e-05*
	(3.88e-05)	(3.87e-05)	(3.80e-05)
Number of applications	-3.72e-06	-3.74e-06	-3.55e-06
	(3.57e-06)	(3.56e-06)	(3.42e-06)
Avg. applications per examiner	-0.000935*	-0.000949*	-0.000917*
	(0.000486)	(0.000484)	(0.000483)
Variance in abstractness	-16.58	-7.877	-7.518
	(39.39)	(38.90)	(38.90)
Constant	0.0480**	0.0607**	0.0605**
	(0.0205)	(0.0259)	(0.0259)
Observations	2,358	2,358	2,358
R-squared	0.633	0.634	0.634
Time FE	Half Year	Half Year	Half Year
Technology FE	USPC	USPC	USPC

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Assessing the Influence of Supreme Court Case *Bilski v. Kappos*

As discussed in the data construction section, the time dimension for this analysis started in 2013 instead of 2011. This choice was made to minimize any impact from the *Bilski* decision on the pre-event trends for *Alice*-affected technologies and other technologies. Rather than limiting the pre-event period, this robustness check allows for a linear time trend difference between the *Alice*-affected and other technologies to account for the impact of *Bilski*. Specifically, we re-run our specifications with the term $t * PatGroup_{it}$ on the sample (2011 – 2016), and assess the appropriateness of a linear time trend using equations (4) and (6).

The regression results, not shown but available upon request, indicate the *Alice* decision had a larger effect on the likelihood of receiving a first office action with a Section 101 rejection, 0.0596 and significant at the 1% level. For first action examination uncertainty, the magnitude was almost the same, -0.0241 and significant at the 1% level. The main results hold up to expanding the dataset time period to 2011, the earliest dataset date permitted by available data.

Potential effects of *Alice* on first office action 102/103/112 rejections

In the final robustness check, we assess the impact of *Alice* on the other main rejection types issued by examiners in the first office action, including Section 102 (novelty), Section 103 (non-obviousness) and Section 112 (clarity and enablement). *Alice* should not impact an examiner's use of these other rejection types for two reasons: (1) *Alice* clarified the law on subject matter eligibility (not novelty, non-obviousness or clarity and enablement issues); and (2), examiners are trained to issue all grounds of rejection on the first office action under the USPTO's compact prosecution policy.[5] The second point implies that examiners shouldn't substitute away from other rejections when issuing more Section 101 rejections after *Alice*.

We estimate equations (4) and (6) with each of the other rejections types. The time period point estimates are provided in Figures 4-9 below. Importantly, none of the figures show a statistically significant discontinuous jump in the rejection rates after *Alice*.

[5] A description of the USPTO's compact prosecution policy is located at: https://www.uspto.gov/web/offices/pac/mpep/s2103.html

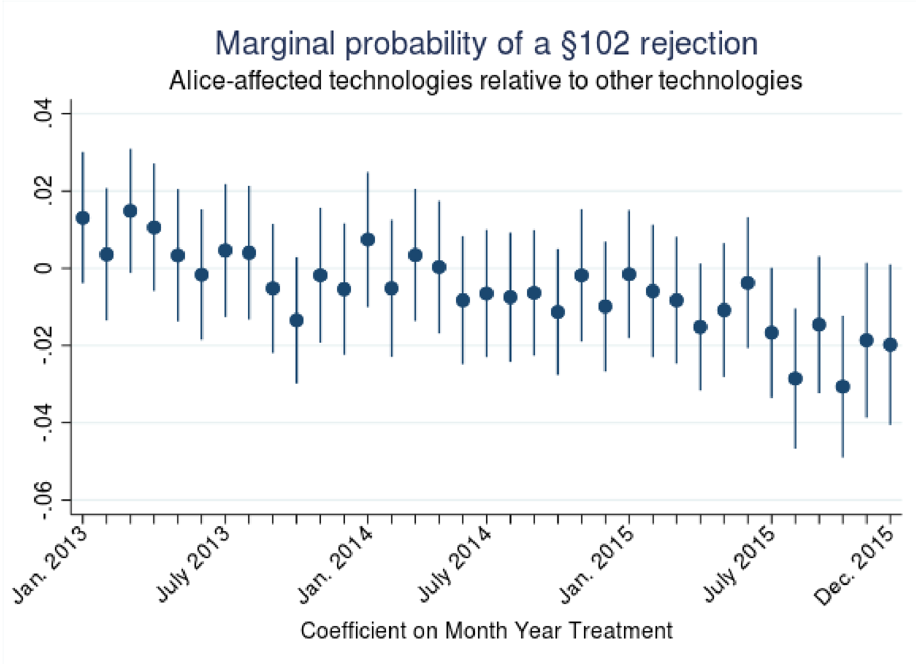


Figure 4: Regression coefficients for Section 102 rejections

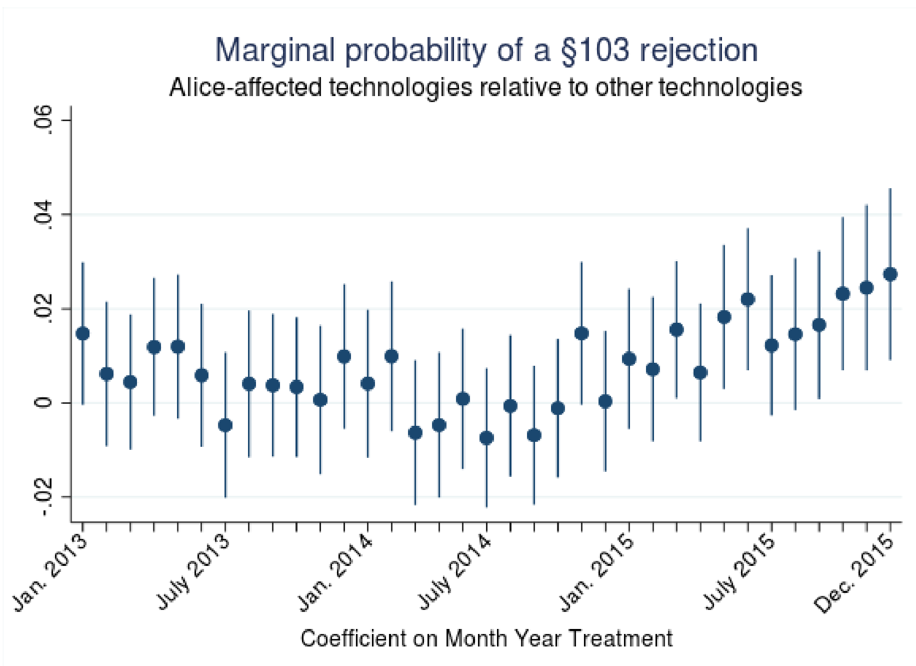


Figure 5: Regression coefficients for Section 103 rejections

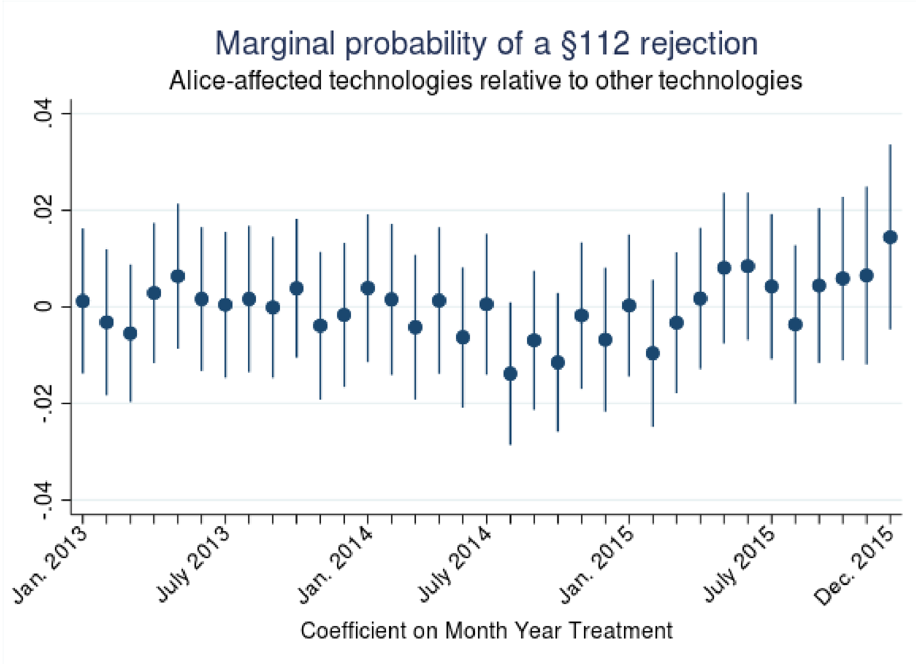


Figure 6: Regression coefficients for Section 112 rejections

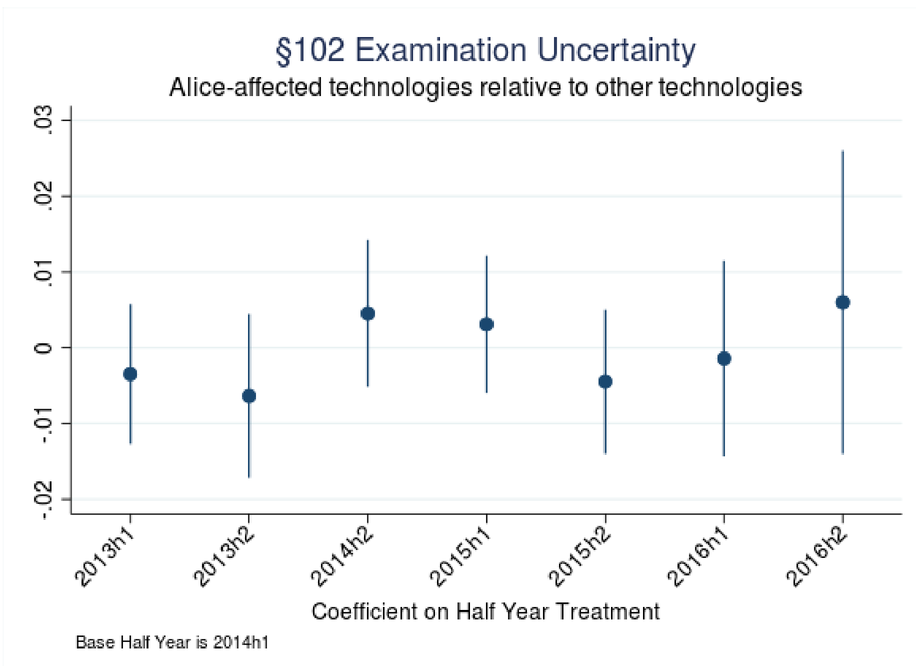


Figure 7: Regression coefficients for Section 102 examination uncertainty

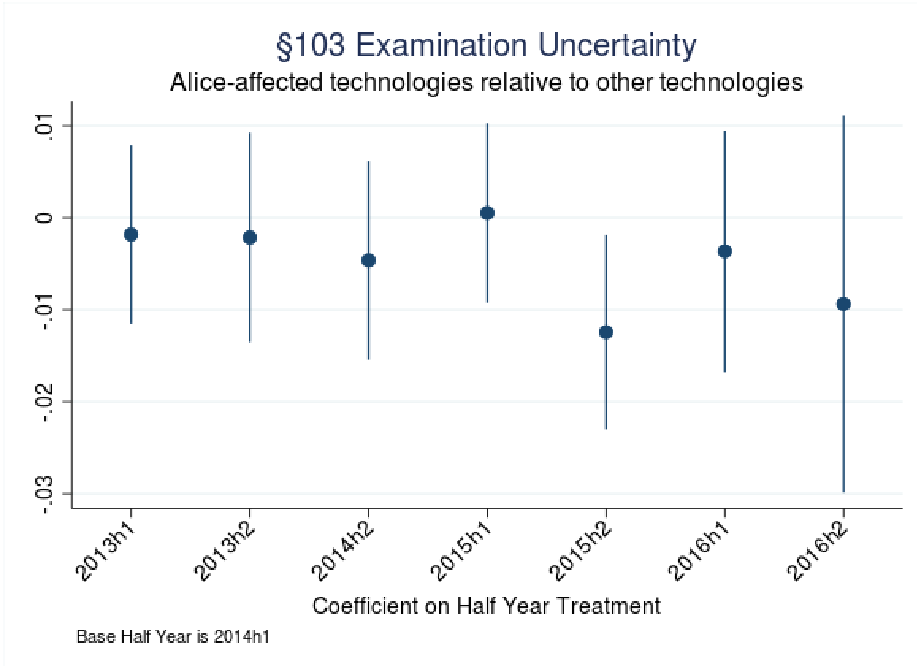


Figure 8: Regression coefficients for Section 103 examination uncertainty

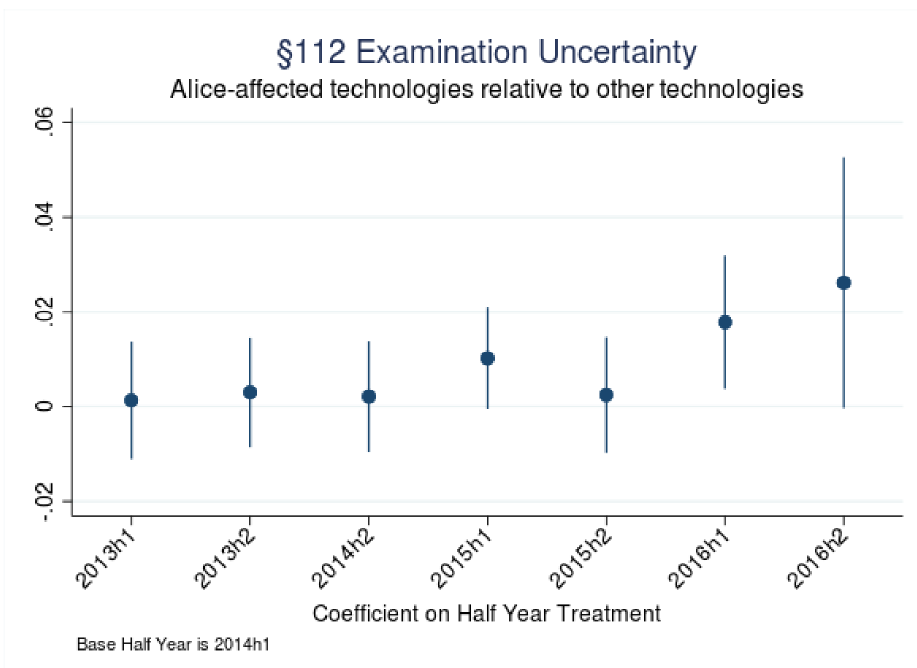


Figure 9: Regression coefficients for Section 112 examination uncertainty

U.S. patent classifications used in the report

The following table listed the U.S. Patent Classifications (USPCs) included in the groups defined as *Alice*-affected and other technologies.

Table 7: U.S. Patent Classifications in *Adjusting to Alice* report

USPC number or range (3-digit)	Alice-affected or other technology group	Description
73	Alice-affected	MEASURING AND TESTING
175	Alice-affected	BORING OR PENETRATING THE EARTH
187	Alice-affected	ELEVATOR, INDUSTRIAL LIFT TRUCK, OR STATIONARY LIFT FOR VEHICLE
235	Alice-affected	REGISTERS
273	Alice-affected	AMUSEMENT DEVICES: GAMES
320	Alice-affected	ELECTRICITY: BATTERY OR CAPACITOR CHARGING OR DISCHARGING
340	Alice-affected	COMMUNICATIONS: ELECTRICAL
342	Alice-affected	COMMUNICATIONS: DIRECTIVE RADIO WAVE SYSTEMS AND DEVICES (E.G., RADAR, RADIO NAVIGATION)

343	Alice-affected	COMMUNICATIONS: RADIO WAVE ANTENNAS
345	Alice-affected	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS
358	Alice-affected	FACSIMILE AND STATIC PRESENTATION PROCESSING
370	Alice-affected	MULTIPLEX COMMUNICATIONS
379	Alice-affected	TELEPHONIC COMMUNICATIONS
380	Alice-affected	CRYPTOGRAPHY
382	Alice-affected	IMAGE ANALYSIS
424	Alice-affected	DRUG, BIO-AFFECTING AND BODY TREATING COMPOSITIONS
434	Alice-affected	EDUCATION AND DEMONSTRATION
435	Alice-affected	CHEMISTRY: MOLECULAR BIOLOGY AND MICROBIOLOGY
436	Alice-affected	CHEMISTRY: ANALYTICAL AND IMMUNOLOGICAL TESTING

455	Alice-affected	TELECOMMUNICATIONS
463	Alice-affected	AMUSEMENT DEVICES: GAMES
564	Alice-affected	ORGANIC COMPOUNDS -- PART OF THE CLASS 532-570 SERIES
700	Alice-affected	DATA PROCESSING: GENERIC CONTROL SYSTEMS OR SPECIFIC APPLICATIONS
704	Alice-affected	DATA PROCESSING: SPEECH SIGNAL PROCESSING, LINGUISTICS, LANGUAGE TRANSLATION, AND AUDIO COMPRESSION/DECOMPRESSION
705	Alice-affected	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION
707	Alice-affected	DATA PROCESSING: DATABASE AND FILE MANAGEMENT OR DATA STRUCTURES
708	Alice-affected	ELECTRICAL COMPUTERS: ARITHMETIC PROCESSING AND CALCULATING
709	Alice-affected	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING
711	Alice-affected	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MEMORY
713	Alice-affected	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT

715	Alice-affected	DATA PROCESSING: PRESENTATION PROCESSING OF DOCUMENT, OPERATOR INTERFACE PROCESSING, AND SCREEN SAVER DISPLAY PROCESSING
725	Alice-affected	INTERACTIVE VIDEO DISTRIBUTION SYSTEMS
726	Alice-affected	INFORMATION SECURITY
2	Other technologies	APPAREL
4	Other technologies	BATHS, CLOSETS, SINKS, AND SPITTOONS
5	Other technologies	BEDS
7	Other technologies	COMPOUND TOOLS
8	Other technologies	BLEACHING AND DYEING; FLUID TREATMENT AND CHEMICAL MODIFICATION OF TEXTILES AND FIBERS
12	Other technologies	BOOT AND SHOE MAKING
14	Other technologies	BRIDGES
15	Other technologies	BRUSHING, SCRUBBING, AND GENERAL CLEANING

16	Other technologies	MISCELLANEOUS HARDWARE (E.G., BUSHING, CARPET FASTENER, CASTER, DOOR CLOSER, PANEL HANGER, ATTACHABLE OR ADJUNCT HANDLE, HINGE, WINDOW SASH BALANCE, ETC.)
19	Other technologies	TEXTILES: FIBER PREPARATION
23	Other technologies	CHEMISTRY: PHYSICAL PROCESSES
24	Other technologies	BUCKLES, BUTTONS, CLASPS, ETC
26	Other technologies	TEXTILES: CLOTH FINISHING
27	Other technologies	UNDERTAKING
28	Other technologies	TEXTILES: MANUFACTURING
30	Other technologies	CUTLERY
33	Other technologies	GEOMETRICAL INSTRUMENTS
34	Other technologies	DRYING AND GAS OR VAPOR CONTACT WITH SOLIDS
36	Other technologies	BOOTS, SHOES, AND LEGGINGS

37	Other technologies	EXCAVATING
38	Other technologies	TEXTILES: IRONING OR SMOOTHING
40	Other technologies	CARD, PICTURE, OR SIGN EXHIBITING
42	Other technologies	FIREARMS
43	Other technologies	FISHING, TRAPPING, AND VERMIN DESTROYING
44	Other technologies	FUEL AND RELATED COMPOSITIONS
47	Other technologies	PLANT HUSBANDRY
48	Other technologies	GAS: HEATING AND ILLUMINATING
49	Other technologies	MOVABLE OR REMOVABLE CLOSURES
51	Other technologies	ABRASIVE TOOL MAKING PROCESS, MATERIAL, OR COMPOSITION
52	Other technologies	STATIC STRUCTURES (E.G., BUILDINGS)

53	Other technologies	PACKAGE MAKING
54	Other technologies	HARNESS FOR WORKING ANIMAL
55	Other technologies	GAS SEPARATION
56	Other technologies	HARVESTERS
57	Other technologies	TEXTILES: SPINNING, TWISTING, AND TWINING
59	Other technologies	CHAIN, STAPLE, AND HORSESHOE MAKING
60	Other technologies	POWER PLANTS
62	Other technologies	REFRIGERATION
63	Other technologies	JEWELRY
65	Other technologies	GLASS MANUFACTURING
66	Other technologies	TEXTILES: KNITTING

68	Other technologies	TEXTILES: FLUID TREATING APPARATUS
69	Other technologies	LEATHER MANUFACTURES
70	Other technologies	LOCKS
71	Other technologies	CHEMISTRY: FERTILIZERS
72	Other technologies	METAL DEFORMING
74	Other technologies	MACHINE ELEMENT OR MECHANISM
75	Other technologies	SPECIALIZED METALLURGICAL PROCESSES, COMPOSITIONS FOR USE THEREIN, CONSOLIDATED METAL POWDER COMPOSITIONS, AND LOOSE METAL PARTICULATE MIXTURES
76	Other technologies	METAL TOOLS AND IMPLEMENTS, MAKING
81	Other technologies	TOOLS
82	Other technologies	TURNING
83	Other technologies	CUTTING

84	Other technologies	MUSIC
86	Other technologies	AMMUNITION AND EXPLOSIVE-CHARGE MAKING
87	Other technologies	TEXTILES: BRAIDING, NETTING, AND LACE MAKING
89	Other technologies	ORDNANCE
91	Other technologies	MOTORS: EXPANSIBLE CHAMBER TYPE
92	Other technologies	EXPANSIBLE CHAMBER DEVICES
95	Other technologies	GAS SEPARATION: PROCESSES
96	Other technologies	GAS SEPARATION: APPARATUS
99	Other technologies	FOODS AND BEVERAGES: APPARATUS
100	Other technologies	PRESSES
101	Other technologies	PRINTING

102	Other technologies	AMMUNITION AND EXPLOSIVES
104	Other technologies	RAILWAYS
105	Other technologies	RAILWAY ROLLING STOCK
106	Other technologies	COMPOSITIONS: COATING OR PLASTIC
108	Other technologies	HORIZONTALLY SUPPORTED PLANAR SURFACES
109	Other technologies	SAFES, BANK PROTECTION, OR A RELATED DEVICE
110	Other technologies	FURNACES
111	Other technologies	PLANTING
112	Other technologies	SEWING
114	Other technologies	SHIPS
116	Other technologies	SIGNALS AND INDICATORS

117	Other technologies	SINGLE-CRYSTAL, ORIENTED-CRYSTAL, AND EPITAXY GROWTH PROCESSES; NON-COATING APPARATUS THEREFOR
118	Other technologies	COATING APPARATUS
119	Other technologies	ANIMAL HUSBANDRY
122	Other technologies	LIQUID HEATERS AND VAPORIZERS
123	Other technologies	INTERNAL-COMBUSTION ENGINES
124	Other technologies	MECHANICAL GUNS AND PROJECTORS
125	Other technologies	STONE WORKING
126	Other technologies	STOVES AND FURNACES
127	Other technologies	SUGAR, STARCH, AND CARBOHYDRATES
128	Other technologies	SURGERY
131	Other technologies	TOBACCO

132	Other technologies	TOILET
134	Other technologies	CLEANING AND LIQUID CONTACT WITH SOLIDS
135	Other technologies	TENT, CANOPY, UMBRELLA, OR CANE
136	Other technologies	BATTERIES: THERMOELECTRIC AND PHOTOELECTRIC
137	Other technologies	FLUID HANDLING
138	Other technologies	PIPES AND TUBULAR CONDUITS
139	Other technologies	TEXTILES: WEAVING
140	Other technologies	WIREWORKING
141	Other technologies	FLUENT MATERIAL HANDLING, WITH RECEIVER OR RECEIVER COACTING MEANS
142	Other technologies	WOOD TURNING
144	Other technologies	WOODWORKING

147	Other technologies	COOPERING
148	Other technologies	METAL TREATMENT
149	Other technologies	EXPLOSIVE AND THERMIC COMPOSITIONS OR CHARGES
150	Other technologies	PURSES, WALLETS, AND PROTECTIVE COVERS
152	Other technologies	RESILIENT TIRES AND WHEELS
156	Other technologies	ADHESIVE BONDING AND MISCELLANEOUS CHEMICAL MANUFACTURE
157	Other technologies	WHEELWRIGHT MACHINES
159	Other technologies	CONCENTRATING EVAPORATORS
160	Other technologies	FLEXIBLE OR PORTABLE CLOSURE, PARTITION, OR PANEL
163	Other technologies	NEEDLE AND PIN MAKING
164	Other technologies	METAL FOUNDING

165	Other technologies	HEAT EXCHANGE
166	Other technologies	WELLS
168	Other technologies	FARRIERY
169	Other technologies	FIRE EXTINGUISHERS
171	Other technologies	UNEARTHING PLANTS OR BURIED OBJECTS
172	Other technologies	EARTH WORKING
173	Other technologies	TOOL DRIVING OR IMPACTING
174	Other technologies	ELECTRICITY: CONDUCTORS AND INSULATORS
177	Other technologies	WEIGHING SCALES
178	Other technologies	TELEGRAPHY
180	Other technologies	MOTOR VEHICLES

181	Other technologies	ACOUSTICS
182	Other technologies	FIRE ESCAPE, LADDER, OR SCAFFOLD
184	Other technologies	LUBRICATION
185	Other technologies	MOTORS: SPRING, WEIGHT, OR ANIMAL POWERED
186	Other technologies	MERCHANDISING
188	Other technologies	BRAKES
190	Other technologies	TRUNKS AND HAND-CARRIED LUGGAGE
191	Other technologies	ELECTRICITY: TRANSMISSION TO VEHICLES
192	Other technologies	192 CLUTCHES AND POWER-STOP CONTROL
193	Other technologies	CONVEYORS, CHUTES, SKIDS, GUIDES, AND WAYS
194	Other technologies	CHECK-ACTUATED CONTROL MECHANISMS

196	Other technologies	MINERAL OILS: APPARATUS
198	Other technologies	CONVEYORS: POWER-DRIVEN
200	Other technologies	ELECTRICITY: CIRCUIT MAKERS AND BREAKERS
201	Other technologies	DISTILLATION: PROCESSES, THERMOLYTIC
202	Other technologies	DISTILLATION: APPARATUS
203	Other technologies	DISTILLATION: PROCESSES, SEPARATORY
204	Other technologies	CHEMISTRY: ELECTRICAL AND WAVE ENERGY
205	Other technologies	ELECTROLYSIS: PROCESSES, COMPOSITIONS USED THEREIN, AND METHODS OF PREPARING THE COMPOSITIONS
206	Other technologies	SPECIAL RECEPTACLE OR PACKAGE
208	Other technologies	MINERAL OILS: PROCESSES AND PRODUCTS
209	Other technologies	CLASSIFYING, SEPARATING, AND ASSORTING SOLIDS

210	Other technologies	LIQUID PURIFICATION OR SEPARATION
211	Other technologies	SUPPORTS: RACKS
212	Other technologies	TRAVERSING HOISTS
213	Other technologies	RAILWAY DRAFT APPLIANCES
215	Other technologies	BOTTLES AND JARS
216	Other technologies	ETCHING A SUBSTRATE: PROCESSES
217	Other technologies	WOODEN RECEPTACLES
218	Other technologies	HIGH-VOLTAGE SWITCHES WITH ARC PREVENTING OR EXTINGUISHING DEVICES
219	Other technologies	ELECTRIC HEATING
220	Other technologies	RECEPTACLES
221	Other technologies	ARTICLE DISPENSING

222	Other technologies	DISPENSING
223	Other technologies	APPAREL APPARATUS
224	Other technologies	PACKAGE AND ARTICLE CARRIERS
225	Other technologies	SEVERING BY TEARING OR BREAKING
226	Other technologies	ADVANCING MATERIAL OF INDETERMINATE LENGTH
227	Other technologies	ELONGATED-MEMBER-DRIVING APPARATUS
228	Other technologies	METAL FUSION BONDING
229	Other technologies	ENVELOPES, WRAPPERS, AND PAPERBOARD BOXES
231	Other technologies	WHIPS AND WHIP APPARATUS
232	Other technologies	DEPOSIT AND COLLECTION RECEPTACLES
234	Other technologies	SELECTIVE CUTTING (E.G., PUNCHING)

236	Other technologies	AUTOMATIC TEMPERATURE AND HUMIDITY REGULATION
237	Other technologies	HEATING SYSTEMS
238	Other technologies	RAILWAYS: SURFACE TRACK
239	Other technologies	FLUID SPRINKLING, SPRAYING, AND DIFFUSING
241	Other technologies	SOLID MATERIAL COMMINUTION OR DISINTEGRATION
242	Other technologies	WINDING, TENSIONING, OR GUIDING
244	Other technologies	AERONAUTICS AND ASTRONAUTICS
245	Other technologies	WIRE FABRICS AND STRUCTURE
246	Other technologies	RAILWAY SWITCHES AND SIGNALS
248	Other technologies	SUPPORTS
249	Other technologies	STATIC MOLDS

250	Other technologies	RADIANT ENERGY
251	Other technologies	VALVES AND VALVE ACTUATION
252	Other technologies	COMPOSITIONS
254	Other technologies	IMPLEMENTS OR APPARATUS FOR APPLYING PUSHING OR PULLING FORCE
256	Other technologies	FENCES
257	Other technologies	ACTIVE SOLID-STATE DEVICES (E.G., TRANSISTORS, SOLID-STATE DIODES)
258	Other technologies	RAILWAY MAIL DELIVERY
260	Other technologies	CHEMISTRY OF CARBON COMPOUNDS
261	Other technologies	GAS AND LIQUID CONTACT APPARATUS
264	Other technologies	PLASTIC AND NONMETALLIC ARTICLE SHAPING OR TREATING: PROCESSES
266	Other technologies	METALLURGICAL APPARATUS

267	Other technologies	SPRING DEVICES
269	Other technologies	WORK HOLDERS
270	Other technologies	SHEET-MATERIAL ASSOCIATING
271	Other technologies	SHEET FEEDING OR DELIVERING
277	Other technologies	SEAL FOR A JOINT OR JUNCTURE
279	Other technologies	CHUCKS OR SOCKETS
280	Other technologies	LAND VEHICLES
281	Other technologies	BOOKS, STRIPS, AND LEAVES
283	Other technologies	PRINTED MATTER
285	Other technologies	PIPE JOINTS OR COUPLINGS
289	Other technologies	KNOTS AND KNOT TYING

290	Other technologies	PRIME-MOVER DYNAMO PLANTS
291	Other technologies	TRACK SANDERS
292	Other technologies	CLOSURE FASTENERS
293	Other technologies	VEHICLE FENDERS
294	Other technologies	HANDLING: HAND AND HOIST-LINE IMPLEMENTS
295	Other technologies	RAILWAY WHEELS AND AXLES
296	Other technologies	LAND VEHICLES: BODIES AND TOPS
297	Other technologies	CHAIRS AND SEATS
298	Other technologies	LAND VEHICLES: DUMPING
299	Other technologies	MINING OR IN SITU DISINTEGRATION OF HARD MATERIAL
300	Other technologies	BRUSH, BROOM, AND MOP MAKING

301	Other technologies	LAND VEHICLES: WHEELS AND AXLES
303	Other technologies	FLUID-PRESSURE AND ANALOGOUS BRAKE SYSTEMS
305	Other technologies	WHEEL SUBSTITUTES FOR LAND VEHICLES
307	Other technologies	ELECTRICAL TRANSMISSION OR INTERCONNECTION SYSTEMS
310	Other technologies	ELECTRICAL GENERATOR OR MOTOR STRUCTURE
312	Other technologies	SUPPORTS: CABINET STRUCTURE
313	Other technologies	ELECTRIC LAMP AND DISCHARGE DEVICES
315	Other technologies	ELECTRIC LAMP AND DISCHARGE DEVICES: SYSTEMS
318	Other technologies	ELECTRICITY: MOTIVE POWER SYSTEMS
322	Other technologies	ELECTRICITY: SINGLE GENERATOR SYSTEMS
323	Other technologies	ELECTRICITY: POWER SUPPLY OR REGULATION SYSTEMS

324	Other technologies	ELECTRICITY: MEASURING AND TESTING
326	Other technologies	ELECTRONIC DIGITAL LOGIC CIRCUITRY
327	Other technologies	MISCELLANEOUS ACTIVE ELECTRICAL NONLINEAR DEVICES, CIRCUITS, AND SYSTEMS
329	Other technologies	DEMODULATORS
330	Other technologies	AMPLIFIERS
331	Other technologies	OSCILLATORS
332	Other technologies	MODULATORS
333	Other technologies	WAVE TRANSMISSION LINES AND NETWORKS
334	Other technologies	TUNERS
335	Other technologies	ELECTRICITY: MAGNETICALLY OPERATED SWITCHES, MAGNETS, AND ELECTROMAGNETS
336	Other technologies	INDUCTOR DEVICES

337	Other technologies	ELECTRICITY: ELECTROTHERMALLY OR THERMALLY ACTUATED SWITCHES
338	Other technologies	ELECTRICAL RESISTORS
341	Other technologies	CODED DATA GENERATION OR CONVERSION
346	Other technologies	RECORDERS
347	Other technologies	INCREMENTAL PRINTING OF SYMBOLIC INFORMATION
348	Other technologies	TELEVISION
349	Other technologies	LIQUID CRYSTAL CELLS, ELEMENTS AND SYSTEMS
351	Other technologies	OPTICS: EYE EXAMINING, VISION TESTING AND CORRECTING
352	Other technologies	OPTICS: MOTION PICTURES
353	Other technologies	OPTICS: IMAGE PROJECTORS
355	Other technologies	PHOTOCOPYING

356	Other technologies	OPTICS: MEASURING AND TESTING
359	Other technologies	OPTICAL: SYSTEMS AND ELEMENTS
360	Other technologies	DYNAMIC MAGNETIC INFORMATION STORAGE OR RETRIEVAL
361	Other technologies	ELECTRICITY: ELECTRICAL SYSTEMS AND DEVICES
362	Other technologies	ILLUMINATION
363	Other technologies	ELECTRIC POWER CONVERSION SYSTEMS
365	Other technologies	STATIC INFORMATION STORAGE AND RETRIEVAL
366	Other technologies	AGITATING
367	Other technologies	COMMUNICATIONS, ELECTRICAL: ACOUSTIC WAVE SYSTEMS AND DEVICES
368	Other technologies	HOROLOGY: TIME MEASURING SYSTEMS OR DEVICES
369	Other technologies	DYNAMIC INFORMATION STORAGE OR RETRIEVAL

372	Other technologies	COHERENT LIGHT GENERATORS
373	Other technologies	INDUSTRIAL ELECTRIC HEATING FURNACES
374	Other technologies	THERMAL MEASURING AND TESTING
375	Other technologies	PULSE OR DIGITAL COMMUNICATIONS
376	Other technologies	INDUCED NUCLEAR REACTIONS: PROCESSES, SYSTEMS, AND ELEMENTS
377	Other technologies	ELECTRICAL PULSE COUNTERS, PULSE DIVIDERS, OR SHIFT REGISTERS: CIRCUITS AND SYSTEMS
378	Other technologies	X-RAY OR GAMMA RAY SYSTEMS OR DEVICES
381	Other technologies	ELECTRICAL AUDIO SIGNAL PROCESSING SYSTEMS AND DEVICES
383	Other technologies	FLEXIBLE BAGS
384	Other technologies	BEARINGS
385	Other technologies	OPTICAL WAVEGUIDES

386	Other technologies	MOTION VIDEO SIGNAL PROCESSING FOR RECORDING OR REPRODUCING
388	Other technologies	ELECTRICITY: MOTOR CONTROL SYSTEMS
392	Other technologies	ELECTRIC RESISTANCE HEATING DEVICES
396	Other technologies	PHOTOGRAPHY
398	Other technologies	OPTICAL COMMUNICATIONS
399	Other technologies	ELECTROPHOTOGRAPHY
400	Other technologies	TYPEWRITING MACHINES
401	Other technologies	COATING IMPLEMENTS WITH MATERIAL SUPPLY
402	Other technologies	BINDER DEVICE RELEASABLY ENGAGING APERTURE OR NOTCH OF SHEET
403	Other technologies	JOINTS AND CONNECTIONS
404	Other technologies	ROAD STRUCTURE, PROCESS, OR APPARATUS

405	Other technologies	HYDRAULIC AND EARTH ENGINEERING
406	Other technologies	CONVEYORS: FLUID CURRENT
407	Other technologies	CUTTERS, FOR SHAPING
408	Other technologies	CUTTING BY USE OF ROTATING AXIALLY MOVING TOOL
409	Other technologies	GEAR CUTTING, MILLING, OR PLANING
410	Other technologies	FREIGHT ACCOMMODATION ON FREIGHT CARRIER
411	Other technologies	EXPANDED, THREADED, DRIVEN, HEADED, TOOL-DEFORMED, OR LOCKED-THREADED FASTENER
412	Other technologies	BOOKBINDING: PROCESS AND APPARATUS
413	Other technologies	SHEET METAL CONTAINER MAKING
414	Other technologies	MATERIAL OR ARTICLE HANDLING
415	Other technologies	ROTARY KINETIC FLUID MOTORS OR PUMPS

416	Other technologies	FLUID REACTION SURFACES (I.E., IMPELLERS)
417	Other technologies	PUMPS
418	Other technologies	ROTARY EXPANSIBLE CHAMBER DEVICES
419	Other technologies	POWDER METALLURGY PROCESSES
420	Other technologies	ALLOYS OR METALLIC COMPOSITIONS
422	Other technologies	CHEMICAL APPARATUS AND PROCESS DISINFECTING, DEODORIZING, PRESERVING, OR STERILIZING
423	Other technologies	CHEMISTRY OF INORGANIC COMPOUNDS
425	Other technologies	PLASTIC ARTICLE OR EARTHENWARE SHAPING OR TREATING: APPARATUS
426	Other technologies	FOOD OR EDIBLE MATERIAL: PROCESSES, COMPOSITIONS, AND PRODUCTS
427	Other technologies	COATING PROCESSES
428	Other technologies	STOCK MATERIAL OR MISCELLANEOUS ARTICLES

429	Other technologies	CHEMISTRY: ELECTRICAL CURRENT PRODUCING APPARATUS, PRODUCT, AND PROCESS
430	Other technologies	RADIATION IMAGERY CHEMISTRY: PROCESS, COMPOSITION, OR PRODUCT THEREOF
431	Other technologies	COMBUSTION
432	Other technologies	HEATING
433	Other technologies	DENTISTRY
438	Other technologies	SEMICONDUCTOR DEVICE MANUFACTURING: PROCESS
439	Other technologies	ELECTRICAL CONNECTORS
440	Other technologies	MARINE PROPULSION
441	Other technologies	BUOYS, RAFTS, AND AQUATIC DEVICES
442	Other technologies	FABRIC (WOVEN, KNITTED, OR NONWOVEN TEXTILE OR CLOTH, ETC.)
445	Other technologies	ELECTRIC LAMP OR SPACE DISCHARGE COMPONENT OR DEVICE MANUFACTURING

446	Other technologies	AMUSEMENT DEVICES: TOYS
449	Other technologies	BEE CULTURE
450	Other technologies	FOUNDATION GARMENTS
451	Other technologies	ABRADING
452	Other technologies	BUTCHERING
453	Other technologies	COIN HANDLING
454	Other technologies	VENTILATION
460	Other technologies	CROP THRESHING OR SEPARATING
462	Other technologies	BOOKS, STRIPS, AND LEAVES FOR MANIFOLDING
464	Other technologies	ROTARY SHAFTS, GUDGEONS, HOUSINGS, AND FLEXIBLE COUPLINGS FOR ROTARY SHAFTS
470	Other technologies	THREADED, HEADED FASTENER, OR WASHER MAKING: PROCESS AND APPARATUS

472	Other technologies	AMUSEMENT DEVICES
473	Other technologies	GAMES USING TANGIBLE PROJECTILE
474	Other technologies	ENDLESS BELT POWER TRANSMISSION SYSTEMS OR COMPONENTS
475	Other technologies	PLANETARY GEAR TRANSMISSION SYSTEMS OR COMPONENTS
476	Other technologies	FRICTION GEAR TRANSMISSION SYSTEMS OR COMPONENTS
477	Other technologies	INTERRELATED POWER DELIVERY CONTROLS, INCLUDING ENGINE CONTROL
482	Other technologies	EXERCISE DEVICES
483	Other technologies	TOOL CHANGING
492	Other technologies	ROLL OR ROLLER
493	Other technologies	MANUFACTURING CONTAINER OR TUBE FROM PAPER; OR OTHER MANUFACTURING FROM A SHEET OR WEB
494	Other technologies	IMPERFORATE BOWL: CENTRIFUGAL SEPARATORS

501	Other technologies	COMPOSITIONS: CERAMIC
502	Other technologies	CATALYST, SOLID SORBENT, OR SUPPORT THEREFOR: PRODUCT OR PROCESS OF MAKING
503	Other technologies	RECORD RECEIVER HAVING PLURAL INTERACTIVE LEAVES OR A COLORLESS COLOR FORMER, METHOD OF USE, OR DEVELOPER THEREFOR
504	Other technologies	PLANT PROTECTING AND REGULATING COMPOSITIONS
505	Other technologies	SUPERCONDUCTOR TECHNOLOGY: APPARATUS, MATERIAL, PROCESS
506	Other technologies	COMBINATORIAL CHEMISTRY TECHNOLOGY: METHOD, LIBRARY, APPARATUS
507	Other technologies	EARTH BORING, WELL TREATING, AND OIL FIELD CHEMISTRY
508	Other technologies	SOLID ANTI-FRICTION DEVICES, MATERIALS THEREFOR, LUBRICANT OR SEPARANT COMPOSITIONS FOR MOVING SOLID SURFACES, AND MISCELLANEOUS MINERAL OIL COMPOSITIONS
510	Other technologies	CLEANING COMPOSITIONS FOR SOLID SURFACES, AUXILIARY COMPOSITIONS THEREFOR, OR PROCESSES OF PREPARING THE COMPOSITIONS
512	Other technologies	PERFUME COMPOSITIONS
516	Other technologies	COLLOID SYSTEMS AND WETTING AGENTS; SUBCOMBINATIONS THEREOF; PROCESSES OF

518	Other technologies	CHEMISTRY: FISCHER-TROPSCH PROCESSES; OR PURIFICATION OR RECOVERY OF PRODUCTS THEREOF
521	Other technologies	SYNTHETIC RESINS OR NATURAL RUBBERS -- PART OF THE CLASS 520 SERIES
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528	Other technologies	SYNTHETIC RESINS OR NATURAL RUBBERS -- PART OF THE CLASS 520 SERIES
530	Other technologies	CHEMISTRY: NATURAL RESINS OR DERIVATIVES; PEPTIDES OR PROTEINS; LIGNINS OR REACTION PRODUCTS THEREOF
534	Other technologies	ORGANIC COMPOUNDS -- PART OF THE CLASS 532-570 SERIES

540	Other technologies	ORGANIC COMPOUNDS -- PART OF THE CLASS 532-570 SERIES
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568	Other technologies	ORGANIC COMPOUNDS -- PART OF THE CLASS 532-570 SERIES

570	Other technologies	ORGANIC COMPOUNDS -- PART OF THE CLASS 532-570 SERIES
585	Other technologies	CHEMISTRY OF HYDROCARBON COMPOUNDS
588	Other technologies	HAZARDOUS OR TOXIC WASTE DESTRUCTION OR CONTAINMENT
601	Other technologies	SURGERY: KINESITHERAPY
602	Other technologies	SURGERY: SPLINT, BRACE, OR BANDAGE
604	Other technologies	SURGERY
606	Other technologies	SURGERY
607	Other technologies	SURGERY: LIGHT, THERMAL, AND ELECTRICAL APPLICATION
623	Other technologies	PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR
701	Other technologies	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION
702	Other technologies	DATA PROCESSING: MEASURING, CALIBRATING, OR TESTING

703	Other technologies	DATA PROCESSING: STRUCTURAL DESIGN, MODELING, SIMULATION, AND EMULATION
706	Other technologies	DATA PROCESSING: ARTIFICIAL INTELLIGENCE
710	Other technologies	ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT
712	Other technologies	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: PROCESSING ARCHITECTURES AND INSTRUCTION PROCESSING (E.G., PROCESSORS)
714	Other technologies	ERROR DETECTION/CORRECTION AND FAULT DETECTION/RECOVERY
716	Other technologies	COMPUTER-AIDED DESIGN AND ANALYSIS OF CIRCUITS AND SEMICONDUCTOR MASKS
717	Other technologies	DATA PROCESSING: SOFTWARE DEVELOPMENT, INSTALLATION, AND MANAGEMENT
718	Other technologies	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: VIRTUAL MACHINE TASK OR PROCESS MANAGEMENT OR TASK MANAGEMENT/CONTROL
719	Other technologies	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: INTERPROGRAM COMMUNICATION OR INTERPROCESS COMMUNICATION (IPC)
720	Other technologies	DYNAMIC OPTICAL INFORMATION STORAGE OR RETRIEVAL
850	Other technologies	SCANNING-PROBE TECHNIQUES OR APPARATUS; APPLICATIONS OF SCANNING-PROBE TECHNIQUES, E.G., SCANNING PROBE MICROSCOPY [SPM]