

**Statement of
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**Hearing on
“Promoting the Useful Arts: How can Congress prevent the
issuance of poor quality patents?”**

**Before the
Subcommittee on Intellectual Property,
Committee on the Judiciary,**

**U.S. Senate, 116 Congress, 1st Session
Washington, D.C.**

October 30, 2019

1 Introduction

I thank the Subcommittee for considering my inputs on the important matter of patent application examination quality at the U.S. Patent and Trademark Office (“PTO”). I am Ron Katznelson, an inventor, entrepreneur, and an independent scholar of the patent system. I am named on 25 U.S. patents and applications, and have founded two startup companies based on patented technologies. I hold undergraduate degrees in mathematics and physics, MSc. in semiconductor physics, and a Ph.D. in electrical engineering (communication theory and systems). I have extensive experience in patent prosecution at the PTO and related administrative law, and have been involved in several patent litigation disputes. I currently serve as Chairman of the Intellectual Property Committee of IEEE-USA and also serve on the Patent Committee of the Small Business Technology Counsel. I provide this statement from the perspective of startup and small-business inventors in my individual capacity, representing neither organization.

The title of this hearing – “how can Congress prevent the issuance of poor quality patents” – is indicative of the false underlying premise of this question because the term “poor quality” is a misnomer for what should be a binary determinant: either a patent is invalid or it is not invalid, a determination that often can only be made *ex post* in hind-sight. In any event, staying for now with this widely-used term, Congress cannot *prevent* the issuance of poor quality patents because *no finite examination time can reduce examination errors to zero*.

The balance that should be struck must include the fact that for nearly a century, patent litigation rate is less than 2 per 1000 patents in force¹ and the parties in

¹ Ron D. Katznelson, “A Century of Patent Litigation in Perspective,” (November 17, 2014) (See Fig. 3) At SSRN: <https://ssrn.com/abstract=2503140>.

such cases devote *orders of magnitude more resources* to evaluate their validity – resources the PTO and the public should never spend on every application. Those who propose to increase the overall public expenditure on patent examination bear the burden of showing substantial *verifiable* evidence that the incremental benefit to the public will exceed the added costs, including in *net* dynamic economic efficiency loss due to depressed patent filings.

That said, I believe there is much that can, and should be done to improve examination quality by training examiners and allocating PTO resources more efficiently to match application complexity and workload. I have provided to the PTO a detailed proposal how to accomplish this by empirical error detecting procedure.² In those comments on examination quality, I presented a detailed proposal for a method for setting examination time per Art Unit and for revising the examiner count system to incorporate application attributes based on empirical measurements of examiner performance.

My proposal demonstrates how the PTO can derive new Art Unit targets for examination time and a related count “correction factor” based on selected application attributes, *while keeping the average counts over the examining corps (and thus average examination time per application) at a fixed level*. In other words, through empirical measurements, the method optimizes reallocation of resources between applications and art units so as to achieve uniform (minimum) examination error rate.

An area of significant opportunity to gain (redirect) about 20% of additional examination resources is by implementing a voluntary Deferred Examination program, where applicants’ drop and withdraw applications and claims prior to a voluntary deferred examination. I refer the reader to a detailed proposal and analysis I made a few years ago.³ The PTO adopted a similar program two years later without also deferring the search and examination fees, which unfortunately doomed it to very low take rate. There is today an opportunity to reintroduce a more complete program.

2 Doubling examination time would drive small business and startup inventors out of the patent system

There are those who advocate massive increases in examination time per application at the PTO. As explained below, there is no verifiable evidence that this will reduce patent litigation costs. Those who propose such a program ignore price elasticity effects and loss of private patent value that dwarfs any purported benefits. The balance Congress should maintain must include careful consideration of adverse effects on the innovation economy due to increase in patent user fees.

² Ron D. Katznelson, [Comments on Enhancement in the Quality of Patents, Docket No.: PTO-P-2010-0004](#) (March 8, 2010).

³ Ron D. Katznelson, [Comments on Deferred Examination of Patent Applications](#) (May 29, 2009).

The appendix contains my analysis of the effects of doubling examination time per application, which nearly doubles the fees that the Office would need to charge. **It is shown that the lost private value of patents would be \$9 billion per year.** In Europe, where the cost to obtain a patent at the European Patent Office (“EPO”) is more than 4X compared to the USPTO, *only 0.67%* of patents are issued to individual inventors.⁴ The loss of patenting opportunities at the PTO in turn would signify substantial loss of patent protection and incentives for investors in new inventions.

3 Patent litigation and adjudication statistics inherently provide no indication of “patent quality”

There is a common refrain in touting the high rate of adjudications that find patents invalid as indicative of underlying patent quality deficiency. This inference is wrong because of the selection nature of litigation — cases that reach litigation are a biased and small subset of underlying disputes.

First, as in other adjudicated legal disputes, patent litigation normally arises and proceeds only when the parties do not settle based on rational evaluation of the quality of their respective cases. Second, as the Priest-Klein theory⁵ predicts, these legal contests are “selected” for adjudication only in close cases in which the parties’ estimates of their respective likelihood of success diverge on close calls. Accordingly, trials are not a random sample from the full range of possible probabilities but rather a selected sample from those cases in which each litigant has a fifty-fifty chance of winning. Cases in which both parties have similar perception of the quality of the case and predict similar outcome are settled – they are not “selected” for litigation. The Priest-Klein model predicts that in civil litigation cases subject to such “selection,” litigants will succeed about 50% of the time. Consequently, Priest and Klein show that the likelihood of success in a trial is invariant to the standard of the decision or *the underlying facts in dispute*. Actual success rate over an ensemble of multiple cases can deviate up to 25% either way from the 50/50 point due to asymmetry between the parties in information or stakes.⁶ Indeed, the percentage of patents in court cases where the patent holder loses in a finding of invalidity is within this range,⁷ but it says nothing about the lower percentage of *all* patents in force *not* selected for litigation that might be

⁴ *EPO Patent Share Source*: “Study on Evaluating The Knowledge Economy - What Are Patents Actually Worth?” EPO, (May 9, 2005).

⁵ Priest, G.L. and B. Klien, “The Selection of Disputes for Litigation.” 13 *Journal of Legal Studies*, 1 (1984); see also Priest, G.L. “Reexamining the Selection Hypothesis,” 14 *Journal of Legal Studies*, 215 (1985).

⁶ Priest (1985) note 5 *supra*.

⁷ See e.g., Ron D. Katznelson, “Patent Continuations, Product Lifecycle Contraction and the Patent Scope Erosion. – A New Insight Into Patenting Trends,” at 36, *Southern California Law Associations Intellectual Property Spring Seminar* (June 8–10, 2007). Available at <http://bitly.com/Patenting-Trends>. (Showing in Figure 6 that district court patent invalidation rates from 1975 to 2005 were around 50% with a variation of [-10% +25%]).

found invalid. This conclusion also applies to post-issuance cases selected for litigation in the Patent Trial and Appeals Board (“PTAB”), which largely mirror the same cases selected for litigation in district court.⁸ The high invalidation rates on either side of the 50% level is inherent to litigation selection – not to the underlying quality of the stock of patents in force. Therefore, Congress and the public should ignore as nonsensical and misleading any suggestion that the high rate of patent invalidation in the courts and at the PTAB is indicative of patent quality of all issued patents.

Ironically, patents of clearly dubious validity are less likely to be selected for litigation because, if they ever come up in infringement dispute, the parties are likely to discover similar deficiencies and litigation will not proceed. Thus, contrary to unsubstantiated notions, adding more such low quality patents to the stock of patents in force would not necessarily result in appreciable increased litigation rate. Similarly, removing low quality patents from the stock of patents in force would not necessarily result in appreciable decrease in litigation rate. Indeed, empirical evidence shows that U.S. Patent Office examination has *no discernable effect on reducing patent litigation rates*: after the U.S. Patent Office started examining patent applications in 1836, patent litigation rates were in fact *higher* than those prevailing prior to 1836, when the U.S. issued patents by mere registration.⁹

Evidently, other factors that determine litigation rate, such as increased infringement activity, competition in the market, and increased use of new technologies, overshadow even radical changes in patent examination regimes. Yet, in the discourse on causes for increased patent litigation, one never hears the most obvious of all causes – increased incentives to infringe. That happens when the patent holder is of limited means compared to a large concern accused of infringement, when the patent law curtails the power of injunctions to prevent infringement, when courts create doctrines under which hindsight can be used to find obviousness, or under fluid and undefined law of patent-eligible subject matter.

Because a patent claim is a legal instrument defining legal boundaries based on the use of words, it is equivalent to a statute. Many so-called “low quality” patent allegations are in fact disputes on claim interpretation, as only 11% of litigated

⁸ Saurabh Vishnubhakat, Arti K. Rai & Jay P. Kesan, “Strategic Decision Making in Dual PTAB and District Court Proceedings,” 31 *Berkeley Tech. L.J.* 45, 81 (2016) (finding that seventy percent of patents associated with a petition before PTAB are also subject to federal court patent litigation).

⁹ See Khan, B. Zorina. *The Democratization of Invention: patents and copyrights in American economic development, 1790-1920*, at 71, Cambridge University Press, (2005) (Number of litigated cases per issued patents were 1.8, 1.3, and 0.7 for the periods 1810-1819, 1820-1829, and 1830-1839 respectively, in contrast with litigation rates of 3.6, 2.1, and 1.5 for 1840-1849, 1850-1859, and 1860 respectively); Beauchamp, Christopher. “The First Patent Litigation Explosion,” 125 *Yale L.J.*, 848, 882 (2015) (patent lawsuits in districts of New York and Pennsylvania rose from about 1 per thousand patents in force in 1830, to 6 per thousand patents in force in 1840).

cases continue on to adjudication passed the *Markman* claim construction adjudication.¹⁰ The patent claim interpretation is often dependent on evolved art and terminologies that could not have been addressed *ex ante* by the examiner even if examination time were doubled. Expecting that litigation necessarily would be eliminated by adding examination time is no different than expecting that there would be no litigation in the courts to interpret statutes if Congress had just spent more time to elucidate the meaning of the statute ...

While the PTO has authority to reallocate examination resources or devise ways to use them more efficiently, it lacks Congressional authority to *increase* them across the board (i.e., it cannot increase the cost of examination per application) even for the laudable purpose of improving examination quality. This is explained below.

4 Setting patent examination quality level (average cost per application) is a substantive policy matter reserved for Congress

The framers of the U.S. Constitution created a patent system that would encourage individual enterprise, in the belief that the pursuit of private returns would lead to the greatest social returns. As a matter of policy, Congress was mindful of the importance of making the patent system affordable to all. When Congress established the patent examination system under the Patent Act of 1836, it set application fees at \$30.¹¹ With this cost, Congress deliberately maintained patent application fees affordable. This was in contrast with the prohibitive application fees then prevailing in other countries, in which patenting was a “sport of kings” inaccessible to persons of ordinary means.¹² Congress anticipated that examination under finite Office resources commensurate with these fees would not be error-free. Indeed, it would accept an application rejection error rate (as perceived by applicants) of 5%.¹³ In the first years of the Office’s examination operations, the Office was fully funded by user fees,¹⁴ the level of which inevitably constituted a substantive Congressional *policy balance* between affordable patenting costs and reasonable examination quality compliance rate.

¹⁰ Jay P. Kesan, Private communication on results of his study with David Schwartz. (Email of December 14, 2018).

¹¹ Patent Act of 1836, Ch. 357, 5 Stat. 117 (Jul. 4, 1836) Sec. 9.

¹² Senate Report Accompanying Senate Bill No. 239, 24th Cong., 1st Sess. (April 28, 1836) (Application fees for the three kingdoms of England, Ireland, and Scotland were \$1,680. They were \$309 in France; \$292 in Spain; and \$208 in Austria).

¹³ *Id.* (“In nineteen cases out of twenty, probably, the opinion of the Commissioner, accompanied by the information on which his decision is founded, will be acquiesced in. When unsatisfactory, the rights of the applicant will find ample protection in an appeal to a board of examiners, selected for their particular knowledge of the subject-matter of the invention in each case.”)

¹⁴ During those years, user fees generated revenues well in excess of the Office’s expenses. See U.S. Patent Office, *Annual report of the Commissioner of Patents for the year 1838*, Washington: G.P.O (1839), p. 56 (Net fee revenues of \$38,424 versus expenses of \$19,243).

Over the years, Congress regularly set patent user fees by statute and appropriated the funds to the PTO, which set examination resources accordingly. Thus, through patent fee legislation, it is Congress — not the PTO — that sets the examination quality level. The policy balance on this issue is substantive and of great impact on the American innovation economy. For example, the high cost of obtaining a patent is cited by startup companies as the top ranking reason for not pursuing a patent.¹⁵ Accordingly, observing that only a very small percentage of issued patents are litigated, Congress in its wisdom may have decided that *further* private resources should be focused only on such disputed patents for enhanced scrutiny rather than *further* increase patenting costs for *all* patent applications.

Laudable as it may be, reducing examination error rate by increasing the average patenting costs to applicants is a *substantive* policy choice which the PTO is not empowered to make. Rather, the issuance of procedural rules is the broadest scope of the PTO's authority under 35 U.S.C. § 2(b): it authorizes the PTO “to promulgate regulations directed only to ‘the conduct of proceedings in the [PTO]’; it does NOT grant the [PTO] the authority to issue substantive rules.”¹⁶

4.1 PTO authority under Section 10 of the AIA is limited

My analysis elsewhere¹⁷ described the limited authority the PTO possesses under Section 10 of the America Invents Act (“AIA”). While the PTO is authorized under Section 10 of the AIA to set and adjust fees, that authority permits the PTO to set fees “only to recover the aggregate estimated costs to the Office for processing, activities, services, and materials relating to patents.”¹⁸ It does not, however, authorize the PTO to *change its aggregate costs* per application and then set fees accordingly. Had Congress intended to vest the PTO with such untethered authority to change fees, there would have been no reason for it to *set* in Section 11 of the AIA an exhaustive fee schedule for all statutory fees as “a reference point for any future *adjustments* to the fee schedule by the Director.”¹⁹ Congress is presumed to have known the effect on examination quality of the fees it set in AIA § 11 — the fees prevailing at that time. In the few years prior to, and including 2011, the PTO's

¹⁵ Ted Sichelman and Stuart J.H. Graham, “Patenting by Entrepreneurs: An Empirical Study, 17 *Michigan Telecommunications and Technology Law Review*, 111, 166-167 (2010) (in a survey of about 1,000 startup respondents, 57% indicated that the cost of getting a patent influenced their company's decision not to patent their most recent invention).

¹⁶ *Merck & Co. v. Kessler*, 80 F.3d 1543, 1549–50 & n.6 (Fed. Cir. 1996); *Tafas v. Dudas*, 511 F. Supp. 2d 652, 663 (E.D. Va. 2007), *citing Merck* (“Section 2(b)(2) does not, however, vest the PTO with any general substantive rulemaking power.”). *See also Therasense, Inc. v. Becton, Dickinson & Co.*, 649 F.3d 1276, 1294 (Fed. Cir. 2011) (same).

¹⁷ Ron D. Katznelson, “The U.S. Patent Office's Proposed Fees Under the America Invents Act—Part I: The Scope of the Office's Fee-Setting Authority,” *Patent, Trademark & Copyright Journal*, Vol. 85, pp. 206-216, (December 7, 2012). Available at <http://bit.ly/PTO-fees-per-AIA-PtI>

¹⁸ AIA § 10(a)(2).

¹⁹ House Report 112–98, Part 1, p. 78 (June 1, 2011) (emphasis added).

measure of examination quality compliance rate was about 95%.²⁰ This examination quality compliance rate during those years was in fact accepted and constructively adopted by Congress when it set the baseline fees in AIA § 11. As such, without Congressional specific delegation of power, the PTO cannot, for example, double the average examination time per application (increase its average cost per application) in order to achieve, say, a 98% quality compliance rate, and then raise its fees under AIA § 11 “to recover the aggregate estimated costs to the Office.” Rather, the only aggregate cost increases that the PTO is authorized to recover through user fees are *exogenous* increases in its cost of production through the annual Consumer Price Index fee adjustment in 35 U.S.C § 41(f). The PTO does not possess plenary fee-setting authority simply because Congress has endowed it with *some* authority to set fees.²¹

As explained above, it is Congress’ prerogative and *duty* to enact substantive policies for achieving certain examination quality levels. Congress did not delegate such authority to the PTO. This is evidenced by the fact that neither Section 10 nor Section 11 of the AIA lay down by legislative act an intelligible principle to which the PTO is directed to conform for changing its average examination cost per application to achieve a certain quality compliance rate.

5 Conclusion

I thank the Subcommittee for considering this information. I urge Congress to move cautiously on any legislative initiative that would make access to the patent system less affordable to inventors. In my prior comments to the PTO described above, I described methods for meeting the PTO examination quality goals where aggregate examination resources are kept at real present levels while optimally reallocating resources to maximize examination quality compliance rates.

Respectfully submitted,

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Signed /Ron Katznelson/

Encinitas, CA.

²⁰ U.S. Patent and Trademark Office, *Performance and Accountability Report, Fiscal Year 2011*, p. 21 (See Patent Final Disposition Compliance Rate and In-Process Compliance Rate, Tables 6-7).

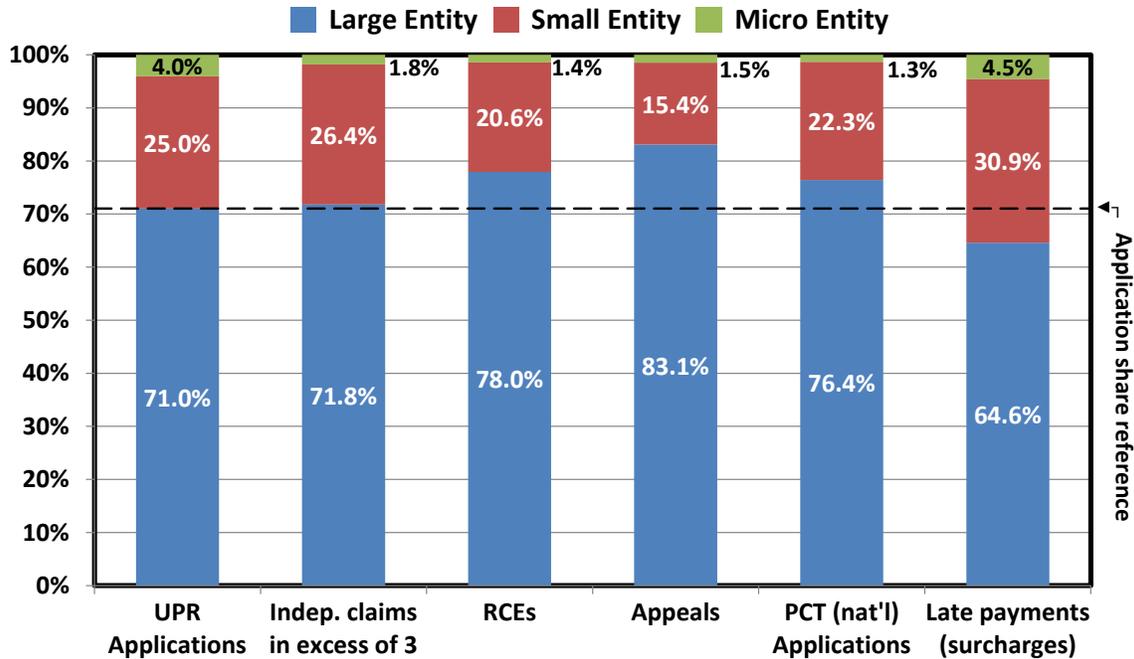
²¹ *Railway Labor Executives' Association v. National Mediation Board.*, 29 F.3d 655, 670 (D.C.Cir.1994) (*en banc*) (An agency does not “possess[] plenary authority to act within a given area simply because Congress has endowed it with some authority to act in that area.”)

APPENDIX

Price elasticity effects of PTO fees and loss of patent rights

The quantity of goods or services consumers purchase (demand) depends on the prices of such goods or services, and their ability to pay such prices. The plot below shows the relative share of selected fee-based filing activities at the PTO in the year following their adjustment by the PTO under its authority enacted in the America Invents Act (“AIA”).

Post AIA filing share at PTO by entity size



Source: FY 2014 Fee Report, Appendix VI to PTO FY 2016 President’s Budget, pp. 150-160. Number of filings is the ratio between the total fee collection for each fee category and the fee set for that category.

Figure 1. Selected filing categories for utility, plant, and reissue (“UPR”) applications at the PTO in FY 2014 by entity size. The categories shown in reference to the entities’ share at filing are: Independent claims in excess of 3, Requests for Continued Examination (RCEs), Appeal briefs filed, Patent Cooperation treaty (PCT) national phase applications, and late payments subject to surcharges.

Note, for example, that the share of small and micro entities’ filings of RCEs and appeals is disproportionately smaller than their application filing share, meaning they may be less able to afford the relatively high fees for these prosecution paths following final rejection of their applications. This undoubtedly means that they are disproportionately deprived of patent claims they would otherwise obtain. Consistent with such liquidity strains on small and micro entities is the fact that they disproportionately end up having to pay surcharges on late payments to the PTO. Doubling fees, as some commentators have proposed, would essentially price many small business and individual inventors out of the patent system. The loss of patent rights due to PTO fee increases can be estimated based on price elasticity analysis, as shown below.

Price elasticity effects

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 PTO, patent fee elasticities indicate the sensitivity (or reactivity) of stakeholders to fee changes. The elasticity (of demand) for a given 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. Let ϵ represent the elasticity value for a particular fee category (for instance, the application fee category). This elasticity is calculated as:

$$(1) \quad \epsilon = \left(\frac{\% \text{ change in quantity}}{\% \text{ change in fee}} \right) = \left(\frac{\frac{(Q_2 - Q_1)}{Q_1}}{\frac{(F_2 - F_1)}{F_1}} \right)$$

Where F_1 and F_2 are the original and new fees respectively, with Q_2 representing the quantity demanded under the new testifee and Q_1 representing the quantity demanded under the original fee. By dividing the change in quantity demanded by Q_1 , one gets the proportionate change relative to the original quantity demanded. The proportionate change in PTO fees, the denominator of equation (1), is calculated similarly. The resulting elasticity values are negative, because PTO stakeholders tend to decrease the quantity demanded as fees increase.

Fee Elasticity Category	Entity Size	Elasticity Estimate	95% Confidence Interval	
			Lower Bound	Upper Bound
Application fees (Filing/Search/Examination)	Large	-0.16	-0.27	-0.06
	Small	Same	Same	Same
Excess Independent Claim Fees	Large ²²	-0.62	-0.79	-0.44
Excess Total Claim Fees		-0.23	-0.35	-0.11
Excess Page Fees		-0.54	-0.95	-0.14
Issue Fees		-0.006	-0.01	-0.001
RCE Fees	Large	-0.08	-0.11	-0.04
	Small	Same	Same	Same
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	Same	Same	Same
2nd Stage Maintenance Fee	Large	-0.10	-0.13	-0.07
	Small	Same	Same	Same
3rd Stage Maintenance Fee	Large	-0.11	-0.12	-0.09
	Small	-0.13	-0.16	-0.09

Table 1. Price elasticity estimates made by the PTO. *Source: “USPTO Section 10 Fee Setting— Description of Elasticity Estimates.”* (July 2019). Appendix to “*USPTO Setting and Adjusting Patent Fees during Fiscal Year 2020.*”

²² The PTO provided no data on estimated elasticities in these categories for small-entities.

The PTO conducted several price elasticity studies based on observations of filing quantities before and after significant fee changes that it made subject to its fee-setting authority under the AIA. The results of these studies are summarized in Table 1. The PTO's analysis is inaccurate for the RCE and appeals categories because these are not independently consumed, as applicants can often substitute one for the other after receiving a final rejection, depending on their relative cost. For example, the price elasticity of RCE was likely underestimated because it was based on the fee changes of 2013, which also included a substantial increase in appeal fees. Because an increase in the appeal fee can drive applicants to increase their demand for RCEs instead, the decline observed in RCE due to its price increase (elasticity of -0.08) is likely substantially less dramatic than it would have been had appeal fees been kept the same and not increased. Such substitution is a function of *cross-elasticity* of demand for these two service alternatives, a 2×2 matrix which the PTO did not estimate.

Doubling examination time would result in economic losses that outweigh any benefits by billions of dollars per year

Doubling examination time would necessarily increase PTO fees, which in turn would result in substantial loss of patent application filings and the dynamic economic benefits of such lost patents. In the following sections I provide a lower bound for such losses.

Increase in fees

The AIA at § 10(a)(2) provides that the PTO may set fees to recover costs: “Fees may be set or adjusted ... only to recover the aggregate estimated costs to the Office for *processing, activities, services, and materials* relating to patents ... including *administrative costs of the Office* with respect to such patent ... fees.” (Emphasis added).

In the most recent fee adjustment notice of proposed rulemaking, the PTO identified its projected expenses for FY 2020, the current fiscal year. Patent operations will cost \$3.170 billion, including \$2.153 billion for patent examining; \$93 million for patent trial and appeals; \$161 million for patent information resources; \$28 million for activities related to IP protection, policy, and enforcement; and \$734 million for general support costs necessary for patent operations (e.g., the patent share of rent, utilities, legal, financial, human resources, other administrative services, and Office-wide IT infrastructure and IT support costs).²³

Doubling examination time requires doubling the number of examiners because examiners operating under a tight production expectancy system are presumed to be fully utilized. All expense components that support the examiner corps will be proportional to the growth in the examiner work force and would therefore also

²³ *Setting and Adjusting Patent Fees During Fiscal Year 2020*, 84 *Fed. Reg.* 37,398, 37,406 (July 31, 2019).

approximately double. The exceptions are the expense components that do not serve the examiner work force (\$93 million for patent trial and appeals and \$28 million for activities related to IP protection, policy, and enforcement), which would remain unchanged. The patent operations costs would therefore increase by about

$$(2) \quad \text{Patent operations cost increase} = 100 \times \left(\frac{\$3.170\text{B} - \$0.093\text{B} - \$0.028\text{B}}{\$3.170\text{B}} \right) = 96.2\%$$

Because under AIA § 10(a)(2), all these expenses are to be recovered by fee increases, aggregate fees will rise by this amount, and presumably the application fees would rise proportionately.

Reduced filings and loss of patents due to PTO fee increases

Assuming the price elasticity of -0.16 for the application fees as provided in Table 1, and a fee increase derived in (2) of 96.2%, the percent reduction of patent application filings will be $0.16 \times 96.2\% = 15.4\%$. The PTO's budget request projects 611,200 serialized applications to be filed by the end of this fiscal year.²⁴ This means that the 15.4% reduction in application filings will cause a loss of $611,200 \times 15.4\% = 94,059$ applications.

The loss of initial application filings, however, would not be the only loss. Applications that made it through and are already in the system but received final rejection may not all be appealed or followed with an RCE due to price increases for those services, and thus will be removed from consideration for possible allowance. In a conservative approach, I consider only the losses in appeals and not in RCE filings because appeals are at the final stage. Table 1 shows price elasticities of appeal fees for large and small entities of -0.15 and -0.33 respectively. It is a reasonable assumption that micro entities can be lumped with small entities for elasticity computations. The number of appeals filed in FY 2018 was 11,456.²⁵ Considering the relative share of large entity appeals shown in Figure 1, and the respective elasticities for large and small entities, it can be shown that the price increase of 96.2% will result in a total loss of 2,397 appeals that would not be filed, removing the underlying applications from possible allowance. As a result, a total of $94,059 + 2,397 = 96,456$ applications would be lost per year. Because not all applications ultimately issue as patents, the estimated number of patents lost is given by $96,456 \times 0.77 = 74,271$, where 0.77 is the latest allowance rate reported by the PTO.²⁶

²⁴ U.S. Patent & Trademark Office, *Fiscal Year 2020 Congressional Justification (March 2019)* at 13.

²⁵ USPTO, *Fee Unit Expense Calculation Detail FY2018*, (July 2019), at 7

²⁶ PTO Dashboard, *UPR Allowance Rate, without RCEs*. (September 2019).

The private value of patents lost

The loss of more than 74,000 patents every year entails a tremendous loss in private value and dynamic economic benefit for technologies that would not be protected and therefore likely not exploited. It is difficult, if not impossible, to estimate the value of lost technology exploitation opportunities. Therefore, I limit this analysis to private value of patents, as those were derived from analysis of maintenance fees of unexpired patents.

In its Regulatory Impact Analysis of fee changes after enactment of the AIA, the PTO used \$115,684 and \$70,232 in 2011 dollars as the average private value of a patent for large and small entities respectively.²⁷ With the 2019 share of large entity application filing of 74.6%,²⁸ the weighted average private value is \$104,159 in 2011 dollars. Using the GDP Deflator²⁹ of 1.163 from 2011 to Q2 of 2019, one obtains the average private value of a patent a $\$104,159 \times 1.163 = \$121,181$ in 2019 dollars.

Given 74,271 patents lost per year having an average private value per patent of \$121,181, the total private value lost **every year** is $\$121,181 \times 74,271 = \mathbf{\$9 \text{ Billion}}$.

²⁷ PTO, *Regulatory Impact Analysis, Setting and Adjusting Patent Fees in accordance with Section 10 of the Leahy-Smith America Invents Act*, (September 6, 2012), at 179. (Relying on Bessen (2008) and Serrano (2005) for private values of a patent for large and small entities respectively).

²⁸ See “12-Month Utility, Plant, and Reissue (UPR) Patent Applications Received by Entity (September 2019) (showing 462,115, 137,732, and 19,242

²⁹ See <https://www.bea.gov/data/prices-inflation/gdp-price-deflator> .