USPTO Section 10 Fee Setting—Description of Elasticity Estimates

This document describes the statistical examination of the elasticity of patent user fees at the USPTO. It summarizes the results of this analysis and provides detail on how elasticity was determined for certain user fees.

Background Information

Price elasticity of demand (simply referred to as elasticity throughout this document) is a measurement of how sensitive consumers (applicants) are to changes in price (user fees). If elasticity is low enough (equivalently, demand is *inelastic*), then when fees increase, the decrease in demand for USPTO products/services is small enough that overall revenues increase. If elasticity is high enough (equivalently, demand is said to be *elastic*), then increasing fees will result in less revenue, because demand for USPTO products/services will decrease sufficiently that overall revenue decreases.

Formally, elasticity (ϵ) is defined as the percentage change in the quantity demanded *(Q)* divided by the percentage change in the price of the user fee *(P)* that caused the quantity change:

$$\epsilon = \frac{(Q_2 - Q_1)/Q_1}{(P_2 - P_1)/P_1}.$$

In this formula, Q1 and P1 refer to current quantity and price, and Q2 and P2 refer to the new quantity and price. Under this formula, because quantity decreases when price increases, and quantity increases when price decreases, elasticity will always be negative. Elasticity between 0

and -1 is called “inelastic” (meaning little or no change in quantity relative to price), and those greater (in magnitude) than -1 are called “elastic” (meaning greater change in quantity relative to price).

Once elasticity is known, one can directly estimate the impact of a price change on revenues. For example, if we know that elasticity is -0.5, then a 10% increase in fees would lead to a 5% decrease in quantity. Since aggregate revenue is price (fee) multiplied by quantity (workload), revenue will change from the old revenue P_0Q_0 to the new revenue P_1Q_1.

$$P_1Q_1=P_0(1+10\%)Q_0(1-5\%) = P_0Q_0\ (1.1\times\ 0.95) = P_0Q_0\ (1.045)$$

That is, at an elasticity of -0.5, a 10% fee increase leads to a 4.5% revenue increase.[1]

Elasticity Impact on Demand for USPTO Products and Services

The Office determined elasticity for all major patent services experiencing fee changes. In the case of maintenance fee payments, we developed a strategy to estimate elasticity using publicly available data. In the case of pre-grant fees, we relied on reasonable estimates from peer-reviewed publications, as well as reasonable estimates from economic theory.

Two caveats must be noted. First, these results are based on the latest data available at the time of the publication of this document. Second, the USPTO is proposing fee changes greater than those routinely implemented in the past. Making predictions about large changes based on experience with small changes is challenging. That said, the results represent a reasonable evidence-based approach.

[1] For more about elasticity, see chapter 5 of “Principles of Microeconomics”, 6th Edition, by N. Gregory Mankiw.

The specific methodology for determining elasticity for user fees and hence the impact on new applications and patent services is discussed in the rest of this document. Before turning to the specifics, it is useful to describe some established economic principles with respect to demand elasticity. In general, demand will be more elastic:

1. When the good is not a necessity;
2. When there are many substitutes available for the good; and,
3. The longer the time horizon.

Goods that are necessities tend to be more inelastic than other goods. For instance, tobacco and gasoline are known to be inelastic. If it is difficult to find alternatives, then users will be less sensitive to price changes. This is related to the availability of substitutes. In a sense, the fact that a good is a necessity means that it has few substitutes. Conversely, if many substitutes are available, then it is very easy for consumers to switch out of the high priced good, and to switch into other alternatives.

The time horizon is also associated to some degree with the availability of substitutes. In the very short run, it may be difficult to switch away from a particular good, like gasoline, when the price increases. However, over the long term, consumers can more easily adjust their gasoline consumption. They can buy a more fuel efficient car, move closer to work, plan carpools, take public transit, or adjust vacation plans. That is, they can more easily adapt to the higher prices over the long run by switching into available substitutes for gasoline or driving.

These theoretical principles are important for analyzing different types of fees, as discussed below. For instance, Filing/Search/Exam (FSE) fees are necessities for filing a patent

application. However, other fees can be thought of as "optional" in comparison. For example, applicants can attempt to reduce the number of excess claims in an application.

Methodology for Pre-grant Fees

For pre-grant fees, the Office relies on outside estimates of patent application demand elasticity. In particular, one recent peer reviewed paper by de Rossenfosse and van Pottelsberghe de la Potterie[2] (hereafter RP) provides our base estimates for FSE elasticity. The study in this paper represents the most recent publication in the field, along with the largest and most recent dataset. It also provides separate estimates of long-run and short-run elasticity. RP use annual data from three patent offices (the U.S., Japan, and the European Patent Office) over the time period 1980-2007. While the authors use data from three different patent offices, their estimation strategy employs office-level fixed effects in order to control for unobserved differences among the offices. Additionally, they control for observed differences in GDP per capita, research and development expenditures, and other observed characteristics that may differ across countries and regions.

They employ an error correction model (ECM), which enables them to calculate both short-run and long-run elasticities for patent applications. There is no specific definition for "short-run" and "long-run" with respect to calendar time. Short-run refers to the instantaneous change, and long-run refers to a time long enough to enable all actors to fully internalize all the fee changes into their decision-making. As noted above, long-run elasticity is generally greater than short-

[2] Gaetan de Rassenfosse and Bruno van Pottelsberghe de la Potterie, "On the Price Elasticity of Demand for Patents," *Oxford Bulletin of Economics and Statistics*, V74, N1 (2012) pp. 58-77.
http://www.uspto.gov/aia_implementation/fees.jsp#heading-1

run elasticity for most goods. The estimates by RP show that demand for patent applications tends to be very inelastic (p. 72), in both the short-run and long-run.

RP calculate the elasticity of patent applications across all three offices based on a price that approximates the total fees from filing through grant for a representative patent application. In the U.S., RP approximate these fees to include large entity FSE, publication and issuance, and excess claims fees (based on the average number of claims). The elasticities are calculated for this "aggregate" fee, as follows:

- Short-run elasticity is about -0.09 with a range from -0.06 to -0.12
- Long-run elasticity is about -0.30 with a range from -0.15 to -0.49

Again, these calculations show that demand for patent application services is inelastic.

It is important to note that this elasticity is different than calculating elasticity for FSE fees alone. In particular, the estimated elasticity for FSE alone should be lower (i.e., more inelastic) than the elasticity for total fees. An example helps to clarify the proposition. Suppose that FSE fees constitute exactly half of total fees. If FSE fees increase by 20%, total fees would increase by only 10%. As a consequence of the price increase, suppose that we were to observe patent applications to fall by 5%. Calculating elasticity with respect to total fees would generate an elasticity of -0.5 (-5%/10%). However, calculating elasticity with respect to FSE fees would generate an elasticity of -0.25%. Neither of these elasticities is "right" or "wrong." It depends on the context in which they are to be used and the extent to which applicants are sensitive to different fees in different ways. For instance, we expect the number of new applications to be sensitive to both FSE and issuance fees. However, we expect new applications to be *more*

sensitive to FSE fees than to issuance fees since FSE fees are certain while issuance fees are uncertain and may not be paid if a patent is not allowed.

RP do include some estimates for entry fees alone (FSE), but they are not the focus of the paper. Nonetheless they serve as another data point with which to form an opinion about the appropriate elasticity to apply to the analysis of USPTO fees. For entry fees, RP find:

- Short-run elasticity for FSE fees is about -0.07.
- Long-run elasticity for FSE fees is about -0.18, but this estimate is imprecisely measured. A 95% confidence interval includes positive values and also values as high in magnitude as -0.5.

Constant elasticity or changing elasticity?

A caveat to the above results is that the estimation by RP assumes a constant elasticity. This is a very common specification for econometric estimates of elasticity, but it does have some shortcomings. First, patent fee changes have historically been relatively minor in percentage terms. It is reasonable to expect that small price changes will produce quantity changes consistent with those observed in the past. However, significant price restructuring (including large increases for some fees, coupled with large decreases for other fees) means that these estimates are "predicting outside the sample" with respect to elasticity.

Further, from a theoretical standpoint, for a sufficiently high price demand for any particular good or service *must* become elastic. If it were not so, it would mean that no matter how high price rises, revenue would always increase. This cannot be true for the entire range of demand. The range over which elasticity can be expected to be constant is not known for patent

applications.[3] Although we believe that it would *not* be reasonable to expect that the demand for patent applications will become elastic for the prices in the Notice of Public Rulemaking.

Mandatory fees

FSE fees represent *mandatory fees*. That is, these fees must be paid by every applicant if they are to receive a patent (conditional on allowance). However, some fees are not mandatory, even if they tend to be highly utilized for some types of applications or applicants.

Excess claims fees, application size, surcharges, and extension of time fees allow for more discretion by the applicant. Unlike FSE fees, applicants can avoid extension of time fees. However, they may choose to pay extension of time fees in order to increase the likelihood of allowance. Because these fees involve more discretion, they are likely to be more elastic than FSE fees. In this context, FSE fees can be thought of as a necessity in comparison to other mid-process avoidable fees.

Issuance fees are paid only conditional on allowance, but they are mandatory at that time. Given that allowance is uncertain, applicants may be less sensitive to issuance fee changes.

Estimates for the proposed rulemaking

For the purposes of the proposed rulemaking, the Office is interested in the sensitivity to individual fees, because the response to individual fees can have an impact on total aggregate revenue and IP stakeholders. Taking RP's estimates for aggregate fees and entry fees together, the following values are used from within the range provided by RP:

[3] Note that for maintenance fee payments, we utilize a different empirical strategy so that elasticity is not constrained to be constant.

- Short run elasticity of FSE fees = -0.10 (FY2013-2014). This figure is representative of the approximate mid-point of RP's range.
- Long run elasticity of FSE fees = -0.15 (FY2015 -2017). This figure from the low-end of RP's range is conservative.
- Patent issue and publication fees are a critical source of the Office's work and revenue, but the proposal calls for fees for these services to decrease for all applicants. To be conservative, we do not account for any *positive* impact on new applications that would result from lowering these fees.
- To be conservative, for purposes of this elasticity analysis, we used an assumption that the decreased pendency will not induce any new applications (that is that the demand elasticity with respect to pendency is zero).
- For non-mandatory fees, such as excess claims fees, we apply an across the board -0.30 elasticity. From a theoretical standpoint, non-mandatory fees should be more elastic than FSE fees. However, without better empirical evidence, it is difficult to ascertain exactly how much higher the elasticity will be. Thus, for these fees, we apply the mid-point of RP's long-run elasticity estimate. Further, we used an assumption that because applicants can adjust more quickly to mid-process fees, the impact takes place immediately (so that the short-run elasticity and long-run elasticity are both -0.30).

Methodology for Appeals

Due to data constraints and the implementation of new fees, the Office was unable to use regression analysis to estimate elasticity for appeal services. Also, literature on this topic is sparse and was judged to be of limited relevance to the proposed fee restructure. In this instance,

the Office relied on the limited data available and subject matter expertise (internal Office experts and external stakeholders) to estimate the sensitivity of demand for patent appeals. Given this, the Office applies a 10% decrease in demand for appeals for each year under the proposed fee structure due to the overall increase in fee rates for appeals.

Methodology for Maintenance Fees

In preparation for setting maintenance fee rates, historical renewal rates of patents were examined since maintenance fees were first collected. The Office analyzed the extent to which maintenance fee changes affected renewal rates to estimate elasticities. The analysis is based on more than 1.8 million individual fee-paying events since the creation of patent maintenance fees at the USPTO.[4] Regression analysis was used to construct elasticity. Using a probit regression[5], the probability of renewal at each maintenance fee due date was estimated to be a function of the following variables:

- The maintenance fee (real dollars)
- Future expected maintenance fees (real dollars)
- The application and issue fees paid by the patent holder at the time of application and issuance
- The remaining life of the patent
- Whether the patent holder was a small entity at the time of the maintenance fee payment

At the first maintenance payment, all issued patents were included in the sample. For the second maintenance payment, only patents that paid the first maintenance fee are included; and, similarly for the third maintenance payment.

For all regressions, maintenance fees were found to be negatively correlated with the probability of renewing the patent. The statistical relationship between price and the expected quantity of

[4] USPTO maintenance fee event files can be found at https://eipweb.uspto.gov/SOMS/start.swe?SWECmd=Start&SWEHo=eipweb.uspto.gov and also at http://www.google.com/googlebooks/uspto-patents-maintenance-fees.html

[5] For more about probit regression, see chapter 16 of "A Guide to Econometrics" by Peter Kennedy.

renewals can be used to calculate the elasticity of renewal with respect to price. Table 1 shows the estimated elasticities at different price levels. The percentage increase that is near the proposed fee increase is highlighted in gray for each fee. As the table demonstrates, larger price increases are associated with larger elasticities; however, all elasticities remain well in the inelastic range. Further, elasticity tends to be highest at the second renewal period and lowest at the first renewal period.

The econometric estimates help to form a reasonable basis for the elasticities used in the NPRM

- For the first maintenance fee (3.5 years):
    - We apply the point estimate of -0.11 (for a 40% price increase) in the short-run (2013-2014)
    - For the long-run elasticity (2016-2017) we apply a value of -0.13, which represents the top (in magnitude) of the 95% confidence interval
    - For the intervening year (2015) we interpolate and apply the value of -0.12
- For the second maintenance fee (7.5 years):
    - We apply the point estimate of -0.18 (for a 30% price increase) in the short-run (2013-2014)
    - For the long-run elasticity (2016-2017) we apply a value of -0.20, which represents the top (in magnitude) of the 95% confidence interval
    - For the intervening year (2015) we interpolate and apply the value of -0.19
- For the third maintenance fee (11.5 years), we apply the same values as for the second maintenance fee. These values are more elastic than those estimated for the third

maintenance fee, and thus represent a conservative estimate with respect to calculating revenue.

Table 1. Estimated Elasticities for Renewal Payments

(gray shading indicates proposed increases in this rulemaking)

Maintenance Fee Payment	Price Increase	Elasticity Estimate	95% Confidence Interval	
3.5 years	10%	-0.056	-0.062	-0.050
	20%	-0.071	-0.079	-0.062
	30%	-0.089	-0.101	-0.077
	40%	-0.110	-0.126	-0.094
	50%	-0.135	-0.157	-0.114
	60%	-0.165	-0.192	-0.137
	70%	-0.200	-0.235	-0.164
	80%	-0.239	-0.284	-0.195
	90%	-0.285	-0.340	-0.230
	100%	-0.338	-0.405	-0.270
7.5 years	10%	-0.138	-0.155	-0.122
	20%	-0.157	-0.176	-0.138
	30%	-0.177	-0.199	-0.155
	40%	-0.198	-0.223	-0.172
	50%	-0.220	-0.249	-0.191
	60%	-0.244	-0.277	-0.211
	70%	-0.269	-0.306	-0.231
	80%	-0.295	-0.337	-0.253
	90%	-0.322	-0.370	-0.275
	100%	-0.351	-0.404	-0.299
11.5 years	10%	-0.084	-0.107	-0.061
	20%	-0.093	-0.119	-0.068
	30%	-0.103	-0.132	-0.074
	40%	-0.113	-0.145	-0.081
	50%	-0.123	-0.159	-0.088
	60%	-0.134	-0.173	-0.095
	70%	-0.145	-0.188	-0.102
	80%	-0.156	-0.204	-0.109
	90%	-0.168	-0.220	-0.116
	100%	-0.180	-0.236	-0.124

Elasticity and its Overall Impact on Workload

To calculate the change in demand, or workload, due to a change in price (fee) the following formula is used:

Change in Demand/Workload = (Elasticity) X (% change in fee rate)

Table 2 below displays the calculation for the change in workload due to the change in price for major patent user fees for the alternatives described in this proposed rulemaking. For each alternative, the same elasticities are used for each respective fee category with the exception of maintenance fees (see the section above on the methodology for maintenance fees for an explanation on why elasticities vary by alternative).

For FSE, appeal, and excess claims fees the percentage change in fee rates are calculated by summing relevant fees. For example, the percentage change in fee rate for excess claims fees is calculated by comparing the sum of all three categories of excess claims fees (independent, total, and multiple) before and after the fee change. In the case of appeals, the relevant fees are the notice of appeal, forwarding an appeal (if applicable), and request for an oral hearing.

In the case of maintenance fees, the change in demand is applied to the renewal rate for each stage. Since maintenance fees are a function of the number of patents previously granted, which varies considerably by year, applying the elasticity measure to the renewal rate allows for consistent effect across years. For all other fee categories, the change in workload is applied directly to the number demanded.

Since the proposed alternative is not expected to take effect until about the middle of fiscal year 2013, the elasticities for fiscal year 2013 are halved to account for this.

Table 2. Elasticity and Effects on Workload for Alternatives Described in Proposed Rulemaking

Elasticity and Effects on Workload for each Alternative FY2013-FY2017												
Fee Name and Fiscal Year	**Alternative 1 - Proposed Alternative: Set and Adjust Section 10 Fees Fee**			**Alternative 2 - Fee Cost Recovery Fee**			**Alternative 3 - Across-the-Board Adjustment**			**Alternative 4 - Initially Proposed to PPAC**		
	Elasticity	*% Change in Fees*	*Elasticity Effect (% Change in workload)*	**Elasticity**	*% Change in Fees*	*Elasticity Effect (% Change in workload)*	**Elasticity**	*% Change in Fees*	*Elasticity Effect (% Change in workload)*	**Elasticity**	*% Change in Fees*	*Elasticity Effect (% Change in workload)*
Utility Filing/Search/Examination and Application Size												
FY 2013 (beginning mid year)	-0.10	27.0%	-1.3%	-0.10	211.1%	-10.6%	-0.10	6.3%	-0.3%	-0.10	46.0%	-2.3%
FY 2014	-0.10		-2.7%	-0.10		-21.1%	-0.10		-0.6%	-0.10		-4.6%
FY 2015-2017	-0.15		-4.0%	-0.15		-31.7%	-0.15		-0.9%	-0.15		-6.9%
1st Request for Continued Examination												
FY 2013 (beginning mid year)	-0.10	29.0%	-1.5%	-0.10	82.8%	-4.1%	-0.10	7.5%	-0.4%	-0.10	82.8%	-4.1%
FY 2014	-0.10		-2.9%	-0.10		-8.3%	-0.10		-0.8%	-0.10		-8.3%
FY 2015-2017	-0.15		-4.4%	-0.15		-12.4%	-0.15		-1.1%	-0.15		-12.4%
2nd and Subsequent Request for Continued Examination												
FY 2013 (beginning mid year)	-0.10	82.8%	-4.1%	-0.10	N/A	N/A	-0.10	N/A	N/A	-0.10	N/A	N/A
FY 2014	-0.10		-8.3%	-0.10		N/A	-0.10		N/A	-0.10		N/A
FY 2015-2017	-0.15		-12.4%	-0.15		N/A	-0.15		N/A	-0.15		N/A
1st Stage Maintenance												
FY 2013 (beginning mid year)	-0.11	39.1%	-2.2%	-0.14	-47.8%	3.3%	-0.06	6.1%	-0.2%	-0.11	39.1%	-2.2%
FY 2014	-0.11		-4.3%	-0.14		6.7%	-0.06		-0.4%	-0.11		-4.3%
FY 2015	-0.12		-4.7%	-0.15		7.2%	-0.07		-0.4%	-0.12		-4.7%
FY 2016-2017	-0.13		-5.1%	-0.16		7.6%	-0.07		-0.4%	-0.13		-5.1%
2nd Stage Maintenance												
FY 2013 (beginning mid year)	-0.18	24.1%	-2.2%	-0.24	-58.6%	7.0%	-0.14	6.9%	-0.5%	-0.18	24.1%	-2.2%
FY 2014	-0.18		-4.3%	-0.24		14.1%	-0.14		-1.0%	-0.18		-4.3%
FY 2015	-0.19		-4.6%	-0.25		14.7%	-0.15		-1.0%	-0.19		-4.6%
FY 2016-2017	-0.20		-4.8%	-0.26		15.2%	-0.16		-1.1%	-0.20		-4.8%
3rd Stage Maintenance												
FY 2013 (beginning mid year)	-0.18	53.5%	-4.8%	-0.24	-50.2%	6.0%	-0.14	6.6%	-0.5%	-0.18	57.7%	-5.2%
FY 2014	-0.18		-9.6%	-0.24		12.0%	-0.14		-0.9%	-0.18		-10.4%
FY 2015	-0.19		-10.2%	-0.25		12.6%	-0.15		-1.0%	-0.19		-11.0%
FY 2016-2017	-0.20		-10.7%	-0.26		13.1%	-0.16		-1.1%	-0.20		-11.5%
Appeals												
FY 2013 (beginning mid year)		138.0%	-5.0%		294.0%	-10.0%		7.9%	0.0%		217.0%	0.0%
FY 2014			-10.0%			-20.0%			0.0%			0.0%
FY 2015-2017			-10.0%			-20.0%			0.0%			0.0%
Excess Claims												
FY 2013 (beginning mid year)	-0.10	65.8%	-3.3%	-0.10	1.5%	-0.1%	-0.10	6.5%	-0.3%	-0.10	84.4%	-4.2%
FY 2014	-0.10		-6.6%	-0.10		-0.2%	-0.10		-0.7%	-0.10		-8.4%
FY 2015	-0.15		-9.9%	-0.15		-0.2%	-0.15		-1.0%	-0.15		-12.7%
FY 2016-2017	-0.20		-13.2%	-0.20		-0.3%	-0.20		-1.3%	-0.20		-16.9%