Fordham Intellectual Property, Media and Entertainment Law Journal

Volume 35 *XXXV*
Number 4

Article 1

2025

Registry Systems as Gatekeepers: How Patent Registries Create Systemic Barriers to Innovation

Miriam Marcowitz-Bitton

Ori Sharon

Registry Systems as Gatekeepers: How Patent Registries Create Systemic Barriers to Innovation

Cover Page Footnote

* Full Professor, Bar-Ilan University Faculty of Law, S.J.D. University of Michigan Law School. ** Assistant Professor, Bar-Ilan University Faculty of Law. S.J.D., Duke University School of Law. The authors thank Mike Schuster—Associate Professor, Terry College of Business, University of Georgia, J.D. South Texas College of Law—for assisting in collecting and analyzing the data. His contribution to was essential to the present research. This study is supported by a grant from the Israel Science Foundation. Grant No. 1735/23.

Registry Systems as Gatekeepers: How Patent Registries Create Systemic Barriers to Innovation

By: Miriam Marcowitz-Bitton[*] & Ori Sharon[**]

Picture an inventor. Anyone at all. We bet you imagined a man, is that right? If you did, that's not surprising—our study of over 140,000 patent applications reveals that three out of four patents name all-male inventors, and only three percent of patents represent the inventions of women-only teams. But this massive gender gap is not just about who chooses to invent—it's about who gets to protect their innovations through the patent system.

This Article presents groundbreaking evidence that women face systemic barriers in securing patents, even when they clear the hurdles to become inventors. Drawing on an unprecedented dataset spanning four major patent offices (USPTO, EPO, WIPO, and IPO), we find that patent applications from teams with female inventors are significantly less likely to be granted than those from all-male teams—even when controlling for technology field, team size, and filing location. Moreover, when women secure patents, their innovations receive fewer citations from future inventors, suggesting their contributions are routinely undervalued.

These findings challenge the conventional wisdom that gender gaps in patenting reflect the underrepresentation of women in technical fields. Instead, our data reveal how the patent system itself, through high costs, complex procedures, and human discretion in examination, creates additional barriers for women inventors. This matters because patents are more than mere pieces of

[*] Full Professor, Bar-Ilan University Faculty of Law, S.J.D. University of Michigan Law School.

[**] Assistant Professor, Bar-Ilan University Faculty of Law. S.J.D., Duke University School of Law.

The authors thank Mike Schuster—Associate Professor, Terry College of Business, University of Georgia, J.D. South Texas College of Law—for assisting in collecting and analyzing the data. His contribution to was essential to the present research.

This study is supported by a grant from the Israel Science Foundation. Grant No. 1735/23.

paper—they're crucial tools for attracting investment, building companies, and shaping technological progress.

Previous studies have offered glimpses of these disparities by looking at single patent offices or global averages. Our multi-jurisdictional analysis provides the first comprehensive picture of how patent systems worldwide may be stifling women's innovations. The implications are stark: when patent systems disproportionately exclude women inventors, we all lose out on potential breakthroughs and economic growth.

To address these systemic barriers, we propose specific reforms to make patent systems more accessible and equitable. These include procedural changes to reduce examiner bias, expanded support for underrepresented inventors, and—most ambitiously—a new "unregistered patent" system that could provide baseline protection while reducing entry barriers. At stake is not just fairness in innovation, but the future of technological progress itself.

I. INTRODUCTION 870
II. THE EVOLUTION AND THEORY OF REGISTRIES 880
A. PROPERTY REGISTRIES 880
B. IP REGISTRIES 882
III. THE HIDDEN COSTS OF REGISTRATION SYSTEMS 885
A. THE HIDDEN COSTS OF IP REGISTRATION SYSTEMS 886
1. DIRECT ECONOMIC BARRIERS 886
A) FILING AND MAINTENANCE FEES 887
B) COSTS ACROSS IP REGISTRATION SYSTEMS 888
C) LEGAL REPRESENTATION COSTS 889
2. STRUCTURAL AND SOCIAL BARRIERS 889
A) INSTITUTIONAL AND ORGANIZATIONAL BARRIERS 890
B) ORGANIZATIONAL

STRUCTURE IMPACTS 891
C) NETWORK ACCESS LIMITATIONS 891
D) SUPPORT SYSTEM DISPARITIES... 892
3. THE ROLE OF HUMAN DISCRETION IN REGISTRATION SYSTEMS 892
A) EXAMINER DECISION PATTERNS 893
I. IMPACT OF SUBJECTIVE STANDARDS 893
II. JUDICIAL REVIEW AND SYSTEMIC BARRIERS 895
IV. UNEQUAL OUTCOMES: THE DISTRIBUTIVE EFFECTS OF IP REGISTRATION SYSTEMS 895
A. GENDER AND RACIAL DISPARITIES IN OUTCOMES 896
B. FINANCIAL BARRIERS TO IP REGISTRATION .. 897
C. STRUCTURAL BARRIERS DURING PROSECUTION 898
D. BROADER IMPLICATIONS FOR WOMEN ENTREPRENEURS 899
V. EMPIRICAL EVIDENCE 899
A. WHY FOCUS ON A COUNTRY AND WHY ISRAEL? 899
B. DATA COLLECTED 902
C. FINDINGS 905
1. FEMALE REPRESENTATION IN PATENT APPLICATIONS 905
2. GENDER BREAKDOWN OF INVENTOR TEAMS 911
3. REGRESSION ANALYSIS OF PATENT GRANT BY FEMALE REPRESENTATION 913
4. FORWARD CITATION ANALYSIS 916
VI. DISCUSSION 918
VII. RECOMMENDATIONS FOR REFORM 924
A. INSTITUTIONAL AND ADMINISTRATIVE

REFORMS 924
B. ENHANCING INSTITUTIONAL SUPPORT AND RESOURCES 926
C. ADDRESSING STRUCTURAL AND CULTURAL BARRIERS TO INNOVATION 927
1. STRUCTURAL BARRIERS: SUPPORTING FAMILY RESPONSIBILITIES 927
2. CULTURAL BARRIERS: INCREASING PARTICIPATION IN PATENT-INTENSIVE FIELDS 927
D. UNREGISTERED PATENTS 928
VIII. CONCLUSION 931
DA - VARIABLE DEFINITIONS 933
APPENDIX B – PATENT APPLICATIONS FROM ISRAELI INVENTORS BY YEAR 937
APPENDIX C – PERCENTAGE OF TEAM GENDER COMPOSITION AMONG ONLY ISRAELI INVENTORS 942
APPENDIX D – PERCENTAGE OF WOMEN AMONG ONLY ISRAELI INVENTORS 944
APPENDIX E – REGRESSION ANALYSIS ON PERCENT OF FEMALE ISRAELI INVENTORS 946

I. INTRODUCTION

In 1809, Mary Dixon Kies became the first American woman to receive a patent when she revolutionized the hat industry with the invention of a method for weaving straw with silk.[1] Despite her groundbreaking achievement, Kies faced substantial challenges as an inventor.[2] Societal norms of the early 19th century often limited

[1] *Mary Dixon Kies*, NAT'L INVENTORS HALL OF FAME, https://www.invent.org/inductees/mary-dixon-kies [https://perma.cc/CW6R-43HR].

[2] Dawn Ellmore, *Mary Dixon Kies: the First Woman to Receive a U.S. Patent, and Who Continues to Impact on Our Easter Celebrations*, MEDIUM (Apr. 1, 2021),

female participation in scientific fields, and the patent system was predominantly male-oriented.[3] Although the Patent Act of 1790 permitted "any person or persons" to apply for patents, women seldom did so, partly due to cultural constraints.[4] Kies' decision to patent her invention was a pioneering act that challenged these societal barriers. Tragically, she died in poverty after a fire destroyed her patent documentation.[5] Her story marked not a breakthrough, but a harbinger of modern issues with the patent system—centuries later, systemic barriers continue to impede women inventors' ability to protect their intellectual property.

Mary Beatrice Davidson Kenner's experience exemplifies how race and gender have historically intersected to obstruct access to patent protection. Kenner, an African American inventor, developed a sanitary belt in the 1920s—a precursor to modern menstrual hygiene products—but was unable to secure a patent for over thirty years due to financial constraints and systemic exclusion.[6] When she finally received a patent in 1957, companies that had initially expressed interest in licensing the product withdrew upon discovering her race.[7] Despite holding multiple patents over her lifetime, Kenner's inventions were never commercially adopted, and she received little recognition or financial benefit from her work.[8] Her story illustrates the compounded structural barriers that have long

---

https://dawn-ellmore.medium.com/mary-dixon-kies-the-first-woman-to-receive-a-u-s-9172460cc765 [https://perma.cc/S2GM-SJ4Q].

3 Rainer Frietsch et al., *Gender-Specific Patterns in Patenting and Publishing*, 38 RES. POL'Y 590, 592–95 (2009).

4 David Tristan, *May 5, 1809: Mary Dixon Kies, First Woman to Receive a U.S. Patent*, ABC27 (May 5, 2023), https://www.abc27.com/digital-originals/may-5-1809-mary-dixon-kies-first-woman-to-receive-a-u-s-patent [https://perma.cc/5JBK-9JFB].

5 NAT'L INVENTORS HALL OF FAME, *supra* note 1; Tristan, *supra* note 4.

6 *Mary Beatrice Kenner: The Inventor Who Changed Women's Lives*, HISTORY HIT (May 30, 2023), https://www.historyhit.com/mary-beatrice-kenner-the-inventor-who-changed-womens-lives/.

7 *Mary Davidson Kenner: An Unsung Inventor and Pioneer in Women's Health*, UPSCALE MAG. (May 5, 2023), https://upscalemagazine.com/mary-davidson-kenner-an-unsung-inventor-and-pioneer-in-womens-health/.

8 *Id.*

impeded marginalized inventors from fully participating in the intellectual property regime.

Sara Blakely, the founder of shapewear company Spanx, faced these systemic barriers when she sought to patent her innovative undergarment design.[9] Initially, she aimed to work with a female patent attorney but discovered that none existed in Georgia at the time.[10] Blakely was forced to approach male attorneys, who not only failed to grasp the potential of her idea, but also quoted fees ranging from $3,000 to $5,000—sums she couldn't afford.[11] Undeterred, she navigated the patenting process largely on her own, ultimately securing a patent that laid the foundation for her now billion-dollar business.[12] Blakely's experience highlights the gatekeeping role and dismissive attitudes of intellectual property ("IP") professionals that often discourage women from pursuing protection for their innovations.[13] Her path to success, while extraordinary, underscores the structural and cultural barriers that continue to hinder women inventors.[14]

These stories, spanning centuries, share a disheartening theme: women inventors have long faced systemic exclusion, whether through societal bias, economic barriers, or institutional indifference. While there has been progress toward gender equality, the world of intellectual property remains deeply inequitable.

Collectively, these individual experiences reflect broader systemic failures in intellectual property protection. The challenges faced by Kies, Kenner, and Blakely are not merely isolated incidents or products of unique circumstance—they exemplify how registration systems, despite their promise of equal access, can

---

9 Mark Laudi, *Spanx's Founder Couldn't Afford a Patent Attorney. So She Figured Out How to Protect Her IP Herself.*, PITCHMARK (Jan. 27, 2022, 10:30 AM), https://www.mynewsdesk.com/sg/pitchmark/news/spanxs-founder-couldnt-afford-a-patent-attorney-so-she-figured-out-to-protect-her-ip-herself-441341 [https://perma.cc/ZLK6-9NB7].

10 *Id.*

11 *Id.*

12 *See id.*

13 *Id.*

14 *See id.*

function as gatekeepers that disproportionately exclude inventors from marginalized populations.[15] Their stories reveal a troubling pattern: systems designed to protect innovation often create barriers through complex interactions between economic constraints, administrative discretion, and institutional biases.[16]

To understand this paradox, we must examine the fundamental architecture of property registration systems and their evolution into modern IP frameworks. Registration systems were initially conceived to strengthen property rights and commercial activity by creating clear, accessible frameworks for protecting and transferring assets.[17] Yet their structure and operation often perpetuate the very inequities they claim to address.[18] By tracing how seemingly neutral administrative processes can reinforce existing power structures, we can better understand why after centuries of access, female inventors continue to face systemic barriers to the patent system.[19]

Property registries have long been heralded as cost-effective tools for administering property rights, providing public notice, and facilitating economic transactions.[20] Land registries, used for centuries, have served as critical mechanisms for defining ownership and streamlining the transfer of real property.[21] Building on

---

15 *Id.*

16 Recent research shows that female inventors exhibit lower grant rates throughout the entire prosecution process (not just first action grant rates or the like). *See* Michael Schuster & Jordana Goodman, *Gender Inventorship Equity in Patent Prosecution*, 15 SCI. REP. 2070, 2072 (2025).

17 Miriam Marcowitz-Bitton & Emily Michiko Morris, *The Distributive Effects of IP Registration*, 23 STAN. TECH. L. REV. 306, 308–10 (2020).

18 *Id.*

19 INVENT TOGETHER, *supra* note 12.

20 Douglas G. Baird & Thomas H. Jackson, *Information, Uncertainty, and the Transfer of Property*, 13 J. LEGAL STUD. 299, 303–04 (1984); Abraham Bell & Gideon Parchomovsky, *Of Property and Information*, 116 COLUM. L. REV. 237, 245–46 (2016).

21 Kenneth G. C. Reid, *From Registration of Deeds to Registration of Title: A History of Land Registration in Scotland*, UNIV. OF EDINBURGH SCH. OF L. RSCH. Paper Series No. 2015/29, at 2–3 (discussing the primary motivations for establishing Scotland's first land registry—publicity and the protection of acquirers—while noting that in other jurisdictions, the primary impetus was secured lending). *Cf.* Jindřich Frajer & David Fiedor, *A Historical Curiosity or a Source of Accurate Spatial Information on Historical Land Use? The Issue of Accuracy of Old Cadastres in the Example of Josephian*

this foundation, IP registries for patents, copyrights, and trademarks have become essential for protecting the rights of inventors, creators, and entrepreneurs.[22] These systems are widely celebrated for protecting property rights and fostering economic growth.[23] Yet, academic discourse has primarily focused on their advantages, often overlooking their potential to create significant barriers for underrepresented groups.[24]

Recent studies reveal that these registries impose profound distributive effects, disproportionately impacting women, racial and ethnic minorities, and other marginalized groups.[25] High costs, procedural complexity, and potential examiner biases collectively hinder equitable access to IP protections.[26] While these barriers affect all disadvantaged groups, their impact on women inventors is particularly pronounced.[27] Globally, women remain vastly underrepresented in patent filings.[28] A 2015 World Intellectual Property Organization study of Patent Cooperation Treaty applications found that less than 30% of filings included female inventors, and fewer than 5% were solely attributable to women.[29]

Cadastre from the Habsburg Empire, 100 LAND USE POL'Y 104937, at 2 (2021) (examining the origins of land registries in Bohemia as mechanisms for tax collection).

22 Chinmoy Nath Saha & Swapan Bhattacharya, *Intellectual Property Rights: An Overview and Implications in Pharmaceutical Industry*, 2(2) J. ADVANCED PHARM. TECH. RSCH. 88, 88 (2011).

23 Marcowitz-Bitton & Morris, *supra* note 17, at 312–13; Baird & Jackson, *supra* note 20, at 303–04.

24 *Id.*

25 Kyle Jensen et al., *Gender Differences in Obtaining and Maintaining Patent Rights*, 36 NATURE BIOTECHNOLOGY 307, 307 (2018). *See generally* Robert Brauneis & Dotan Oliar, *An Empirical Study of the Race, Ethnicity, Gender, and Age of Copyright Registrants*, 86 GEO. WASH. L. REV. 101 (2018). Research shows that female inventors exhibit lower grant rates throughout the entire prosecution process (not just first action grant rates or the like). Marcowitz-Bitton & Morris, *supra* note 17, at 333–34 (references therein). *See generally* Schuster & Goodman, *supra* note 16; Gauri Subramani & Michelle Saksena, *Untapped Potential: Investigating Gender Disparities in Patent Citations* (USPTO Econ., Working Paper No. 2024-3, 2024).

26 Gema L. Martinez et al., *Identifying the Gender of PCT Inventors*, at *7 (WIPO, Working Paper No. 33, 2016).

27 *See generally* Brauneis & Oliar, *supra* note 25.

28 Martinez et al., *supra* note 26, at 8.

29 Martinez et al., *supra* note 26, at 8.

This gender disparity is not a recent phenomenon.[30] Historically, women were virtually absent from patent systems.[31] A major British Intellectual Property Office study revealed that female inventors constituted less than 5% of European Patent Office applicants for most of the 20th century.[32] Although the proportion of female inventors has more than doubled in the last two decades, surpassing 10%, progress remains painfully slow.[33] Today, geographical variations underscore the persistence of these inequities: women inventors are most common in France (11.7%) and Russia (15.7%) but least represented in Japan (3.7%), Korea (4.4%), and Germany (5.5%).[34] The global average is just 7.2%, with Britain (7.3%) and the U.S. (8.7%) reflecting similar trends.[35] These disparities do not align with broader socioeconomic indicators like Gross Domestic Product (GDP) or labor market participation, suggesting that they are rooted in the structural design of IP systems.[36]

This systemic exclusion of women is mirrored in broader entrepreneurial activity.[37] Recent studies show that only 10% to 15% of U.S. startups are founded by women.[38] These statistics highlight how barriers within IP systems intersect with cultural and institu-

---

30 *See* EUR. PAT. OFF., WOMEN'S PARTICIPATION IN INVENTIVE ACTIVITY: EVIDENCE FROM EPO DATA 18 (2022).

31 *Id.*

32 *Id.*

33 *See id.*

34 UK INTELL. PROP. OFF., GENDER PROFILES IN WORLDWIDE PATENTING: AN ANALYSIS OF FEMALE INVENTORSHIP 30 (2016).

35 *Id.* This inter-country variation is consistent with that found in other studies. *See* Rainer, *supra* note 3, at 592–95 (2009); Fulvio Naldi et al., *Scientific and Technological Performance by Gender*, HANDBOOK OF QUANTITATIVE SCI. AND TECH. RSCH. 299, 307 (H.F. Moed, W. Glanzel & U. Schmoch eds., 2004).

36 *See* Holly Fechner & Matthew S. Shapanka, *Closing Diversity Gaps in Innovation: Gender, Race, and Income Disparities in Patenting and Commercialization of Inventions*, 19 TECH. & INNOVATION J., 727–34 (2018).

37 *See generally* Candida G. Brush et al., *Women Entrepreneurs 2014: Bridging the Gap in Venture Capital*, FORBES (Sept. 30, 2014, 10:26 PM) https://www.forbes.com/sites/babson/2014/09/30/women-entrepreneurs-bridging-the-gender-gap-in-venture-capital/ [https://perma.cc/WE6G-LC57].

38 *See id.*; *see also* Paul A. Gompers & Sophie Q. Wang, *Diversity in Innovation* 4 (NBER, Working Paper No. 23082, 2017). *See generally* Spencer L. Tracy, Jr., *Accelerating Job Creation in America: The Promise of High-Impact Companies*, SBA OFF. OF ADVOC. (2011).

tional inequities, creating a persistent cycle of exclusion.[39] The subsequent analysis will delve deeper into these systemic biases, revealing how the IP system—designed to foster innovation—has instead perpetuated inequities that undermine its core objectives.[40]

The consequences of systemic exclusion from the IP system extend far beyond individual inventors, reverberating across broader economic and societal domains.[41] The underrepresentation of women in patent ownership has profound implications: their innovations are less likely to be commercialized, limiting their contribution to economic growth and social equality.[42] Patents not only protect inventions but also signal credibility and technological expertise, essential for securing investment and building successful enterprises.[43] When women are excluded from this system, their capacity to innovate and contribute to the economy is systematically diminished.[44]

The impact is particularly acute in entrepreneurship.[45] Female entrepreneurs, who already face significant challenges in accessing funding, are further disadvantaged by lower rates of patenting.[46] Without the protections and market advantages that patents confer, women are less likely to secure start-up financing, a key driver of entrepreneurial success.[47] This gap in IP ownership thereby perpetuates broader disparities in economic opportunity and innovation leadership.[48]

---

39 *See generally* Tracy, Jr., *supra* note 38.

40 *See infra* Parts III–VI.

41 Miriam Marcowitz-Bitton et al., *Unregistered Patents & Gender Equality*, 43 HARV. J.L. & GENDER 47, 49 (2020).

42 *Id.*

43 Bronwyn H. Hall et al., *Patents as Quality Signals? The Implications for Financing Constraints on R&D*, 25 ECON. INNOVATION & NEW TECH. 197, 198 (2016).

44 *See* Marcowitz-Bitton et al., *supra* note 41, at 49–50.

45 *See generally* Marcowitz-Bitton et al., *supra* note 41.

46 *See* Marcowitz-Bitton et al., *supra* note 41, at 49–50.

47 *See* Marcowitz-Bitton et al., *supra* note 41, at 49–50; Bronwyn H. Hall, Dirk Czarnitzki & Hanna Hottenrott, *Patents as Quality Signals? The Implications for Financing Constraints on R&D*, 25 ECON. INNOVATION & NEW TECH. 197, 197–98 (2016).

48 *See* Marcowitz-Bitton et al., *supra* note 41, at 49–50.

The systemic barriers such as economic constraints, administrative discretion, and institutional biases are reflected in a growing body of literature on gender disparities in IP and entrepreneurship.[49] Scholars have argued that IP law often reinforces existing social hierarchies by favoring male-dominated fields and undervaluing areas where women are more active, thereby perpetuating gender-based inequities.[50] While this scholarship has advanced important critiques, much of it relies on theoretical assumptions rather than empirical evidence.[51] Similarly, studies on female entrepreneurship highlight significant disadvantages for women, including limited access to funding,[52] smaller professional networks,[53] and structural biases in commercializing innovation.[54] These barriers are compounded by the complexity and cost of the patenting process,[55] the underrepresentation of women in patent-intensive fields,[56] and the absence of uniform support structures across organizations.[57]

This study seeks to address these gaps by providing an empirical analysis of the gender gap in patenting, using the United States and Israel as two prominent case studies.[58] The United States is a global innovation leader, and as such, it is essential to study the

---

[49] *See, e.g.*, Fechner & Shapanka, *supra* note 36, at 728.

[50] *See, e.g.*, Marcowitz-Bitton et al., *supra* note 41, at 50.

[51] Marcowitz-Bitton et al., *supra* note 41, at 49–50.

[52] *See* Paula E. Stephan & Asmaa El-Ganainy, *The Entrepreneurial Puzzle: Explaining the Gender Gap*, 32 J. TECH. TRANSFER 475, 481 (2007). *See* ALICIA ROBB, ACCESS TO CAPITAL AMONG YOUNG FIRMS, MINORITY-OWNED FIRMS, WOMEN-OWNED FIRMS, AND HIGH-TECH FIRMS 31 (2013).

[53] *See* Fiona E. Murray & Lisa L. Graham, *Buying Science & Selling Science: Gender Stratification in Commercial Science*, 16(4) INDUS. & CORP. CHANGE 657, 662 (2007).

[54] *Id*. at 659–60; DELIXUS, INC. & NAT'L WOMEN'S BUS. COUNCIL, EQUITY IN INNOVATION: WOMEN INVENTORS AND PATENTS 18–27 (2012).

[55] HEIDI HARTMANN ET AL., CLOSING THE GENDER GAP IN PATENTING, INNOVATION, AND COMMERCIALIZATION: PROGRAMS PROMOTING EQUITY AND INCLUSION, INST. FOR WOMEN'S POL'Y RSCH. 18-22 (2016), https://iwpr.org/closing-the-gender-gap-in-patenting-innovation-and-commercialization-programs-promoting-equity-and-inclusion/ [https://perma.cc/LX9H-D39S]

[56] *See generally* Donna J. Kelley et al., *Global Entrepreneurship Monitor 2010 Women's Report*, GLOB. ENTREPRENEURSHIP RSCH. ASS'N (2011).

[57] Waverly W. Ding et al., *Gender Differences in Patenting in the Academic Life Sciences*, 313 SCI. 665, 665–66 (2006); HARTMANN ET AL., *supra* note 55, at 27–28.

[58] *See* discussion *infra* Part V.

gender gap in U.S. patenting.[59] As a global leader in technological innovation and entrepreneurship, Israel also offers unique context for examining how systemic barriers manifest in a highly dynamic yet persistently inequitable innovation ecosystem.[60] By focusing on patenting trends and outcomes among American and Israeli inventors, this research contributes critical data to a field that has often relied on anecdotal or theoretical insights, advancing our understanding of how gender-based inequities in IP systems can be addressed.[61]

This study has significant implications for understanding and addressing systemic barriers in IP registration. By isolating the registration process as a source of disparity, this research challenges the assumption that gender gaps in patenting are merely a reflection of broader societal inequities.[62] Instead, it reveals how registration systems themselves perpetuate these gaps.[63] The United States' and Israel's innovation ecosystems, with their high patenting rates and significant gender disparities, offer a microcosm through which to explore these issues and develop actionable solutions.[64]

This case study also provides a model for broader reforms.[65] The lessons learned from the United States and Israel can inform efforts to make IP systems more inclusive and equitable globally. By demonstrating how registration processes interact with systemic inequities, this research underscores the importance of designing IP systems that support diverse innovators and contributes to the broader goal of fostering innovation that is not only prolific but also inclusive.[66]

---

59 *See* discussion *infra* Part V.

60 *See* discussion *infra* Part V.

61 *See* discussion *infra* Part V.

62 *See* discussion *infra* Part VI.

63 *See infra* Part VI.

64 *See infra* Part VI; *New OUSPTO Study Finds Women's Participation in Patenting Associated with Substantial Economic Value*, U.S. PAT. & TRADEMARK OFF. (Feb. 2, 2024), https://www.uspto.gov/about-us/news-updates/new-uspto-study-finds-womens-participation-patenting-associated-substantial [https://perma.cc/3YSZ-LEYW].

65 *See infra* Part VII.

66 *See infra* Part VII.

The article proceeds as follows. Part II explores the historical and theoretical foundations of registration systems, tracing their evolution from land registries to modern IP frameworks. It examines how registries function as mechanisms for providing public notice, facilitating transactions, and protecting ownership rights while also reinforcing systemic inequities.[67]

Part III details the economic, structural, and discretionary barriers embedded within registration systems. It compares IP registration to other historically exclusionary registration frameworks, such as voter registration, and examines how high fees, legal complexities, and examiner discretion disproportionately burden underrepresented groups, particularly women inventors.[68]

Part IV presents empirical evidence demonstrating how registration requirements lead to gender disparities in patenting.[69] It discusses lower patent approval rates for women, differences in the scope of granted claims, and the economic disadvantages women face due to systemic bias in the IP system.[70]

Part V provides a data-driven analysis of gender disparities in patenting outcomes, drawing on a multijurisdictional dataset of over 140,000 patent applications filed between 2001 and 2017. It reveals that patents filed by female inventors have lower approval rates, receive fewer citations, and are less likely to be commercialized compared to those filed by male inventors.[71] The analysis demonstrates that mixed-gender teams achieve better outcomes than all-female teams, yet still lag behind all-male teams.[72] It incorporates findings from applications to the United States Patent and Trademark Office (USPTO), the European Patent Office (EPO), the Israel Patent Office (IPO), and the World Intellectual Property Organization (WIPO - for Patent Cooperation Treaty

---

67 *See infra* Part II.
68 *See infra* Part III.
69 *See infra* Part IV.
70 *See infra* Part IV.
71 *See infra* Part V.
72 *See infra* Part V.

(PCT) filings), illustrating the systemic nature of these disparities and their implications for innovation policy.[73]

Part VI interprets the findings from the empirical analysis, highlighting key disparities in patent approval rates, claim scope, and citation frequency between male and female inventors. It links these outcomes to broader themes in innovation policy, economic opportunity, and social equity.[74] This Part critically examines how administrative discretion exacerbates these disparities and explores potential structural and behavioral explanations for the observed trends.[75]

Part VII proposes actionable policy solutions to reduce gender-based disparities in patenting. These recommendations include procedural changes to minimize examiner bias, financial support mechanisms for underrepresented inventors, and the potential adoption of an "unregistered patent" system to lower entry barriers.[76]

II. THE EVOLUTION AND THEORY OF REGISTRIES

A. Property Registries

Property registries have evolved from essential tools of governance to sophisticated instruments fundamental to modern economic systems.[77] These systems resolve core challenges of ownership clarity, market trust, and financial coordination, and thus play a crucial role in economic development.[78] Absence of such registries would not only increase ownership disputes, but also fundamentally undermine market efficiency.[79]

---

[73] *See infra* Part V.

[74] *See infra* Part VI.

[75] *See infra* Part VI.

[76] *See infra* Part VII.

[77] *See* Flora Vern, *Land Registration Systems & Discourses of Property*, 29 EUR. REV. PRIV. L. 835, 836–37 (2021).

[78] *Id.*; Klaus Deininger & Gershon Feder, *Land Registration, Governance, and Development: Evidence and Implications for Policy*, 24(2) WORLD BANK RSCH. OBSV. 233, 236 (2009).

[79] PETER DALE & JOHN MCLAUGHLIN, LAND ADMINISTRATION 7 (2000).

Land registries, among humanity's earliest mechanisms for property administration, originated to facilitate taxation and resolve disputes.[80] As state capacity grew, these systems transformed into crucial infrastructure for economic coordination and investment protection.[81] Modern property registries remain the most cost-effective tools for documenting and protecting ownership rights, particularly for real property.[82] By definitively identifying true ownership and preventing fraudulent claims, they create both security and efficiency in property transactions.[83]

Registries serve three interconnected core functions: public notice, transaction facilitation, and ownership protection.[84] The public notice function ensures transparency about rights' existence, boundaries, and ownership—particularly crucial for *in rem* rights that are valid against the world.[85] This benefits both rights holders, who need not individually assert claims, and the public, who face reduced verification costs.[86] Registries enable efficient market transactions through centralized ownership verification.[87] They facilitate transfers of partial rights without requiring physical possession and protect against unauthorized takings.[88] By formalizing ownership records, they minimize both legal costs and disputes between parties.[89] This framework aligns with economic theories encouraging legal institutions to reduce transaction costs and enhance market efficiency.[90]

---

80 Klaus Deininger & Gershon Feder, *Land Registration, Governance, and Development*, 24(2) WORLD BANK RSCH. OBSERVER 233, 234 (2009).

81 *Id*.

82 Bell & Parchomovsky, *supra* note 20, at 252.

83 Bell & Parchomovsky, *supra* note 20, at 252.

84 Baird & Jackson, *supra* note 20, at 301; BENITO ARRUÑADA, INSTITUTIONAL FOUNDATIONS OF IMPERSONAL EXCHANGE: THEORY AND POLICY OF CONTRACTUAL REGISTRIES 6 (2012). *See generally* Benito Arruñada, *Registries*, 1 MAN & ECON. 209 (2014).

85 Baird & Jackson, *supra* note 20, at 301.

86 Baird & Jackson, *supra* note 20, at 301.

87 Bell & Parchomovsky, *supra* note 20, at 250–51.

88 Bell & Parchomovsky, *supra* note 20, at 237, 242, 245; Baird & Jackson, *supra* note 20, at 305–08.

89 Arruñada, *supra* note 84, at 213; Bell & Parchomovsky, *supra* note 20, at 258–59.

90 *See* YORAM BARZEL, ECONOMIC ANALYSIS OF PROPERTY RIGHTS 7 (1997); Gary D. Libecap & Dean Lueck, *The Demarcation of Land and the Role of Coordinating Property*

Registries provide two essential protective functions: preventing fraud through definitive ownership records and enabling recovery of misappropriated assets.[91] In systems requiring substantive examination, registries transcend mere recordkeeping to become active gatekeepers of the validity and legitimacy of rights.[92] Beyond operational efficiency, registries generate broader societal benefits.[93] Their role in clarifying ownership and minimizing disputes strengthens faith in legal and economic institutions, and this faith bolsters the economy, promoting entrepreneurship and equitable development.[94]

Though rooted in land registration, these foundational principles of clarity, coordination, and protection extend to IP systems. As innovation drives modern economies, IP registries have become essential for managing intangible assets with the same rigor applied to physical property.[95] However, IP registration systems present unique challenges that warrant careful examination.[96]

B. IP Registries

The rise of knowledge-based economies necessitated new mechanisms for protecting intangible assets, leading to the emergence of intellectual property registries as sophisticated extensions of traditional property systems.[97] While these registries share fundamental features with land registries—providing public notice and formalizing ownership claims[98]—they extend beyond physical

---

Institutions, 119 J. POL. ECON. 426, 428 (2011); Patrick W. Schmitz, *Bargaining Position, Bargaining Power, and the Property Rights Approach*, 119 ECON. LETTERS 28, 29 (2013).

91 *See* Bell & Parchomovsky, *supra* note 20, at 283.

92 Marcowitz-Bitton & Morris, *supra* note 17, at 353–58.

93 Marcowitz-Bitton & Morris, *supra* note 17, at 353–58.

94 Marcowitz-Bitton & Morris, *supra* note 17, at 353–58.

95 STEPHEN EZELL & NIGEL CORY, THE WAY FORWARD FOR INTELLECTUAL PROPERTY INTERNATIONALLY, INFO. TECH. & INNOVATION FOUND. 1, 9 (Apr. 2019).

96 *See* discussion *infra* Part II.B.

97 Onileowo Temitope Teniola & Muharam Farrah Merlinda, *Evaluation of Intellectual Property Rights (IPR) Significance in Promoting Innovation and Entrepreneurship*, 5 INT'L J. RSCH. PUBL'N & REV. 1418, 1421 (2024).

98 Robert P. Merges, *Intellectual Property and the Cost of Commercial Exchange: A Review Essay*, 93 MICH. L. REV. 1570, 1590–91 (1995). *See generally* Robert P. Merges,

property boundaries to protect the driving forces of modern economies: technological innovations, creative expression, and commercial identifiers.[99] Through rigorous documentation and examination procedures, IP registries enable inventors and creators to assert and protect their rights in an increasingly competitive global marketplace.[100]

IP rights create essential innovation incentives by safeguarding against unauthorized use.[101] Beyond protecting against infringement,[102] these rights secure inventors' market position[103] while signaling technological expertise and legitimacy to stakeholders.[104] The economic impact is clear: IP protection significantly increases inventors' ability to attract funding, build successful ventures, and generate economic value.[105]

A Transactional View of Property Rights, 20 BERKELEY TECH. L.J. 1477 (2005) (arguing that intellectual property promotes transactions through its role as property).

[99] Marcowitz-Bitton & Morris, *supra* note 17, at 311–27.

[100] Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255, 1287–309 (2009) (discussing how patents help startups compete in the market by preserving their competitive edge); Teniola & Merlinda, *supra* note 97, at 1421.

[101] Gideon Parchomovsky & Peter Siegelman, *Towards an Integrated Theory of Intellectual Property*, 88 VA. L. REV. 1455, 1466–68 (2002); Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L.J. 473, 482 (2005); Ward S. Bowman Jr., *Patent and Antitrust Law: A Legal and Economic Appraisal* 2–3 (1973); Diamond v. Chakrabarty, 447 U.S. 303, 307 (1980) ("Patent law offers 'inventors exclusive rights for a limited period as an incentive for their inventiveness and research efforts.'") (citing Kewanee v. Bicron, 416 U.S. 470, 480–81 (1974)); Panel Report, *Canada—Patent Protection of Pharmaceutical Products*, WTO Doc. WT/DS114/R (adopted Mar. 17, 2000) ("Patent laws establish a carefully defined period of market exclusivity as an inducement to innovation.").

[102] *See* WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 295–96 (2003).

[103] Parchomovsky & Siegelman, *supra* note 87, at 1466–68; LANDES & POSNER, *supra* note 102, at 295–96 (discussing how patents protect against copying); Teniola & Merlinda, *supra* note 97, at 1418–19.

[104] *See generally* Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625 (2002) (discussing how IPRs can transmit signals about the value of information as well as protect it).

[105] *See* Marcowitz-Bitton & Morris, *supra* note 17, at 331–33; EMMA WILLIAMS-BARRON ET AL., INNOVATION AND INTELLECTUAL PROPERTY AMONG WOMEN ENTREPRENEURS, INST. WOMEN'S POL'Y RSCH. 24–26 (2018), https://iwpr.org/innovation-

In addition, IP registries generate value beyond transactions by creating infrastructure for innovation ecosystems.[106] Their standardized frameworks facilitate inventor collaboration, market access, and commercialization.[107] Through network effects, each additional participant increases the system's overall utility by expanding the pool of verified ownership information.[108] Such documentation is particularly crucial for intangible rights that depend entirely on clear records for enforcement.[109]

IP registration plays a central role in validating rights and resolving disputes.[110] By establishing clear priority rules and serving as a mechanism to verify ownership claims,[111] the registry system efficiently resolves conflicts, discourages duplicative innovation, reduces transaction costs, and encourages investment.[112] These efficiency gains extend beyond individual transactions to strengthen market fairness.

Ultimately, IP registries serve three broad functions: documenting innovation and catalyzing knowledge sharing. Beyond preserving technological developments, they transform private innovations into public assets through disclosure requirements.[113] This "patent bargain"—time-limited exclusive rights in exchange for

---

and-intellectual-property-among-women-entrepreneurs/ [https://perma.cc/M475-ZF4Q]; Brian L. Frye, *Invention of a Slave*, 68 SYRACUSE L. REV. 181, 188 (2018).

106 Teniola & Merlinda, *supra* note 97, at 1421.

107 Priyanka Wandhe, *The Intellectual Property Landscape: Safeguarding Innovations Derived from Basic Science*, *in* UNLEASHING THE POWER OF BASIC SCIENCE IN BUSINESS 285, 285–310 (2024); Teniola & Merlinda, *supra* note 97, at 1418; Henry E. Smith, *Institutions and Indirectness in Intellectual Property*, 157 U. PA. L. REV. 2083, 2119 (2009).

108 Marcowitz-Bitton & Morris, *supra* note 17, at 313.

109 *See* Shubha Ghosh, *Patents and the Regulatory State: Rethinking the Patent Bargain Metaphor After Eldred*, 19 BERKELEY TECH. L.J. 1315, 1319–21 (2004).

110 Heald, *supra* note 101, at 454.

111 *See* Bell & Parchomovsky, *supra* note 20, at 278–79; Jonathan Klick & Gideon Parchomovsky, *The Value of the Right to Exclude: An Empirical Assessment*, 165 U. PA. L. REV. 917, 931 (2016); *see also* Baird & Jackson, *supra* note 18, at 303–11.

112 Marcowitz-Bitton & Morris, *supra* note 20, at 314–15.

113 Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 541 (2009) (explaining that "[p]atent disclosure is essential" to future innovation).

public disclosure—advances both individual and collective innovation.[114]

III. THE HIDDEN COSTS OF REGISTRATION SYSTEMS

Although registration systems offer powerful tools for formalizing ownership and incentivizing innovation, they also come at significant costs. Financial burdens, procedural complexities, and institutional barriers disproportionately affect women, small businesses, and minority inventors.[115] Hidden costs are often overshadowed by discussions of registries' benefits, though they fundamentally shape access to property rights.

Registration systems for land, voting, and IP share core functions in providing public notice and legal clarity. Their common structural limitations—high transaction costs, reliance on human discretion, and restricted accessibility—create similar barriers across domains.[116] These limitations systematically exclude underrepresented groups from fully accessing their rights, regardless of the specific registration context.[117]

The history of American voter registration illustrates how seemingly neutral registration systems can institutionalize discrimination. Nineteenth-century registration laws introduced ostensibly objective requirements—literacy tests, poll taxes, and character standards—that functioned as powerful tools of exclusion.[118] Local

---

[114] *See, e.g.*, J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc., 534 U.S. 124, 142 (2001) (explaining that disclosure is important because it is "the quid pro quo of the right to exclude"); Alan L. Durham, *Patent Symmetry*, 87 B.U. L. REV. 969, 983 (2007); Jennifer E. Rothman, *The Questionable Use of Custom in Intellectual Property*, 93 VA. L. REV. 1899, 1966 (2007) (explaining that property rights are granted in exchange for disclosure).

[115] *See* JOZEFINA CUTURA, CHALLENGES FOR WOMEN INVESTORS AND INNOVATORS IN USING THE INTELLECTUAL PROPERTY SYSTEM–A LITERATURE REVIEW 9 (July 2019), https://www.wipo.int/export/sites/www/ip-development/en/agenda/docs/literature_review.pdf [https://perma.cc/D39J-K9LN].

[116] Marcowitz-Bitton & Morris, *supra* note 17, at 346–58.

[117] Marcowitz-Bitton & Morris, *supra* note 17, at 346–58.

[118] Marcowitz-Bitton & Morris, *supra* note 17, at 357–59. *See generally* Dayna L. Cunningham, *Who Are to Be the Electors? A Reflection on the History of Voter*

officials wielded broad discretionary authority in enforcing these requirements, systematically disenfranchising African-American voters and other marginalized groups.[119] While presented as anti-fraud measures, these registration requirements effectively barred large segments of society from participating in democratic processes.[120]

A. The Hidden Costs of IP Registration Systems

IP registration systems create similar barriers through three key mechanisms: prohibitive costs, discretionary examination processes vulnerable to bias, and requirements for specialized procedural knowledge.[121] Like historical voting restrictions, these seemingly neutral features disproportionately burden individuals and groups lacking financial resources or institutional support, perpetuating existing social and economic inequities.[122]

This section examines these systemic barriers, beginning with their direct economic impact. IP registration and maintenance require substantial financial investment and technical expertise, resources often unavailable to underrepresented inventors. For women, minorities, and small businesses, these economic hurdles combined with existing structural inequities limit access to IP protection and its associated benefits. The following subsections detail how these barriers operate and what is their cumulative effect on innovation access.

1. Direct Economic Barriers

The financial costs of securing intellectual property rights create significant barriers to access, particularly for underrepresented inventors. These costs manifest through three primary channels: basic registration fees, ongoing maintenance requirements, and le-

Registration in the United States, 9 YALE L. & POL'Y REV. 370 (1991) (describing the long history of discrimination in U.S. voting rights).

119 *See* Marcowitz-Bitton & Morris, *supra* note 17, at 357–58.

120 *See* Marcowitz-Bitton & Morris, *supra* note 17, at 357–58; Cunningham, *supra* note 118, at 370.

121 *See* Marcowitz-Bitton & Morris, *supra* note 17, at 346.

122 Marcowitz-Bitton & Morris, *supra* note 17, at 347–61.

gal representation expenses. Together, they form a complex web of financial obligations that can effectively exclude many inventors from the IP system.

a) Filing and Maintenance Fees

Patent protection requires substantial upfront investment. The process begins with patent searches costing between $165 and $660,[123] followed by possible provisional applications ($70-$280) that provide inventors with temporary protection.[124] Non-provisional applications introduce far greater expenses, with mandatory filing, examination, and issuance fees ranging from several hundred to several thousand dollars, depending on the applicant's size classification.[125]

The cost burden extends well beyond initial filing. Maintenance fees—required at 3.5, 7.5, and 11.5 years after issuance—range from $3,200 to over $12,000 over a patent's lifetime.[126] Additional charges for late submissions, extensions, or expedited review can add thousands more.[127] In total, patent prosecution typically costs between $10,000 and $40,000, with complex cases demanding even greater investment.[128]

---

123 *Patent Process Overview*, U.S. PAT. & TRADEMARK OFF. (Feb. 5, 2025, 11:11 AM), https://www.uspto.gov/patents/basics/patent-process-overview [https://perma.cc/78CQ-XTM8]; Bell & Parchomovsky, *supra* note 20, at 272.

124 *See* U.S. PAT. & TRADEMARK OFF., *supra* note 123; *USPTO Fee Schedule*, U.S. PAT. & TRADEMARK OFF. (Mar. 1, 2025, 12:01 AM), https://www.uspto.gov/learning-and-resources/fees-and-payment/uspto-fee-schedule#Patent%20Fees [https://perma.cc/8KPY-ZLM8].

125 *Design Patent Application Guide*, U.S. PAT. & TRADEMARK OFF. (Oct. 1, 2024, 12:08 PM), https://www.uspto.gov/patents/basics/apply/design-patent [https://perma.cc/6PEK-B8UV]; *General Information About 35 U.S.C. 161 Plant Patents*, U.S. PAT. & TRADEMARK OFF. (May 22, 2024, 2:23 PM), https://www.uspto.gov/patents/basics/apply/plant-patent [https://perma.cc/7KCZ-M37H]; *see Nonprovisional (Utility) Patent Application Filing Guide*, U.S. PAT. & TRADEMARK OFF. (Nov. 22, 2023, 9:53 AM), https://www.uspto.gov/patents/basics/apply/utility-patent [https://perma.cc/RG6U-YH64]; *USPTO Fee Schedule*, *supra* note 124.

126 *See USPTO Fee Schedule*, *supra* note 124.

127 *See USPTO Fee Schedule*, *supra* note 124.

128 Graham et al., *supra* note 100, at 1311.

These financial demands disproportionately impact underrepresented groups. Women, minority inventors, and small-business entrepreneurs, disproportionately affected, frequently abandon patent pursuits due to limited financial resources and institutional support.[129] The average extended timeline of patent prosecution—nearly three years—compounds these barriers, requiring sustained financial commitment throughout the examination process.[130]

b) Costs Across IP Registration Systems

While patent costs are most substantial, other forms of IP protection also present significant financial hurdles. Trademark registration fees range from $275 to $600 per class, with maintenance fees of $300 to $500.[131] Though lower than patent costs, these expenses multiply quickly for businesses seeking protection across multiple categories or jurisdictions.[132]

Copyright registration appears most accessible, with basic filing fees of $45 to $65 for individual filings.[133] For those who enlist legal assistance, costs can rise to between $250 and $500 per application.[134] However, volume can make even these modest fees prohibitive. Professional photographers, for instance, may need to register thousands of works, creating cumulative costs that exceed their financial capacity. When scaled across large portfolios, even

---

[129] Marcowitz-Bitton & Morris, *supra* note 17, at 335–36; Graham et al., *supra* note 100, at 1309–11.

[130] ROBB, *supra* note 50, at 31; Stephan & El-Ganainy, *supra* note 52, at 481; Graham et al., *supra* note 100, at 1309; Leahy-Smith America Invents Act, Pub. L. No. 112–29 § 26, 125 Stat. 284, 336 (2011); Marcowitz-Bitton & Morris, *supra* note 17, at 328–35; *see USPTO Fee Schedule*, *supra* note 124.

[131] *Trademark Process*, U.S. PAT. & TRADEMARK OFF. (Jan. 18, 2025, 12:00 AM), https://www.uspto.gov/trademarks/basics/trademark-process [https://perma.cc/ZVP7-CYYM].

[132] Marcowitz-Bitton & Morris, *supra* note 17, at 353.

[133] *Fees*, U.S. COPYRIGHT OFF., https://www.copyright.gov/about/fees.html [https://perma.cc/E6QU-9P44].

[134] *See id.;* Nicholas Wells, *How Much Does a U.S. Copyright Registration Cost?*, NICHOLAS WELLS, https://wellsiplaw.com/how-much-does-a-u-s-copyright-registration-cost/ [https://perma.cc/5YDQ-ME56]; *Registration Processing Times*, U.S. COPYRIGHT OFF., https://www.copyright.gov/registration/docs/processing-times-faqs.pdf [https://perma.cc/27K7-27XP].

the more 'affordable' IP registrations can become insurmountable barriers.[135]

c) Legal Representation Costs

The technical complexity of IP registration often necessitates professional legal assistance, substantially increasing costs for applicants. Patent attorneys typically charge between $6,000 and $20,000 per application, with complex cases or multiple office actions driving fees even higher.[136] While trademark and copyright filings demand less expertise, they still incur significant legal expenses—$1,500 to $3,000 for trademark applications and $250 to $500 for copyright registration.[137]

Although registration systems are designed to reduce verification costs and minimize reliance on legal services, the complexity of procedural requirements often makes professional expertise essential. The resulting legal costs pose particularly significant obstacles for individual inventors with limited resources.[138]

This disparity in access to legal expertise directly affects outcomes. Applications handled by experienced patent attorneys are 68% more likely to succeed than *pro se* filings,[139] demonstrating how the practical necessity of professional guidance effectively excludes many potential applicants from successfully securing IP rights.

2. Structural and Social Barriers

Economic costs present significant challenges to many inventors, but structural and social barriers often magnify these difficul-

---

[135] *See* John Tehranian, *The Emperor Has No Copyright: Registration, Cultural Hierarchy, and the Myth of American Copyright Militancy*, 24 BERKELEY TECH. L.J. 1399, 1448 (2009); Charles Ossola, *Registration and Remedies: Recovery of Attorney's Fees and Statutory Damages Under the Copyright Reform Act*, 13 CARDOZO ARTS & ENT. L.J. 559, 560 (1995).

[136] Gene Quinn, *The Cost of Obtaining a Patent in the US*, IPWATCHDOG (Apr. 4, 2015, 3:05 PM), https://ipwatchdog.com/2015/04/04/the-cost-of-obtaining-a-patent-in-the-us/id=56485/ [https://perma.cc/LGP4-M2GA].

[137] *See* Marcowitz-Bitton & Morris, *supra* note 17, at 350–53.

[138] *See* ARRUÑADA, *supra* note 84, at 22.

[139] *See* Marcowitz-Bitton & Morris, *supra* note 17, at 351.

ties. Reliance on intermediaries, disparities in organizational support, limited access to professional networks, and the unequal distribution of resources combine to exclude underrepresented groups—particularly women and minority inventors—from fully participating in the IP system.

Barriers extend beyond financial constraints to encompass knowledge gaps in navigating IP registration systems. Success requires not only understanding complex procedural requirements but also recognizing strategic advantages of different protection methods.[140] This expertise typically comes through institutional support or informal mentorship networks—resources often unavailable to marginalized inventors.[141]

While various underrepresented groups face barriers in IP systems, their experiences differ significantly based on social, cultural, and behavioral factors specific to each community. Unlike economic hurdles, which affect all resource-limited inventors similarly, structural barriers operate through distinct social dynamics unique to each group's context and positioning.

This complexity and our focus on gender disparities in IP systems lead to the following discussion, which examines how structural and social barriers specifically impede women's ability to secure and benefit from IP protections. This targeted analysis allows us to better understand the unique challenges women inventors face within the IP registration system.

a) Institutional and Organizational Barriers

IP registration heavily relies on intermediaries such as law firms and university technology transfer offices (TTOs) to navigate the complex patenting process.[142] For women inventors, these intermediaries play a critical but complicated role. TTOs and patenting services provide essential resources—technical advice, professional contacts, and strategic guidance—that women often cannot

---

140 *See* Marcowitz-Bitton & Morris, *supra* note 17, at 359–60.

141 *See* Marcowitz-Bitton & Morris, *supra* note 17, at 310.

142 Marcowitz-Bitton et al., *supra* note 41, at 62.

access through informal networks.[143] Unlike male inventors, who typically leverage personal connections for support, women depend more heavily on institutional structures for assistance.[144] This reliance creates vulnerability as women unaffiliated with universities or corporations frequently lack access to any institutional support system.[145] Thus, without robust institutional backing or financial support, many female inventors struggle to overcome registration barriers.

b) Organizational Structure Impacts

Workplace structure significantly influences women's patenting outcomes. Research shows women in hierarchical firms patent less frequently than their male counterparts, while those in flexible, network-oriented organizations achieve higher patenting rates.[146] This pattern suggests that organizational culture and structure directly affect women's ability to protect their innovations.[147]

c) Network Access Limitations

Professional and academic networks critically influence patent success, yet women face systematic exclusion from these networks.[148] The underrepresentation of women in STEM fields limits their access to established innovation networks.[149] Even when women gain access, their networks typically include fewer experienced scientists and a higher proportion of other women, restricting access to key resources and opportunities.[150]

---

143 Marcowitz-Bitton et al., *supra* note 41, at 60–62.

144 *See* Murray & Graham, *supra* note 53, at 671; Ding et al., *supra* note 57, at 665.

145 DELIXUS, INC. & NAT'L WOMEN'S BUS. COUNCIL, *supra* note 54, at 23.

146 Kjersten Bunker Whittington & Laurel Smith-Doerr, *Women Inventors in Context: Disparities in Patenting Across Academia and Industry*, 22 GENDER & SOC'Y 194, 194 (2008); Taehyun Jung & Olof Ejermo, *Demographic Patterns and Trends in Patenting: Gender, Age, and Education of Inventors*, 41 TECH. FORECASTING & SOC. CHANGE 110, 117 (2014).

147 Whittington & Smith-Doerr, *supra* note 146, at 207.

148 Ding et al., *supra* note 57, at 666.

149 *See* Murray & Graham, *supra* note 53, at 675–79.

150 *See* Murray & Graham, *supra* note 53, at 677, 679, 683.

The network disparity is particularly stark in academia, where men occupy more central positions, gaining advantages in collaborative co-patenting opportunities.[151] Women faculty report fewer industry contacts and reduced access to resources needed for assessing patentability and commercial value.[152] This network isolation directly impacts women's ability to transform research into protected innovations.[153]

d) Support System Disparities

Women inventors face systematic disadvantages in accessing support systems crucial for IP protection. Women inventors are far less likely than men to secure venture capital funding.[154] The venture capital gap severely limits their ability to pursue patent filings and commercialize innovations.[155] This disparity extends to institutional support: many feel overly dependent on their universities' TTOs, which often lack the capacity to provide comprehensive support.[156]

3. The Role of Human Discretion in Registration Systems

Beyond economic and structural barriers, the discretionary nature of registration systems often creates inequitable outcomes. The registration process relies heavily on human decision-makers, whose subjective judgments can introduce biases, particularly when standards are vague or highly discretionary.[157] These biases, whether conscious or unconscious, disproportionately impact underrepresented groups, including women and minority inventors, and exacerbate existing inequities in access to intellectual property rights.[158]

---

151 Murray & Graham, *supra* note 53, at 672–76.
152 Ding et al., *supra* note 57, at 666.
153 Ding et al., *supra* note 57, at 666–67.
154 *See* ROBB, *supra* note 50, at 19 tbl.5; Stephan & El-Ganainy, *supra* note 52, at 481.
155 *See* Marcowitz-Bitton et al., *supra* note 41, at 60.
156 *See* Ding et al., *supra* note 57, at 667; Murray & Graham, *supra* note 53, at 671, 681.
157 Marcowitz-Bitton & Morris, *supra* note 17, at 353–59.
158 *See* Marcowitz-Bitton & Morris, *supra* note 17, at 353–59.

a) Examiner Decision Patterns

Patent examiner discretion plays a crucial role in determining outcomes, particularly for applications with ambiguous or novel technical claims. These applications are especially vulnerable to discretionary rejections, often based on subjective interpretations of patentability standards such as nonobviousness or utility.[159] The impact of this discretion becomes evident in empirical data.

Studies show that patent applications filed by women are up to 21% more likely to be rejected by the United States Patent and Trademark Office (USPTO) than those filed by men, even when controlling for the field of invention.[160] This gender gap becomes particularly pronounced when applicants have names easily recognizable as feminine.[161] Conversely, applications with harder-to-characterize names achieve higher acceptance rates, suggesting implicit gender bias influences examiner decision-making.[162]

Even when women secure patents, the scope and value of their rights are often negatively affected. Examiners tend to allow fewer independent claims in women's applications and frequently narrow the claims they do approve, reducing the patents' overall impact and commercial utility.[163] These patterns reveal how subjective judgments in the examination process can systematically diminish the value of IP rights granted to underrepresented inventors.[164]

i. Impact of Subjective Standards

The criteria for intellectual property protection—including novelty, nonobviousness, and utility—are inherently vague and open to interpretation.[165] This ambiguity grants examiners significant discretion, often leading to inconsistent outcomes and unequal

---

159 Marcowitz-Bitton & Morris, *supra* note 17, at 331.

160 Jensen et al., *supra* note 25, at 307.

161 W. Michael Schuster et al., *An Empirical Study of Patent Grant Rates as a Function of Race and Gender*, AM. BUS. L.J. 281, 304–05 (2020); Jensen et al., *supra* note 25, at 309.

162 Jensen et al., *supra* note 25, at 309.

163 DELIXUS, INC. & NAT'L WOMEN'S BUS. COUNCIL, *supra* note 54, at 10.

164 Jensen et al., *supra* note 25, at 308.

165 Marcowitz-Bitton & Morris, *supra* note 17, at 331.

treatment of applicants.[166] Administrative processes that rely on such complex standards exacerbate these inequities by allowing discretionary interpretations that disproportionately disadvantage underrepresented groups.[167]

IP registration frameworks employ either rules or standards, each affecting access differently. Rules provide clear, ex ante guidance, limiting discretion to factual determinations.[168] Standards, however, offer only broad principles requiring contextual interpretation.[169] While this flexibility enables adaptation to technological evolution,[170] it necessarily introduces human judgment that can perpetuate discrimination.[171]

IP protection criteria illustrate the inherent challenges of standards-based systems. Patent, copyright, and trademark standards intentionally maintain ambiguity to accommodate diverse innovations.[172] This flexibility, however, enables examiners to justify potentially biased decisions.[173] Gender bias in patent examination suggests broader concerns, as administrative decision-making frequently reflects cultural and racial biases.[174] The "PHOSITA" (Person Having Ordinary Skill in the Art) standard for assessing utility and nonobviousness demonstrates this problem—assessments of "ordinary skill" often incorporate cultural assumptions that disadvantage women and minority inventors.[175]

---

166 Marcowitz-Bitton & Morris, *supra* note 17, at 331.

167 Marcowitz-Bitton & Morris, *supra* note 17, at 354–56.

168 Marcowitz-Bitton & Morris, *supra* note 17, at 354.

169 Marcowitz-Bitton & Morris, *supra* note 17, at 354.

170 Danielle Keats Citron, *Technological Due Process*, 85 WASH. UNIV. L. REV. 1249, 1302 (2008); Louis Kaplow, *Rules Versus Standards: An Economic Analysis*, 42 DUKE L.J. 557, 586–87 (1992).

171 Evan J. Criddle, *When Delegation Begets Domination: Due Process of Administrative Lawmaking*, 46 GA. L. REV. 117, 162 (2011).

172 Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1576 (2003); Emily Michiko Morris, *Res or Rules? Patents and the (Uncertain) Rules of the Game*, 18 MICH. TELECOMMS. & TECH. L. REV. 481, 486 (2012).

173 Criddle, *supra* note 171, at 162–63.

174 Elaine Golin, *Solving the Problem of Gender and Racial Bias in Administrative Adjudication*, 95 COLUM. L. REV. 1532, 1532–33, 1544–49 (1995).

175 Dan L. Burk, *Diversity Levers*, 23 DUKE J. GENDER L. & POL'Y 25, 37–38 (2015); Dan L. Burk, *Do Patents Have Gender?*, 19 AM. UNIV. J. GENDER SOC. POL'Y & L. 881, 883–84, 907–09 (2011).

The patent system's definition of patentable subject matter reflects broader systemic biases. Traditional concepts of "invention," "technology," and "industrial application" often embody androcentric perspectives that disadvantage female inventors.[176] Moreover, patent examiners, typically drawn from the same technical fields as inventors, may carry forward existing industry biases—such as racism and sexism—prevalent in those industries into their decision-making.[177]

ii. Judicial Review and Systemic Barriers

The limited scope of judicial review compounds these problems. While applicants can appeal adverse decisions, procedural complexity and high legal costs often deter challenges from marginalized groups. Courts generally defer to administrative agencies' expertise, providing minimal oversight of examination decisions.[178] This combination of high barriers to appeal and limited judicial review allows systemic inequities to persist unchecked.

IV. UNEQUAL OUTCOMES: THE DISTRIBUTIVE EFFECTS OF IP REGISTRATION SYSTEMS

The structural, economic, and procedural barriers embedded in IP registration systems manifest in stark and well-documented disparities in outcomes.[179] These inequities disproportionately affect women and minority inventors, reflecting systemic biases within IP systems and perpetuating broader inequalities in innovation and entrepreneurship. This section examines the empirical evidence highlighting these disparities and their impact on marginalized groups.

---

[176] Shlomit Yanisky-Ravid, *Eligible Patent Matter—Gender Analysis of Patent Law: International and Comparative Perspectives*, 19 AM. UNIV. J. GENDER SOC. POL'Y & L. 851, 852–54, 875–77 (2011).

[177] *See* Marcowitz-Bitton & Morris, *supra* note 17, at 331; Martin H. Redish & Kristin McCall, *Due Process, Free Expression, and the Administrative State*, 94 NOTRE DAME L. REV. 297, 307–08 (2018).

[178] Dickinson v. Zurko, 527 U.S. 150, 152 (1999); Ronald J. Krotoszynski, Jr., *Taming the Tail That Wags the Dog: Ex Post and Ex Ante Constraints on Informal Adjudication*, 56 ADMIN. L. REV. 1057, 1060 (2004).

[179] *See* discussion *infra* Part IV.A.

A. Gender and Racial Disparities in Outcomes

Empirical studies consistently reveal persistent gender and racial disparities in IP registration outcomes. For instance, patent applications submitted by African-American inventors face lower grant rates compared to those from white inventors, even when controlling for technological field and institutional affiliation.[180] Similarly, women inventors encounter systematic disadvantages throughout the patenting process, particularly when their names are easily identifiable as feminine.[181] These trends remain after controlling for applicant size, inventor team size, filing year, and application family size.[182]

Study after study, including a comprehensive World Intellectual Property Organization (WIPO) survey of international patent application patterns, has shown a sizeable gender gap in applications for and grants and ownership of patents.[183] Recent studies indicate that female inventors experience lower patent grant rates at every stage of the prosecution process, rather than only at initial stages, such as first action grant rates.[184] Less than 30% of international patent applications list female inventors, and less than 5% list only female inventors.[185] Women are far less likely to own IPRs, even in areas of near gender parity.[186] Academic patenting

---

180 Schuster et al., *supra* note 161, at 306.

181 Jensen et al., *supra* note 25, at 309.

182 Schuster et al., *supra* note 161, at 304.

183 Jonathan M. Barnett, *The Anti-Commons Revisited*, 29 HARV. J.L. & TECH. 127 *passim* (2015); Martinez et al., *supra* note 26, at 2; Ding et al., *supra* note 57, at 666; Whittington & Smith-Doerr, *supra* note 146, at 204 tlb. 1; Kjersten B. Whittington & Reed College, *Gender, Motherhood, and Scientific Work Across Employment Sectors: Commercial Patenting in Academia and Industry*, 38 WORK & OCCUPATIONS 417, 417–56 (2011).

184 Subramani & Saksena, *supra* note 25, at 20; Schuster & Goodman, *supra* note 16, at 2070.

185 Martinez et al., *supra* note 26, at 8 fig. 1; INTELL. PROP. OFF., GENDER PROFILES IN WORLDWIDE PATENTING: AN ANALYSIS OF FEMALE INVENTORSHIP 30 (2016).

186 Dana Kanze et al., *We Ask Men To Win and Women Not To Lose: Closing the Gender Gap in Startup Funding*, 61 ACAD. MGMT. J. 586, 597 (2018); HARTMANN ET AL., *supra* note 55, at 3; NAT'L WOMEN'S BUS. COUNCIL, 2017 ANNUAL REPORT: ACCELERATING THE FUTURE OF WOMEN ENTREPRENEURS – THE POWER OF THE ECOSYSTEM 15 (2017), https://www.nwbc.gov/wp-content/uploads/2023/11/2017-annual-report-1.pdf [https://perma.cc/6F9E-K4S4].

reveals very similar trends, even in areas approaching gender parity (such as bioscience),[187] and even when controlling for other causative variables, such as age and institutional affiliation.[188] Women also patent less often than they publish.[189]

When women do secure patents, examiners typically allow fewer claims and impose narrower scope limitations than in men's applications, reducing their practical and commercial value.[190] Moreover, patents granted to women receive fewer citations and face lower maintenance rates by their assignees, diminishing their visibility and impact within innovation ecosystems.[191]

B. Financial Barriers to IP Registration

Female entrepreneurs face disproportionate financial hurdles in securing IP protection. Women typically raise less capital and receive lower firm valuations than men, constraining their ability to finance costly IP registrations.[192] On crowdfunding platforms like Kickstarter, women hold only about 35% of project leadership positions, reflecting broader disparities in entrepreneurial representation.[193] Recent studies reveal that women found merely 10-15% of

---

[187] Annette I. Kahler, *Examining Exclusion in Woman-Inventor Patenting: A Comparison of Educational Trends and Patent Data in the Era of Computer Engineer Barbie*, 19 AM. UNIV. J. GENDER SOC. POL'Y & L. 773, 776–77 (2011).

[188] *Id*.

[189] Frietsch et al., *supra* note 3, at 592–95.

[190] *See* Schuster et al., *supra* note 161, at 320; Jensen et al., *supra* note 25, at 309.

[191] Jensen et al., *supra* note 25, at 307.

[192] Dora Gicheva & Albert N. Link, *The Gender Gap in Federal and Private Support for Entrepreneurship*, 45 SMALL BUS. ECON. 729, 733 (2015); Sharon Poczter & Melanie Shapsis, *Know Your Worth: Angel Financing of Female Entrepreneurial Ventures*, 25–7 SSRN (2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2782266 [https://perma.cc/667N-TXY5].

[193] Poczter & Shapsis, *supra* note 192, at 24; Gicheva & Link, *supra* note 192, at 733; Hadar Gafni et al., Gender Dynamics in Crowdfunding (Kickstarter): Evidence on Entrepreneurs, Investors, Deals and Taste-Based Discrimination (Dec. 1, 2019) (unpublished manuscript) at *25, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2442954, [https://perma.cc/668J-D7R7].

U.S. startups, highlighting the systemic barriers limiting their participation in innovation ecosystems.[194]

This financial gap actively deters women from pursuing IP protection, creating a significant barrier to securing their rights. Research demonstrates that patent applications and grants substantially increase inventors' chances of obtaining funding from multiple sources.[195] Consequently, women's limited access to IP protection becomes a critical disadvantage in the entrepreneurial landscape.[196]

The venture capital environment presents particularly stark challenges for women. Men are four times more likely than women to secure venture funding, a disparity commonly attributed to investor bias.[197] This creates a self-reinforcing cycle of disadvantage: without adequate resources to file patents, women entrepreneurs struggle to attract investment, which in turn limits their ability to compete effectively in the marketplace.[198]

C. Structural Barriers During Prosecution

Even when women overcome initial financial hurdles to file patent applications, they face significant structural disadvantages during the prosecution process.[199] This is particularly evident in the life sciences, where applications from all-female teams are 11% less likely to receive approval than comparable applications from all-male teams.[200] Women are also less likely to appeal rejections, suggesting systemic barriers extend beyond initial examination.[201]

The impact of these structural barriers manifests in patent quality and scope. When women do secure patents, their applications typically include fewer claims, and those claims often face more

---

194 Tracy, Jr., *supra* note 38; Brush et al., *supra* note 37; Gompers & Wang, *supra* note 38, at 4.

195 WILLIAMS-BARRON ET AL., *supra* note 105, at 31–33.

196 Marcowitz-Bitton et al., *supra* note 41, at 61.

197 Alicia Robb, *Ghana & the Next Wave of Entrepreneurship in Africa*, 2 J. ENTREPRENEURSHIP & ORG. MGMT. 1 (2013); *see* Stephan & El-Ganainy, *supra* note 52, at 481.

198 Gafni et al., *supra* note 193, at 25; Stephan & El-Ganainy, *supra* note 52, at 486.

199 Schuster et al., *supra* note 161, at 306.

200 Marcowitz-Bitton et al., *supra* note 41, at 58; Jensen et al., *supra* note 25, at 308.

201 Jensen et al., *supra* note 25, at 308.

restrictive limitations compared to men's applications.[202] This systematic narrowing of patent scope reduces both practical utility and market value, effectively marginalizing women inventors within innovation ecosystems.

D. Broader Implications for Women Entrepreneurs

These disparities in IP registration create cascading effects for women entrepreneurs. The relationship between IP protection and business success creates a troubling cycle: financial constraints limit access to IP protection, while a lack of IP protection hinders access to financing.[203] Because patents play a crucial role in securing startup funding,[204] women's limited access to IP protection directly impacts their ability to grow successful ventures.[205]

This cyclical disadvantage perpetuates systemic inequities in entrepreneurship and innovation. Women find themselves not only underrepresented as patent holders but also disproportionately excluded from the economic opportunities that robust IP protection enables.[206] The result is a self-reinforcing system of exclusion that continues to stifle women's contributions to technological advancement and economic growth.

V. EMPIRICAL EVIDENCE

A. Why Focus on a Specific Country and Why Israel?

Existing research on gender disparities in IP registration has drawn mainly on data from major registration offices, such as the USPTO, the European Patent Office (EPO), and the UK Patent Of-

---

202 Jensen et al., *supra* note 25, at 308.

203 *See generally* Joynal Abdin et al., *Financial Constraints, Intellectual Property Rights Protection and Incremental Innovation: Evidence From Transition Economy Firms*, 198 TECH. FORECASTING & SOC. CHANGE J., 112982 (Jan. 2024), https://www.sciencedirect.com/science/article/pii/S0040162523006674 [https://perma.cc/RLP5-AMW4].

204 *See* Graham et al., *supra* note 100, at 1326; Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 343 (2010).

205 *See* INST. WOMEN'S POL'Y RES., THE STATUS OF WOMEN IN THE STATES 89 (2015).

206 Marcowitz-Bitton et al., *supra* note 41, at 49.

fice. While these studies provide critical insights, they rely on data from worldwide applicants, leaving room for misinterpretation.[207] Disparities in patent filings and approvals observed at these offices may reflect global inequalities rather than systemic flaws in the registration process. Critics might argue that such disparities arise from external factors, including unequal access to education or economic resources, rather than from the operation of the offices themselves.[208] Addressing these critiques requires a methodological shift that isolates the registration process as the subject of study, and thus eliminating potentially confounding variables.

A country-specific approach offers an effective solution. By focusing on patent filings originating from a single jurisdiction, this study avoids the confounding influence of international disparities and isolates the registration process's role in producing gender disparities. As such, we believe Israel serves as an ideal candidate for such a case study. Its compact yet prolific innovation ecosystem, coupled with significant gender disparities in patenting, provides an exceptional opportunity to examine the intersection of systemic barriers and registration processes.

Israel's reputation as the "Start-Up Nation" makes it a compelling site for exploring the impact of IP registration systems.[209] Since the 1990s, its high-tech sector has driven economic growth and innovation, earning international recognition for its robust contributions to fields such as biotechnology and cybersecurity.[210] The

---

[207] *See* Trung Tran, *What Are the Common Big Data Challenges & the Best Ways Out?*, ORIENTSOFTWARE (Nov. 7, 2022), https://www.orientsoftware.com/blog/big-data-challenges/ [https://perma.cc/4ZT8-SX6H].

[208] *See* INST. WOMEN'S POL'Y RES., *supra* note 205, at 89.

[209] *See* Adrian Bridgwater, *How Israel Became a Technology Startup Nation*, FORBES (Feb. 21, 2020, 4:38 AM), https://www.forbes.com/sites/adrianbridgwater/2020/02/21/how-israel-became-a-technology-startup-nation/ [https://perma.cc/7KRQ-SNXV] ("The term startup nation was the title of a 2009 book by Dan Senor and Saul Singer about the economy of Israel."); Gil Avnimelech & Assaf Amit, *From Startup Nation to Open Innovation Nation: The Evolution of Open Innovations Activities Within the Israeli Entrepreneurial Ecosystem*, 53 RES. POL'Y 105079, at 1–2, 13–14 (2023).

[210] Catherine de Fontenay & Erran Carmel, *Israel's Silicon Wadi: The Forces Behind Cluster Formation* 12, 33 (Stan. Inst. Econ. Pol'y Rsch., Discussion Paper No. 00-40, 2001); Gil Avnimelech & Morris Teubal, *Creating Venture Capital Industries That Co-*

global significance of Israeli technological advancements is evidenced by its high patenting rates and active engagement in international IP systems.[211] However, these successes mask stark gender disparities in innovation, with women significantly underrepresented among patent holders and entrepreneurs.

A 2015 WIPO study of Patent Cooperation Treaty (PCT) applications illustrates these disparities.[212] Only 14% of Israeli PCT filings included female inventors, a figure well below the global average of 29%.[213] Historical trends are equally concerning. Between 1995 and 1999, only 11.6% of international patent applications from Israel were filed by women, increasing marginally to 13.5% among Israeli residents by 2015.[214] Even in biotechnology, a sector where women are more prevalent, only 40% of Israeli inventions involved female inventors.[215]

This disparity is particularly striking given Israel's relatively high representation of women in STEM fields compared to global averages.[216] It suggests that gender gaps in patenting are not simply a reflection of broader social inequities but are also tied to the operation of IP registration systems. This aligns with findings from Israeli scholars who examined U.S. patent filings by Israelis be-

---

Evolve With High Tech: Insights From an Extended Industry Life Cycle Perspective of the Israeli Experience, 35 RES. POL'Y 1477, 1495 (2006); *see* Bresnahan et al., *'Old Economy' Inputs for 'New Economy' Outputs: Cluster Formation in the New Silicon Valleys*, 10 INDUS. & CORP. CHANGE 835, 843 (2001).

211 *See, e.g.*, Manuel Trajtenberg & Gill Shiff, *Identification and Mobility of Israeli Patenting Inventors* 4 (Pinhas Sapir Ctr. for Dev. Tel Aviv Univ., Discussion Paper No. 5-2008, 2008).

212 Martinez et al., *supra* note 26, at 35.

213 Martinez et al., *supra* note 26, at 8, 30.

214 Martinez et al., *supra* note 26, at 10.

215 OECD, HIGHLIGHTS FROM THE OECD SC., TECH. & INDUS. SCOREBOARD 2017 – THE DIGIT. TRANSFORMATION 63 (2017).

216 *See* ISRAELI PARLIAMENT COMM. FOR SCI. & TECH., WOMEN FACULTY IN ISRAELI UNIVERSITIES FOR THE YEAR 2010 (2012); COMM. FOR ADVANCEMENT AND REPRESENTATION OF WOMEN IN HIGHER EDUC. INST. IN ISRAEL, REPORT (2015); ISRAEL COUNCIL FOR HIGHER EDUC., THE HIGHER EDUCATION SYSTEM IN THE YEAR 2016 4 (2017); ISRAEL COUNCIL FOR HIGHER EDUC., STUDENTS IN HIGHER EDUCATION INSTITUTIONS BY FIELD, DEGREE, TYPE OF INSTITUTION, AND GENDER FOR THE YEAR 2018 (2018).

tween 1963 and 1999.[217] Their analysis revealed that only 3% of these applications were filed by women, with an additional 4% associated with gender-neutral names, for a total of merely 7% female representation.[218]

The decision to study Israel also represents a methodological departure from prior research. Whereas most studies have focused on major registration offices, few have examined patent filings based on the applicant's country of origin across multiple jurisdictions.[219] Israel's centralized patent system and compact innovation ecosystem offer unique advantages in this regard.[220] Analyzing Israeli applications filed at the USPTO, EPO, PCT, and Israel Patent Office (IPO) allows for a comparative analysis of registration systems. This approach identifies whether specific systemic barriers are exacerbated or mitigated by variations in registration practices, offering valuable insights applicable to broader contexts.

The methodology employed in this study takes full advantage of Israel's unique data landscape. Drawing on over 140,000 patent applications filed between 2001 and 2017, it uses name-matching methodologies to infer inventor gender and incorporates variables such as filing year, Cooperative Patent Classification (CPC) code, and entity size to control for confounding factors.[221] These methodological choices ensure that the study isolates the impact of the registration process on gender disparities while accounting for broader contextual influences.

B. Data Collected

The primary data source for this project was the Google Patents Dataset.[222] From it, patent applications that name an inventor from

---

[217] Trajtenberg & Shiff, *supra* note 211, at 32

[218] Trajtenberg & Shiff, *supra* note 211, at 32.

[219] *See supra* notes 25–36 and accompanying text.

[220] *See* Saul Lach et al., *Together but Apart: ICT and Productivity Growth in Israel* 4 (Samuel Neaman Inst., Working Paper No. STE-WP-41-2008, 2008).

[221] *See infra* Appendix A.

[222] *Google Patents Public Data*, GOOGLE CLOUD, https://console.cloud.google.com/marketplace/product/google_patents_public_datasets/google-patents-public-data [https://perma.cc/L7ZR-ZAJG] ("Google Patents Public Data,

Israel were identified for four patent offices: the USPTO, the EPO, the IPO, and WIPO (for Patent Cooperation Treaty (PCT) filings). The EPO and USPTO both require that applications list the name and country of residence for inventors.[223] The PCT requires that inventor information be disclosed "if the national law of at least one of the designated States requires it."[224] The IPO does not, however, specifically require the applicant to name inventors.[225]

These limitations (i.e., not mandating disclosure of the inventors' names) at the PCT and IPO present an issue for data collection. We address this problem through the use of Google Patents' family identifications, which give a unique identifier to applications with "the same set of priority claims[,] usually when the same or very similar patent is filed in more than one country."[226] With this in mind, we identified all patent applications that listed at least one Israeli inventor from the EPO, USPTO, and PCT. Then, any family members of those applications that listed no inventor data were added to the dataset.[227]

After identifying applications listing an Israeli inventor, gender information had to be ascertained. Unfortunately, none of the relevant patent offices collect and publish inventor demographics. Accordingly, consistent with prior research, we employed a name/nationality/gender database.[228] To this end, we utilized the

provided by IFI CLAIMS Patent Services, is a worldwide bibliographic and US full-text dataset of patent publications.").

223 EPC Implementing Regulations R. 19(1)(a) ("The request for grant shall contain: (a) the designation of the inventor"); 35 U.S.C. § 115(a) ("The application for patent . . . shall include the name of the inventor for any invention claimed in the application.").

224 Patent Cooperation Treaty (PCT) art. 4, June 19, 1970, 1160 U.N.T.S. 231.

225 *Id.* § 11(a), Patents Law, 5727-1967, (Isr.) ("A patent application shall be submitted to the Office in the prescribed manner and form, together with the prescribed fee, and it shall include the name of the applicant, an address in Israel for the service of documents and a specification of the invention.").

226 *About Google Patents Search Results Page*, GOOGLE (2025), https://support.google.com/faqs/answer/7049588?hl=en [https://perma.cc/WS6L-QVCD].

227 We note one limitation of this approach. Due to an inherent limitation in the data, applications that never disclosed inventor identity in a filing in one of the relevant jurisdictions will not appear in our dataset.

228 Paul R. Gugliuzza & Rachel Rebouché, *Gender Inequality in Patent Litigation*, 100 N.C. L. REV. 1683, 1698 (2022); Schuster et al., *supra* note 161, at 433.

data in Gema Martinez et al.'s article Identifying the Gender of PCT Inventors.[229] That dataset associates an inventor's name and location with their expected gender.[230] Using this information, Martinez et al. coded the gender for just over 90% of named inventors and a hint more for inventors from Israel.[231] From this and patent family data, gender (and nationality) information was estimated for applications that do not list the inventors (i.e., for Israeli filings that don't list inventor data but that have a U.S. family member that does).[232]

To control for variations in grant rate by technology, each application was coded with the first Cooperative Patent Classification code (3-digit) listed on the application.[233] To address differences in success rates by country and time, we added variables for filing year and patent office jurisdiction. Lastly, we controlled for the perceived importance of the invention by including the international family size[234] (as shown via Google Patents' family identifications) and for firm size by adding a dummy for "small entities"[235] (in USPTO applications).

Additionally, we coded each application with a variety of inventor-related variables. Initially, we added aggregate counts of male, female, and gender unidentifiable inventors. We conducted two versions of these counts: one counting only Israeli inventors and one counting all inventors. Similarly, for each patent application, its percentage of female inventors (out of inventors for whom

---

229 Martinez et al., *supra* note 26, at 8.

230 *See* Martinez et al., *supra* note 26, at 10. For a more detailed account of how we employed this database under "Inventor Gender" see *infra* Appendix A.

231 *See* Martinez et al., *supra* note 26, at 10.

232 *See infra* Appendix A (describing how the number of inventors of each gender, including those with no identified gender, and their nationality was estimated by averaging relevant information from patent family members that listed inventor names and locations).

233 For a full description of this coding process, see *infra* Appendix A.

234 *See* Christopher K. Larus et al., *Patent Value: Scoring Patents Using Characteristics of Patents in Litigation*, 57 LES NOUVELLES 196, 199 (2022); *see also* John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 458 (2004).

235 *See* Christy, Inc. v. United States, 141 Fed. Cl. 641, 653 n.6 (Fed. Cl. 2019); *see also* Ulead Sys., Inc. v. Lex Comput. & Mgmt. Corp., 351 F.3d 1139, 1142 (Fed. Cir. 2003).

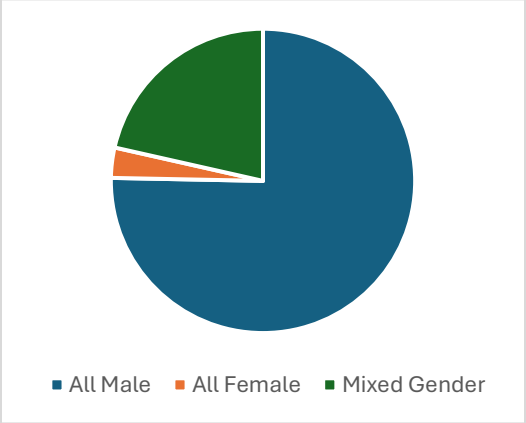
gender could be estimated) was calculated for only Israeli inventors and for all inventors.

C. Findings

1. Female Representation in Patent Applications

The number of patent applications naming an Israeli inventor in the four studied jurisdictions increased over the period studied (filed 2001–17), going from just over 6,000 in 2001 to almost 12,000 in 2017.[236] This increase was not, however, equally distributed by gender. Filings from all-male teams increased from 4,957 to 8,398, and mixed gender teams grew from 1,021 to 2,680. In contrast, female-only teams added only 168 additional applications in 2017 compared to 2001, up from 153 to 321.[237] A full breakdown of these trends is presented in Appendix B.

Our next analysis looks at all applications (filed 2001–17 in the four studied patent offices and naming at least one Israeli inventor) and breaks them into three groups: all-male inventor teams, all-female inventor teams, and mixed-gender inventor teams. Figure 1 shows that approximately three-quarters of these applications only name male inventors.



[236] *See infra* Appendix B.

[237] *See infra* Appendix B (breaking down the trends of patent applications based on gender).

Figure 1: Applications by Inventor Team Composition[238]

In full, there were 106,121 all-male team applications (75.3%), 4,522 all-female team applications (3.2%), and 30,257 mixed-gender team applications (21.5%) that named at least one Israeli inventor from 2001–17 at the USPTO, EPO, IPO, and WIPO.[239] This calculation disregarded any inventors whose gender could not be ascertained, which led to 4,011 applications being set aside.

Appendix C presents similar data but only analyzes applications where every inventor was from Israel. For that case, any filing with at least one non-Israeli inventor was disregarded.[240] Results were largely the same: 77.8% all-male teams, 3.8% all-female teams, and 18.4% mixed inventor teams.[241]

Moving from team composition, we next investigate the percentage of all named inventors that are female on patent applications with at least one Israeli inventor in the four jurisdictions studied.[242] To be clear, Figure 2 below calculates the percentage of female inventors for a particular jurisdiction for a specific year. For example, if there were 1000 named inventors (whose gender could be identified) in jurisdiction X in year Y, and 250 of them were identified as women, the point for jurisdiction X in year Y on Figure 2 would be 25%.

We analyzed 23,448 applications from the EPO, 11,726 from the IPO, 73,142 from the USPTO, and 32,584 PCT filings—all filed between 2001 and 2017, inclusive.[243] Our findings are broad-

238 Image on file with author.

239 *See infra* Appendix B.

240 *See infra* Appendix C.

241 *See infra* Appendix C.

242 This is the aggregate count of all female inventors. So, if an application names four female inventors and six male inventors, that application would count for four female inventors (numerator) and 10 total inventors (denominator). This doesn't include inventors for whom no gender could be associated.

243 More specifically, for the European Patent Office (EP), we analyzed 1,134 applications filed in 2001, 1,016 in 2002, 968 in 2003, 1,187 in 2004, 1,389 in 2005, 1,531 in 2006, 1,482 in 2007, 1,367 in 2008, 1,345 in 2009, 1,329 in 2010, 1,398 in 2011, 1,252 in 2012, 1,540 in 2013, 1,494 in 2014, 1,613 in 2015, 1,735 in 2016, and 1,668 in 2017. For the Israel Patent Office (IL), filings were 821 in 2001, 813 in 2002, 631 in

ly consistent across jurisdictions, with women representing between 10-20% of named inventors in most years.[244]

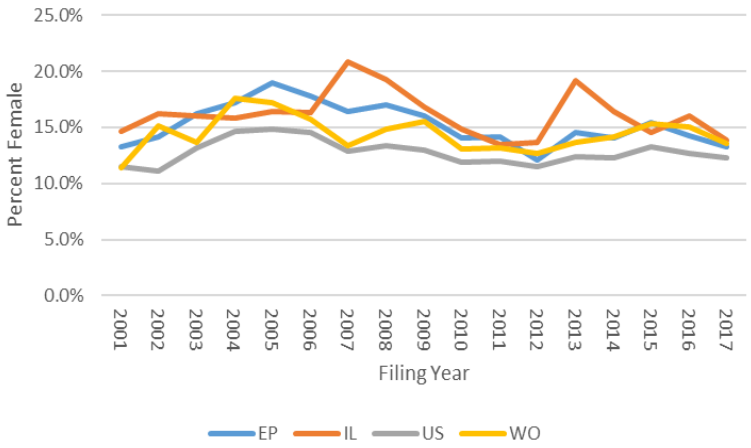


Figure 2: Percentage of All Female Inventors[245]

These results raise two potential underlying mechanisms. First, female inventors may be underrepresented because they represent a minority of employees in patent-heavy fields, such as science and engineering.[246] Second, women might apply for patents at a lower per capita rate than their male counterparts. A comparison to employment trends in Israel provides support for both contentions.[247]

2003, 568 in 2004, 454 in 2005, 780 in 2006, 843 in 2007, 715 in 2008, 630 in 2009, 665 in 2010, 719 in 2011, 666 in 2012, 705 in 2013, 740 in 2014, 705 in 2015, 571 in 2016, and 700 in 2017. For the United States Patent and Trademark Office (US), the numbers were 2,731 in 2001, 2,576 in 2002, 2,449 in 2003, 2,740 in 2004, 3,298 in 2005, 3,708 in 2006, 4,068 in 2007, 3,957 in 2008, 3,764 in 2009, 3,816 in 2010, 4,526 in 2011, 5,071 in 2012, 5,685 in 2013, 5,690 in 2014, 6,223 in 2015, 6,303 in 2016, and 6,537 in 2017. Lastly, for the World Intellectual Property Organization (WIPO), there were 1,445 applications filed in 2001, 1,283 in 2002, 1,221 in 2003, 1,471 in 2004, 1,775 in 2005, 2,014 in 2006, 2,157 in 2007, 2,204 in 2008, 1,869 in 2009, 1,805 in 2010, 2,040 in 2011, 1,857 in 2012, 2,264 in 2013, 2,077 in 2014, 2,254 in 2015, 2,354 in 2016, and 2,494 in 2017.

244 *See infra* Figure 2.

245 Image on file with author.

246 *See* Murray & Graham, *supra* note 53, at 675–79.

247 ISRAEL CENT. BUREAU OF STAT., DEVELOPMENT OF THE HIGH-TECH SECTOR IN ISRAEL 1995-2014 23, 32, 143, 156 (2017).

According to the Israel Bureau of Statistics, women are in the minority across almost every patent-centric field.[248] From 2009-2016, women comprised 28.1% and 35.6% of research and development employees.[249] Similar trends were identified for hi-tech fields (34.1%–35.8%, 2009-2014) and engineering and architecture (37.5%–38.5%, 2009-2012).[250] Only in other types of professional and scientific and technical services did women represent a majority (56.1%–58.3%, 2013-2016).[251] In summary, within the relevant fields of technology, women are largely underrepresented—making it unsurprising that they represent a minority of inventors.

But even considering that disparity, female inventors are still underrepresented in patent applications. Assuming representation among research and development employees will be largely mimicked among named inventors, women are also underrepresented at the per capita level.

And while female representation is lacking in each jurisdiction studied, it was consistently lowest in applications filed at the USPTO. These trends are confirmed in the aggregate in Table 1 below, which shows the Israeli office to have the highest rate of female representation across all years studied and the U.S. office to have the lowest (with a total difference of about 3.5%).

Table 1 below further breaks down the percentage of inventors who are women from an application with at least one Israeli inventor by jurisdiction over the full period studied by high/low years.

---

248 *Id*. at 156.
249 *Id*.
250 *Id*.
251 *Id*.

Table 1: Summary Statistics for All Inventors Who Are Women

Country	All Years	High Year	High Pct	Low Year	Low Pct
EP	15.2%	2005	19.0%	2012	12.1%
IL	16.2%	2007	20.8%	2011	!3.5%
US	12.7%	2005	14.8%	2002	11.1%
WO	14.4%	2004	17.6%	2001	11.4%

Figure 2 and Table 1 analyze all patent applications naming at least one Israeli inventor to describe the percentage of investors who are women out of all inventors in a given year and jurisdiction.[252] Appendix C presents the same analysis but excludes all non-Israeli inventors. As shown therein, results are consistent with the above.[253]

Similar trends are apparent when we look at inventor gender at the application level. In this instance, instead of calculating the percent of inventors that are women, we ask whether an application names at least one female inventor (regardless of her country of origin).[254] If an application names at least one female inventor, it is coded as 1 and 0 otherwise. We then calculate the average of this number by the filing office.[255] The below chart analyzes 23,448 applications from the EPO, 11,726 from the IPO, 73,142 from the USPTO, and 32,584 PCT filings—all filed between 2001 and 2017, inclusive.[256]

---

252 *See infra* Appendix C.

253 *See infra* Appendix C.

254 *See infra* Figure 3.

255 This graph (Figure 3) analyzes the data at the application level. Thus, if the application names at least 1 female inventor (regardless of how many inventors and if there are any male inventors), then that adds 1 to the numerator (and adds 1 to the denominator). If the application only lists men, then that adds 0 to the numerator and adds 1 to the denominator.

256 *See infra* Figure 3.

In comparison to the percentage of inventors that are women (shown in Figure 2), Figure 3 shows an elevated percentage of applications that name at least one female inventor. While no single jurisdiction dominates with regard to female representation, the European Patent Office has the greatest percentage of applications that include a female inventor more often than not.[257] This is confirmed by Table 2 below, in which the EPO leads the pack, with 26.8% of applications across the period studied naming at least one woman as an inventor.

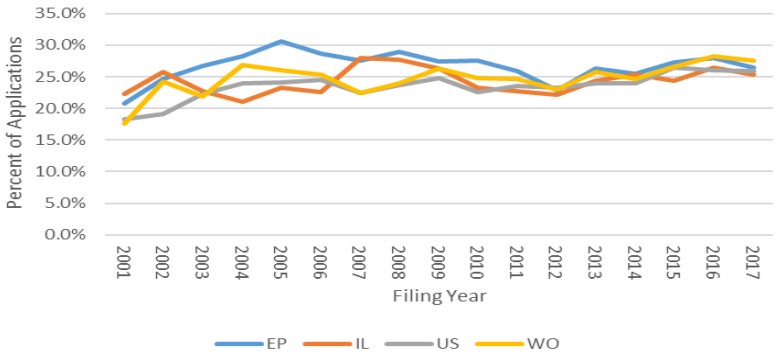


Figure 3: Percentage of Applications Including a Female Inventor[258]

Tabe 2 below gives the aggregate and high/low points of applications that name at least one female inventor by jurisdiction. We see a largely consistent rate of female representation across the period studied, with the lowest aggregate percentage (USA, 23.9%) being 2.9% lower than the highest (Europe, 26.8%).[259] The data likewise suggest improvements in gender representation, with the nadirs for each jurisdiction occurring within the first 4 years studied.

---

257 Ding et al., *supra* note 57, at 666.
258 Imagine on file with author.
259 *See infra* Table 2.

Table 2: Summary Statistics for All Female Inventors

Country	All Years	High Year	High Pct	Low Year	Low Pct
EP	26.8%	2005	30.6%	2001	20.8%
IL	24.4%	2007	28.0%	2004	21.1%
US	23.9%	2015	26.5%	2001	18.3%
WO	25.0%	2016	28.2%	2001	17.6%

2. Gender Breakdown of Inventor Teams

We next evaluated trends related to the gender breakdown of inventor teams. The following chart presents attributes of three- and four-member teams as a function of gender.[260] We first looked at the breakdown of 3-member teams from filings in any of the 4 studied jurisdictions. As might be expected from the prior subsection, predominantly male teams are much more common than those including a woman. Indeed, almost 70% of 3-inventor teams consist of three men.[261]

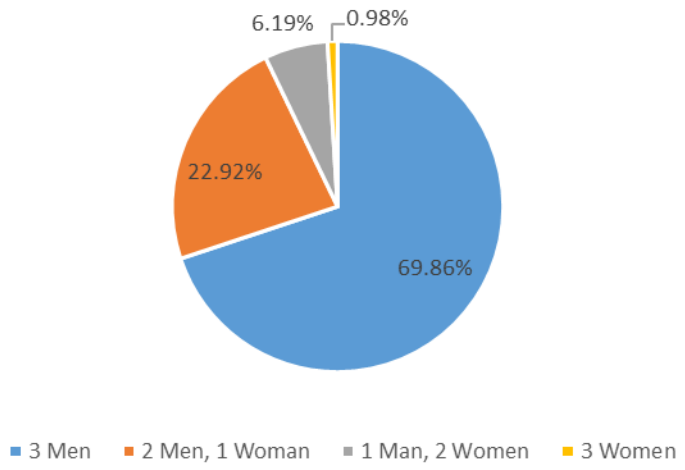


Figure 4: Three-Inventor Teams – Gender Breakdown[262]

260 *See infra* Figure 4.
261 *See infra* Figure 4.
262 Image on file with author.

This trend continues for applications naming four inventors. Within this cadre, all-male teams constitute 58.9% of applications.[263] Likewise, 3-male teams represent an additional 25.9%, such that teams with 75% or more men comprise 74.8% of applications.[264] As a comparison, if one assumes (unrealistically) that the odds of any inventor being male or female is 50%, we would expect teams including 3 or 4 men to be just over 30% of the body of applications.

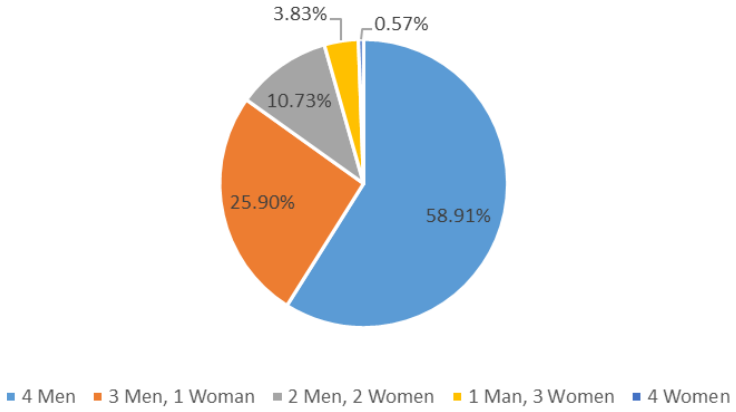


Figure 5: Four-Inventor Teams – Gender Breakdown[265]

Finally, we analyzed the team size breakdown of all-male, all-female, and mixed gender teams with 4 or fewer inventors. As we see in Table 3, all female teams are significantly more likely to be a single inventor than all-male teams, and all-male teams are more likely to be multi-member. We would expect such an allocation among all-female teams due to the significant disparity in the number of male and female inventors.

Assuming the percentage of female inventors is approximately 15% (a valid estimation based on Figure 2), we would expect the

263 *See infra* Figure 5.
264 *See infra* Figure 5.
265 Image on file with author.

number of all-female teams with 2 members to be about 15% the size of solo inventor applications, all else equal. While the actual rate is closer to 30%,[266] probability would predict (and the data supports) that all-female teams would substantially lean towards smaller teams. This stands in contrast to the expected and observed tendency of all male teams to be more evenly distributed over applications with one to four inventors.

Table 3: Male, Female, and Mixed Gender Teams by Size (max 4 inventors)

Team	4 inventors pct	3 inventors pct	2 inventors pct	1 inventor pct	Number of teams
All female	1.86%	5.93%	20.87%	71.20%	3,484
All Male	8.33%	18.25%	31.15%	42.10%	80,995
Mixed	26.46%	37.82%	33.11%		16,243

3. Regression Analysis of Patent Grant by Female Representation

This part moves away from aggregate representation and addresses whether female inventors are as likely as their male counterparts to secure a patent—all else equal. We conduct this analysis on applications naming at least one inventor from Israel across three patent offices: the USPTO, EPO, and IPO. For each model, female inventors are estimated to be less likely to secure a patent after controlling for a variety of co-varieties.[267]

Table 4 presents the results of logistic regression of patent grant rates (1 if granted) on the percentage of female inventors (continuous from 0 to 1). We conduct this analysis for each of the three relevant jurisdictions and for all three in the aggregate. Con-

[266] This rate may be indicative of gender homophily of some variety among female inventors.

[267] Ding et al., *supra* note 57, at 666– 67.

trol variables include the application's family size (a proxy for value), the total number of inventors, the percentage of named inventors that are from Israel, and (for the U.S.-based model) whether small entity status was claimed.[268] A series of dummy variables was employed based on the filing year and technological class (three-digit CPC code).

Logistic regression yields odds ratios for the percentage of all inventors that are female on Patent Grant that vary between .615 (Israel) to .726 (Europe).[269] In the aggregate, the odds ratio for the percentage of all inventors who are female is .703. This indicates that the odds of an all-female team obtaining a patent are 29.7% lower than an all-male team, all else being equal.[270]

It is notable that the below regression model (for the United States) was rerun on a dataset of *all* applications filed with the USPTO in the same timeframe and the odds ratio for percent of female inventors was .796, as illustrated in Table 4. This indicates that female applicants from Israel are less likely to secure a patent in the United States compared to other female applicants who file at the USPTO—all else being equal. Our study cannot, however, identify a mechanism driving this variation.

---

268 *See infra* Appendix E.

269 *See infra* Table 4.

270 *See infra* Appendix D. Here we note that the N is larger as compared to the Percentage of Israeli inventors that are women, which is presented in the regression charts in Appendix C. This is because if all Israeli inventors are non-gendered, then the Percentage of Israeli inventors that are women is null and the row is excluded.

Table 4: Logistic Regression of Patent Grant on Percentage of All Female Inventors

Logistic Regression	**All Countries**	**Israel**	**Europe**	**United States**
Number of Observations	104,981	10,316	23,421	71,192
Pseudo R Squared	0.0696	0.1188	0.0558	0.0875
Percent of All Inventors that are Female	0.703 (0.021) ***	0.615 (0.055) ***	0.726 (0.044) ***	0.698 (0.027) ***
Members in the Application's Family	1.029 (0.001) ***	1.082 (0.005) ***	1.058 (0.003) ***	1.011 (0.001) ***
Total Inventors	1.031 (0.004) ***	0.955 (0.014) **	1.003 (0.007)	1.014 (0.005) **
Percent of Inventors from Israel	0.834 (0.027) ***	0.721 (0.102) *	0.835 (0.059) *	1.088 (0.044) *
Small Entity (US)				0.338 (0.006) ***
Filing Year Controls	x	x	X	x
CPC (Three Digit) Controls	x	x	X	x
Jurisdiction Controls	x			
Constant	0.61 (0.044) ***	1.067 (0.238)	0.438 (0.065) ***	3.678 (0.341) ***
***p < 0.001, **p < 0.01, *p < 0.05 (Standard errors in parentheses.)				

4. Forward Citation Analysis

Forward citations are references to a subject patent by later applications or patents.[271] Forward citations have been used as a proxy for patent value in literature[272] and the courtroom.[273] This part compares forward citations before the USPTO by Israeli inventors (all-male teams, all-female, and mixed gender) and all USPTO patents. As discussed below, U.S. patents that name at least one Israeli inventor are cited more often than comparable U.S. patents, but among the patents with an Israeli inventor, teams that include a woman are cited less often.

But before we delve into our conclusions, two problems in comparing citations counts must be addressed. The first is differences by technological field. Certain fields may generate more citations and accordingly, patents in that field will accrue a greater number of citations—all else being equal.[274] The second problem is temporal in nature. Patents issued earlier in time have a longer period in which to accrue citations, and accordingly, we expect them to have a greater number of citations.[275] Normalization of citation count is thus appropriate.[276]

To this end, we took citation data from the USPTO's PatentView dataset (2022 edition) and calculated the average number of forward cites for each USPC class for each grant year.[277] This is our baseline for each class x year. From this, we normalized the

---

[271] *See* Comcast Cable Commc'ns, LLC v. Sprint Commc'ns Co., LP, 218 F. Supp. 3d 375, 382 (E.D. Pa. 2016).

[272] W. Michael Schuster, *The Patent Examiner Sweepstakes*, 60 AM. BUS. L.J. 599, 630 (2023).

[273] PersonalWeb Techs., LLC v. Int'l Bus. Mach. Corp., No. 16-cv-01266-EJD, 2017 WL 3476082, at *1 (N.D. Cal. Aug. 7, 2017).

[274] *See* Ali Ganzi, *The Growing Number of Patent Citations to Scientific Papers: Changes in the World, Nations, and Fields*, 62 TECH. IN SOCI. J., 101–276 (Aug. 2020).

[275] *Id.*

[276] *See* Wei Hu et al., *Impact of Patent Litigation on the Subsequent Patenting Behavior of the Plaintiff Small and Medium Enterprises in Japan*, 51 INT'L REV. L. & ECON. 23, 25 (2017).

[277] *See* PATENTSVIEW, https://patentsview.org/home [https://perma.cc/X436-2FZX]; *PatentSearch API Reference*, PATENTSVIEW, https://search.patentsview.org/docs/docs/Search%20API/SearchAPIReference [https://perma.cc/ZS82-36DZ].

number of citations to any given patent and control for variations by technological class and grant year by dividing the number of citations to a single patent by the number normalized citations to the average patent in the same grant year/USPC class. Thus, a normalized citation of 1 would be equal to the average. Then we averaged that for all male, all female, and mixed teams.

We saw that for all inventor teams naming at least one Israeli inventor in a U.S. patent, the average normalized citation rate is 1.23.[278] This means that, on average, U.S. patents with an Israeli inventor are cited 23% more often than other patents of the same time/tech class when compared to *all* U.S. patents. Given forward citations' usage as a proxy for patent value, this may indicate that these patents are of greater than average value (compared to patents of the same age and technological field).

We next compared citation data for all-male, all-female, and mixed gender teams that include at least one Israeli inventor. As would be predicted from the literature,[279] teams including male inventors are cited more. Specifically, the average normalized citation rate for all male teams was 1.26. For mixed teams, it was 1.22. For female-only teams, it was 1.00.

However, one must view these observations in context. Recent research by Subramani and Saksena indicates that gendered patterns in citation behavior may be driven, at least in part, by the tendency for male inventors to disproportionately cite to other male inventors.[280] Accordingly, while the average all-male team receives 26% more normalized citations than the average all-female team, this observation may be due to gender homophily in citation behaviors and does not exclusively represent value differences.

---

278 *See infra* Appendix E.

279 *See* Jensen et al., *supra* note 25, at 308.

280 Subramani & Saksena, *supra* note 25, at 3. Female inventors are reported to do the same (i.e., cite to female inventors), though to a lesser degree.

VI. DISCUSSION

Generally, the key findings of our study are that there was a significant increase in patent applications at the four patent offices studied that name an Israeli inventor from 2001 to 2017.[281] However, all-male teams dominate these applications over all-women teams (~75% to ~3%).[282] Within our data, women account for between 10 and 20% of all named inventors. This data alone demonstrates a gender disparity in patenting activity in the Israeli innovation market.

As our study reveals, the discrepancy is even more prominent than it appears at first glance. A granular examination of the gender composition of mixed-group patent applications (N=20,952) shows not only that women are underrepresented as inventors named in patents emerging from the innovative market, but also that women are outnumbered by men in joint applications filed in this sector with inventors of both genders.[283] Indeed, almost 70% of 3-inventors teams consist of three men.[284] In the 4-inventor teams almost 59% consist of four men.[285] This data reinforces the overall finding that women's participation in the patenting activity in Israel is significantly lower than that of men. Furthermore, examining the number of patent applications filed by women alone and men alone in the Israeli innovation market shows that the percentage of applications filed by women alone is significantly lower than their (already low) representation in the innovative job market.[286]

As discussed above, these results can be explained in two possible ways: (1) female inventors are underrepresented because they represent a minority of employees in patent-heavy fields, such as science and engineering, and (2) women might apply for patents at

---

281 *See infra* Appendix B fig. B1.
282 *See infra* Appendix B fig. B5.
283 *See infra* Appendix C.
284 *See* discussion *supra* Section V.C.2.
285 *See supra* Figure 5.
286 *See* ISRAEL CENT. BUREAU OF STAT., *supra* note 246, at 143.

a lower per capita rate than their male counterparts.[287] The second explanation is more worrisome because female inventors are underrepresented at the per capita level.

Interestingly, the study shows that while female inventors are still underrepresented, applications filed at the USPTO were at the lowest rate while the highest rate of applications was at the IPO. This finding suggests that female inventors are represented in applications that are domestic rather than international in nature, which is clearly a lower quality signifier.

This study also explored the gender breakdown of inventor teams. The primary finding is that all male teams are more common than those including a woman.[288] Almost 70% of 3-inventor teams consist of three men.[289] This trend continues for applications naming four inventors where all male teams constitute 58.9% of applications.[290]

Moreover, all female teams are significantly more likely to be single inventors than all male teams, which are more likely to be multi-member.[291] This allocation amongst female inventors can be explained by the significant disparity in the number of male and female inventors and possibly female tendency to work alone rather than collaborate with others.

The study also found that the grant rates for Israeli female inventors is between .615 (Israel) to .726 (Europe).[292] In the aggregate, the odds ratio for female inventors is .703, which is 29.7% lower than an all-male team grant rate, all else being equal.[293]

More specifically, the grant rates for teams that are 100% men and include at least one Israeli inventor was as follows. The aggregate grant rate was 63.77%. In the U.S. - 69.76%, IL - 63.57%, and

---

[287] *See* discussion *supra* Section V.C.1 (explaining how these hypotheses are both supported by Israeli data.)

[288] *See* discussion *supra* Section V.C.2.

[289] *See* discussion *supra* Section V.C.2.

[290] *See* discussion *supra* Section V.C.2.

[291] *See* discussion *supra* Section V.C.2.

[292] *See supra* Table 4.

[293] *See* discussion *supra* Section V.C.3.

EPO - 44.44%.[294] For teams that are 100% women and include at least one Israeli inventor the aggregate grant rate is 51.99%.[295] In the U.S. – 57.20%, IL – 54.41%, and EPO – 36.49%.[296] It is thus clear that in all jurisdictions men's grant rates are significantly higher.

Consistent with prior research on patent grant rate in the United States, we find that applications naming a female inventor are less likely to be granted than all-male teams.[297] This conclusion remains after accounting for the field of technology, patent office, and inventor team size. These applications are also less likely to secure a patent in the United States compared to other female applicants who file at the USPTO – all else being equal. Our study cannot, however, identify the reasons driving this variation.

We further find differences in forward citation patterns in our set of patents naming Israeli inventors. After normalizing forward citations to account for field of technology and filing years, patents with at least one Israeli inventor were found to be cited 23% more than comparable patents issued from the USPTO.[298] These citations are not, however, equally distributed by gender.[299] Teams with female inventors receive fewer citations than all-male patents, although it is notable that all-female teams with an Israeli inventor receive essentially the same number of citations as the average USPTO patent.[300] This finding is consistent with prior research showing that female inventors are cited less often,[301] but it simultaneously diverges in that all-female teams do not have a lower citation count relative to the average USPTO-issued patent.

The main findings of this study draw a clear picture revealing Israeli women's low rate of participation in the patenting activity in Israel, the U.S., and the EPO, both as compared with men's par-

---

294 *See infra* Appendix E.
295 *See infra* Appendix E.
296 *See infra* Appendix E.
297 *See, e.g.*, Schuster et al., *supra* note 161, at 304.
298 *See* discussion *supra* Section V.C.4.
299 *See* discussion *supra* Section V.C.4
300 *See* discussion *supra* Section V.C.4
301 Subramani & Saksena, *supra* note 25, at 6.

ticipation in patenting activity and with the representation of women in the STEM workforce. That is, the gender gap in patenting in Israel is expressed in the (even more pronounced) gender disparity in the patenting activity in the Israeli market—an activity that is perceived as central in the STEM fields, which aim to produce useful innovative products. This uncovers a dimension of the gender gap that has been poorly explored, and that reflects a significant disparity in women's integration in the innovation market.

Indeed, it can be argued that fewer women apply for patents in the innovation market in Israel than men due to their lower representation among those employed in the STEM fields. However, there is no reliable, historical data showing the number of women in the STEM fields in Israel, with the exception of a few years that were addressed in the findings discussed above.

Moreover, the comparison reveals broadly that women are underrepresented in the patenting activity in Israel, even when compared to their representation in the STEM job market for a selected group of years. This finding suggests that among women who engage in research and development jobs in the STEM fields in Israel, fewer women engage in patent activity than their male colleagues. These findings mimic the results found in another study led by one of the co-authors of this Article on the Israeli academy.[302]

It is interesting to note, however, that women's participation in patenting in Israel is greater than patenting generally and worldwide.[303] Indeed, our study reveals that women in the Israeli innovative markets are named in 10% to 20% of the applications filed in all jurisdictions examined.[304] The percentage of Israeli women's patenting is much higher than the average representation of women in patenting generally worldwide which is 7.2% and is also higher than the U.S. average representation of women in patenting, which

---

[302] *See generally* Miriam Marcowitz-Bitton et al., *Where the Gender Gap Meets Academic Patenting: An Empirical Study*, 18 OHIO ST. TECH. L. J. 239 (2022).

[303] Trajtenberg et al., *supra* note 211, at 32.

[304] *See infra* Appendix E tbl. E1.

is 8.7%.[305] These findings call for further comparative and in-depth research focusing on the reasons for this gap.

Last, our analysis used application fees and procedures as proxies for application costs/barriers. As policy and fiscal matters, the IPO occasionally changes application fees, although changes do not always increase fees when adjusted to inflation.[306] We used two specific changes to conduct two natural experiments. First, until December 2012, application fees were uniform across all inventors, but since then, certain inventors now enjoy a 40% discount in application fees.[307] These include individuals, small companies (by turnover/revenue) and academic institutions.[308] A second procedural change was in 2015, when electronic applications replaced the old-fashioned physical applications process, thereby lowering the overall costs of filing patent applications.[309] We used these two changes to evaluate the potential effect of application costs as a differential barrier to women and men on the assumption that the higher application costs before either or both of these changes will have an empirically greater tendency to create or reinforce a gender gap in patenting than the lowered application costs after either or both of these changes. Our study found that these two changes have not led to more filings by women in the years that followed the change.[310]

In the five years before and after 2012, the percentage of female applications (applications including at least one woman) filed in Israel were about the same, or actually a bit lower.[311] This suggests that the fee change has not had an impact. The same trend is observed when we study the percentage of inventors who are

---

[305] *See infra* Appendix E tbl. E1.

[306] Email from Mark Lauroesch, Exec. Dir. of Intell. Prop. Owners Ass'n, to Brendan Hourigan, Off. of the Chief Fin. Officer, U.S. Pat. & Trademark Off., Re: Proposed Patent Fee Adjustments, https://www.uspto.gov/sites/default/files/documents/IPO.pdf [https://perma.cc/MZD4-67BJ].

[307] *See USPTO Fee Schedule*, *supra* note 124.

[308] *See USPTO Fee Schedule*, *supra* note 124.

[309] *See Nonprovisional (Utility) Patent Application Filing Guide*, *supra* note 125.

[310] *See infra* Appendix B, fig. B2.

[311] *See infra* Appendix B, fig. B4.

women; no change is observed, and actually their number was a bit lower after 2012.[312]

As for the move to online filing in 2015, our data was more limited, as we only looked at data for filings up to 2017.[313] We can conclude that in the years before the change, there was a small bump in women's representation in the two years before 2015 versus the two years after 2015.[314] Yet, we actually see a greater jump in women's representation in other jurisdictions over that same period. [315] This suggests that we cannot conclude anything from the data regarding the impact of the move to online filing of patent applications.

To conclude, understanding the gender gap in the Israeli innovative market requires more than a comparison of each gender's representation in the innovative market. Indeed, a more complete (though certainly not exhaustive) picture of women's incomplete integration into some of this central innovative activity emerges from the close look we have taken at how male and female inventors participate in the innovative industry through patenting. Our findings highlight the need for follow-up studies to examine the reasons women take part in patenting activities at lower rates than men and the barriers to women's optimal integration into the innovative market. For example, it is necessary to explore whether women lack access to patenting resources.[316] The policies and practices regarding patenting in the innovative market should be examined to determine whether this sector optimizes access by female inventors. Additionally, practices within STEM research groups should be examined to investigate whether there exists gender bias in determining who will be named as inventors in patent applications.[317]

The gender gap in patenting may also have implications concerning financial incentives for women. As mentioned above, in-

---

312 *See infra* Appendix B, fig. B2.
313 *See infra* Appendix B, fig. B2.
314 *See infra* Appendix B, fig. B5.
315 *See infra* Appendix D, fig. D1.
316 DELIXUS, INC. & NAT'L WOMEN'S BUS. COUNCIL, *supra* note 54, at 25.
317 *See* Golin, *supra* note 174, at 1533.

ventors may be entitled to royalties.[318] Accordingly, women's comparatively low representation in patenting may produce a significant earning gap. As a result, women who have succeeded professionally and have integrated into the innovative market within the STEM fields may still suffer from earning inferiority. The gender gap in patenting may also affect women's reduced exposure to the business sector, which can, in turn, reduce their professional opportunities.

Finally, the lack of optimal integration of women in the patenting world may hinder the accomplishment of gender equality goals in promoting innovation, as the potential of women inventors in the STEM fields is not fully achieved.

VII. RECOMMENDATIONS FOR REFORM

The empirical evidence demonstrates significant disparities in IP registration systems that disproportionately affect women and other underrepresented groups. While eliminating these barriers would require fundamental changes to existing legal frameworks, this Article proposes several concrete reforms that could meaningfully improve access to IP protection.

A. Institutional and Administrative Reforms

Patent offices should implement several procedural modifications to reduce examiner bias and improve accessibility. Our data and previous research show that patent applications by women inventors face significantly higher rejection rates, even when controlling for technological field.[319] To address these disparities, offices should adopt anonymized review processes that redact inventor demographics during initial examination phases. While complete anonymity throughout the entire process may be impractical due to necessary face-to-face interactions, removing identifying

---

[318] Teniola & Merlinda, *supra* note 97, at 1420.

[319] Marcowitz-Bitton & Morris, *supra* note 17, at 331.

information during preliminary reviews could help reduce bias in critical early decisions.[320]

Oversight and training mechanisms also play an important role. Studies have documented how unconscious biases affect administrative decision-making,[321] suggesting the need for examiner training on bias awareness and decision-making processes. However, evidence on the effectiveness of such training programs has been mixed.[322]

Data collection and monitoring are crucial for addressing disparities.[323] Currently, most patent offices do not collect demographic information on inventors, hampering research efforts and policy development.[324] Following the America Invents Act's model requiring USPTO studies on patent policy, offices should implement voluntary demographic data collection programs. This information—kept separate from examination files—would enable regular audits of grant patterns and help measure the impact of reform efforts. In the age of artificial intelligence technological tools can also be developed to uncover bias.

Finally, patent offices should expand financial accessibility measures. Building on existing micro-entity provisions, fee schedules should be restructured to better accommodate resource constraints.[325] Income-based fee adjustments, similar to those already available to small and micro entities, could be extended to other qualifying applicants to reduce financial barriers to patent protection.[326] Our study did not demonstrate the short-term effects of

---

320 *See Examination of Applications and Proceedings in the United States Patent and Trademark Office*, U.S. PAT. & TRADEMARK OFF. (Oct. 2015).

321 Golin, *supra* note 174, at 1533.

322 *See, e.g.*, Tomas Chamorro-Premuzic, *Implicit Bias Training Doesn't Work*, BLOOMBERG (Jan. 4, 2020), https://www.bloomberg.com/view/articles/2020-01-04/implicit-bias-training-isn-t-improving-corporate-diversity [https://perma.cc/WU8G-TF28]. *But see* Sarah M. Jackson et al., *Using Implicit Bias Training to Improve Attitudes Toward Women in STEM*, 17 SOC. PSYCH. EDUC. 419, 432 (2014) (finding implicit bias training to be partially effective).

323 Marcowitz-Bitton & Morris, *supra* note 17, at 331.

324 *Patent Process Overview*, *supra* note 123.

325 *See* DELIXUS, INC. & NAT'L WOMEN'S BUS. COUNCIL, *supra* note 54, at 28.

326 *See generally* Abdin et al., *supra* note 203.

such fees reductions but it can serve as a promising tool to handle the gender gap probably over longer periods.

B. Enhancing Institutional Support and Resources

Research reveals significant gender differences in attitudes toward patent commercialization among women. Studies show that women scientists often perceive patenting activities as conflicting with their core academic responsibilities, particularly teaching and student mentorship.[327] By contrast, male academics tend to view commercial activities as complementary to their teaching duties.[328] Further research documents widespread ambivalence among women scientists regarding commercial science, suggesting the need for institutional interventions.[329]

Universities can address these concerns through clear policies that legitimize commercialization activities. Institutional guidelines should explicitly recognize patenting and technology transfer in promotion and tenure decisions, providing concrete metrics for evaluating these contributions. Such frameworks would help normalize commercialization activities and provide clarity about their role in academic advancement. Additionally, implementing mandatory invention disclosure requirements could encourage more systematic consideration of patent protection across gender lines in all sectors.

Evidence suggests that TTOs have contributed to increasing women's patent participation in recent decades.[330] However, support resources remain fragmented, particularly outside academia.[331] While various assistance programs exist across jurisdictions, many inventors—especially women—struggle to identify and access available resources.[332] Creating a comprehensive, centralized data-

---

327 Ding et al., *supra* note 57, at 666.

328 Ding et al., *supra* note 57, at 666.

329 Murray & Graham, *supra* note 53, at 681.

330 Cassidy R. Sugimoto et al., *The Academic Advantage: Gender Disparities in Patenting*, 10 PLOS ONE, at 8 (2015).

331 Marcowitz-Bitton et al., *supra* note 41, at 62.

332 DELIXUS, INC. & NAT'L WOMEN'S BUS. COUNCIL, *supra* note 54, at 17.

base of support services would help inventors across all sectors navigate the patenting process more effectively.

C. Addressing Structural and Cultural Barriers to Innovation

Efforts to address gender disparities in patenting must tackle both the structural and cultural barriers that limit women's participation in intellectual property systems. This dual strategy emphasizes the importance of enabling immediate access to resources and opportunities while fostering long-term cultural shifts in patent-intensive fields.

1. Structural Barriers: Supporting Family Responsibilities

Research consistently identifies work-family balance as the primary obstacle facing female scientists and innovators. Studies in the United States demonstrate that female academic scientists cite family responsibilities as a major barrier to career advancement and patenting activities.[333] Addressing these challenges requires concrete institutional responses. Universities and research institutions should implement flexible tenure clock policies accommodating childbirth and family formation, while providing accessible, high-quality on-site childcare facilities. Enhanced dual-career hiring programs supporting academic couples, combined with family-friendly scheduling and comprehensive parental leave policies, can help normalize caregiving responsibilities within scientific as well as industry careers. These policies not only support the retention of women in science and innovation but also help create equitable environments where women can contribute fully to patent-intensive fields.[334]

2. Cultural Barriers: Increasing Participation in Patent-Intensive Fields

Cultural shifts are equally essential for addressing the gender gap in patenting.[335] While women's general underrepresentation

---

[333] Sue V. Rosser, *Using POWRE to ADVANCE: Institutional Barriers Identified by Women Scientists and Engineers*, 16 NWSA J. 50, 56–57, 63–64 (2004).

[334] *Id*. at 63.

[335] *See* DELIXUS, INC. & NAT'L WOMEN'S BUS. COUNCIL, *supra* note 54, at 27.

among STEM degree holders accounts for only a small portion of the patenting gender gap, their absence in patent-intensive fields—particularly engineering—accounts for nearly one-third of the observed disparity.[336] Closing this gap requires coordinated action across multiple fronts.[337] Educational institutions must strengthen programs targeting women and girls' participation in patent-intensive STEM fields, while professional organizations should develop robust mentorship programs connecting emerging and established inventors.[338] These efforts should be paired with broader initiatives challenging traditional gender roles in innovation through targeted outreach and support networks.[339] Equally important are systemic reforms in workplace policies, including enhanced enforcement of anti-discrimination measures and reformed hiring practices that address implicit biases in selection and promotion decisions.[340] These interpersonal and systemic interventions work together to promote an inclusive innovation culture that supports women's full participation in the patent system.[341]

D. Unregistered Patents

While the reforms proposed above are important, they face significant implementation challenges and may take years to yield meaningful results.[342] In two previous articles, one of our co-authors developed a detailed proposal for an unregistered patent rights regime to complement the current registration-only system.[343] Building upon that work, this Article advocates for implementing this alternative pathway that would help disadvantaged

---

336 Jennifer Hunt et al., *Why Don't Women Patent?*, 12–13, (Nat'l Bureau of Econ. Rsch., Working Paper No. 17888, 2012), https://www.nber.org/papers/w17888 [https://perma.cc/5UHF-X2T7].

337 *See* NAT'L WOMEN'S BUS. COUNCIL, *supra* note 186, at 24.

338 *See* Ding et al., *supra* note 57, at 666.

339 *See* NAT'L WOMEN'S BUS. COUNCIL, *supra* note 186, at 35.

340 *See* Rosser, *supra* note 333, at 64–66.

341 *See* Rosser, *supra* note 333, at 64–66.

342 *See* Rosser, *supra* note 333, at 73.

343 *See* Marcowitz-Bitton & Morris, *supra* note 17, at 307; Marcowitz-Bitton et al., *supra* note 41, at 47.

inventors protect their innovations while avoiding the barriers of traditional patent registration.[344]

Under this proposal, protection would automatically attach to inventions meeting existing patentability standards—including subject matter eligibility,[345] novelty,[346] utility,[347] and non-obviousness[348]—when they are made publicly available through exhibition, trade use, or publication. This approach is similar to the rules regarding "publicly available" inventions under the current patent regime's novelty doctrine.[349] Rights would be enforceable only against direct copying, with independent creation serving as a complete defense, similarly to copyright law.[350] The presumption of validity would be rebuttable by a preponderance of evidence rather than clear and convincing evidence, reflecting the lack of administrative examination. Protection would last for three years from first publication,[351] with inventors retaining the option to file for full patent protection within the first year, consistent with the grace period under 35 U.S.C. § 102(b) of the America Invents Act.[352]

---

344 *Cf.* Ann Bartow, *Fair Use and the Fairer Sex: Gender, Feminism and Copyright Law*, 14 AM. UNIV. J. OF GENDER SOC. POL'Y & L. 551, 570 (2006) (advocating for similarly limited copyright rights with low entry barriers to address gender-based copyright gap).

345 *See* 35 U.S.C. § 101.

346 The novelty requirement means that the invention was not previously made public knowledge. *Id*. § 102; DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 9 (Univ. of Chi. Press, 1st ed., 2009).

347 The utility requirement means that the invention holds some real-world application. 35 U.S.C. § 101; BURK & LEMLEY, *supra* note 346, at 9.

348 The nonobviousness requirement means that a person having ordinary skill in the relevant art would not be able to immediately create it with little effort. 35 U.S.C. § 103; BURK & LEMLEY, *supra* note 346, at 9.

349 *See* Metallizing Eng'g Co. v. Kenyon Bearing & Auto Parts Co., 153 F.2d 516, 518 (2d Cir. 1946); Helsinn Healthcare S.A. v. Teva Pharms. USA, Inc., 139 S. Ct. 628, 631–32 (2019).

350 17 U.S.C. § 106.

351 *Cf.* Council Regulation 6/2002, art. 11, 2002 O.J. (L3) 1, 5 (discussing terms of protection for unregistered design rights in the E.U.).

352 *See* ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, PATENT LAW AND POLICY 390–91 (7th ed. 2017).

This proposal addresses several key barriers facing disadvantaged inventors: prohibitive upfront costs including filing and renewal fees, potential examiner bias in the registration process, and the need for specialized patent law knowledge. While enforcement through litigation would still require significant resources, inventors may find it easier to secure funding once their inventions prove valuable enough to attract copying. Moreover, studies by Delixus, Inc. & National Women's Business Council from 2012 show that the shorter protection period may be sufficient in fast-moving technical fields like software and electronics.[353]

Because of the concerns that would undoubtedly arise about monopolistic rights, anticommons, and other issues, the proposed unregistered patent regime would be very limited in form.[354]

Several features mitigate potential concerns about this new regime. For instance, the system protects only against copying, preserving the public notice function since infringers would necessarily have knowledge of the protected invention. The limited duration and scope—coupled with maintaining traditional patentability standards subject to judicial review—minimize anticompetitive effects while still incentivizing eventual registration for inventions requiring longer protection. Although comparing similar technologies without formal patent claims presents challenges, courts and the USPTO already engage in similar analyses when evaluating novelty against prior art.[355]

---

353 DELIXUS, INC. & NAT'L WOMEN'S BUS. COUNCIL, *supra* note 54, at 27.

354 *See* Marcowitz-Bitton et al., *supra* note 41, at 73–88; *see also* Charles-Henry Massa & Alain Strowel, *Community Design: Cinderella Revamped*, 2003 EUR. INTELL. PROP. REV. 68, 68–71 (discussing similar unregistered rights for designs in the E.U.); *cf.* Council Regulation 6/2002, art. 11, 2002 O.J. (L3/5) 1, 5 (granting community designs similarly unregistered protections).

355 BURK & LEMLEY, *supra* note 346, at 14 (explaining how patent examiners will conduct a search of the patent against "prior art": existing patents and publications that might be similar to the invention defined in the claims).

VIII. CONCLUSION

This Article addressed the benefits of registries as well as their distributive effects, focusing on the gender gap in patenting.[356] While registries are critical for governance and innovation, we have empirically found that women are significantly underrepresented in patenting both in the U.S. and Israel.[357] This suggests that registries must evolve in a way that addresses systemic inequities which unlock the full potential of underrepresented groups.[358] By addressing the structural barriers in registration systems, we can create a more inclusive and equitable framework for fostering innovation and economic growth.

This study has explored the gender gap in the Israeli and American markets. Although past studies have examined the disparity in men's and women's representation in various contexts,[359] our study looked empirically at differences in men's and women's participation in patenting in the Israeli and American market. Specifically, we examined the filing rates of patent applications by male and female inventors and revealed a gender gap that is prominent.[360]

This finding calls for further studies to examine the causes of this phenomenon and to formulate solutions for optimizing women's integration in the Israeli and American innovative industries, and, in particular, in the patenting and commercialization activities taking place in the industry. Women's low rate of participation in patenting activity has tangible financial consequences: as a group, female inventors benefit less than their male counterparts from the financial rewards that stem from patenting. This observation is consistent with the overall data on the gender pay gap in the general workforce.[361] Moreover, the low integration of women into knowledge transfer activities and patent commercialization may

---

356 *See supra* Part IV.

357 *See supra* Part IV.

358 *See supra* Part VII.A.

359 Marcowitz-Bitton et al., *supra* note 41, at 73–88.

360 *See infra* Appendix B.

361 Frietsch et al., *supra* note 3, at 591. *See generally* Poczter & Shapsis, *supra* note 192.

reduce their exposure to the private market, which can, in turn, affect their professional opportunities.

Our findings provide a springboard for further in-depth research on various aspects of women's integration in the innovative market to identify failures in achieving gender equality that may be masked by women's increasing representation in various industries. As the results of our study make clear, equality in the market is also whether female inventors can and do participate in patenting and other important research and development activities at rates similar to that of their male colleagues.

APPENDIX A - VARIABLE DEFINITIONS

Variable	Definition and Source
Inventor Gender	The gender associated with the first and/or middle name of inventors. Inventor name and country (if available) was extracted from the Google Patents Database. The inventor's first name was then extracted from their full name as the string before the first space. The middle name was the string between the first and second space. The pattern was repeated for the second and third middle name. The first name and country were then compared to the Martinez, Raffo, et al. dataset. If a match was identified, the inventor was coded with a gender. If no match was identified, the process was repeated for the middle name(s) and country code. If no match was identified, the first name (and if necessary, middle names) was compared to the Martinez, Raffo, et al. dataset without a country. From this, the inventor's gender was coded as the most common name associated with that name in the dataset. If no gender was associated through this means, the inventor was coded with no gender. Sources: Google. (2023). Google Patents, from https://en.wikipedia.org/wiki/Google_Patents [https://perma.cc/9ZYH-6F8B] (hereinafter the "Google Patents Dataset"); Gema Lax Martínez, Julio Raffo & Kaori Saito, Identifying the Gender of PCT Inventors, World Intellectual Property Organization Economic Research Working Paper No. 33 (2016).

Country Code	The country where the relevant patent filing occurred. For current purposes, the dataset includes filings from the United States Patent and Trademark Office (USPTO), European Patent Office (EPO), Israel Patent Office (IPO), and the World Intellectual Property Organization (WIPO - for Patent Cooperation Treaty filings). Source: Google Patents Dataset
Family ID	Google assigns a family ID to related applications across multiple jurisdictions. "The simple patent family is all of the patents that share the same set of priority claims. This is usually when the same or very similar patent is filed in more than one country." About Google Patents, GOOGLE, https://support.google.com/faqs/answer/7049588/searchresults-page?hl=en&ref_topic=6390989 [https://perma.cc/RD59-ZTXX]. Source: Google Patents Dataset
Family Members	The number of applications filed in a family across all jurisdictions. Source: Google Patents Dataset
Filing Year	The year the application was filed, regardless of priority claims. Source: Google Patents Dataset

CPC Class	The 3-letter Cooperative Patent Classification (CPC) is identified as the "first listed" in the Google Patents Dataset. It is notable that in some instances, the dataset had multiple instances that were listed as first. In that case, a random CPC code entry was kept from those listed as "first." Source: Google Patents Dataset
One if Granted	This is a dummy variable indicating whether the patent application was granted. For EPO and USPTO filings, grant data was extracted from the Google Patents Dataset. For IPO filings, grant data was extracted from the IPO website. For WIPO PCT filings, no patent can be granted, so this is a null variable for those filings. Our grant data ends in April of 2023 for the USPTO and EPO and in November of 2023 for the IPO. Accordingly, any application that was not granted as of this date is coded as "0" for this variable, even if subsequently granted. Sources: Google Patents Dataset; Patent Search, ISRAEL PATENTS ONLINE, https://israelpatents.justice.gov.il/search/en/ [https://perma.cc/M7YL-BVLB].
Inventor Count, Gender Count and Percentage	The total number of inventors. The count of the number of male, female, or no gender inventors in aggregate (from any country) or from Israel exclusively. The percentage of inventors for whom a gender was associated that were male or female in aggregate (from any country) or from Israel exclusively.
Small Entity	For USPTO applications only, a dummy variable that identifies whether the applicant can

claim a discount status (e.g., small or micro entity).

Source: Patent Examination Research Dataset (PatEx), U.S. PAT. & TRADEMARK OFFICE, https://www.uspto.gov/ip-policy/economic-research/research-datasets/patent-examination-research-dataset-public-pair [https://perma.cc/EW32-AZNS].

APPENDIX B – PATENT APPLICATIONS FROM ISRAELI INVENTORS BY YEAR

The following shows the number of applications filed by Israelis generally over the years studied. The first shows the aggregate number of filings (in the 4 jurisdictions studied) that list at least one Israeli inventor (regardless of their gender).

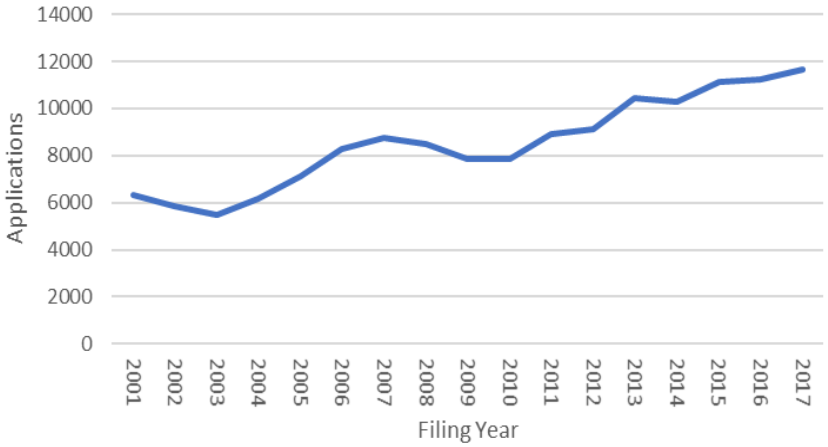


Figure B1: Applications (All Jurisdictions)

This chart represents a subset of the above, looking only to the aggregate number of filings in all 4 jurisdictions studied with 100% female inventor teams.

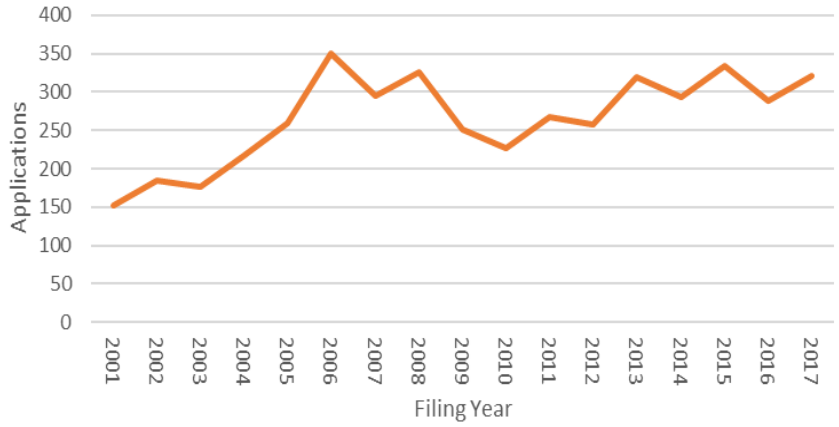


Figure B2: Applications (All Jurisdictions, Female-Only Teams)

This chart represents a subset of the above, looking only at the aggregate filings in all four jurisdictions studied with 100% male inventor teams.

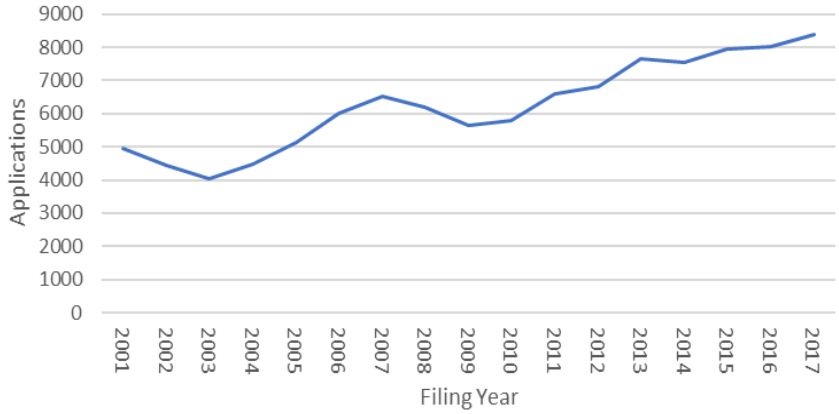


Figure B3: Applications (All Jurisdictions, Male-Only Teams

This chart represents a subset of the above, looking only at the aggregate filings in all four jurisdictions studied with mixed gender inventor teams.

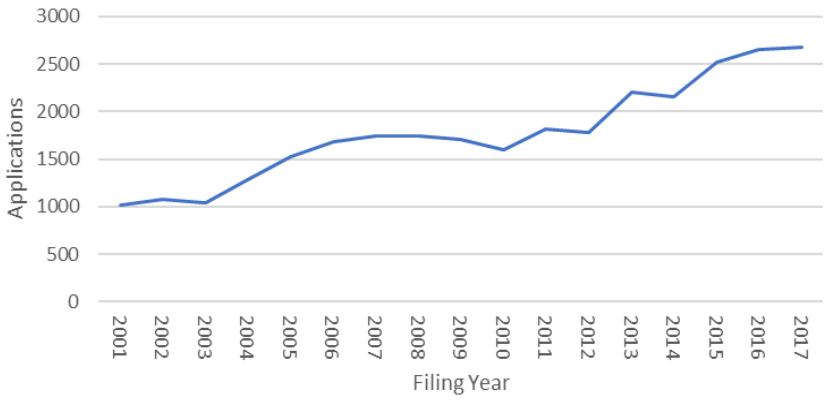


Figure B4: Applications (All Jurisdictions, Mixed Gender Teams)

The following is a summary chart comparing the above three graphs, showing inventor teams with at least one Israeli inventor for aggregate filings in the four studied patent offices.

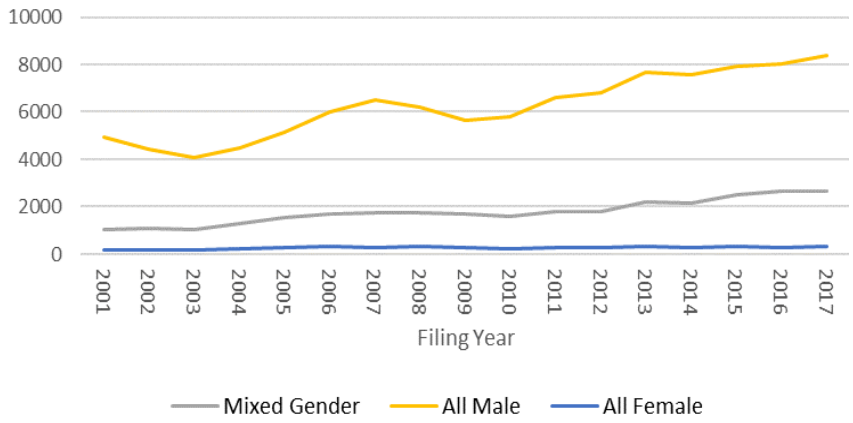


Figure B5: Applications (All Jurisdictions By Gender)

The below further breaks down these trends by presenting the top application publications (across all four patent offices) by field of technology and their rank (with 1 being the CPC class with the

most filings) for filings with at least one Israeli inventor.[362] The following columns break this data into male, female, and mixed gender inventor teams.[363]

---

[362] We studied 141,606 applications filed between 2001 and 2017, inclusive—73,101 from the USPTO, 33,516 from WIPO, 24,096 from the EPO, and 10,893 from the IPO.

[363] For teams with only male inventors, the most common CPC classes were A61 (first—Medical or Veterinary Science; Hygiene—20.05%), G06 (second—Computing; Calculating; Counting—18.41%), H04 (third—Electric Communication Technique—16.81%), G01 (fourth—Measuring; Testing—5.77%), H01 (fifth—Basic Electric Elements—2.93%), G02 (sixth—Optics—1.80%), A01 (seventh—Agriculture; Forestry; Animal Husbandry; Hunting; Trapping; Fishing—1.65%), C07 (eighth—Organic Chemistry—1.60%), C12 (ninth—Biochemistry; Beer; Spirits; Wine; Vinegar; Microbiology; Enzymology; Mutation or Genetic Engineering—1.42%), and G11 (tenth—Information Storage—1.28%).

For teams with only female inventors, the most common CPC classes were A61 (first—Medical or Veterinary Science; Hygiene—30.47%), C07 (second—Organic Chemistry—12.25%), G06 (third—Computing; Calculating; Counting—11.37%), H04 (fourth—Electric Communication Technique—9.82%), C12 (fifth—Biochemistry; Beer; Spirits; Wine; Vinegar; Microbiology; Enzymology; Mutation or Genetic Engineering—6.99%), G01 (sixth—Measuring; Testing—5.93%), A01 (seventh—Agriculture; Forestry; Animal Husbandry; Hunting; Trapping; Fishing—1.48%), A47 (eighth—Furniture; Domestic Articles or Appliances; Coffee Mills; Spice Mills; Suction Cleaners in General—1.26%), G09 (ninth—Education; Cryptography; Display; Advertising; Seals—1.06%), and A41 (tenth—Wearing Apparel—0.82%).

Table B1 – Field of Technology Data

CPC Class	CPC Title	Filing (all)	Percent (all)	Rank	Filing (male)	Percent (male)	Rank	Filings (female)	Percent (female)	Rank	Filings (mixed)	Percent (mixed)	Rank
A61	MEDICAL OR VETERINARY SCIENCE; HYGIENE	30,906	21.83%	1	21,277	20.05%	1	1,378	30.47%	1	7,383	24.40%	1
G06	COMPUTING; CALCULATING; COUNTING	26,278	18.56%	2	19,534	18.41%	2	514	11.37%	3	5,596	18.49%	2
H04	ELECTRIC COMMUNICATION TECHNIQUE	22,128	15.63%	3	17,843	16.81%	3	444	9.82%	4	3,265	10.79%	4
G01	MEASURING; TESTING	8,069	5.70%	4	6,125	5.77%	4	268	5.93%	6	1,519	5.02%	6
C07	ORGANIC CHEMISTRY	6,007	4.24%	5	1,700	1.60%	8	554	12.25%	2	3,679	12.16%	3
C12	BIOCHEMISTRY; BEER; SPIRITS; WINE; VINEGAR; MICROBIOLOGY; ENZYMOLOGY; MUTATION OR GENETIC ENGINEERING	3,928	2.77%	6	1,505	1.42%	9	316	6.99%	5	2,022	6.68%	5
H01	BASIC ELECTRIC ELEMENTS	3,840	2.71%	7	3,109	2.93%	5	29	0.64%	17	639	2.11%	7
G02	OPTICS	2,348	1.66%	8	1,912	1.80%	6	18	0.40%	23	361	1.19%	10
A01	AGRICULTURE; FORESTRY; ANIMAL HUSBANDRY; HUNTING; TRAPPING; FISHING	2,300	1.62%	9	1,756	1.65%	7	67	1.48%	7	399	1.32%	9
G03	PHOTOGRAPHY; CINEMATOGRAPHY; ELECTROGRAPHY; HOLOGRAPHY	1,611	1.14%	10	1,080	1.02%	14	11	0.24%	29	507	1.68%	8

APPENDIX C – PERCENTAGE OF TEAM GENDER COMPOSITION AMONG ONLY ISRAELI INVENTORS

The below pie graph shows the number of applications filed by women only, men only and mixed groups for all applications filed in the 4 studied jurisdictions. It looks only at applications for inventor teams that are 100% Israeli inventors; the second looks at applications that name at least one Israeli inventor.

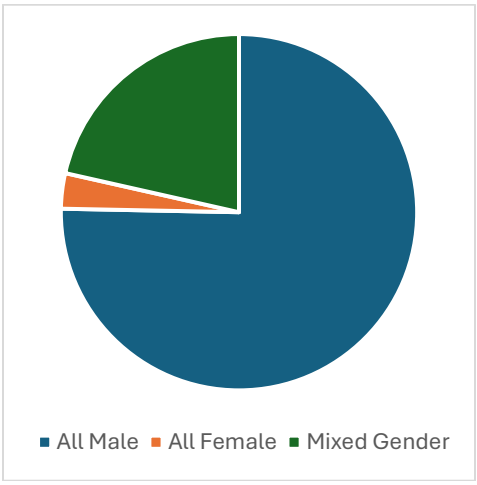


Figure C1: Applications by Inventor Team Composition (Only All Israeli Teams)

Here is the raw data for the 100% Israeli inventor teams. Note that there are 81.1% as many applications that name 100% Israeli teams as there are applications that list at least one Israeli inventor. The above chart disregards the 3,929 applications with no inventor for whom gender could be estimated.

Table C1 – Data for All-Male, All-Female, and Mixed Gender Teams for 100% Israeli Inventor Teams

Male	**Female**	**Mixed**	**No Gender**
88,356	4,260	20,952	3,929
77.8%	**3.8%**	**18.4%**	

APPENDIX D – PERCENTAGE OF WOMEN AMONG ONLY ISRAELI INVENTORS

The below chart and figure look at the percentage of all named Israeli inventors in a given year and jurisdiction who are women. This calculation ignores any inventor who is not from Israel in calculating the percentage of aggregate inventors who are women. This chart analyzed 23,234 applications from the EPO, 11,661 from the IPO, 72,081 from the USPTO, and 32,307 PCT filings—all filed between 2001 and 2017, inclusive.[364]

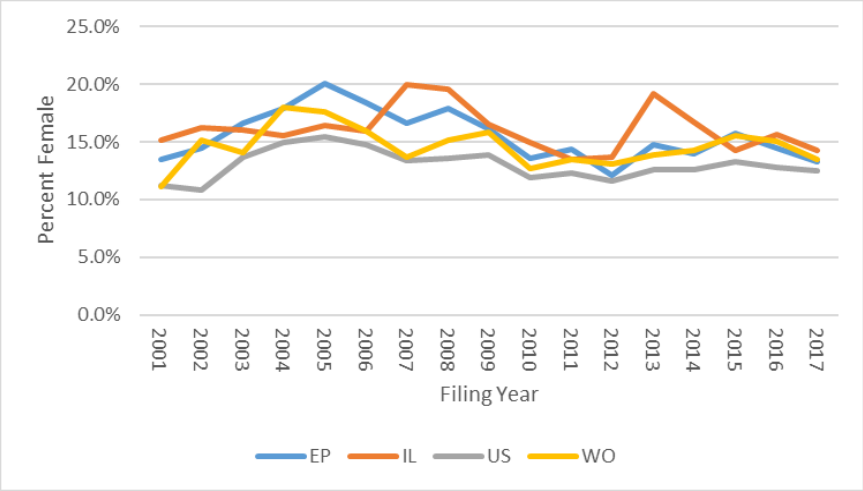


Figure D1: Percentage of Only Israeli Inventors that Are Women

The below chart breaks down the percentage of inventors from Israel who are women from an application with at least one Israeli inventor by jurisdiction over the full period studied by high/low years.

[364] These numbers are slightly lower than the prior chart, as the prior chart included any application for which the gender of at least one inventor could be identified. In contrast, this chart includes any application for which the gender of at least one inventor *from Israel* could be identified.

Table D1 – Summary Statistics for Only Israeli Inventors who are Women

Country	All Years	High Year	High Pct	Low Year	Low Pct
EP	15.5%	2005	20.1%	2012	12.1%
IL	16.1%	2007	20.0%	2011	13.5%
US	13.0%	2005	15.4%	2002	10.8%
WO	14.6%	2004	18.0%	2001	11.1%

APPENDIX E – REGRESSION ANALYSIS ON PERCENT OF FEMALE ISRAELI INVENTORS

In the below Figure E1, we present the results of logistic regression analysis similar to that from Figure 3 in the body text, except that the primary independent variable is the percentage of Israeli inventors who are women. This stands in contrast to Figure 3, in which the primary independent variable was the percentage of *all* inventors who are women. Results are largely similar to Figure 3.

We found that the higher the percentage of inventors from Israel who are female, the lower the grant rate across all jurisdictions. As shown below, we see highly significant odds ratios for the percentage of Israeli inventors that are female on Patent Grant that vary between .625 (Israel) to .718 (United States). In aggregate, the odds ratio for percent Israeli inventors who are female is .716.

Table E1: Logistic Regression of Patent Grant on Percentage of Israeli Inventors that are Female

Logistic Regression	**All Countries**	**Israel**	**Europe**	**United States**
Number of Observations	103,655	10,256	23,208	70,139
Pseudo R Squared	0.0693	0.1193	0.0567	0.0873
Percent of Israeli Inventors that are Female	0.716 (0.02) ***	0.625 (0.054) ***	0.7 (0.041) ***	0.718 (0.026) ***
Members in Application's Family	1.03 (0.001) ***	1.082 (0.005) ***	1.059 (0.003) ***	1.011 (0.001) ***

Total Inventors	1.032 (0.004) ***	0.955 (0.014) **	1.002 (0.007)	1.014 (0.005) **
Percent of Inventors from Israel	0.848 (0.029) ***	0.694 (0.102) *	0.811 (0.059) **	1.113 (0.047) *
Small Entity (US)				0.338 (0.006) ***
Filing Year Controls	X	x	x	x
CPC (Three Digit) Controls	X	x	x	x
Jurisdiction Controls	x			
Constant	0.596 (0.043) ***	1.086 (0.248)	0.448 (0.067) ***	3.579 (0.336) ***
***p < 0.001, **p < 0.01, *p < 0.05 (Standard errors in parentheses.)				