From: Ron Katznelson
Sent: Friday, June 05, 2009 4:39 PM
To: AC6/Comments
Cc: Bahr, Robert
Subject: Deferred Examination Comments

Attention: Robert W. Bahr

Please accept my late-filed comments directed to the Office's inquiry on Deferred Examination.
The extra time was required to finalize a study attached to my comments. I believe that my comments and study will provide important information on this subject.

Best regards,

Ron

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Selected-Works: http://works.bepress.com/rkatznelson/

The Hon. John J. Doll
Acting Under Secretary of Commerce;
Acting Director of the USPTO
Mail Stop Comments-Patents
Commissioner for Patents
P.O.Box 1450,
Alexandria, VA 22313-1450

May 29, 2009

Via e-mail to AC6comments@uspto.gov

Re: *Request for Comments and Notice of Roundtable on Deferred Examination for Patent Applications* **74** *Fed. Reg.* 4946 (January 28, 2009).

Dear Acting Under Secretary Doll:

I wish to thank you for inviting me to participate in the USPTO's February 12 Roundtable on Deferred Examination for Patent Applications (see webcast, agenda and attendee list). I commend you and your staff for engaging in this preliminary inquiry, which I hope will lead to a thoughtful and comprehensive rulemaking inquiry and ultimately to a rulemaking process adopting this practice.

This submission is made to complement my remarks made during the Roundtable, and to further explain the basis of my strong support for the Office's adoption of an Examination On Request ("EOR") procedures in order to reduce pendency and improve patent quality.

During the Roundtable, I alluded to my upcoming public policy paper on EOR and the attached slide set is a summary of my draft paper. Also included as an appendix to the slide set, you will find my draft of a second paper on EOR, which focuses solely on workload savings of EOR systems. The model and parameters analyzed in the paper predict that if the USPTO were to implement a three-year deferral EOR procedure, there would be between 15% to 25% savings in examination workload and an 8% to 11% drop in examined applications compared to the flow under current practice.

I look forward to further participation in your deliberative process on ways to reduce USPTO workload and increase patent quality.

Respectfully submitted by

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Attachment: PowerPoint presentation and Appendix

Examination-On-Request - A Deferred Examination Proposal for the U.S. Patent Office

By

Ron D. Katznelson, Ph.D.

Comments submitted to USPTO

May 29, 2009

Examination On Request (EOR) - Content

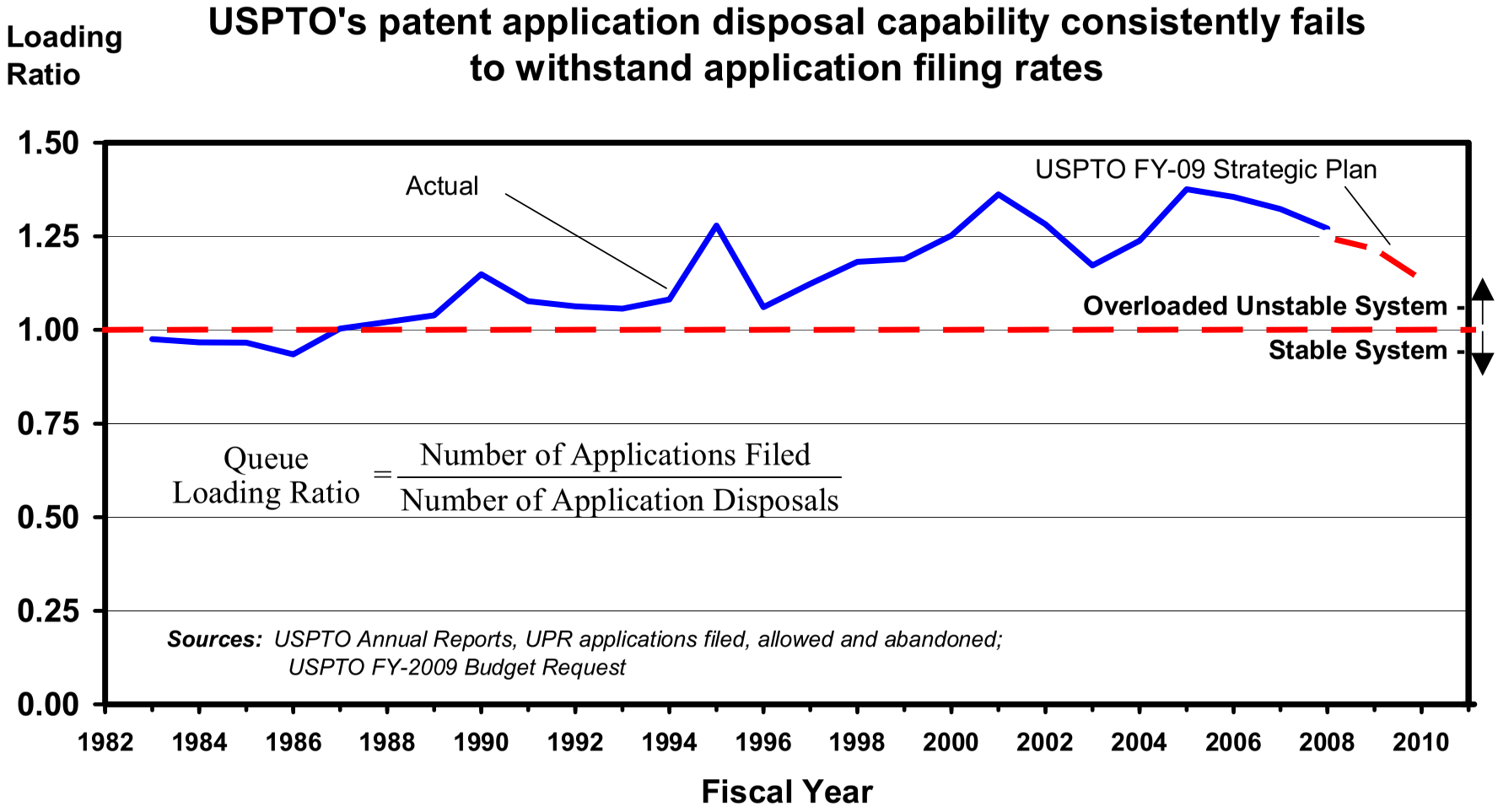
- Acceleration of patent claim obsolescence and the skyrocketing application backlog at the USPTO call for adoption of EOR
- Advantages of EOR
- International experience with EOR
- An EOR system proposed for the U.S.
  - For new applications
  - For existing applications in USPTO's backlog
- Analysis of the proposed EOR system's fit within the existing statutory framework.
- Addressing concerns related to EOR
  - Public Notice Delay
  - Late Claiming
- Other further considerations for EOR implementation.
- Conclusion

Skyrocketing application backlog at the USPTO calls for adoption of Examination On Request system

- The USPTO accumulated more than 1.2 million applications pending examination, three times the number pending a decade ago.
- Incoming patent application filing rate exceeds USPTO's examination disposal capability by 20%.
- The USPTO strategic plan forecasts that examination resource shortfall compared to incoming applications will continue well into 2013.[1]
- **Examination On Request (AKA Deferred Examination) can quickly and effectively reverse this 20-year old trend**.
  - Assuming a 3-year deferral system, an unexamined application dropout rate of 8%-11% is expected. Moreover, even in applications for which examination would ultimately be requested, some original claims would be withdrawn, resulting in ***a larger fraction*** of withdrawn claims (Claim Dropout Rate).
  - The examination workload savings to USPTO would be more than the Application Dropout rate. It would be proportional to the Claim Dropout Rate, which is expected to be in the range of 15%-25%.

1. *See* FY 2009 Budget of the USPTO, at http://www.uspto.gov/web/offices/ac/comp/budg/fy09pbr.pdf (Compare 'UPR Applications Filed' and 'UPR Disposals' at page 19).

EOR Goal: Halt PTO application backlog growth – Achieve Application Loading Ratio ≤1

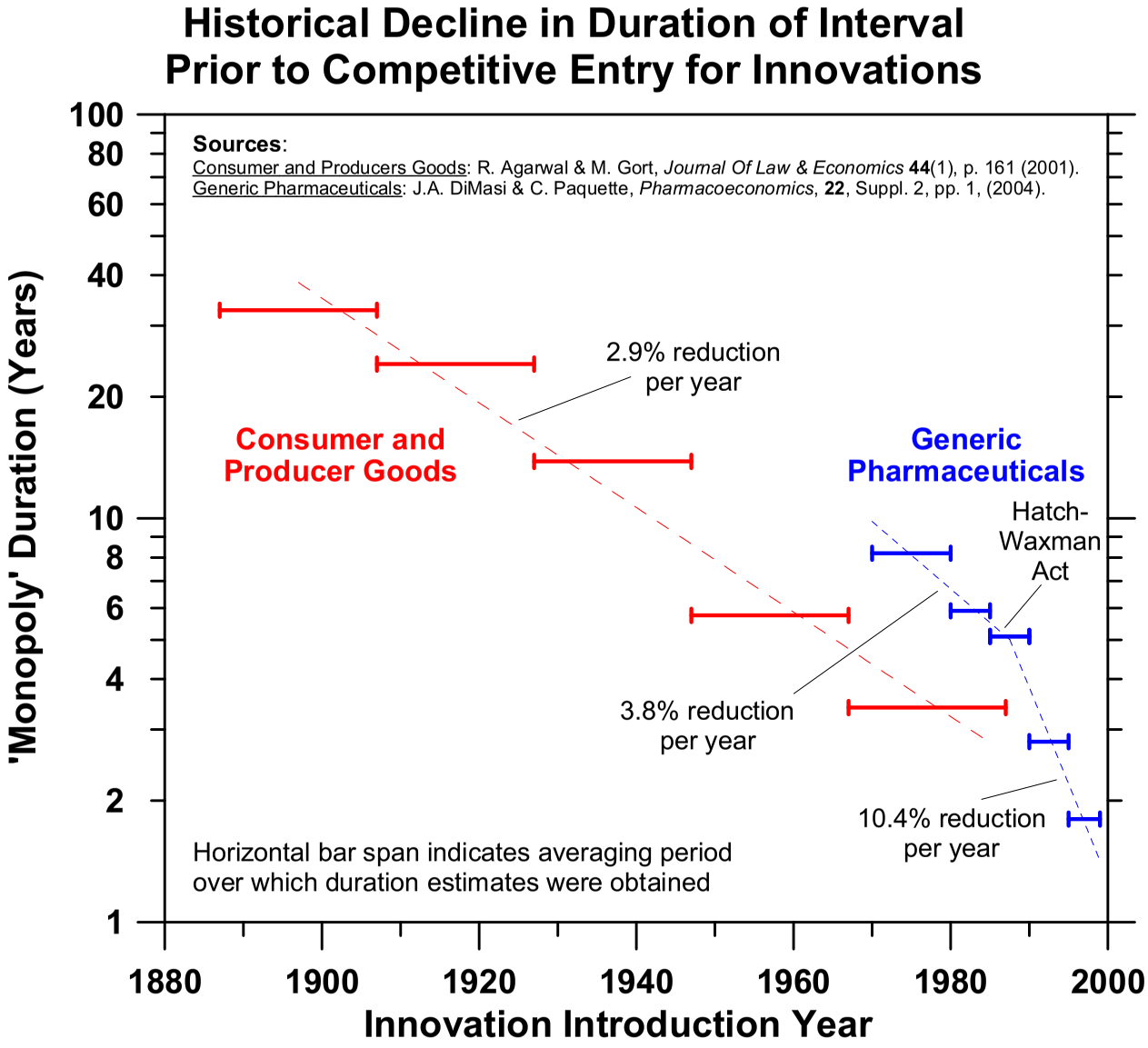


- USPTO forecasts examination resources shortfall of 15% to 20% in the next fiscal year. An EOR program can make up for that shortfall, thereby achieving application queuing stability and subsequent pendency reduction.

EOR targets the consequences of ***product lifecycle contraction and acceleration of claim obsolescence***

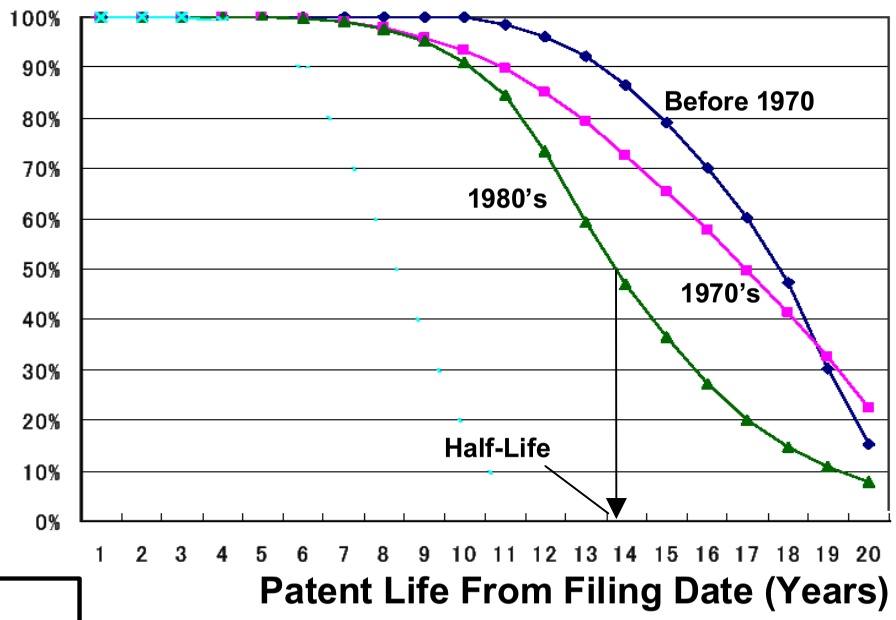
- Increase need for filing Provisional and Continuation applications.
  - A larger fraction of original applications require follow-up late claiming in order to cover specific new features/products and in order to appropriate equivalent returns from inventions.
  - Results in increased number of applications.
- A larger fraction of claims become obsolete by the time the USPTO issues the patent.
  - These obsolete examined applications are progressively less likely to fetch patent renewal revenues to the USPTO.
  - Substantial examination workload savings could be obtained by not examining these obsolete claims in the first place.

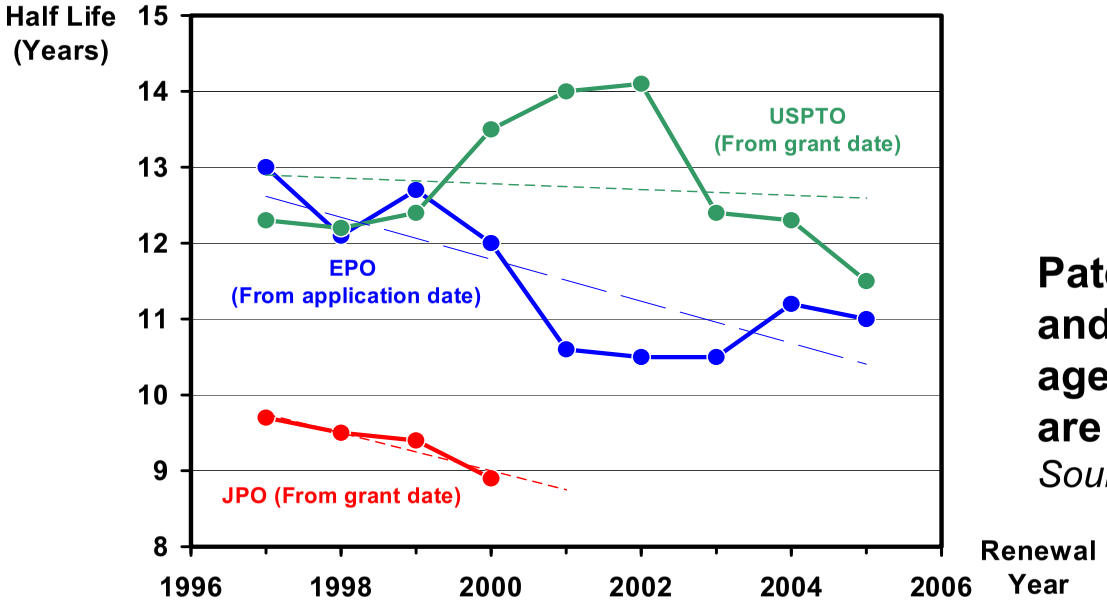
Contraction of Product Lifecycle Accelerates Patent Claim Obsolescence



Patent Lifetime Erosion Due to Product Lifecycle Shortening

Percent of patents surviving after renewal payments at the JPO by grant era. *Source*: Tokyo Institute of Intellectual Property (2006).





Patent lifetime at the USPTO, EPO and JPO. Half-Life is the patent age at which 50% of the patents are not renewed by their owners. *Source*: Trilateral Patent Offices (2006).

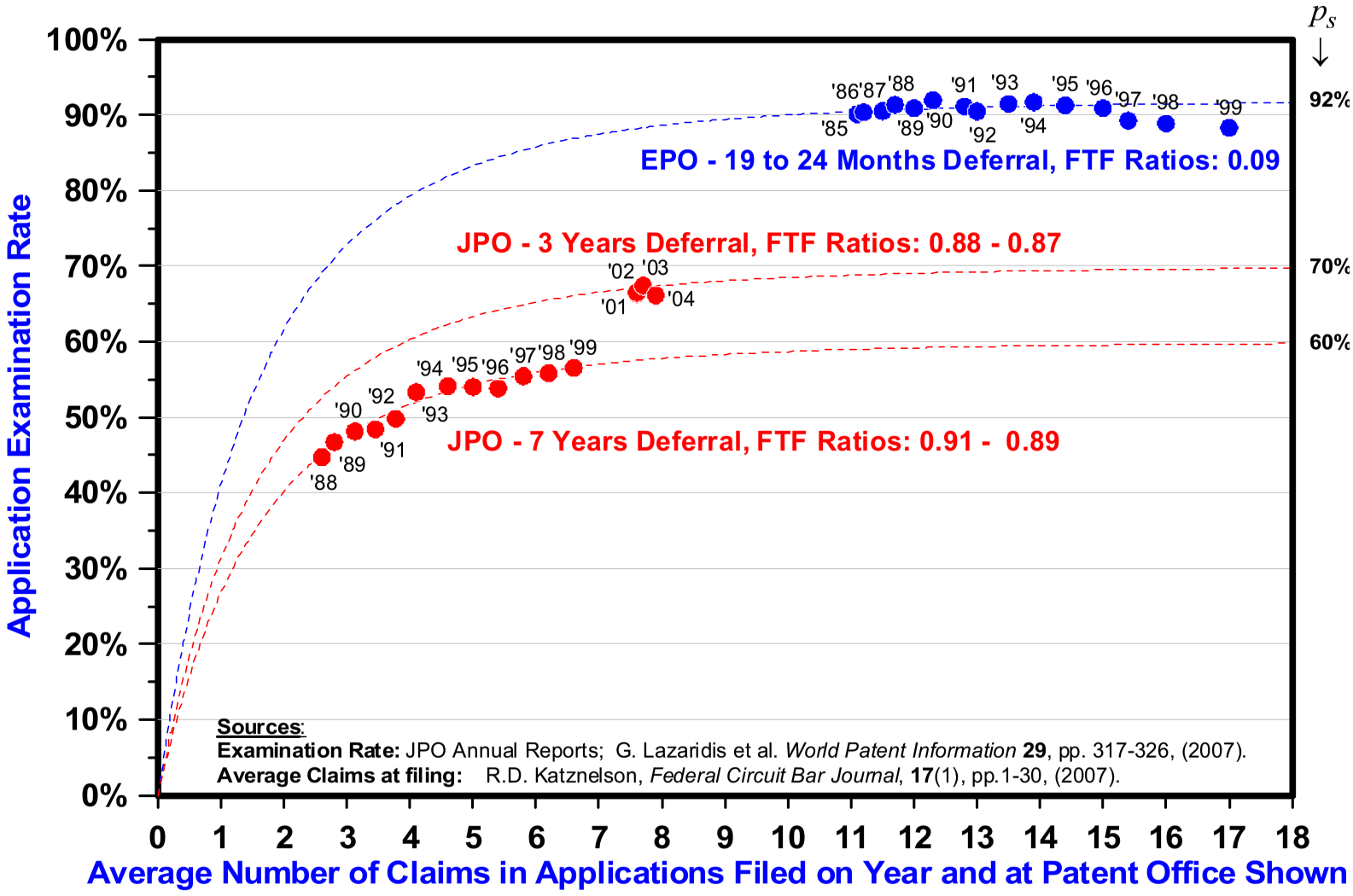
Examination-On-Request (EOR) Advantages

- **To Applicant:**
  - Permits deferral of the patenting decision until the technology features and market opportunities are better understood.
  - Defers or saves user fees and even larger patent prosecution costs.
- **To USPTO:**
  - Examination workload savings.
    - Avoid examining claims that the applicant does not need anymore.
    - Reduction in the number of RCE and Continuation applications.
  - Improved quality by receiving Search Reports and prior art from interested 3rd parties having special expertise in the art.
  - Financial gains by increased renewal fee yield. Examination investments would be made only in patents having longer renewal life.
- **To the Public:**
  - Overall pendency reduction and reduced patent term adjustments.
  - Earlier public notice for non-deferred and secret applications.
  - Elimination of R&D costs for 'designing-around' "clutter" claims that would otherwise issue under the current system.

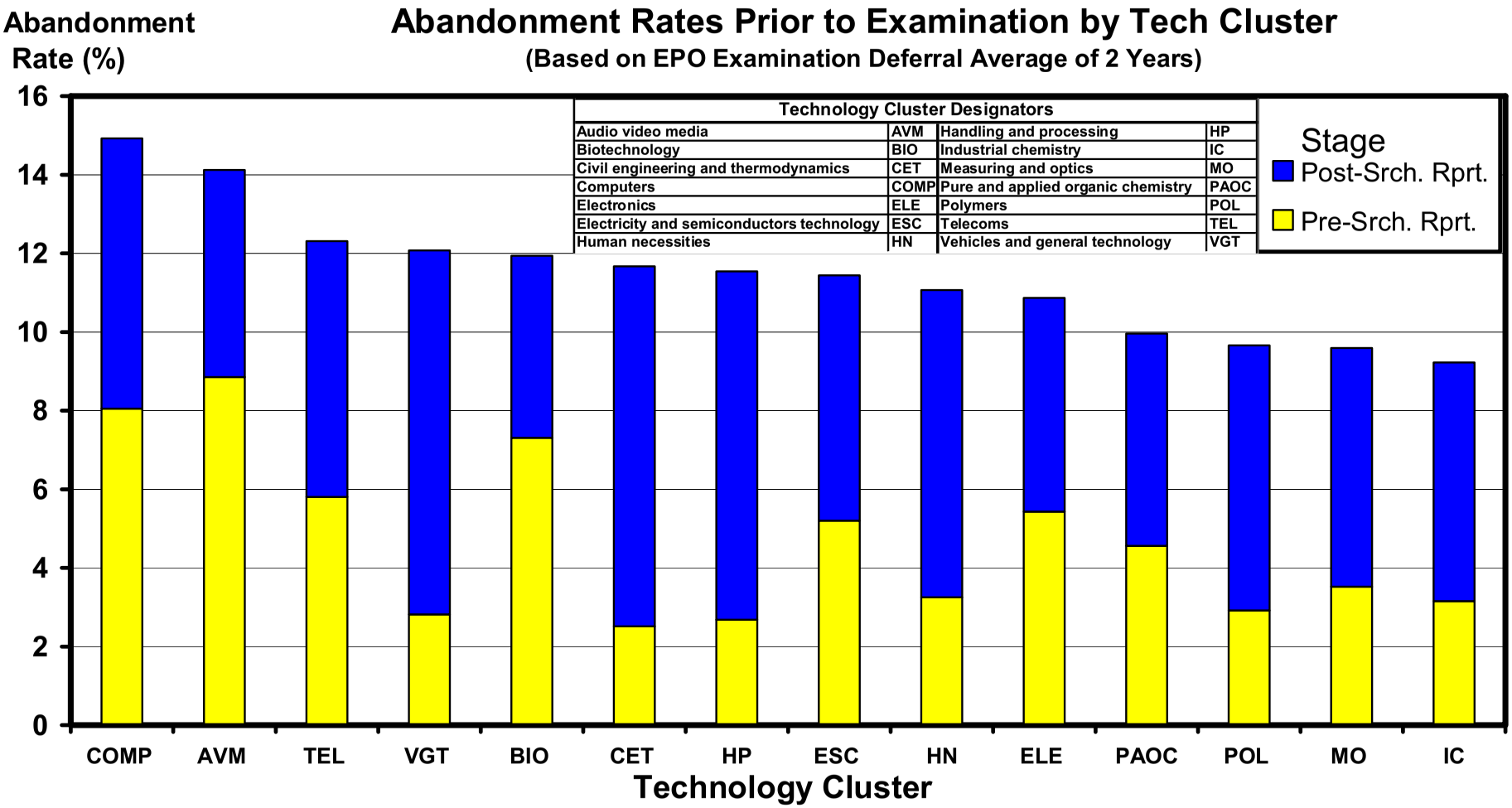
International experience at national patent offices employing Examination On Request (EOR) or 'Deferred Examination' systems

Examination rate by patent application year and by average number of claims at filing that year

Examination Rate at National Patent Offices



Substantial abandonment under EPO's EOR follows the Search Report publication (the last 6 months of deferral period)

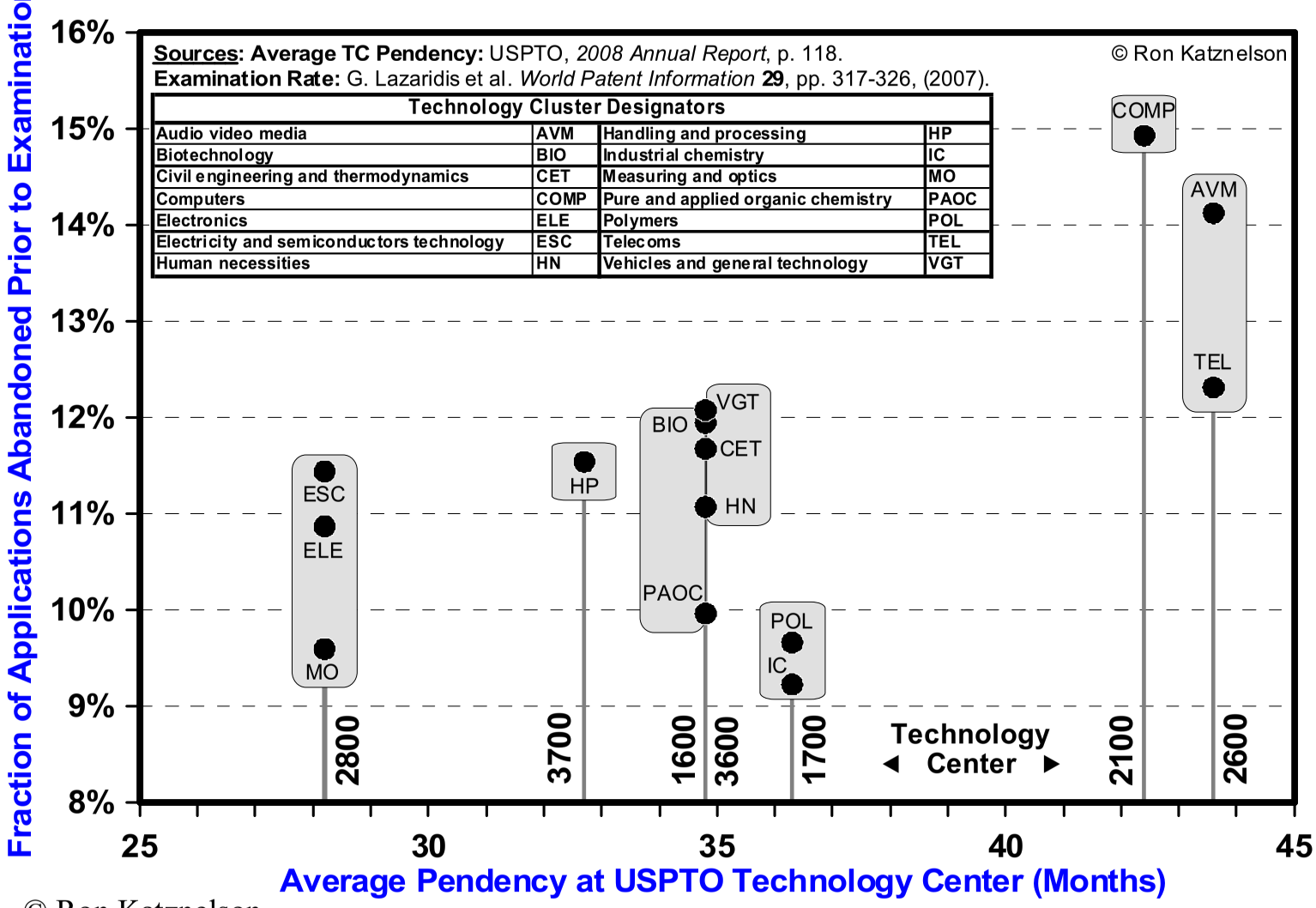


Sources: G. Lazaridis et al. *World Patent Information* **29**, pp. 317-326, (2007)

EOR's workload savings at USPTO would likely be higher where they are most needed

Abandonment Rate Prior to Examination by Technology Cluster

(Based on EPO Examination Deferral Average of 2 Years)



A Proposal For Patent Examination-On-Request System For the United States

Examination-On-Request considerations

- This proposal works within the current statute and ***requires no new legislation***
- Under the current statutory fee structure, estimated fees that may be deferred ***upon a rule change*** until a Request for Examination are:
  - $540 Search Fee (Large Entity); $220 Examination Fee (Large Entity); ~ $440 Excess Claim Fees (Independent and Total claims fees, averaged on all applications[1]). Total potential deferred ≅ $1,200.
  - Statutory fee incentive changes should be considered only if these existing incentives prove insufficient.
- Slide 11 shows that substantial abandonment prior to examination is induced by the Search Report (SR). Preferably, U.S. EOR should also have an SR feature.
- Assuming a 3-year deferral system, an application dropout rate of 8%-11% with a claim dropout rate of 15%-25% would be expected. (See Appendix).
- A 20% claim dropout rate would more than compensate for USPTO's projected examination shortfall – halting and subsequently reducing pendency.

1. Based on FY2006 data produced in the *Tafas v. USPTO* (2007) case , corrected for recent fee changes and estimated average increase in claim count since FY2006.

Proposed EOR System –New Applications

- (a) Permit applicants to elect by simple checkboxes between two options upon filing a new application:
  - (i) Proceed to examination as in current rules or;
  - (ii) Defer examination until an express request for examination is filed within **[3]** years after the application filing date (Maximum Deferral Period).
- (b) Upon making a deferral election, an applicant is required to execute a *Declaration & Non-Exclusive Limited Power of Attorney***,** for the purposes of the *ex parte* process described below and in subsequent slides.
- (c) Any delay due to applicant's examination deferral would be subtracted from any patent term extension credit to the applicant under 35 U.S.C. § 154(b).
- (d) Applications subject to secrecy election under 35 U.S.C. § 122(b)(2)(B) are excluded from deferral and will be examined automatically as in current rules.
- (e) Upon a declaration under 37 C.F.R. § 10.18, payment of fees and pursuant to the *Limited Power of Attorney*, any third party can (anonymously) request a search and/or examination of a published application for which no examination request was filed. The requester may also submit prior art in accordance with 37 C.F.R. § 1.99 at that time.
- (f) Applications for which no request for examination is filed within the Maximum Deferral Period would be deemed abandoned. Appropriate statutory § 133 safeguards from abandonment would be provided through extension of time petitions and the like.

Proposed conditions for PTO's acceptance of applicants' election for new application deferral

- The application is in condition for publication and all statutory §111(a) requirements are complete except for
  - Payment of Examination Fee, Excess Claim Fees and Excess pages Fee.
  - Payment of Search Fee (Optional).
  - Submission of an IDS would be optional, but subject to an IDS fee if filed more than **[**14**]** months after the application filing date. **[**This pre-publication IDS condition benefits third parties who may trigger an examination and/or search based on the publication**]**
- The applicant has not filed a nonpublication request under §122(b)(2)(B)(i), or has filed a request under §122(b)(2)(B)(ii) to rescind a previously filed nonpublication request.
- The Applicant executed and filed with the USPTO a ***Declaration & Non-Exclusive Limited Power of Attorney*** designating any third party to act on the Applicant's behalf as Applicant's authorized agent for perfecting the patent application under §111(a) at any time by:
  - Requesting examination;
  - Paying the Examination, Excess Claim and Excess pages Fees; and
  - Requesting a Search and paying the Search Fee, or submitting a Search Report [in the manner required under Accelerated Examination, *see* MPEP § 708.02(a)(I)(H)].

Proposed EOR System – Applications in backlog

- (a) An application already pending in PTO's backlog would be selected as eligible for deferral if it meets the following conditions (Eligible Applications):
  - The application received no First Action On the Merits (FAOM).
  - The application is not subject to secrecy election under 35 U.S.C. §122(b)(2)(B).
  - The application was filed no more than **[**34**]** months prior to the EOR rule's effective date.
- (b) Prior to a FAOM on Eligible Applications, the PTO would send a Refund Election Action to all applicants of Eligible Applications, requiring affirmative response within **[**60**]** days by electing one of the following options:
  - (i) Examination deferral election under which the applicant would receive a refund of the Examination Fee. The applicant would be required to make the application ready for publication and to execute a *Declaration & Non-Exclusive Limited Power of Attorney***,** for the purposes described below and in subsequent slides. Examination deferral would be up to the Maximum Deferral Period after the application date.
  - (ii) Election for maintaining the application's examination track, forgoing the Examination Fee refund.
  - The application would be abandoned due to failure to respond to the Refund Election Action after the statutory notice and response period.
- (c) Any delay due to applicant's examination deferral would be subtracted from any patent term extension credit to the applicant under 35 U.S.C. §154(b).
- (d) Upon a declaration under 37 C.F.R. § 10.18, payment of Examination Fee and pursuant to the *Limited Power of Attorney*, any third party can (anonymously) request examination of a deferred published application for which no examination request was filed. The requester may also submit prior art in accordance with 37 C.F.R. § 1.99 at that time.
- (e) Applications for which no request for examination is filed within the Maximum Deferral Period would be deemed abandoned. Appropriate statutory § 133 safeguards from abandonment would be provided through extension of time petitions and the like.

Proposed Conditions For PTO's Extraction of Applications from the backlog queue for Deferral

- The application has received no FAOM and has been pending no more than [34] months.
- The application is in condition for publication and all §111(a) requirements are complete and
  - Applicant requested a refund of the Examination Fee, reversing §111(a) completeness.
  - Submission of an IDS would be optional at the Deferral Election date, but subject to an IDS fee if filed after the Deferral Election date.
- The applicant has not filed a nonpublication request under §122(b)(2)(B)(i), or has filed a request under §122(b)(2)(B)(ii) to rescind a previously filed nonpublication request.
- The Applicant executed and filed with the USPTO a ***Declaration & Non-Exclusive Limited Power of Attorney*** designating any third party to act on the Applicant's behalf as Applicant's authorized agent for perfecting the patent application under §111(a) at any time by:
  - Requesting examination and paying the Examination Fee; and
  - Submitting a Search Report [in the manner required under Accelerated Examination, *see* MPEP § 708.02(a)(I)(H)].

The proposed EOR system is cabined within the existing statutory framework

- No reach for agency *Chevron* deference is required because the proposed EOR system is within the intent and clear language of the statute.
- USPTO authority under 35 U.S.C. §2(b)(2) for promulgating the proposed EOR system is also supported by the legislative history of 35 U.S.C. § 41:

In 2003, the USPTO asked Congress to approve a new user fee structure specifically to enable the separation of the filing decisions from the search and examination decisions that applicants make. The USPTO submitted its fee restructuring proposal to Congress with specific language in the Administration's proposed bill entitled "*United States Patent and Trademark Fee Modernization Act of 2003*".[1] In support of its proposed legislation, the PTO submitted to Congress a "*Proposal to Restructure Patent and Trademark Fees and Practices for Fiscal Year 2003*"[2] detailing the user fee separation and breakdown. In fulfilling every aspect of the USPTO request, Congress specifically authorized the USPTO under the Consolidated Appropriations Act of 2004[3] to charge separately for the user fee components, thereby enabling USPTO's implementation of separate refunds and Examination On Request procedures. For example, prior to enactment, the House Report specifically identified the Examination Fee as payable later than the filing fee.[4]

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[1] At http:// www.uspto.gov/web/offices/com/strat21/feebill.htm

[2] At http://web.archive.org/web/20031208101011/http://www1.uspto.gov/web/offices/com/strat21/action/sr1fr1.htm

[3] Pub. L. 108–447, 118 Stat. 2809 (2004). (Amends 35 U.S.C. § 41 in a manner that separates application fee into filing fee, search fee and examination fee to permit separate payments or refunds of examination and search fees).

[4] *See* H. R. Rep. 108-241, at 16 (2003) ("The examination fee, however, may be paid at a later time if paid within ***such period*** and ***under such conditions*** (including payment of a surcharge) ***as may be prescribed by the Director***." Emphasis added).

Fitting EOR Practice within the existing statutory framework – *PTO and Applicants' use of the authorized fee structure*

- Deferral would result from PTO's new rule-based "*scheduled acquiescence*", triggered by an Applicant's Deferral Election requesting to keep an application *incomplete* under § 111(a):
  - § 111(a)(3): "The application must be accompanied by the ***fee required by law***. The fee and oath may be submitted ***after*** the specification and any required drawing are submitted***, within such period and under such conditions***, including the payment of a surcharge, ***as may be prescribed by the Director***."
  - "Fee required by law" pertinent to deferral include § 41(a)(3)(A) – Examination Fee; § 41(a)(1)(B) – Excess claim fees; § 41(a)(1)(G) – Excess pages fees; and § 41(d)(1)(A) – Search fee.
- Note also that, whereas the statute requires that the filing fee be paid "***On filing*** each application…" § 41(a)(1)(A), no such requirement pertains to the other fees listed above.[1]

1. *See also* H. R. Rep. 108-241, at 16 (2003) ("The examination fee, however, may be paid at a later time if paid within ***such period and under such conditions*** (including payment of a surcharge) ***as may be prescribed by the Director***."

Fitting EOR practice within the existing statutory framework – *Patent Term Adjustments*

- Because Patent Term Adjustments (PTA) due to USPTO delays in First Action under §154(b)(1)(A) are keyed-off the date on which an application is made complete under §111(a), applicants cannot receive PTA credit for the deferral period prior to First Action under current law. See § 154(b)(1)(A)(i)(I).
- Because § 154(b)(1)(B)(iii) excludes from PTA credit "any delay in the processing of the application by the [USPTO] ***requested by the applicant.***", issuance of patents with more than 3 years pendency would not entitle applicants to PTA credit due to a delay attributable to their election to defer examination.
- Note also USPTO's general authority in § 154(b)(2)(C)(iii):

  "The Director shall prescribe regulations ***establishing the circumstances*** that constitute a failure of an applicant to engage in reasonable efforts to conclude processing or examination of an application."

Fitting EOR practice within the existing statutory framework – "*unperfecting*" *backlog applications*

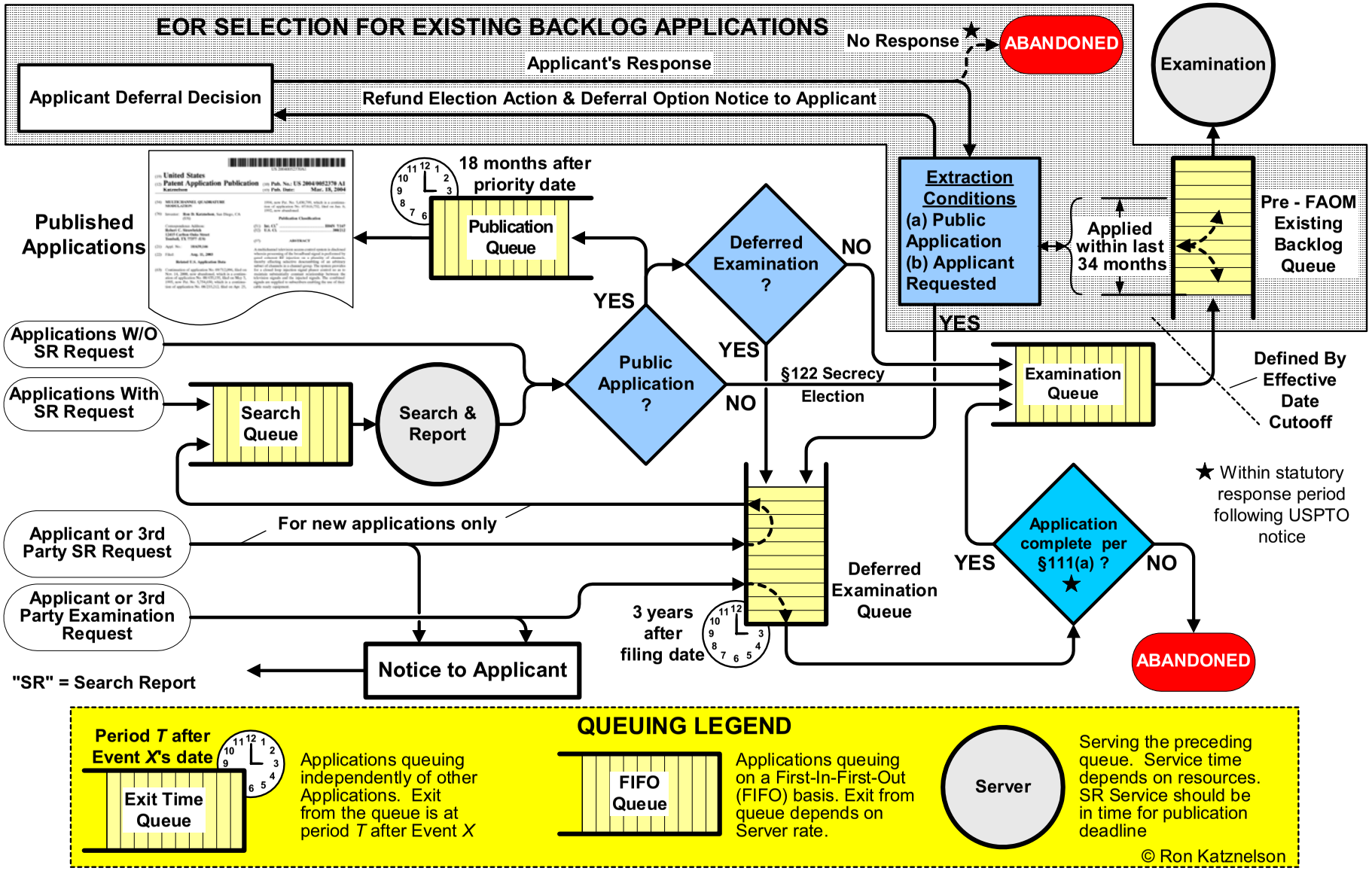
- Under the current statute, the PTO actually has no authority to suspend the examination of an application that meets the statutory requirements:

  "The Director ***shall*** cause an examination to be made of the application and the alleged new invention; and if on such examination it appears that the applicant is entitled to a patent under the law, the Director ***shall*** issue a patent therefor." § 131.

- Moreover, having paid all fees and having complied with §111(a), applicants would have very little incentive to defer examination of an existing application in the backlog.
- However, Applicant's request and receipt of a refund of the Examination Fee would reverse §111(a) completeness of the application. The search fee for Eligible Applications may not be refundable because searches might have commenced on such applications prior to a FAOM.[1] **[**Depending on PTO's financial considerations, an offer to refund the Excess Claim and Excess Pages Fees might also be appropriate to increase applicants' incentive to defer**]**.
- Since examination would be deferred and the Examination Fee would be paid upon later commencement (or may never be required), USPTO's general authority to issue refunds therefor are provided by statute: "The Director ***may refund any fee*** paid by mistake or any amount ***paid in excess of that required***." § 42(d).
- Major drop-off savings to the PTO may come from applicants who would not respond to USPTO's Refund Election ***Action***. Authority for such abandonment prior to FAOM is provided by statute "[u]pon failure of the applicant to prosecute the application within six months after ***any action*** therein…" § 133.

1. However, the USPTO resolved this issue, permitting such refunds in its Search Fee Refund rules. *See* **71** *Fed Reg.* 12281 (Mar. 10, 2006).

Proposed Examination-On-Request for USPTO



Delayed Public Notice Concerns

- Third parties may request examination in order to prevent a patentee from holding off prosecution of an application that others find problematic and in need of early patentability resolution.
- Secret applications would not be deferred.
- Public notice argument as to the 18 months delay in third-parties' ability to request examination is particularly moot in view of the longer FAOM delays.[1]
- Assertion that EOR "harms innovators due to delays in public notice of patent scope" is speculative folklore, unsupported by facts or analysis. *See next slide*.

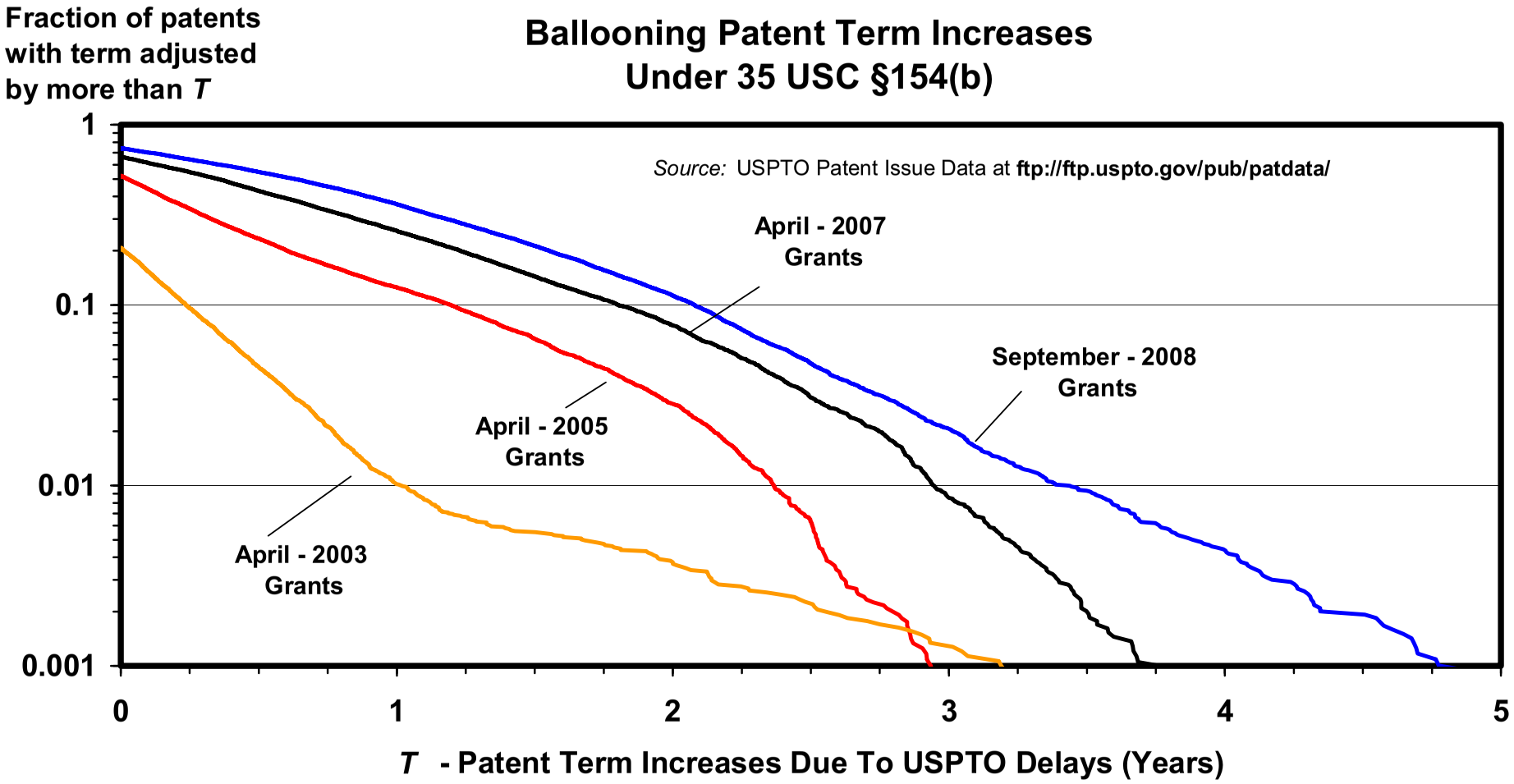
1. First Office Action average pendency is currently at 25.6 months, and growing. *See* USPTO's FY 2008 Annual Report, at page 62.

Given substantial USPTO workload savings of EOR, those objecting to it on grounds of "harm to innovators due to delayed public notice" must bear the burden of showing that EOR's public notice ***net effects*** are harmful

- Without EOR's workload savings, public notice by ***all*** issued patents would be delayed ***further*** due to runaway pendency increases (see next slide).
- Under EOR, every deferred application causes ***all*** later applications to move out of turn ***ahead*** in the examination queue, resulting in ***earlier*** public notice for these ***other*** applications. Are public notice delays in deferred applications *really* more harmful than the ***benefits*** of the ***earlier*** public notice in other issued applications?
- Because secret applications under §122 election would not be eligible for deferral, they would ***all*** move ahead in the examination queue and would publish earlier than under the current examination system. Therefore, any public notice harm from secret "submarine" patents would be ***reduced*** under the EOR system.
- The EOR system would enable some direct filing of Nonprovisional deferred applications instead of using the current practice of Provisional applications. The former type would be published ***earlier***, advancing the public notice by one year.
- Without EOR, innovators are taxed by having to invest R&D in non-infringing solutions "designing-around" patent claims that would have never issued under an EOR system. This major public notice harm would be ***eliminated*** under EOR.

Patent Term Adjustment Due to PTO Delays

These pendency delays are typically <u>in addition</u> to the statutory 3-year pendency baseline



"Late Claiming" Objections are a 'Red Herring'

- Objections on the grounds that EOR permits "late claiming" ignore a very simple fact that applicants may (and) do so at any time under the current system by filing new claims in Continuations.
  - In fact, under EOR, the need for late claiming in chains of Continuations that keep cases "live" would not be necessary and would likely diminish.
- "Late claiming" concerns must be addressed not by rejecting the EOR system but by a broader debate on the patent bargain balance of interests.
  - This balance is currently struck in §120 by permitting applicants to protect their inventions by late claiming provided the claims have full §112 support in the original disclosure (which the public receives ***without any deferral***).

Other advantages to the public – Shorter private right period

- Delay due to deferral would be at applicants expense.
  - Patent Term Adjustment (PTA) under §154(b) would be withheld during the deferral period.
- Because non-deferred applications would receive earlier office actions, and because deferred applications would receive no PTA credit, overall PTA credit grants by the PTO would be reduced substantially. The Public benefits from the shorter "monopoly."

Further considerations for EOR implementation

- Search Report (SR)
  - The value of having an SR prior to the deadline for requesting examination should not be underestimated. There are, however, inefficiencies in separating the search and examination functions. For existing backlog applications, a refund of search fees would be a substantial USPTO cash (but not recognized revenue) liability.
  - These disadvantages must be balanced against the following advantages:
    - The additional Claim Dropout workload benefits would likely exceed the search inefficiency loss (See Slide 11).
    - Enabling a 3rd party requester to submit an SR in lieu of paying the search fee, as codified in 35 U.S.C. § 41(d)(1)(D), would provide the USPTO a substantial quality boost because 3rd party requesters are very familiar with the subject matter and have a vested interest in conducting most relevant searches. It will reinvigorate USPTO's slogan "***Quality is a Shared Responsibility***".
- Existing Application Backlog
  - For these pending applications, this EOR proposal does not call for refund of the Search Fee, Excess Claims or Pages fees, thereby reducing incentives for deferral but providing an important very low entry costs for participating 3rd parties who may have many applications to deal with. Is there a better way to resolve the tension between USPTO's financial refund liability and deferral gains?
- Permit Deferral of applications filed via the PCT?

Conclusion

- EOR provides substantial advantages to applicants, the USPTO and the public
- An effective EOR can be implemented under current law
- Further examination of the features of a well crafted EOR system shows that Public Notice concerns of such EOR are unfounded
- The USPTO should proceed with a formal Notice Of Inquiry on EOR implementation as soon as possible

Thank You

Ron Katznelson

ron@bileveltech.com

APPENDIX

A Simple Workload Savings Model for Patent Offices Employing Examination On Request (Deferred Examination) Systems

Ron D. Katznelson

I. INTRODUCTION

The purpose of an Examination On Request (EOR) system, or as it is often called, Deferred Examination system, is to allow patent applicants a set period between filing and examination, during which they would be allowed to withdraw with little or no penalty, or request examination of an updated claim set. The approach provides an opportunity for "second thoughts" that would eliminate commercially useless or marginal inventions by early voluntary withdrawal, either because the applicant loses interest in patenting the subject matter or because the search report casts doubt on the likelihood of patent grant. This would allow examiners to concentrate on those cases where the applicant had a serious commercial interest in obtaining a grant, as shown by their willingness to pay the fees for substantive examination. Substantial examination workload savings can be therefore realized by the patent office.

The historic, legal and public-policy aspects of EOR are beyond the scope of this paper, as it focuses only on a quantitative assessment of the potential workload savings for the U.S. Patent and Trademark Office (USPTO), should it adopt an EOR system. Section II introduces a model of patent applications and claims dropout during a deferral period. It describes empirical data from foreign patent offices employing EOR and introduces key parameters used in the model. These parameters are the *commercial survival probability*, the *claim protection failure probability* and the *probability density of the total number of claims* in applications filed in a given patent office. A simple mathematical model describing the relative number of applications that are ultimately examined (Examination Rate) is derived and compared with empirical data. Finally, Section III applies the model developed in Section II to the USPTO. The numerical values of the model's parameters are evaluated based on available supportive data and are subsequently used to estimate the potential workload savings at the USPTO, as projected by the model.

II. THE MODEL

Consider the ensemble $\mathcal{A}$ of all patent applications filed in a given national patent office during a given year and for which a request for examination was subsequently due. Each member of the ensemble $\mathcal{A}$ contains a description of an invention pertaining to certain technology subject matter and one or more patent claims covering the specific features of that invention.

By the time the examination deferral period ends, say t months after the application date, an applicant must decide whether to invest further in an application to maintain it and proceed with its examination. During time t, the applicant may discover either that the technology is not sufficiently valuable (better alternatives or flaws in the technology are discovered), or the patentability of the invention comes into question. Note that in most cases, this information is unavailable (either unavailable at practical cost, or totally unknowable even at infinite cost) at the time that an applicant must make a filing decision to avoid statutory bars. Further, because of the "use it or lose it" asymmetry of patent statutes, applicants *must* file applications that later turn out to be commercially

non-viable. This asymmetry biases the future outcomes: information that comes in over time *t* will predominantly be information that tips the balance toward abandonment. Because there are costs for maintaining and continuing the prosecution of the application, some proportion of applicants will decide to abandon their applications if forced to make an invest-or-abandon choice in light of the information that develops. Alternatively, for applications that have estimated value that exceeds the estimated cost of further prosecution, the applicant will file a request for examination no later than time *t.*[1]

For simplicity, this model considers two factors to be required for a given application to move forward to examination. The first, which we will call *commercial survival*, is that its specific *technological solution path* and *subject matter* at the time the application was made, be regarded by its owner as non-obsolete, worth protecting and therefore having "survived" as commercially viable after time *t*. The second factor is *claim protection*, *i.e.*, the ability of the specification to support the claims made and the ability of such claims to reasonably protect a commercial exploitation of the survivable subject matter. Several empirical studies have confirmed what one would expect from ordinary common sense, that the number of claims correlates well with applicants' perception of commercial value and importance, and that when asserted, applications with more claims are more likely to have claims that are valid and infringed. We therefore use the number of claims in an application as a proxy for the strength of *claim protection*, although as discussed below, it may be difficult to truly separate indicators of the number of claims in an application from indicators on the maturity and commercial survivability of the subject matter.

In any event, like most other economic decision-making, both of these factors are subjective in nature. The tipping-point in applicants' decisions depends on their perceptions of relative costs and benefits for continuing and requesting examination on an application. Of course, these tipping points may differ for various national patent systems even for the same inventions.

A. Dependence on Applications' Commercial Survival

As to the first factor, we denote by $\mathcal{S}_t$ the event, and by $p_s(t)$ its probability over the ensemble $\mathcal{A}$, that an application would have "survived" the *commercial subject matter* criteria by the examination request time *t.* It is evident that $p_s(t)$ is a declining function of t – the Maximum Examination Deferral period, making the event $\mathcal{S}_t$ less likely for longer deferral periods *t*. For example, the move at the JPO from seven-year deferral to three-year deferral remarkably increased application survival rate, because less of the abandonment-favoring information becomes available before the expiration of the shorter time *t*, as shown in Figure 4 below.

The timing of the patent application with respect to the invention's development timeline appears to be of greater effect on the amount of commercially-surviving subject matter in an application. Applications filed as priority applications immediately after the invention's conception under a First-To-File (FTF) patent priority systems are more likely to be abandoned before the examination

[1] *See e.g.* H.C. Peterson and W.C. Lewis, *Managerial Economics*, pp. 511-512, 4th Edition, Prentice Hall PTR, (1998) (Generally accepted economic theory holds that individuals and companies will invest in an asset only when the perceived value of the expected economic benefits secured by the asset exceeds the anticipated investment required to obtain or maintain the asset, or both to obtain and maintain the asset, taking into account appropriate risk factors, anticipated rates of return, and related considerations).

request time t than mature applications. Mature applications are those filed not immediately following the conception, but after the inventor took more time for reduction to practice, developing optimal embodiments and best modes of practicing the invention. Mature applications also have the benefit of experimentation and extensive review of the prior art. They are also those filed as second filings, claiming priority to an earlier filing date, such as provided by the Paris Convention or under divisional and continuation laws. For the most part, these latter applications are filed after vetting the content of the application and are therefore generally more likely to survive after deferral.

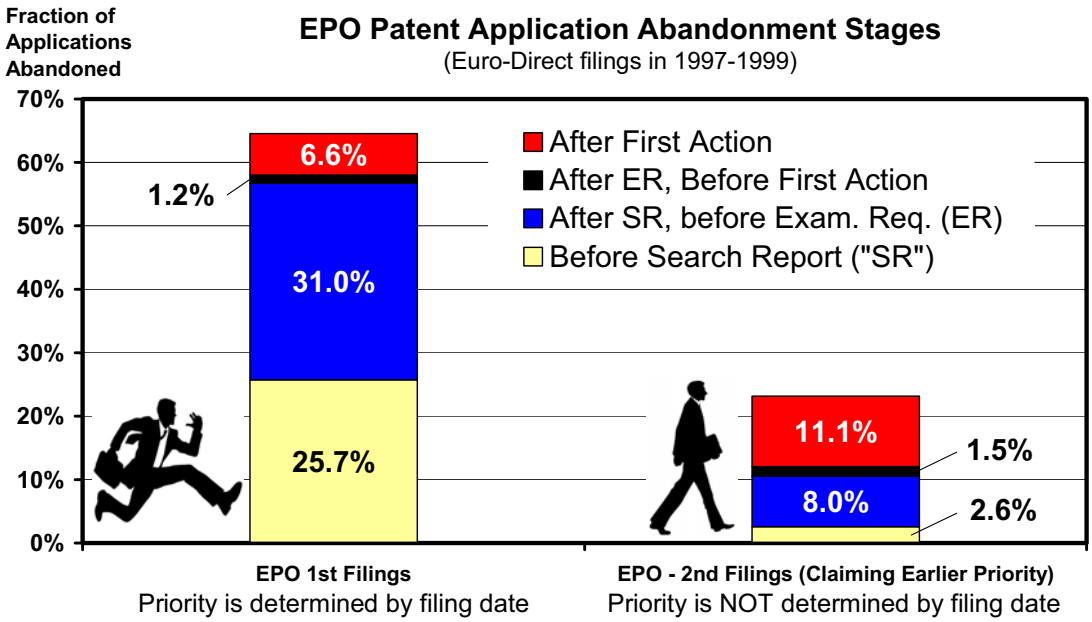


Figure 1. Applications with priority dependant on filing date (under First-To-File law) are less mature and are more likely to be abandoned. *Data Sources*: EPO Data from G. Lazaridis et al. *World Patent Information,* **29**, pp. 317-326, (2007). "First Action" herein means the withdrawal components in column (4) as defined in the heading of Table 2 of Lazaridis et al.

Evidently, there are stark differences under deferred examination systems, between abandonment rates of applications filed under FTF priority constraints and those of secondary filings (i.e., more mature applications). This can be seen for applications filed directly at the European Patent Office (EPO) shown in Figure 1. This figure shows that 58% of EPO-Direct applications filed under the FTF haste to establish a priority date are withdrawn prior to examination compared to only 12% of secondary filings. This rate is even slightly lower for applications entering the EPO via the PCT route (not shown), as those applications undergo an additional selection of maturity and value. Thus, the *commercial* survival probability $p_s(t)$ over the ensemble $\mathcal{A}$ of ***all*** applications in a given national patent office will depend on the relative share of applications that are FTF priority applications. We define the "FTF Ratio" of a given patent office as its share of first-filings under FTF priority in the total application pool. Applications that claim priority to an earlier date than their filing date are not FTF priority applications. For example, because applications at the Japan Patent Office (JPO) are dominated by domestic applicants filing under Japan's first-to-file regime, the FTF Ratio at the JPO has ranged between 0.91 to 0.87, whereas the FTF Ratio at the European Patent Office (EPO) has been far lower, only 0.09.[2] The FTF Ratio at the USPTO is zero because under the First-To-Invent-

[2] The estimates for the JPO were based on the relative share of domestic applications reported in the statistical appendices of the JPO Annual Reports. The EPO estimate was obtained based on the following: Lazaridis reports that during the years 1997-1999, there were 22,271 direct first-filings and 121,826 direct second-filings at the EPO. The

with-strong-grace-period law, the actual legal priority date of an application is earlier than its filing date and because U.S. applicants do not "race to the patent office" shortly after the conception of an invention to establish a legal priority date. Moreover, foreign applicants claim earlier priority to their foreign application and thus file only more mature applications in the U.S. Thus, the commercial survival probability $p_s(t)$ for the USPTO is expected to be higher than that of the EPO or the JPO.

Another element affecting the *commercial* survival probability $p_s(t)$ is the applicant's perception of the residual value of keeping the examination option open compared to the prosecution costs. Thus, abandonment decisions depend on fee amounts, which can easily change $p_s(t)$ by several percent. This calculus is present even after requesting examination and applicants may opt-out prior to first office action at a rate that depends on available fee refund amount. This can be seen in Figure 2 for applications pending first office action at the JPO. It should be noted, however, that after-examination-request withdrawal inducements are far less efficacious than those available before a request. This is because applications subject to examination after a deferral period survived for a reason, and the facts are unlikely to change enough to warrant abandonment only months later.

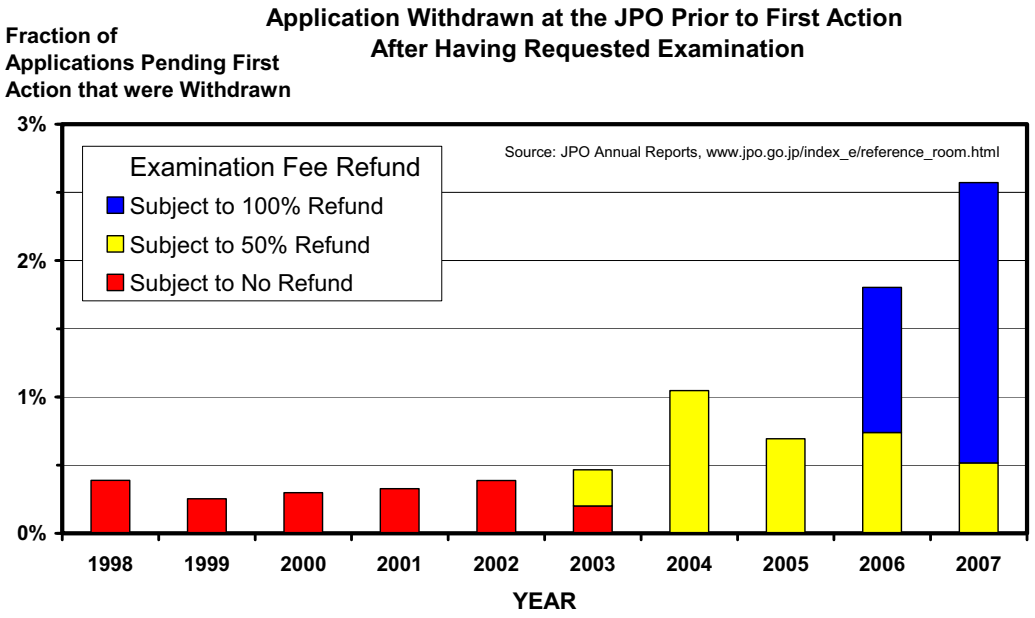


Figure 2. Increases in withdrawals prior to examination due to examination fee refund policies at the JPO. Effective October 2003, the JPO instituted application withdrawal incentives by refunding 50% of the examination fees for withdrawals prior to first action. As of '03, relevant JPO fees in '03 U.S. dollars were: Examination fees: $1,583; Excess claim fees based on average number of claims in '03 at the JPO: $263. The refund amount was raised to 100% of the examination fees in August 2006. *Source*: JPO.

EPO Annual Reports for this period show that these applications, including all indirect filings during the period totaled 244,350 applications. Thus, the EPO FTF ratio is 22,271/244,350 = 0.091. This low FTF Ratio should not be confused with that of European national patent offices, which typically receive a lot more first-filings FTF priority applications.

B. Dependence on the Number of Claims in Patent Applications

Data suggests that applications having large number of claims are less likely to be abandoned. Thus, as to the second factor required for an application to move forward for examination (claim protection), we use the number of claims in an application as an empirical attribute in the model. Let **c** denote the integer-valued random variable consisting of the total number of claims in an application drawn at random from the ensemble $\mathcal{A}$. For simplicity and for reasons discussed below, we do not make a distinction between independent claims and dependent claims in this total count. Let $f(k)$ be the probability density function defined over the ensemble $\mathcal{A}$ for the total number of claims in an application. $P\{\mathbf{c} \quad k\} \quad f(k)$ is the probability that **c,** the total number of claims in an application selected at random, is equal to k. We therefore have

$$\sum_{k \ 0}^{\infty} f(k) = 1, \text{ and } \langle \mathbf{c} \rangle = E\{\mathbf{c}\} \quad \sum_{k \ 0}^{\infty} k f(k), \tag{1}$$

where $E\{\bullet\}$ denotes the statistical expectation over the ensemble $\mathcal{A}$ and where $\langle \mathbf{c} \rangle$ is accordingly the average number of claims in applications of the ensemble.

It is not sufficient in our model for an application to have survived the *commercial survival* criteria; an applicant will only request examination if that commercial value aligns with *claim protection* available in the application. We denote by p the probability that a claim fails to provide the necessary *claim protection* criteria for the survivable subject matter to which the claim is directed, as perceived by the applicant and that such failure is statistically independent of other claims.[3] We also assume that p is identical for all the claims in the application, regardless of their type. Of course, these assumptions are likely incorrect but we make them nonetheless in order to provide a simple and tractable analytic solution intended to provide only a qualitative functional insight. Thus, given an application's *commercial survival* (i.e. given the event S_t), an application having k claims must have had all k claims fail the *claim protection* criteria for it to be abandoned prior to a request for examination at t. Accordingly, the pre-examination abandonment probability *conditioned* on its commercial survival and on its number of claims k, is given by

$$P\left\{\text{Abandonment} \middle| S_t; \mathbf{c} \quad k\right\} \quad p^k. \tag{2}$$

Because $p < 1$, the conditional application abandonment probability declines exponentially with k, the number of claims in the application.

Although we "explain" above the functional dependence of the conditional abandonment probability on k through a model of statistical claim coverage power, the actual cause of this functional dependence need not be determined or resolved here. This is because our model can absorb several (perhaps more plausible) causes for such decline in probability with number of claims. For example, it may well be that the reason for higher survivability of an application is not because it has more claims but because its subject matter is more valuable, which is the cause for its large number of claims. Applicants tend to invest more in applications they perceive to be more valuable, and one of the key targets for that investment is crafting and submitting more claims. Absent any detailed

[3] Note that this assumption actually pertains to the state of the *disclosure* as supportive of the number of claims because it is assumed that upon a request for examination in an EOR system, an applicant can replace or amend claims prior to examination, provided those are supported by the original disclosure. As we shall see below, the mere fact that the originally filed claims fail with probability p means that first-action would not be wasted on *these* failed claims.

causal knowledge of the economic parameters, we adopt a simplified, but empirically reasonable model, that the probability of abandonment decreases exponentially with increasing number of claims, as shown in (2). In this case, p is regarded as a *parameter* (that only "looks like" probability) to be determined empirically by fitting the analytical results to the available data.

Based on this exponential decline model, accounting for all applications within the full spectrum of claim count[4] yields the following conditional abandonment probability over the ensemble $\mathcal{A}$:

$$P\{\text{Abandonment}|S_t\} \quad \sum_{k\ 1}^{\infty} p^k f(k) \quad \sum_{k\ 0}^{\infty} p^k f(k), \tag{3}$$

With substitution of the variable p, one can readily recognize the expression on the right-hand side of (3) as that of the statistical moment generating function[5] associated with the probability density function $f(k)$. It is given by

$$\Phi_{\mathbf{c}}(u) \quad E\{e^{u\mathbf{c}}\} \quad \sum_{k\ 0}^{\infty} e^{uk} f(k)\ . \tag{4}$$

Using this notation and substituting u above by setting $e^u \quad p$, we obtain from (3) the following:

$$P\{\text{Abandonment}|S_t\} \quad \sum_{k\ 0}^{\infty} p^k f(k) \quad \Phi_{\mathbf{c}}(\ln(p)) \tag{5}$$

Given the application's commercial survival, the probability that it will *not* be abandoned (hence, examined) is simply one minus the expression in (5). Using this fact and the relation between conditional probabilities and unconditional probabilities, we obtain the unconditional examination probability across the ensemble of all applications in the given national patent office:

$$P\{\text{Examination}\} \ P\{\text{Examination}|S_t\}P\{S_t\} \ \left[1-P\{\text{Abandonment}|S_t\}\right]p_s \ \left[1-\Phi_{\mathbf{c}}(\ln(p))\right]p_s\,. \tag{6}$$

For brevity, we have dropped the notational dependence on t from $p_s(t)$. It should be understood, however, that longer deferral periods t would generally reduce this probability value. The benefit of the simple expression in (6) is that it admits analytical solutions in cases where the moment generating function $\Phi_{\mathbf{c}}$ of the claim probability density is known and can be expressed in terms of the mean value $\langle \mathbf{c} \rangle$. For purposes of obtaining our estimates, it would be beneficial to adopt a known density function that provides a reasonable approximation fit to $f(k)$ on the one hand, and on the other hand, has an analytically tractable moment generating function that can be expressed in terms of the average number of claims $\langle \mathbf{c} \rangle$. This we do in the next section.

C. Analytical Approximation of Probability Distributions for Claims in Patent Applications

Figure 3 shows empirical probability density functions for patent applications filed at the European Patent Office ("EPO") during two eras as reported by EPO researchers.[6] This author is unaware of any published results on claim number distributions in applications filed at other patent offices that

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[4] For formal convenience in extending the sum in (3) to include $k = 0$, we take $f(0) = 0$, i.e. that an application subject to examination contains at least one claim.

[5] David Stirzaker, *Elementary probability*, Cambridge University Press, 2nd Edition (2003), p. 245.

[6] E. Archontopoulos, D. Guellec, N. Stevnsborg, B. Van Pottelsberghe de la Potterie and N. Van Zeebroeck, When small is beautiful: Measuring the evolution and consequences of the voluminosity of patent applications at the EPO, *Information Economics And Policy,* **19**(2), pp. 103-132, (June 2007) (See Figure 3 at 122).

employ EOR systems, although the mean value at the Japanese Patent Office ("JPO") over the years have been available.[7] As to the EPO researchers' data, the pronounced 'spikes' at 10 and 20 total claims are due to the step-up of application claim fees at the EPO above 10 total claims and at the USPTO above 20 total claims respectively. Because the claim fee effects in U.S. claim populations produces a pronounced step at the 20-claim mark,[8] and because many U.S. priority applications are filed unchanged at the EPO, the U.S. claim "spike" affects the EPO statistics. This is particularly pronounced in more recent years as shown in the 2000-2004 distribution, when U.S. priority-based application share at the EPO was higher than 20 years earlier.

A negative binomial probability density having two independent parameters that control its functional shape was found to provide an adequate match for our approximation purposes, particularly at the lower claim count region below the 10-claim spike.[9] The shapes of such density functions are superimposed and labeled in Figure 3.

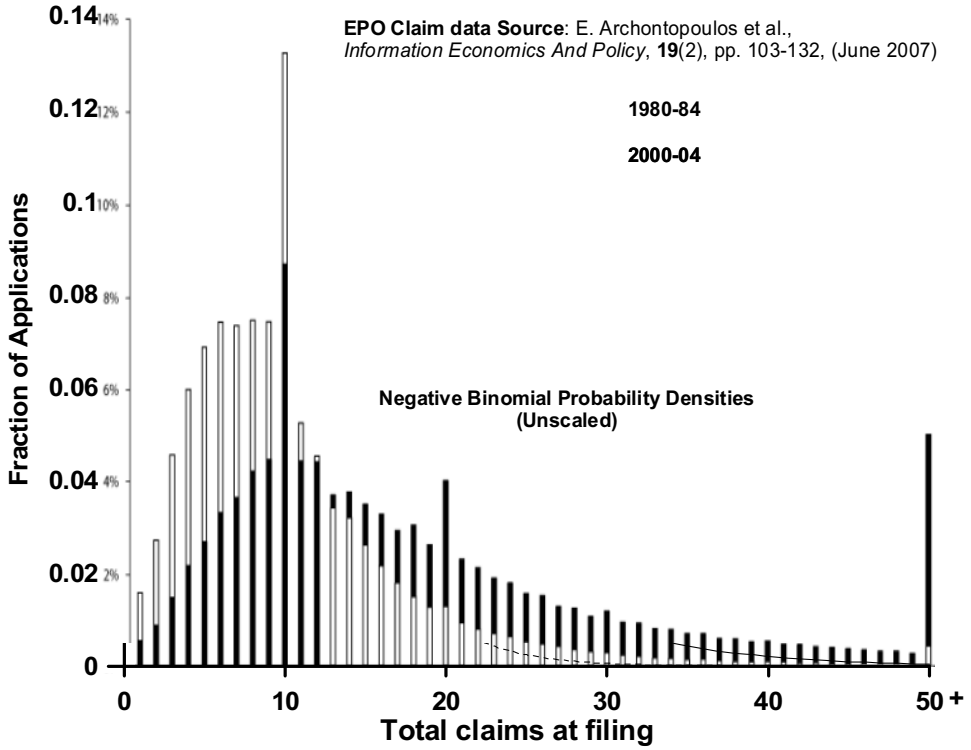

Figure 3. Probability density function of the total number of claims in European patent applications filed during 1980 - 1984 and 2000 - 2004. Each such function is matched with similarly shaped negative binomial probability density, shown with absolute probability values that are not to scale**.**

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[7] Ron D. Katznelson. "Defects In The Economic Impact Analysis Provided By The USPTO For Its New Claims and Continuation Rules. Appendix E to Amicus Curiae Brief" *Tafas/GSK v. Dudas et al*., U.S. District Court, Eastern District of Virginia. Case No. 1:07-cv-846, (hereinafter referred to as *Tafas v. USPTO* (2007)), Doc. 258-5, (January 10, 2008), at 13, available at http://works.bepress.com/rkatznelson/16/.

[8] *See* Katznelson (2008), note 7, at 15, Figure 3. *See also* slide 23 in: Ron D. Katznelson. "The Perfect Storm of Patent Reform?" *Fenwick & West Lecture Series Inaugural Symposium*, UC Davis School of Law, Davis, CA. (Nov. 7, 2008). Available at http://works.bepress.com/rkatznelson/54/, (showing a diagonal high probability 'ridge' corresponding to a total of 20 claims below and parallel to the 25 "total claim limit" line in U.S. applications).

[9] Several well-known discrete (integer) valued probability densities were considered for modeling these empirical distribution excluding the 10 and 20 claim 'spikes'. Both the Poisson and the binomial distributions were found to provide inferior fit to the data, as they permit fewer degrees of freedom for fitting to the empirical densities.

The negative binomial probability density function is given by:[10]

$$f_{r,\varepsilon}(k) \quad \frac{\Gamma(k+r)}{k!\Gamma(k)}\varepsilon^r(1-\varepsilon)^k \quad {}_{r \text{ integer}}\binom{k+r-1}{k}\varepsilon^r(1-\varepsilon)^k;\ \text{for } 0<\varepsilon<1 \text{ and } k \quad 0,1,2,\ldots. , \tag{7}$$

where $\Gamma(k)$ is the Gamma function that coincides with the factorial function $(k\text{-}1)!$ at positive integers k. For a random integer **c** distributed in accordance with the negative binomial density in (7), the mean value and the moment generating function are given respectively by:

$$\langle \mathbf{c} \rangle \quad E\{\mathbf{c}\} \quad r\frac{1-\varepsilon}{\varepsilon}; \quad \text{and} \quad \Phi_{\mathbf{c}}(u) \quad E\left\{e^{u\mathbf{c}}\right\} \quad \left[\frac{\varepsilon}{\left(1-(1-\varepsilon)e^{u}\right)}\right]^r. \tag{8}$$

Because of the exponential decline in the magnitude of the weighting term p^k in (5), the contributions of the $f(k)$ terms for k in the order of 10 or more are negligible for relevant values of p. Thus, the spikes and other deviations of the model distribution from the actual distribution at large values of k have negligible effects on our model and the parameters were selected for best approximation of the distribution at lower k values.

This author found that, although the distribution in (7) is endowed with two independent parameters, it could be well matched to empirical claim distributions having different means (such as those in Figure 3) by using a single variable parameter, provided that r is selected to have a fixed value[11] of $r = 4$. We use this parameter value in numerical calculations throughout the remainder of this paper.

D. Closed-Form Solution for Application Examination Rates

Under the assumptions made in the previous section above, $\langle \mathbf{c} \rangle$ is the only remaining free variable upon which the probability density depends. Therefore, the expression on the left-hand side of (8) above can be used to substitute ε in terms of $\langle \mathbf{c} \rangle$ into the expression for the moment generating

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[10] *See* Stirzaker (2003), note 5. at 245; *See also* http://en.wikipedia.org/wiki/Negative_binomial_distribution.

[11] For the special case where r is an integer, the negative binomial distribution is known as the *Pascal distribution*. It is the probability distribution of a certain number of failures and successes in a series of independent and identically distributed Bernoulli trials. For $k+r$ Bernoulli trials with success probability ε, the negative binomial provides the probability of k failures and r successes, with success on the last trial. It is thus intuitively tempting to envision r as a ***latent*** variable characterizing the number of inventive concepts that patentees perceive as having successfully covered in an application, by drafting k claims. They do not "stop adding more claims" in the application so long as they perceive a "failure" to adequately cover these r latent inventive concepts. According to this heuristic view, the last instance for which applicants perceive coverage "failure" during this process is when claim k is included, at which point they stop adding more claims. Under this intuitive framework, the ability to precisely fit claim distributions using the same value of $r = 4$ over an historical span of decades, is remarkable. This suggests that the historical changes in the distributions and the growth in the average number of claims $\langle \mathbf{c} \rangle$ are merely due to the reduced "success" probability ε that a claim adequately covers one inventive concept. Under this intuitive framework, ε can be thought of as a measure of claim breadth and that historically, claim scope had diminished over time, necessitating more claims. This notion is consistent with other evidence of historical claim-scope erosion described by this author in: "Patent Continuations, Product Lifecycle Contraction and the Patent Scope Erosion – A New Insight Into Patenting Trends", *Southern California Law Associations Intellectual Property Spring Seminar*, Laguna Niguel, CA, (June 8 - 10, 2007), available at http://works.bepress.com/rkatznelson/3/.

function on the right hand side of (8). Accordingly, since we have set $e^{u} \quad p$, we rewrite (6) and arrive at the probability of examination as follows:

$$P\{\text{Examination}\} \quad \left(1-\left[\frac{\varepsilon}{(1-(1-\varepsilon)p)}\right]^{r}\right)p_s \quad \left(1-\left[\frac{r}{\langle \mathbf{c}\rangle(1-p)+r}\right]^{r}\right)p_s \qquad (9)$$

The model in (9) provides an intuitive insight into the examination rate data obtained from national patent offices. The examination probability in applications at the respective office is an increasing function of $\langle \mathbf{c}\rangle$ with values that asymptotically approach p_s with large average number of claims. Three curves based on (9) are superimposed with broken lines on plots of actual data from the EPO and the JPO. Using the fixed value of $r = 4$ discussed above, the two available parameters p and p_s were used for fitting the function in (9) to the data in Figure 4. Unfortunately, only the JPO 7 - year deferral data had sufficient spread to meaningfully constrain unique possible values of p and p_s, yielding the empirical fit values of $p = 0.36$ and $p_s = 0.6$. For the other two curves (JPO 3-year deferral and EPO variable deferral) the value of $p = 0.36$ was kept, resulting in p_s values of 0.7 and 0.92 for the JPO and the EPO respectively. The latter are shown as the asymptotic values of examination rates on the right hand side of Figure 4.

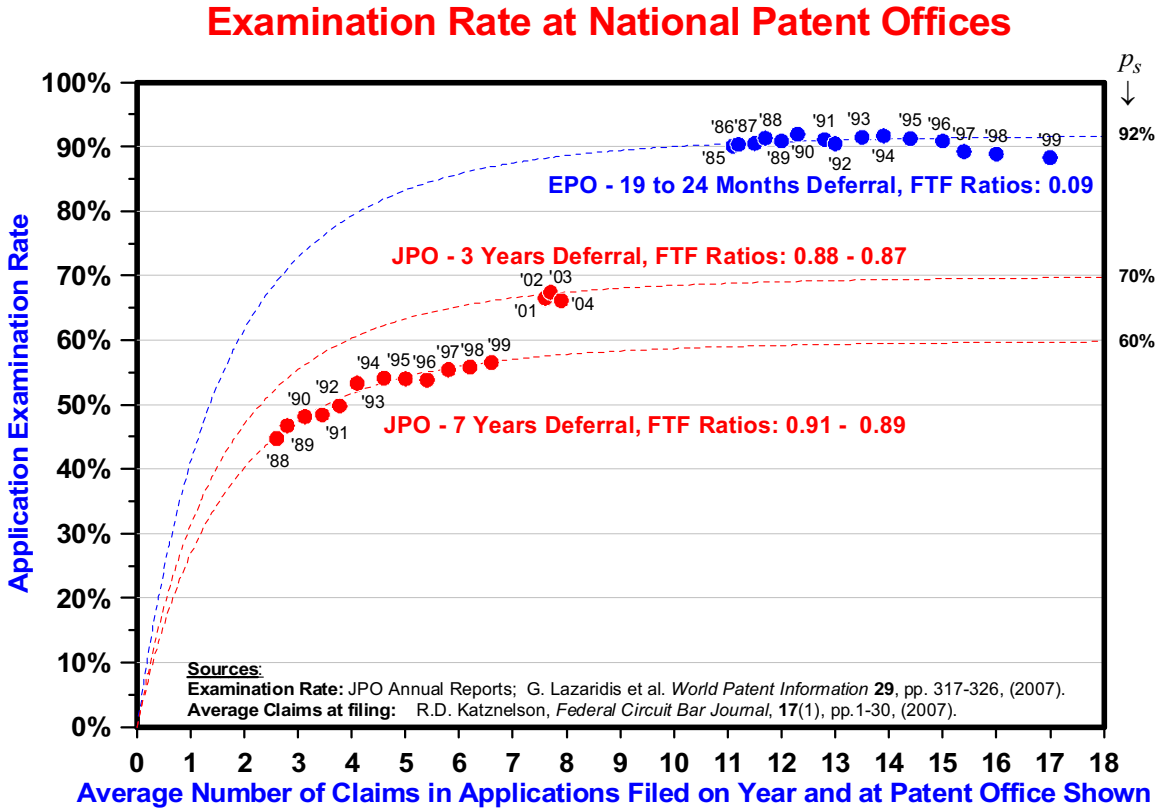

Figure 4. Examination rates (Probability of Examination) at the EPO and the JPO versus the average number of claims filed at the respective patent office in the years shown by labels for each point. The deferral period at the JPO has changed from seven years to three years starting for applications filed after October 2001, shown in a separate cluster. The FTF Ratio ranges shown for the respective patent offices correspond to the estimated fraction of applications in that office that arrive as First-To-File priorities. For the EPO, the FTF ratio is based on the fraction of EPO first-filings in '97-'99 as reported by Lazaridis. The JPO FTF Ratio was estimated by the ratio of resident filings to all filings as given in the JPO annual reports.

E. Examination Workload Savings in EOR Systems

Whereas workload savings is related to the fraction of applications abandoned prior to examination under an EOR system, accounting for the actual savings is a bit more complex than just counting dropped applications. For simplicity, we use the total number of claims in applications examined as a measure of examination workload. For simplicity, we also assume that examiner workload for searching and issuing a First Action On Merit (FAOM) is a fixed fraction $a < 1$ of the total work required for an application disposal. Of all N applications in the ensemble, there are two categories of applications that give rise to workload savings in EOR systems. The first category contains the applications that do not survive the commercial survival criterion. Under the model, this occurs with probability $1 - p_s$, irrespective of the number of claims and thus the number of claims dropped prior to first action in this category is given by

$$(1-p_s)\sum_{k\ 0}^{\infty} k\,f(k)N \quad (1-p_s)\langle \mathbf{c}\rangle N \tag{10}$$

The second category is the category of applications having commercially-surviving subject matter but having claims that are dropped as useless due to failure to provide claim protection. Because we assume that each claim in such applications will be useless with probability p, independently of all other claims, the number of claims dropped prior to first action in this second category is given by

$$p_s p\sum_{k\ 0}^{\infty} k\,f(k)N = p_s p\langle \mathbf{c}\rangle N \tag{11}$$

Although the applications in this category may survive (except those dropped applications for which *all k* claims are useless), upon a request for examination, the dropped claims will instead be replaced or amended for presentation on first-action. Thus, the examination workload savings associated with both of these categories of dropped claims is that no *first-action* is taken on *these* claims. Therefore the FAOM savings are given by weighing the sum of the terms in (10) and (11) by the FAOM workload fraction a:

$$\text{FAOM Savings} \quad a(1-p_s)\langle \mathbf{c}\rangle N + a\,p_s p\langle \mathbf{c}\rangle N \quad a\langle \mathbf{c}\rangle N\left[1-p_s(1-p)\right] \tag{12}$$

As to examination savings under EOR beyond first-action work, the FAOM savings accounted for above with respect to the first category in (10) are the only savings expected for this category. This is because there would be no secondary office actions on applications that do not survive the commercial survival criterion even under an automatic examination system as applied at the USPTO today. In this latter case, these applications would be dropped after FAOM anyway.

In contrast, there would be claim examination work savings beyond FAOM for some applications in the second category in (11). This is because, unlike automatic examination systems that otherwise sustain full prosecution of the claims (or substitute claims) in an application with commercially-surviving subject matter, none of the claims in abandoned applications of this category would be presented under EOR. To obtain the total number of claims in abandoned applications that are in this otherwise commercially-surviving second category, we must use the probability density of the number of claims in abandoned applications. That is, we look for the *conditional* probability of having k claims in a survivable-subject-matter application *given* that it is abandoned under the model:

$$f\left(k\middle|S_t;\text{Abandonment}\right)\quad P\left\{\mathbf{c}\quad k\middle|S_t;\text{Abandonment}\right\}$$
$$\frac{P\left\{\text{Abandonment}\middle|S_t;\ \mathbf{c}\quad k\right\}}{P\left\{\text{Abandonment}\middle|S_t;\right\}}P\left\{\mathbf{c}\quad k\middle|S_t\right\}\quad\frac{p^k}{\Phi_{\mathbf{c}}\left(\ln(p)\right)}f(k), \tag{13}$$

We have used Bayes' theorem for conditional probabilities in the transition to the second line in the equation above, after which the identities in (2) and (5) were substituted in the numerator and denominator respectively. The resulting probability density in (13) for the number of claims in abandoned applications is a weighted version of the ensemble distribution *f*(*k*), with relatively more applications having fewer number of claims *k,* as they are more likely to be abandoned in accordance with our model. To obtain the secondary Office Action (OA) savings based on the total number of claims dropped in these abandoned applications, we note that the total number of such abandoned applications is $P\left\{\text{Abandonment}\middle|S_t\right\}p_sN=\Phi_{\mathbf{c}}\left(\ln(p)\right)p_sN$, across which, the number of claims are distributed according to (13). We therefore sum the number of dropped claims over all values of *k* and multiply by 1 – *a,* the relative remaining examination work after FOAM, to obtain the workload savings in secondary OAs:

$$\text{Secondary OA Savings} = (1-a)\Phi_{\mathbf{c}}\left(\ln(p)\right)p_sN\sum_{k\ 0}^{\infty}k\,f\left(k\middle|S_t;\text{Abandonment}\right)$$
$$(1-a)p_sN\sum_{k\ 0}^{\infty}k\,p^k f(k)\quad(1-a)p_sN\sum_{k\ 0}^{\infty}p\frac{\partial}{\partial p}\left(p^k\right)f(k)\quad(1-a)p_sNp\frac{\partial}{\partial p}\left[\Phi_{\mathbf{c}}\left(\ln(p)\right)\right], \tag{14}$$
$$(1-a)p_sN\Phi_{\mathbf{c}}'\left(\ln(p)\right),\quad\text{where }\Phi_{\mathbf{c}}'\text{ is the derivative of }\Phi_{\mathbf{c}}.$$

The last term in the first line of (14) was obtained by reversing the order of differentiation and summation and recognizing that the resulting sum is the moment generating function given in (5).

For the negative binomial distribution case, we use the moment generating function in (8), substituting ε as we have for (9) and using it in (14) to obtain

$$\text{Secondary OA Savings} = (1-a)p_sNp\frac{\partial}{\partial p}\left[\frac{r}{r+\langle\mathbf{c}\rangle(1-p)}\right]^r=(1-a)p_sNp\langle\mathbf{c}\rangle\left[\frac{r}{r+\langle\mathbf{c}\rangle(1-p)}\right]^{r+1}, \tag{15}$$

By summing the FAOM savings from (12) and the secondary OA savings from (15) we obtain the total workload savings

$$\text{Total Savings} = \langle\mathbf{c}\rangle N\left\{a\left[1-p_s(1-p)\right]+(1-a)p_sp\left[\frac{r}{r+\langle\mathbf{c}\rangle(1-p)}\right]^{r+1}\right\} \tag{16}$$

Finally, because the measure for the total examination workload currently under automatic examination system is $\sum_{k\ 0}^{\infty}kf(k)N\quad\langle\mathbf{c}\rangle N$, the *relative* savings due to EOR is given by the following fraction:

$$\text{Relative Savings} = \text{Total Savings}/\langle\mathbf{c}\rangle N\quad a\left[1-p_s(1-p)\right]+(1-a)p_sp\left[\frac{r}{r+\langle\mathbf{c}\rangle(1-p)}\right]^{r+1} \tag{17}$$

after a search report. Abandonment after the search report can be the dominant component, particularly in offices having low FTF Ratio, as seen in the second-filings column of Figure 1. The second component (discovery of new facts over time) is the major factor for the dependence of p_s on t, the Maximum Deferral period. So for example, the EPO deferral period for the application years shown in Figure 4 ranged between 19 to 24 months, increasing only in the last few years up to 33 months.[15] The EPO asymptote of $p_s = 0.92$ should therefore be associated with maximum deferral period of less than two years. As explained earlier, the relatively low FTF Ratio (0.09) at the EPO explains the relatively low commercial survival dropout rate as compared to the JPO. Because the FTF Ratio at the USPTO is even lower (zero), a comparable deferral period at the USPTO would likely result in higher survival probability than that at the EPO. However, because we assume a three-year maximal deferral, the survival probability is harder to pin down. Thus, obtaining bounds from other evidence and estimating the expected decline rate per year of p_s is desirable.

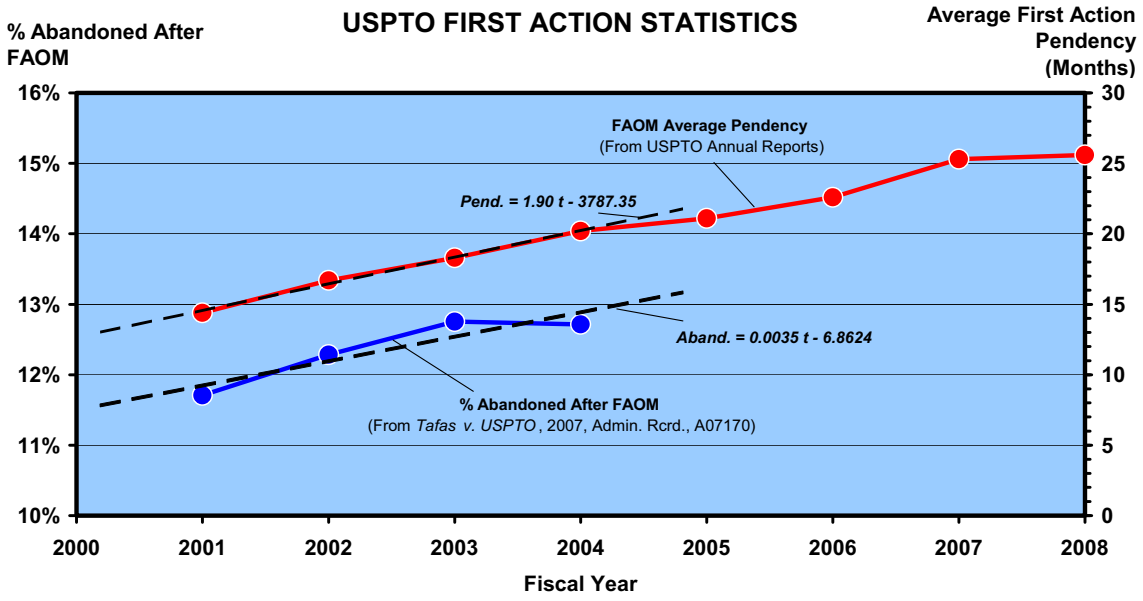

Figure 5. Abandonment after First Action On Merit (FAOM) and average FAOM pendency at the USPTO. Note that longer FAOM average pendency corresponds to increased application abandonment after FAOM. See text.

For that purpose, Figure 5 shows relevant FAOM statistics at the USPTO where application survival after first action is highly related to p_s. This is because under current USPTO practice, there is no mechanism or incentive for applicants to drop out prior to examination. Express abandonment prior to examination entails no upside to the applicant, as no refund is received, and the tangible downside is absorbing the expense of tracking, writing, sending and docketing an abandonment request letter. Therefore, application survival rate after FAOM can serve as a *lower bound* estimate for p_s in the USPTO, if appropriately adjusted for the longer deferral time compared to FAOM pendency.

[15] Examination deferral in the EPO terminates 6 months after the publication of the search report. According to the Trilateral Patent Statistics Report (http://www.trilateral.net/statistics/tsr.html), EPO search reports have been issued after average pendencies that increased from 14.7 months for 1995 search reports to 17.2 months for 1998 and to 27.3 months for such reports issued in 2001. Thus, taking into account the reports' delay spread, during the application years for which the asymptote is a good fit in Figure 4, deferral was estimated to range from 13+6 months to 18+6 months. The lower examination rates seen in the last few application years ending in 1999, for which average deferral is estimated to have been 27.3+6 = 33.3 months based on 2001 issued report pendencies, is therefore not surprising.