Setting and Adjusting Patent Fees during Fiscal Year 2020—Description of Elasticity Estimates

This appendix describes the statistical modeling and estimation of the United States Patent and Trademark Office (USPTO) patent fee elasticities. These estimates help the USPTO gauge the impact of patent fee changes on the demand for services. The first section defines the concept of elasticity and discusses how elasticities relate to revenue. This is followed by an overview of the elasticity findings in nine broad patent fee categories: filing/search/examination fees, excess independent claims fees, excess total claims fees, application size (excess page) fees, issue fees, request for continued examination (RCE) fees, appeal fees, America Invents Act (AIA) trial fees, and maintenance fees. The final section summarizes the data and statistical approaches used to estimate the elasticity values for each category.

# Elasticities: Definition and Revenue Implications

In economics, the price elasticity of demand (elasticity) is a measurement of how sensitive consumers are to changes in the price of a product or service. For the USPTO, patent fee elasticities help gauge the sensitivity (or reactivity) of stakeholders to potential fee changes. The elasticity (of demand) for a USPTO service is defined as the percentage change in the quantity of the service demanded by stakeholders divided by the percentage change in the fee for that service. To make this example concrete, let represent the elasticity value for a particular fee category (for instance, the filing/search/examination fee category). This elasticity is calculated as:

where is the change in the quantity demanded by stakeholders, with representing the quantity demanded under the new fee and representing the quantity demanded under the original fee. By dividing the change in quantity demanded by , one gets the proportionate change relative to the original quantity demanded. The proportionate change in USPTO fees, the denominator of the equation above, is calculated similarly. The resulting elasticity values are negative because USPTO stakeholders tend to decrease the quantity demanded as fees increase and increase the quantity demanded as fees fall.

For services for which the USPTO assesses fees, elasticity values generally fall into one of two ranges. First, when the elasticity is less than zero but greater than -1 (), demand is described as inelastic. Under inelastic demand, stakeholders are relatively insensitive to fee changes. For instance, a fee increase of 10 percent will result in stakeholders reducing the quantity of the USPTO service demanded, but this reduction will be smaller than the fee change (less than 10 percent). In practical terms, inelastic demand for a USPTO service means an increase in the fee for that service results in more revenue to the USPTO. The second range () is described as elastic. Under elastic demand, stakeholders are relatively sensitive to fee changes. As before, a fee increase of 10 percent will result in stakeholders reducing the quantity of the USPTO service demanded, but with elastic demand, this reduction in quantity demanded will be larger than the fee change (greater than 10 percent). With elastic demand, an increase in the fee for a USPTO service will result in less revenue for the Office.

With an elasticity value, one can determine the impact of a fee change on revenues. For example, if the elasticity for a USPTO service is -0.5 (inelastic), then a 10 percent increase in fees for that service will lead to a 5 percent decrease in quantity. Because revenue is defined as the fee () multiplied by the quantity of services demanded (), total revenue *before* the fee increase is . After the fee increase, the new revenue can be represented as . The following shows that revenue after the fee increase in our example is greater than revenue before the fee increase ():

That is, at an elasticity of -0.5, a 10 percent fee increase leads to an increase in revenue of 4.5 percent.

To demonstrate, take the case in which a fee () is initially $100 but increases to $110 () and the elasticity of demand remains -0.5 for that particular service. Also assume that the increase in the fee causes the quantity demanded for this service to fall from 100 () to 95 (). In this scenario, revenue has increased from $10,000 to $10,450 after the 10 percent increase in the fee rate despite the 5 percent decrease in the quantity demanded as shown below:

# Elasticity Findings for the Nine Fee Categories

Table 1 presents the elasticity estimates for nine USPTO fee categories as well as the 95 percent confidence intervals associated with the point estimates. For all point estimates and confidence intervals, the USPTO fee categories are inelastic ().

# Table 1: USPTO Fee Elasticity Estimates

|  | | | 95% Confidence Interval | |
| --- | --- | --- | --- | --- |
| Fee Elasticity Category | **Entity Size (Large/Small)** | **Elasticity Estimate** | **Lower Bound** | **Upper Bound** |
| Filing/Search/Examination | Large | -0.16 | -0.27 | -0.06 |
|  | Small | No diff. | No diff. | No diff. |
| Excess Independent Claim Fees | n/a | -0.62 | -0.79 | -0.44 |
| Excess Total Claim Fees | n/a | -0.23 | -0.35 | -0.11 |
| Application Size (Excess Page) Fees | n/a | -0.54 | -0.95 | -0.14 |
| Issue Fees | n/a | -0.006 | -0.01 | -0.001 |
| RCE Fees | Large | -0.08 | -0.11 | -0.04 |
|  | Small | No diff. | No diff. | No diff. |
| Appeal Fees | Large | -0.15 | -0.27 | -0.04 |
|  | Small | -0.33 | -0.52 | -0.13 |
| AIA Trial Fees | n/a | -0.15 | -0.25 | -0.06 |
| 1st Stage Maintenance Fee | Large | -0.06 | -0.07 | -0.05 |
|  | Small | No diff. | No diff. | No diff. |
| 2nd Stage Maintenance Fee | Large | -0.10 | -0.13 | -0.07 |
|  | Small | No diff. | No diff. | No diff. |
| 3rd Stage Maintenance Fee | Large | -0.11 | -0.12 | -0.09 |
|  | Small | -0.13 | -0.16 | -0.09 |

# Note that all reported estimates are statistically significant at the 5 percent level. Not applicable (n/a) means that differences in entity size were not modeled. No difference (No diff.) means that large and small entity fee elasticities do not show statistically significant differences.

Small entity stakeholders do not react differently than large entity stakeholders, except in two categories: appeals and 3rd stage maintenance decisions. Small entities are more sensitive to fee changes in these two categories, particularly with respect to appeals. The elasticity estimates for excess independent claims, excess total claims, and application size (excess pages) are noticeably larger in absolute value relative to fees such as filing/search/examination. This fits with economic intuition that suggests stakeholders will be more sensitive to fee changes (more elastic) when they have more flexibility making choices, such as whether or not to incur fees for excess claims or pages.

# Data and Model Summaries for the Nine Fee Categories

**Filing/Search/Examination (FSE) Fees**

The USPTO postulates that stakeholder decisions to apply for a new patent depend on—among other factors—the fees they expect to pay the USPTO. In the literature, researchers have treated the definition of expected fees in a variety of ways, with some researchers including attorney/agent fees and others including post-grant fees, such as those required to maintain a patent to full term. The definition used by the USPTO, which is similar to the work by de Rossenfosse and van Pottelsberghe de la Potterie (2012), is narrower. Expected fees are defined as those payments needed to complete the first full round of prosecution (i.e., a USPTO “balanced disposal”—the period from initial application through a patent’s first final rejection or allowance). To account for variation across technology areas, the USPTO calculates expected fees based on historical data for each USPTO technology center (TC).

The USPTO constructed a longitudinal database by TC and quarter. In most specifications, observed quarters are for the years 2001 through 2018. The econometric model took the following form:

where is the natural log number of serialized patent filings in TC i and quarter t and is a one quarter lag of new filings. is the real expected fee (i.e., adjusted for inflation) facing potential applicants before filing in TC i for the prior quarter (t-1). **X** is a matrix of other factors and includes the natural log of average patent pendency in the TC for the prior quarter (t-1), share of new applications (i.e., those with no parent application) in the TC for the prior quarter (t-1), share of applications with foreign priority in the TC for the prior quarter (t-1), and the share of applications from small entities in the TC for the prior quarter (t-1). represents a full set of quarterly time dummy variables to capture common influences across TCs due to the passage of time. is a TC-specific variable that accounts for time constant characteristics of that individual TC.

This is a dynamic model with panel data that utilizes the Arellano-Bond estimator, which is a generalized method of moments estimator used to estimate dynamic panel data models. The coefficient on the expected fee, , estimates the elasticity of serialized patent filings per quarter—the percentage change in new serialized filings in response to a 1.0 percent change in expected fees. To ensure the results did not depend critically on the definition of expected fees, the office ran alternative models using expected fees through issuance. Also, to investigate the possibility that small entities have a different FSE elasticity, an interaction term was included between expected fees and the lagged share of small entity applications. These models did not find a statistically significant difference in the elasticities across entity size. As shown in Table 1, the results indicate an FSE fee elasticity of -0.16, which means a 10 percent aggregate increase in the FSE fees can be expected to result in a 1.6 percent reduction in application filings. The 95 percent confidence interval for this elasticity ranges from -0.27 to -0.06.

**Excess Independent Claim, Excess Total Claim, and Application Size (Excess Page) Fees**

To estimate fee elasticities for excess independent claims, excess total claims, and application size (excess page) fees, the USPTO analyzed stakeholder responses to the 15 percent fee increases introduced in the AIA (76 Fed. Reg. 59115 (September 23, 2011)) for excess independent claims ($220 to $250), excess total claims ($52 to $60), and application size (excess pages) ($270 to $310). To compare patent applications filed before the fee change with those filed after the fee change, the Office constructed a patent application-level dataset with applications filed six months to three months before the 2011 fee change and patent applications filed three months to six months after the fee change. The six months surrounding the fee change were not included in the sample because applicants could choose to file an application before the fee change, and this would confound the estimates with strategic behavior.

The USPTO estimated three linear probability models, one for each decision to pay excess independent claim fees, excess total claims fees, and application size (excess page) fees. The model is expressed as:

where is equal to 1 if the applicant paid the respective excess fee (i.e., for independent, total, or size (page)) and 0 otherwise. is a variable indicating whether the patent application was filed before the 2011 fee change (taking a value of 0) or after the fee change (taking a value of 1). The specification also accounts for technology and entity size. Based on this model, the quantity response to the fee change can be approximated using the percentage change in the predicted values. The percentage change in each fee type was calculated based on the 2011 fee change.[[1]](#footnote-2) A bootstrapping method was used to estimate the appropriate confidence intervals.

As shown in Table 1, the result for the excess independent claim fees indicates an elasticity of -0.62, which means that the USPTO would expect a 10 percent increase in the fee to lead to a 6.2 percent decrease in the number of times stakeholders would choose to include excess independent claims in their applications. The 95 percent confidence interval for this elasticity ranges from -0.79 to -0.44. The result for the excess total claim fee is an elasticity of -0.23 with a 95 percent confidence interval that ranges from -0.35 to -0.11. Finally, the estimated elasticity for application size (excess pages) is -0.54 with a 95 percent confidence interval that ranges from -0.95 to -0.14, which is a wider confidence interval than other estimates in this analysis due to the relatively larger variations in the data series.

**Issue Fees**

Following a notice of allowance, stakeholders are required to pay an issue fee before the patent becomes a granted legal right. Having reached an allowance, historical patent data indicates that most stakeholders choose to pay the issue fee. This suggests that stakeholders are likely to be insensitive to issue fee changes (i.e., demand is inelastic).

The approach used for estimating the issue fee elasticity was very similar to the approach discussed in the last section for excess claim and application size (page) fees. In this case, the USPTO focused on stakeholder responses to the 2013 rule, Setting and Adjusting Patent Fees (78 Fed. Reg. 4212 (January 18, 2013)), with issue fee change ($1,770 to $960) effective January 2014. The data consists of all applications with a first allowance recorded within three months before or three months after the issue fee change. The model has the same form as that in the last section except for the addition of time dummy variables to account for common filing year influences. The linear probability model is expressed as:

is a variable indicating whether the patent allowance took place before the 2014 issue fee change (taking a value of 0) or after the fee change (taking a value of 1). The issue fee for large entities was used as the basis for calculating the percentage change in 2014 issue fees, and a bootstrapping method provided appropriate confidence intervals. The elasticity estimate indicates that stakeholders are very insensitive to issue fee changes. The value of -0.006 is very close to zero (*see* Table 1). It is statistically significant, with a 95 percent confidence interval ranging from -0.01 to -0.001.

**Request for Continued Examination (RCE) Fees**

To estimate the fee elasticity for RCEs, the USPTO again focused on the 2013 Setting and Adjusting Patent Fees rule for the RCE fee change. In March of that year, the fees for RCEs were reconstructed into a first RCE fee and a second and subsequent RCE fee. The first RCE fee was increased from $930 to $1,200, an increase of 29 percent. For applicants who had previously filed at least one RCE, the fee increased from $930 to $1,700, roughly 83 percent. The approach was to estimate the change in the probability of filing an RCE by comparing stakeholder decisions before and after the fee change. The Office constructed a dataset consisting of all patents with final rejections in the year preceding the fee change (April 2012-March 2013) and the year following the fee change (April 2013-March 2014).

Similar to the approaches described above, a linear probability model was specified and estimated. The main variable of interest, , indicated whether an RCE was filed before the 2013 fee change (taking a value of 0) or after the fee change (taking a value of 1). The specification included additional variables to hold other influences constant. These included: (1) whether or not the applicant had filed a previous RCE, (2) the amount of time the application had been pending at the USPTO, (3) the number of independent claims in the initial application, (4) the number of words in the shortest independent claim, (5) the number of appeal cases pending at the Patent Trial and Appeal Board (PTAB), and (6) the relationship between the application and previous parent applications. To explore the influence of entity size, separate models were estimated for large and small entities; however, no statistically significant differences were found. The USPTO also allowed for difference coefficients for patents that had a previous RCE. The elasticities and confidence intervals were derived using the same methods as discussed for excess independent claim, excess total claim, application size (excess page), and issue fees.

As seen in Table 1, the results show that stakeholders are relatively insensitive to changes in RCE fees (i.e., demand is inelastic), with an estimated elasticity of -0.08. The 95 percent confidence interval ranges from -0.11 to -0.04.

**Appeal Fees**

The approach to estimate the elasticity for appeals fees also used a before/after design that focused on the 2013 Setting and Adjusting Patent Fees rule. In March of that year, appeal fees increased, and the USPTO created a new fee regime. For applicants who had not filed a prior RCE during prosecution, the fee increased from $630 to $800, an increase of 27 percent. The Office constructed a dataset consisting of all patents with final rejections in the year preceding the fee change (April 2012-March 2013) and the year following the fee change (April 2013-March 2014).

The model specification and estimation method were the same as discussed above for RCE fees. In this case, the variable captures whether an appeal was filed before the 2013 fee change (taking a value of 0) or after the fee change (taking a value of 1). The Office estimated separate models for large and small entities. Separate elasticities for applications with and without previous RCEs were also estimated, but their difference was not statistically significant.

The results indicate an elasticity of -0.15 for large entities, indicating relatively little sensitivity to appeal fee changes (*see* Table 1). The 95 percent confidence interval ranges from ‑0.27 to -0.04. The elasticity estimate for small entities is -0.33, indicating that small entities are more sensitive to changes in the appeal fee. The 95 percent confidence interval for small entities ranges from -0.52 to -0.13.

**America Invents Act (AIA) Trial Fees**

For AIA trial fees, the USPTO followed the approach used for filing/search/examination fees by constructing a longitudinal database by technology area and quarter. The Office specified a dynamic model of the number of petitions filed in technology areas (defined as areas covered by USPTO technology centers) per quarter and estimated this model using data from September 2014 through March 2018. The econometric model took the following form:

where is the natural log number of petitions filed in technology area i and quarter t and and are quarterly lags of petition filings to capture time dependencies. is the real expected fee (i.e., adjusted for inflation) facing potential petitioners before filing. This was calculated based on historical data specific to each technology area. **X** is a matrix of other factors and includes the petition type (i.e., whether it was an *inter* *partes* review or not), count of the independent claims for the petitioned patent, count of the dependent claims for the petitioned patent, an indicator for whether the petitioned patent was a Patent Cooperation Treaty (PCT) national stage entry, and a count of the number of petitions filed on the focal patent in the preceding quarter, which captures strategic behavior by petitioning entities. represents a full set of quarterly time dummy variables to capture common influences across technology areas due to the passage of time. is a technology-specific variable that accounts for time constant characteristics of that individual technology area.

As this is a dynamic model with panel data, the Arellano-Bond estimator was used. The coefficient on expected fee, , estimates the elasticity of AIA petitions per quarter—the percentage change in new petition filings in response to a 1 percent change in expected fees. As shown in Table 1, the results indicate an AIA petition filing fee elasticity of -0.15 with a 95 percent confidence interval ranging from -0.25 to -0.06.

**Maintenance Fees**

The elasticity estimates for the three stages of maintenance payments were determined based on the fee changes in the 2013 rule, Setting and Adjusting Patent Fees. Effective March 2013, maintenance fees for the first stage renewal payment increased by 39 percent ($1,150 to $1,600), the second stage renewal period fee increased by 24 percent ($2,900 to $3,600) and the third stage renewal period fee increased by 54 percent ($4,810 to $7,400). The USPTO used a before/after design by forming a patent-level dataset using all granted patents with a maintenance fee due date within the six months prior to the March 2013 fee change and from six months to one year after the March 2013 fee change. The second window is six months later to avoid problems with early payments, as patent owners have the option of paying the maintenance fee up to six months before the date on which it is due.

Similar to previous descriptions, the USPTO used models to estimate the probability that an assignee would pay each respective maintenance fee, conditional on whether the maintenance fee payment was due before or after the fee change in 2013. Among the control variables were patent entity size, technology work group fixed effects, filing year fixed effects, fees paid previously related to each patent, the number of allowed claims, the number of forward citations prior to each maintenance date, and the number of inventors. Separate models for large and small entities were estimated. The Office estimated the elasticities using the same methods described above in the description of excess independent claim, excess total claim, excess page, and issue fees.

The results for large entities indicate elasticities of -0.06, -0.10, and -0.11 for the first, second, and third stage maintenance fees, respectively (*see* Table 1). For small entities, the results indicate elasticities of -0.06, -0.12, and -0.13 for the first, second, and third stage maintenance fees, respectively.

1. The fee change for large entities for the elasticity estimate [↑](#footnote-ref-2)