
ESSAY

THE UNMAKING OF “BLACK BILL GATES”: HOW THE U.S. PATENT SYSTEM FAILED AFRICAN-AMERICAN INVENTORS

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The United States government owes African-Americans reparations for the harm of the Transatlantic Slave Trade. Existing reparations scholarship focuses on remedying losses related to real property, healthcare disparities, mass incarceration, and educational opportunities. But reparations for the Transatlantic Slave Trade must also include the value of patents historically denied to African-Americans. Revolutionary contributions from enslaved Black inventors and their descendants catapulted the United States to the top of the global economy. However, the United States denied enslaved Black people the right to property, including intellectual property to maximize the profitability of their inventions. After emancipation, structural racism and racial violence continued to ostracize African-Americans from the patent system until their inventive activity plummeted in the late 1800s. The Transatlantic Slave Trade’s legacy endures in the patent context: its violence has contributed to the underrepresentation of African-American patent applicants and awardees, stark disparities in income and economic mobility, and forgone inventive contributions. This harm warrants a comprehensive reparations package that confronts gaps in white and African-American inventive activity.

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In 2016, Beyoncé released her hit single *Formation* with the fan-favorite line: “You just might be a Black Bill Gates in the making. . . . I just might be a Black Bill Gates in the making.”¹ *Formation* became the title of her next world tour, grossing more than \$250 million and increasing her then net worth of \$290 million (which has since ballooned to over \$400 million).² While the “Black Bill Gates” paradigm encouraged conversations about generational wealth among African-Americans, the trope curiously exposes that there is no Black Bill Gates.³

In *some* ways similar to Bill Gates, Beyoncé is a remarkable, self-made businessperson; but, her charge to become a Black Bill Gates is over \$100 billion short.⁴ I offer at least one key explanation: Bill Gates holds numerous patents, and Beyoncé holds none. Beyoncé built her more than \$400 million fortune on less profitable forms of intellectual property (IP), namely

¹ *Beyoncé-Formation Lyrics*, GENIUS, <https://genius.com/Beyonce-formation-lyrics> [<https://perma.cc/K3JA-5XB4>].

² See Mahita Gajanan, *Beyoncé's Net Worth*, FORTUNE (Mar. 30, 2017, 2:21 PM), <https://fortune.com/2017/03/30/beyonce-net-worth> [<https://perma.cc/TJG3-JUGY>] (stating Beyoncé's net worth as \$290 million as of March 2017); *Beyoncé Knowles*, FORBES, <https://www.forbes.com/profile/beyonce-knowles> [<https://perma.cc/L3LZ-Q7RM>] (stating Beyoncé's net worth as \$440 million of August 4, 2021); Bob Allen, *Boxoffice Insider: Top Grossing Black Touring Artists*, POLLSTAR (Feb. 26, 2021, 9:35 AM) <https://www.pollstar.com/article/boxoffice-insider-top-grossing-black-touring-artists-147430> [<https://perma.cc/PJ6Z-EZSR>] (“Her most successful trek at the boxoffice was the most recent solo run, the ‘Formation’ world tour that played North American and European stadiums in support of the 2016 album *Lemonade*. She performed 49 shows that year, grossing \$256 million from 2.2 million sold seats.”).

³ See *Billionaires 2020: Bill Gates*, FORBES, <https://www.forbes.com/profile/bill-gates> [<https://perma.cc/WC39-FS75>].

⁴ See *id.* (listing Bill Gates's net worth as \$130 billion as of August 10, 2021).

copyrights and trademarks. The same is true of her husband, Sean “Jay-Z” Carter, whom Forbes named hip-hop’s first billionaire.⁵ While staggering at first glance, The Carters’ \$1.4 billion fortune is small compared to the wealthiest Americans’ and exemplifies the predisposition among Black businesspeople and celebrities to amass wealth via non-patent IP, and in industries—like entertainment—that are not patent-centric. This predisposition contributes to a wide earnings gap between whites and African-Americans, including between white and African-American billionaires.⁶

The wealthiest Americans hold numerous patents—unsurprising considering the value of a patent as a corporate asset.⁷ For example, Jeff Bezos is named in at least 154 of Amazon’s published patents; 11 list him as the sole inventor.⁸ Bill Gates partners with Intellectual Ventures, a large patent holding company, and holds close to one-hundred patents.⁹ African-Americans, by contrast, are flatly underrepresented among patent awardees.¹⁰ This is not to underappreciate the value of trademarks and copyright. However, the novelty requirement for patentability is more demanding than the creativity and distinctiveness requirements for copyright or trademark awards. Accordingly, patents reward early entrants into a field with a unique opportunity to monopolize its revenue streams; copyrights and trademarks do not.

The scarcity of patents awarded to Black people highlights the United States’ history of entrenching white wealth and undercompensating African-

⁵ Zack O’Malley Greenburg, *Artist, Icon, Billionaire: How Jay-Z Created His \$1 Billion Fortune*, FORBES (June 3, 2019, 5:56 AM), <https://www.forbes.com/sites/zackomalleygreenburg/2019/06/03/jay-z-billionaire-worth> [<https://perma.cc/JP74-KTFP>].

⁶ See *Take a Look at the 7 Wealthiest Black Americans*, USA TODAY (Apr. 6, 2021, 4:09 PM), <https://www.usatoday.com/picture-gallery/money/2021/04/06/take-look-7-wealthiest-black-americans/4581780001> [<https://perma.cc/4NMD-PFUT>] (identifying Robert Smith as the wealthiest African-American with a net worth of \$5.2 billion); Kerry A. Dolan, Chase Peterson-Withorn & Jennifer Wang, *The Forbes 400: The Definitive Ranking of the Wealthiest Americans in 2020*, FORBES <https://www.forbes.com/forbes-400> [<https://perma.cc/9VWJ-3NC9>] (identifying Robert Smith as only the 125th wealthiest American).

⁷ 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 727, 733 (2018).

⁸ Tricia Gregg & Boris Groysberg, *What We Learned from Reading Jeff Bezos’ Patents*, HARV. BUS. SCH.: WORKING KNOWLEDGE (Feb. 2, 2020), <https://hbswk.hbs.edu/item/what-we-learned-from-reading-jeff-bezos-patents> [<https://perma.cc/Y2EQ-XBKB>].

⁹ Jon Brodtkin, *Bill Gates Still Helping Known Patent Trolls Obtain More Patents*, ARSTECHNICA (Aug. 14, 2013, 3:20 PM), <https://arstechnica.com/tech-policy/2013/08/bill-gates-still-helping-known-patent-trolls-obtain-more-patents> [<https://perma.cc/5X6L-WNPN>].

¹⁰ See Alex Bell, Raj Chetty, Xavier Jaravel, Neviana Petkova & John Van Reenen, *Who Becomes an Inventor in America? The Importance of Exposure to Innovation*, 134 Q. J. ECON. 647, 648-49, 666-68 (2019) (“Whites are more than three times as likely to become inventors as are blacks.”); Fechner & Shapanka, *supra* note 7, at 729 (noting that African-Americans are awarded patents at much lower rates than white Americans).

Americans.¹¹ During the Transatlantic Slave Trade, Black people invented at impressive rates and contributed inventions that transformed American life and industrialization.¹² However, the patent system barred Black inventors and denied them access to critical economic opportunities. Following emancipation, racial violence and Jim Crow laws forced patenting rates downward among African-Americans.¹³ Patenting rates have still not recovered: African-Americans remain significantly underrepresented among patent applicants, patent awardees, and tangentially, the world's wealthiest people.¹⁴

Human rights violations, such as the Transatlantic Slave Trade, can never be undone. Nonetheless, reparations seek to restore the status of victims as if the harm had not occurred, and paying reparations to victims of human rights violations is historically established. Following World War II, the U.S. joined many countries in pressuring Germany to pay reparations to survivors of the Holocaust.¹⁵ The U.S. then looked inward and issued reparations payments to victims of Japanese Internment and to Hawaiians and Native Americans for seizing their land.¹⁶ After the emancipation of enslaved Black people, the

¹¹ In this Essay, “African-Americans” refers to Black descendants of the Transatlantic Slave Trade whose ancestors resided in North America. The adjacent term “Black people” refers to this same community before 1868, highlighting that until Congress ratified the Fourteenth Amendment the United States did not legally recognize them as American citizens. Here, neither the terms “African-Americans” nor “Black people” reference Black immigrant groups whose ancestors were not victims of the historic Transatlantic Slave Trade or entered the United States after 1900 (unless referencing a dataset from an author who does not distinguish Black ethnicities). Black immigrants to the United States would not be eligible for the reparations payments argued for here because they were not enslaved in the United States and reparations aim to remedy harm directly from a tragedy.

¹² See generally PATRICIA CARTER SLUBY, *THE INVENTIVE SPIRIT OF AFRICAN-AMERICANS: PATENTED INGENUITY* (2004) (discussing the early inventions of Black people in America); Henry E. Baker, *The Negro in the Field of Invention*, 2 J. NEGRO HIST. 21, 21 (1917) (detailing numerous Black inventions and highlighting their role in the “economic, industrial and financial development of our country”); Shontavia Johnson, *America’s Always Had Black Inventors—Even When the Patent System Excluded Them*, THE CONVERSATION (Feb. 19, 2017 3:23 PM), <https://theconversation.com/20americas-always-had-black-inventors-even-when-the-patent-system-explicitly-excluded-them-72619> [<https://perma.cc/35LK-MJ58>] (discussing notable early Black inventions, like a bedframe—the “Boyd Bedstead”—or a steamboat propellor).

¹³ See Lisa D. Cook, *Violence and Economic Activity: Evidence from African American Patents, 1870–1940*, 19 J. ECON. GROWTH 221, 222–27, 227 (2012) (“[Between 1870 and 1940], a rise in race-related violence coincided with greater divergence in patenting rates between black and white inventors.”).

¹⁴ See, e.g., Bell et al., *supra* note 10, at 666–68 (demonstrating the racial disparities in patent awards and applications); Fechner & Shapanka, *supra* note 7, at 729, 732–33 (noting the racial gap in patent applications and awards and discussing the economic significance of patent holding).

¹⁵ See Erin Blakemore, *The Thorny History of Reparations in the United States*, HISTORY (Aug. 29, 2019), <https://www.history.com/news/reparations-slavery-native-americans-japanese-internment> [<https://perma.cc/FR9Y-B2HR>] (discussing Holocaust reparations).

¹⁶ See *id.* (chronologizing and detailing instances where the United States has paid reparations to victims of human rights violations).

United States even issued reparations to white slave owners for the loss of their property.¹⁷ Federal and state governments have also issued reparations for the Tuskegee Experiments, racially motivated massacres, and some instances of police brutality.¹⁸ Although the actual implementation of these efforts is frequently criticized,¹⁹ the gestures nonetheless normalize reparations as an anticipated response to egregious, historical events. However, African-Americans still have not seen reparations for the Transatlantic Slave Trade, even after the 111th Congress finally acknowledged its “246-year” duration and identified the subsequent 100-year Jim Crow era as an immediate consequence with enduring “tangible and intangible” harm.²⁰

Moreover, past reparations efforts have failed to embrace the goal of repairing harm from human rights violations.²¹ They instead resembled *restitution*, a mere acknowledgement that harm has occurred, without prioritizing whether the “larger tear in social fabric” is repaired.²² While reparations should consist of direct payments to African-Americans to

¹⁷ See Tera W. Hunter, *When Slaveowners Got Reparations*, N.Y. TIMES (Apr. 16, 2019) <https://www.nytimes.com/2019/04/16/opinion/when-slaveowners-got-reparations.html> [<https://perma.cc/F854-A44Q>] (discussing the District of Columbia Emancipation Act, which freed Black people enslaved in Washington, D.C. while also compensating slaveowners up to \$300 per every freed African-American).

¹⁸ Blakemore, *supra* note 15.

¹⁹ See Adeel Hassan & Jack Healy, *America Has Tried Reparations Before. Here Is How It Went.*, N.Y. TIMES (June 19, 2019), <https://www.nytimes.com/2019/06/19/us/reparations-slavery.html> [<https://perma.cc/S6UM-3RY7>] (chronologizing various instances of reparations in United States’ history and the public’s reactions thereto).

²⁰ See A Concurrent Resolution Apologizing for the Enslavement and Racial Segregation of African-Americans, S. Con. Res. 26, 111th Cong. (2009) (as passed by Senate, June 18, 2009). Note that enslavement in the United States actually endured for 340 years at minimum. Gillian Brokell, *Before 1619, There Was 1526: The Mystery of the First Enslaved Africans in What Became the United States*, WASH. POST (Sept. 7, 2019), <https://www.washingtonpost.com/history/2019/09/07/before-there-was-mystery-first-enslaved-africans-what-became-us> [<https://perma.cc/6BKR-SS6U>] (explaining that white slavers settled in South Carolina and Georgia as early as 1526); Derrick Bryson Taylor, *So You Want to Learn About Juneteenth?*, N.Y. TIMES (June 19, 2021), <https://www.nytimes.com/article/juneteenth-day-celebration.html> [<https://perma.cc/QDG8-4DJ7>] (explaining that the last enslaved Black people in the United States learned of their emancipation on June 19, 1865, more than two and a half years after President Abraham Lincoln signed the Emancipation Proclamation).

²¹ Vernellia Randall defines reparations:

To many—Black, White and other—reparations is viewed as a paycheck, some undetermined amount of money for some long-ago harm. In my view, that is an incomplete and destructive view of reparations. Rather, reparations should be viewed as an obligation to make the repairs necessary to correct current harms done as a result [of] past wrongs.

Vernellia R. Randall, *Eliminating the Slave Health Deficit: Using Reparations to Repair Black Health*, POVERTY & RACE Nov.–Dec. 2002, at 3, 3

²² *Id.* (“[R]eparations for African Americans, conceived as repair, can help mend this larger tear in the social fabric for the benefit of both Blacks and mainstream America.” (quoting Eric Yamamoto)).

acknowledge the Transatlantic Slave Trade as a historic and repugnant tragedy, reparations must go beyond one-time payments. Reparations must also introduce thoughtful programming that repairs the economic and social harm of the Transatlantic Slave Trade, including the value of IP that the United States denied to Black people.

Reparations conversations have traditionally centered the losses of real property, educational opportunity, health inequity, or mass incarceration.²³ This Essay is the first to insist that a budget for reparations include the value of patents that were denied to African-Americans for inventions that propelled the United States to the top of the global economy. Additionally, this Essay makes an important advancement in intellectual property scholarship, which has rarely considered racial disparities among intellectual property awardees.²⁴ Part I explains how enslavement, Black Codes, and violence obstructed African-Americans' access to patents and related economic opportunities. Part II juxtaposes African-Americans' contributions in large-scale industries alongside their compensation and access to legal defenses. Finally, Part III highlights the multigenerational, financial consequences of underrepresentation in the patent system and outlines a possible reparations approach.

I. THE U.S. LEGALLY AND CONSTRUCTIVELY REJECTED AFRICAN-AMERICANS FROM THE PATENT SYSTEM UNTIL AFRICAN AMERICAN INNOVATION RATES COLLAPSED

Many of the Founding Fathers were inventors who understood that innovation promised national wealth, employment opportunities, and higher living standards.²⁵ They allocated Congress the power to protect Americans' intellectual property interests in Article 1, Section 8 of the United States Constitution.²⁶ The Patent Act of 1790 offered patent protection to “any useful art, manufacture, engine, machine, or device, or any improvement therein not before known or used,” and granted inventors the “sole and exclusive right and

²³ See, e.g., Ta-Nehisi Coates, *The Case for Reparations*, THE ATLANTIC (June 2014), <https://www.theatlantic.com/magazine/archive/2014/06/the-case-for-reparations/361631> [<https://perma.cc/7CF7-AD9R>] (discussing a wide range of historical harms against African-Americans and enslaved Black people, and noting considerations for reparations).

²⁴ See generally ANJALI VATS, *THE COLOR OF CREATORSHIP* (2020) (discussing “the complex ways that whiteness and its attendant property interests structure intellectual property law, often in the guise of equality and race neutrality”).

²⁵ See P. NARAYANAN, *PATENT LAW* 2-3 (2d ed., 1985); Devlin Hartline & Kevin Madigan, *How Strong Patents Make Wealthy Nations*, CTR. FOR INTELL. PROP. X INNOVATION POL'Y (June 24, 2016), <https://cpip.gmu.edu/2016/06/24/how-strong-patents-make-wealthy-nations> [<https://perma.cc/2XFL-5E4M>].

²⁶ U.S. CONST. art. I, § 8, cl. 8. (“The Congress shall have Power . . . [t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries . . .”).

liberty of making, constructing, using and vending to others to be used.”²⁷ Despite subsequent amendments, similar language continues to describe the core of the patent right.²⁸

While the patent system is designed to further the interest of the national economy (rather than the inventor),²⁹ stimulating innovation nonetheless requires direct incentives to inventors. Thus, a successful patent system relies on a quid pro quo: the government sanctions a time-limited monopoly, allowing an inventor the exclusive opportunity to profit, and the inventor discloses the working of the invention to the nation to promote continued innovation and ultimately national economic value creation.³⁰ In the end, the chief reward to inventors is financial.

However, the United States did not maintain a quid pro quo to African-American inventors, even though African-American innovation propelled the nation’s economy. As noncitizens, enslaved Black people could not own property, including intellectual property, and were denied related opportunities for compensation.³¹ In 1857, the U.S. Commissioner of Patents officially ruled that enslaved Black people could not own patents when a slaver tried to patent a cotton scraper invented by Ned, an enslaved person.³² During the period of enslavement, many free Black people were also denied their right to own patents, as they were also noncitizens.³³

As the Civil War commenced, the 1861 Confederate Congress passed legislation legalizing patent applications by enslaved inventors,³⁴ but it was

²⁷ Patent Act of 1790, ch. 7, 1 Stat. 109, 109-12.

²⁸ 35 U.S.C. § 101.

²⁹ See NARAYANAN, *supra* note 25, at 1-2.

³⁰ See, e.g., Stephen Haber, *Patents and the Wealth of Nations*, 23 GEO. MASON L. REV. 811, 829 (2016) (“[P]atent intensive industries in countries that improve the strength of patents experience faster growth in value added than less patent-intensive industries in those same countries.”).

³¹ See SLUBY, *supra* note 12, at 30-32 (discussing the historical relationship of African-Americans to patents). *But see* DYLAN C. PENNINGROTH, *THE CLAIMS OF KINFOLK: AFRICAN AMERICAN PROPERTY AND COMMUNITY IN THE NINETEENTH-CENTURY SOUTH* 69 (2003) (“Even more oddly from a legal standpoint, the federal government twice in the 1830s issued patents to an enslaved man from Maryland for corn harvesters. These cases were probably unusual because they involved signed documents that guaranteed legal rights (to land and intellectual property) . . .”) (footnote omitted).

³² Letter from Joseph Holt, Comm’r of Patents, to Oscar J. E. Stuart (Nov. 24, 1857), *reprinted in* Brian L. Frye, *Invention of a Slave*, 68 SYRACUSE L. REV. 181, 194 (2018); *Invention of a Slave*, 9 Op. Att’y Gen. 171, 171-72 (1858) (affirming the Commissioner of Patents’ opinion); *see also* Kara W. Swanson, *Race and Selective Legal Memory: Reflections on Invention of a Slave*, 120 COLUM. L. REV. 1077, 1078 (2020) (describing the rationale behind enslaved people’s ineligibility to file for patent protection).

³³ See Deborah J. Merritt, *Hyppatia in the Patent Office: Women Inventors and the Law, 1865–1900*, 35 AM. J. LEGAL HIST. 235, 303 (1991) (“The Patent Office refused to grant patents to slaves, and some authorities believed that this ban extended to ‘free colored’ inventors as well.”) (footnote omitted).

³⁴ See PENNINGROTH, *supra* note 31, at 220 n.190 (“An 1858 ruling by attorney general barred any more such patents. Yet in 1861 the Confederate Congress took steps to insure that enslaved inventors could receive patents.”).

largely impractical for African-Americans to exercise this right.³⁵ According to the 1870 and 1880 censuses, the \$100 fee to prosecute a successful patent application exceeded 85% of an average African-American family's total assets; meanwhile, the fee constituted less than 7% of a white family's assets, which averaged \$1,500.³⁶ Where African-Americans could piece together the money for fees, financial hurdles to patenting remained paramount. For example, J.W. Benton, who invented a derrick for hoisting, walked from Kentucky to Washington D.C. because he could not afford transportation.³⁷ His patent was awarded October 2, 1900.³⁸

Social castes further restricted African-Americans to working in service professions where access to attorneys, bankers, industrial suppliers, or other entrepreneurs were uncommon.³⁹ State laws, like Black Codes, hindered African-Americans' ability to enter certain professions altogether. Freed Blacks had almost no technical training, as it was illegal to teach an enslaved person how to read and write. African-American children also received an inferior education in segregated schools. Where African-Americans continued inventing, they often feared their race would stigmatize their inventions and limit sales, so many disassociated themselves from their inventions and engaged patent intermediaries.⁴⁰ Even as select African-American inventors surmounted institutional hurdles and patented inventions, many had trouble defending their patents because segregation laws precluded access to patent attorney offices in "white-only" neighborhoods.⁴¹

³⁵ See Merritt, *supra* note 33, at 304 ("Discriminatory state laws, however, continued to handicap inventors of color. The infamous 'Black Codes' of the Reconstruction era limited the ability of Black citizens to change jobs, own property, and pursue certain occupations.").

³⁶ *Id.* at 303-04.

³⁷ Baker, *supra* note 12, at 35.

³⁸ *Id.*

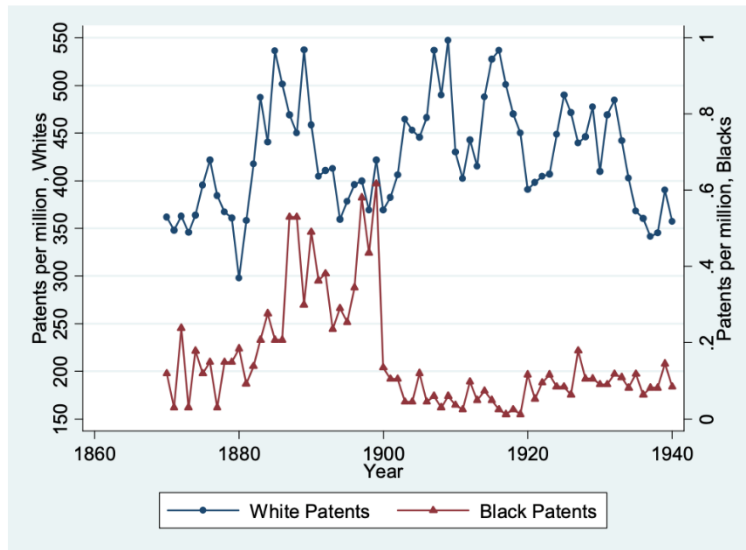
³⁹ Merritt, *supra* note 33, at 304.

⁴⁰ See *id.* at 305 ("Nineteenth-century racism, finally, discouraged successful inventors of color from publicly claiming their creations. In 1891, a Black woman who had patented a new clothes wringer explained that she sold her patent rights rather than attempt to market the wringer herself because 'if it was known that a negro woman patented the invention, white ladies would not buy the wringer.'"); Cook, *supra* note 13, at 222 (discussing the chilling effect of lynching on African-American patenting); cf. Naomi R. Lamoreaux & Kenneth L. Sokoloff, *Intermediaries in the U.S. Market for Technology, 1870-1920*, at 7-8 (Nat'l Bureau of Econ. Rsch., Working Paper No. 9017, 2002), https://www.nber.org/system/files/working_papers/w9017/w9017.pdf [<https://perma.cc/XVH3-FXUC>] (discussing how inventors would sell or license the rights to their invention to an intermediary between 1870 and 1920). Patent intermediaries assume the responsibility to commercialize an invention. This practice has often transferred responsibilities from inventors to patent agents and lawyers, allowing inventors an opportunity to prioritize innovation over logistics. However, for an African-American inventor, engaging patent intermediaries was less an opportunity for specialization and more an opportunity to circumvent racism—ironically by transferring more capital to oppressors.

⁴¹ See Cook, *supra* note 13, at 226.

In addition to structural inequality, African-Americans faced threats to their lives while trying to patent. In *Violence and Economic Activity: Evidence from African American Patents, 1870–1940*, Lisa Cook explores how innovation rates among African-Americans dropped at the turn of the nineteenth century, highlighting the effect of racial violence on African-American innovation.⁴² Lynching correlates with a decrease in inventive activity among African-Americans but not among whites.⁴³ Figure 1, a line graph from Cook, shows the number of patents held by Black and white individuals per million, from 1870 to 1940.⁴⁴ It shows that Black-held patents per million generally increased at the same rate as white-held patents (although at a much lower level) from 1870 until the late 1890s. However, following the landmark *Plessy v. Ferguson* decision in 1896, which legalized “separate but equal” public facilities for Black and white Americans,⁴⁵ African-American patenting collapsed, tumbling from nearly 0.7 patents per million in 1889 to 0.15 patents per million in 1900. African-American patenting did not recover from this drop, rarely climbing above 0.15 patents per million from 1900 to 1940 while white patents fluctuated from 370 to 550 patents per million.

Figure 1: Black and White Utility Patents, Per Million, 1870–1940⁴⁶



⁴² *Id.* at 224 (describing direct and indirect economic effects of violence on Black inventors, such as looting of the business district where their workshops were located, which in turn decreased property values, “reduce[d] financing opportunities[,] and increase[d] operating costs”).

⁴³ *Id.* at 242.

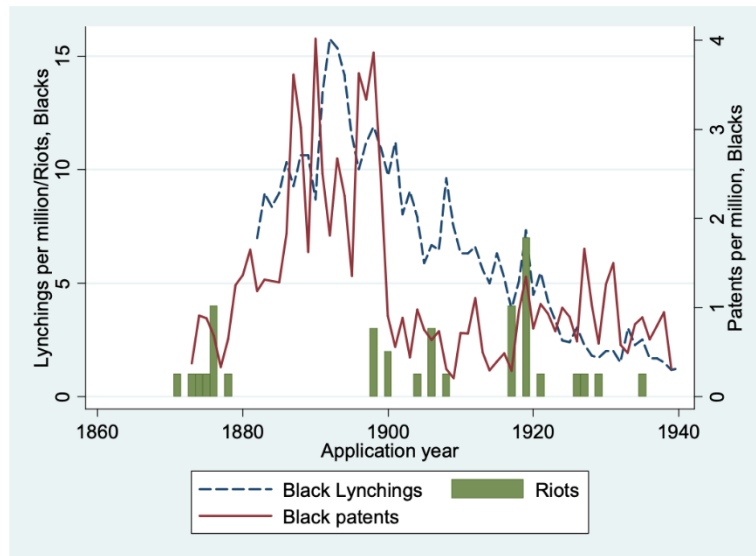
⁴⁴ *Id.* at 227 fig.1.

⁴⁵ 163 U.S. 537, 552 (1896) (Harlan, J., dissenting).

⁴⁶ Cook, *supra* note 13, at 227 fig.1.

Figure 2, also from Cook, shows Black-held patents per million alongside both lynching and riots per million.⁴⁷ In 1896, African-American lynching peaked, and African-American patenting rates plummeted, depressing economic activity (measured by patent activity) by one percent per year, or the equivalent of a year's worth of total U.S. patent activity among African-Americans. African-American patent activity has still not recovered.⁴⁸

Figure 2: Conflict and Black Inventive Activity, 1870–1940⁴⁹



Thus, while the patent system facilitated a quid pro quo for white inventors, African-American inventors were violently pushed out of patenting, and left legally and physically defenseless. The consequences of ostracizing African-Americans from patenting are perpetual and contribute to insular inventive communities. In their paper *Who Becomes an Inventor in America? The Importance of Exposure to Innovation*, Bell, Chetty, and their coauthors examine how a child's exposure to innovation through their parents' coworkers (a measure of their environment) determines the child's propensity

⁴⁷ *Id.* at 228 fig.2.

⁴⁸ See Shontavia Jackson Johnson, *The Colorblind Patent System and Black Inventors*, LANDSLIDE, Mar.–Apr. 2019, at 16, 20 (“[O]ne 2010 study found that from 1970 to 2006, [B]lack American inventors received six patents per million people, compared to 235 patents per million for all U.S. inventors. Another 2016 study found that [B]lack Americans apply for patents at nearly half the rate of whites.”) (footnote omitted) (internal quotation marks omitted).

⁴⁹ Cook, *supra* note 13, at 228 fig.2.

to innovate.⁵⁰ They regress children's innovation rates versus patent rates in their father's industry, as depicted in Figure 3.⁵¹ Column (1) shows that as the number of inventors in a child's father's industry increases by one standard deviation, a child's innovation rate increases by 25.3%.⁵² It follows that a precipitous decline in inventive activity among African-Americans, namely that which followed Jim Crow and racial violence, has carried multigenerational consequences on innovative activity.

Figure 3: Exposure to Innovation from Parents' Colleagues: Children's Innovation Rates Versus Patent Rates in Father's Industry⁵³

Dependent variable:	Fraction inventing (1)	Fraction inventing in patent category (2)	Fraction inventing in patent subcategory (3)	Fraction inventing in patent class (4)	Fraction inventing in patent class (5)
Patent rate in father's industry	0.250 (0.028)				
Patent rate in father's industry in same category		0.163 (0.018)			
Patent rate in father's industry in same subcategory			0.155 (0.017)		
Patent rate in father's industry in same class				0.078 (0.013)	0.0598 (0.0125)
Patent rate in father's industry in same subcategory but other class					0.0044 (0.0008)
Patent rate in father's industry in same category but other subcategory					0.0001 (0.0004)
Patent rate in father's industry in other category					0.0002 (0.0000)

CONTINUED

Dependent variable	Fraction inventing (1)	Fraction inventing in patent category (2)	Fraction inventing in patent subcategory (3)	Fraction inventing in patent class (4)	Fraction inventing in patent class (5)
Fixed effects	None	Patent category	Patent subcategory	Patent class	Patent class
Unit of observation	Father's industry	Father's industry by patent category	Father's industry patent subcategory	Father's industry by patent class	Father's industry by patent class
Number of cells	345	2,415	12,765	153,525	153,525
Mean of dependent variable	0.002341	0.000334	0.000063	0.000005	0.000005
Std. dev. of dependent variable	0.001063	0.000275	0.000118	0.000018	0.000018
Mean of independent variable	0.001040	0.000168	0.000034	0.000003	0.000003
Std. dev. of independent variable	0.002368	0.000654	0.000206	0.000030	0.000030

Notes. This table analyzes how a child's propensity to invent is related to patent rates in his or her father's industry. The sample consists of children in the intergenerational sample (1980-1984 birth cohorts) whose parents are not inventors. Each column presents estimates from a separate OLS regression, with standard errors clustered by industry in parentheses. In column (1), we regress the share of children who become inventors among those with fathers in industry j on the patent rate among workers in industry j , with one observation per industry (six digit NAICS code). We measure the patent rate among workers in each industry as the average number of patents issued to individuals in that industry per year between 1996 and 2012 divided by the average number of workers per year (based on W-2 counts) in each industry between 1999 and 2012. Column (2) is run at the industry-by-patent-category level. Here, we regress the share of children with fathers in industry j who invent in patent category c on the share of workers in industry j who have patents in category c . We include patent category fixed effects in this regression to account for differences in patent rates across categories. Columns (3) and (4) are analogous to column (2), but use more narrowly defined categorizations of patent types: patent subcategories and patent classes. Column (5) replicates column (4) with three additional controls: the fraction of inventors in (i) the same subcategory but in a different patent class, (ii) the same category but a different subcategory, and (iii) other categories. All regressions are weighted by the number of children in each cell. There are 10,213,731 children underlying these regressions, the set of children in the intergenerational sample whose fathers have a nonmissing NAICS code.

The consequences of screening out African-American inventors are compounding, hindering their economic and innovative opportunities and ultimately the U.S. economy. Bell, Chetty, and their coauthors propose that "[i]f women, minorities, and children from low-income families were to invent at the same rate as white men from high-income families, there would be four

⁵⁰ See Bell et al., *supra* note 10, at 685-89.

⁵¹ *Id.* at 681-82 tbl.III.

⁵² *Id.* at 681-82 tbl.III, 686.

⁵³ *Id.* at 681-82 tbl.III.

times as many inventors in the United States as there are today.”⁵⁴ In addition, the authors highlight that lack of exposure among minorities can “screen out” inventions with the potential for the greatest impact on society.⁵⁵ As Black inventions have demonstrably increased living standards, efficiency, and national economic value, it follows that failing to repair the 1896 drop in their inventive activity delays, or even forgoes, profound inventive contributions. These gaps ultimately hinder economic growth: one study found that including more African-Americans and women in the “initial stage of the process of innovation” would increase GDP between 0.64% and 3.3% per capita.⁵⁶

II. RACISM WIDELY COMPROMISED AFRICAN-AMERICAN INVENTORS’ OPPORTUNITIES TO PROFIT FROM THEIR REVOLUTIONARY INVENTIONS

Innovation drives improvements in technology that are responsible for sustained increases in national per capita income.⁵⁷ In the nineteenth century, labor-saving innovation in machinery catapulted the United States’ industrial output from a weak fourth to first in global per capita, surpassing Britain between 1880 and 1900, and setting the stage for modern rates of per capita growth.⁵⁸ Figure 4 below shows the annual totals of patents in the United States population from 1790 to 1846: there is a substantial increase in inventive activity from 1790 to 1846, with per capita numbers increasing nearly 500 percent.⁵⁹

Though underreported, African-American inventions contributed to the United States’ ascendance to the top of the global economy. Patent examiner Henry Baker pieced together a (non-exhaustive) list of 800 patents awarded to Black inventors.⁶⁰ He concluded that African-American inventors contributed to nearly every branch of the industrial arts, including some of the United States’ largest scale industries.⁶¹

⁵⁴ *Id.* at 710.

⁵⁵ *Id.*

⁵⁶ Fechner & Shapanka, *supra* note 7, at 732.

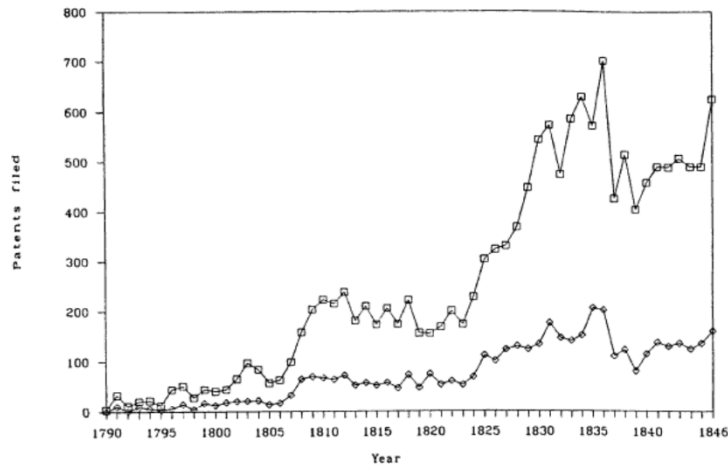
⁵⁷ See Kenneth L. Sokoloff, *Inventive Activity in Early Industrial America: Evidence from Patent Records, 1790–1846*, 48 J. ECON. HIST. 813, 813 (1988).

⁵⁸ See Gavin Wright, *The Origins of American Industrial Success, 1879–1940*, 80 AM. ECON. REV. 651, 652 (1990).

⁵⁹ Sokoloff, *supra* note 57, at 819-20.

⁶⁰ The USPTO does not request a patent applicant’s race.

⁶¹ See generally HENRY E. BAKER, *THE COLORED INVENTOR: A RECORD OF FIFTY YEARS* (1913).

Figure 4: Annual Totals of Patents in the Population and the Sample, 1790–1846⁶²

For example, Jan E. Matzeliger invented the first complete machine to perform all the operations involved in attaching soles to shoes.⁶³ While derisively termed the “nigger machine,” Matzeliger’s invention reduced labor hours, improved employment conditions, and reduced output costs.⁶⁴ Another African-American inventor, Norbert Rillieux, a Louisianan sugar engineer, invented cane and beet sugar evaporation techniques that introduced comparable efficiencies in the sugar industry.⁶⁵

Rillieux and Matzeliger both revolutionized industries that advanced the nation’s economic performance, but racism stifled their opportunities as American inventors. Notably, Matzeliger, a dark-skinned man, saw considerably fewer gains than Rillieux, a white-passing man.⁶⁶ Matzeliger perceived that his invention promised a revolution in the shoe-making industry but lacked the money to patent it. He desperately sold two-thirds ownership in his invention and later gave up the remainder of the patent in exchange for stock in a less fruitful company.⁶⁷ Sidney Winslow, a white

⁶² Sokoloff, *supra* note 57, at 820 fig.1.

⁶³ Baker, *supra* note 12, at 28.

⁶⁴ *Id.* at 28-29.

⁶⁵ SLUBY, *supra* note 12, at 25-29.

⁶⁶ See *Jan Matzeliger Biography* (June 24, 2020), <https://www.biography.com/inventor/jan-matzeliger> [<https://perma.cc/DZ4Q-UADR>] (identifying Matzeliger as a biracial Black man of Surinamese and Dutch descent with dark skin); SLUBY, *supra* note 12, at 25, 29 (“Norbert was the son of the wealthy white engineer, inventor, and French planter Vincent Rillieux and quadroon Constance Vivant[.]” and “[h]e returned to France in 1854, where he experienced practically no racial prejudice . . .”).

⁶⁷ See Brandon Richard, *Moments in Black History: The Man Who Revolutionized the Shoe Industry*, SOLE COLLECTOR (Feb. 7, 2017), <https://solecollector.com/news/2017/02/shoe-lasting-machine-inventor-jan-matzeliger> [<https://perma.cc/MM5M-9NTN>].

multimillionaire, acquired the patent and made it the nucleus of The United Shoe Machinery Company, operating on capital stock worth more than twenty million dollars.⁶⁸ Within twenty years, the company's exports increased from one to eleven million dollars solely because of the superiority of shoes made using Matzeliger's technology.⁶⁹ Meanwhile Matzeliger's descendants never received their share of the now sixty billion dollar shoe-making industry. In contrast, Rillieux's inventions brought him lucrative success, but racism nonetheless forced him to flee to France, where he could live more freely by passing as a white man. Matzeliger and Rillieux's experiences delineate the United States' broad concepts of Blackness, signal the sweeping harm to American innovation, and underscore the extremes endured by the most Black-presenting innovators.

Patenting was difficult for inventors of all colors and races. Patent Examiner Henry Baker was careful to explain that "[a] man may be the first to conceive a new idea, the first to translate that idea into tangible, practical form and reduce it to a patent, but often that 'slip betwixt the cup and the lip' leaves him the last to get any reward for his inventive genius."⁷⁰ Consequently, it may be unclear to some why African-Americans should receive reparations for difficulty patenting inventions, when patenting was generally challenging for Americans. However, for Black inventors, the Transatlantic Slave Trade, and the racist institutions the United States expressly perpetuated, constituted the 'slip betwixt the cup and lip.' The Transatlantic Slave Trade ostracized Black inventors from the patent system specifically because of their race, and diverted the profits from Black inventions into white communities that further entrenched racial inequality. This harm constitutes more than a mundane obstacle to patenting; it is a human rights violation that compounded mundane obstacles, resulting in enduring harm and necessitating direct repair.

The diversion of profits from Black inventions into white communities hindered Black inventors' ability to defend their ideas and compromised their ability to market and further their inventions. With only limited exceptions, these hurdles persisted regardless of a Black inventor's status as born free, freed, or enslaved and continued after emancipation. For example, Henry Bowman patented the use of zigzag stitching for sewing stars onto American flags in 1892,⁷¹ but learned that a competitor in New York was cutting into his

⁶⁸ Baker, *supra* note 12, at 28-29.

⁶⁹ *Id.* at 29.

⁷⁰ *Id.* at 36.

⁷¹ See *American National Flag, 45 Stars, Zig-Zag Stitched, Made by the Henry Bowman Flag Company*, RARE FLAGS, http://www.rareflags.com/RareFlags_Showcase_IAS_00249.htm [<https://perma.cc/H8F3-S6R3>] (displaying an image of Henry Bowman's patented zig-zag-stitched American flag).

business using his invention.⁷² Bowman lacked the financial resources to bring a successful suit for infringement and soon went out of business.⁷³ Similarly, in 1897, E.A. Robinson patented an invention for casting composite and other car wheels, which was infringed by two large corporations.⁷⁴ Robinson brought suit but also lacked the resources to hire a competent lawyer necessary for a successful suit.⁷⁵

Prior to receiving the right to patent, many enslaved Blacks were undercompensated for their inventions. Slavers, like Ned's, appropriated Black inventions without patent protection and profited significantly.⁷⁶ Oftentimes, white people patented enslaved Black people's inventions under their own name. For example, slaver Eli Whitney watched enslaved Black people use a comb-like instrument to remove impurities from cotton.⁷⁷ Whitney allegedly improved upon the invention, patented the cotton gin in 1794, and continued to develop the gin into the nineteenth century.⁷⁸ The gin dramatically increased U.S. cotton imports from 138 thousand pounds per year to 6 million pounds per year and transformed agriculture in the South but, predictably, enslaved Black people went uncompensated.⁷⁹

In contrast, other enslaved Blacks earned appreciable profits from unpatented inventions. Benjamin Montgomery, for example, invented a steamboat propeller for shallow waters and applied for a patent that was denied on account of his race and citizenship status.⁸⁰ Montgomery sold his invention without patent protection and became one of the wealthiest planters in Mississippi.⁸¹ After the Civil War ended, his son purchased eight-hundred acres of land and established his own town, Mound Bayou.⁸²

Similarly, some *free* Black inventors enjoyed lucrative success from their unpatented inventions: Benjamin Banneker, who built the first wooden clock in America; James Forten, who invented an apparatus for managing sails; and

⁷² Baker, *supra* note 12, at 35.

⁷³ *Id.*

⁷⁴ *Id.*

⁷⁵ *Id.* at 35-36; see Paulette Brown-Hinds, *Black American History*, BLACK VOICE NEWS (Mar. 12, 2015), <https://blackvoicenews.com/2015/03/12/black-american-history-5> [<https://perma.cc/PHJ8-E54Z>].

⁷⁶ See *Invention of a Slave*, 9 Op. Att'y Gen. 171, 171-72 (1858) (declaring that inventions by enslaved persons could not be patented, and that slavemasters may not patent an enslaved person's inventions instead); Johnson, *supra* note 12 (explaining that, although Ned's patent was rejected because Ned's slavemaster Oscar Stewart "was not the actual inventor," and "the actual inventor was born into slavery," Stewart was able to exploit and commercialize the invention for significant profit).

⁷⁷ See SLUBY, *supra* note 12, at 13-15; BAKER, *supra* note 61, at 6, 11-12.

⁷⁸ SLUBY, *supra* note 12, at 13-15.

⁷⁹ *Id.* at 15.

⁸⁰ Johnson, *supra* note 12.

⁸¹ *Id.*

⁸² *Id.*

Robert Benjamin Lewis, who contributed a machine for picking oakum.⁸³ Madame C.J. Walker, another well-known African-American inventor, became a millionaire after inventing a series of hair products that transformed the lives of African-American women.⁸⁴

Furthermore, some Black people born enslaved were able to successfully patent their inventions after the Civil War and attain riches. For example, George Washington Carver, one of the nation's best-known agricultural scientists, cultivated over three-hundred inventions from peanuts and patented three inventions.⁸⁵ But questions as to how race limited access to the legal system, shaped business and legal decisions, and limited opportunities to create and maintain multigenerational wealth persist in response to the curious absence of patents on the majority of their inventions.

Because historians have identified numerous African-American inventors and some African-Americans can identify themselves as their heirs, critics may question the appropriateness of reparations to all African-Americans rather than identifiable heirs. This inquiry fails to recognize that U.S. innovation is inextricable from the entire institution of enslavement and the systemic exploitation of Black inventors, rather than the choice deprivation of select Black people. Specifically, it fails to acknowledge the duration of the Transatlantic Slave Trade, the routine theft of African-American inventions, and the institutional consequences that uniquely hinder African-Americans.

First, because of the 340-year duration of the Transatlantic Slave Trade and the 214 years that have since elapsed, the heirs of these inventors are innumerable and unidentifiable—especially considering gaps in documentation.

Next, the case of Eli Whitney and the cotton gin illustrates that it is often impractical to identify Black people responsible for revolutionary innovations because white people routinely exploited Black inventions. The unique role of patent intermediaries in the Black community similarly exposes the persistence with which racism divorced Black inventors from Black inventions.

Finally, the patenting opportunities denied to African-Americans as a result of the Transatlantic Slave Trade, alongside the benefit of African-American innovation to white Americans, perpetuate institutions that harm

⁸³ BAKER, *supra* note 61, at 6.

⁸⁴ Merritt, *supra* note 33, at 304 n. 497.

⁸⁵ See *Carver Peanut Products*, TUSKEGEE UNIV., <https://www.tuskegee.edu/support-tu/george-washington-carver/carver-peanut-products> [<https://perma.cc/45GJ-E68P>] (listing some of the three-hundred products that George Washington Carver invented using the peanut); Mark Boyer, *What Were George Washington Carver's Inventions?*, HOWSTUFFWORKS (Feb. 3, 2021), <https://science.howstuffworks.com/innovation/famous-inventors/george-washington-carvers-inventions.htm> [<https://perma.cc/8MFG-FSM4>] (“[T]he Carver Products Company . . . only ended up patenting three inventions—two for paint and one for cosmetics—the only patents in Carver’s name.”).

African-Americans as a community, not just identifiable heirs of inventors. Compensation packages targeted to identifiable heirs rather than expansive reparations programming would leave many African-Americans uncompensated and fail to repair harm from the Transatlantic Slave Trade.

III. THE MULTIGENERATIONAL CONSEQUENCES OF THE
TRANSATLANTIC SLAVE TRADE WARRANT A REPARATIONS
PACKAGE THAT RESTORES INVENTIVE ACTIVITY
AMONG AFRICAN-AMERICANS AND CORRECTS
GAPS IN ECONOMIC MOBILITY

Following generations of exclusion from the United States' patent system, remarkable disparities between white and African-American earning and economic mobility persist. In 2019, the median household income of African-Americans was \$46,073, compared with \$76,057 for white, non-Hispanic Americans.⁸⁶ Reparations should include direct payments to African-Americans to correct these gaps. But, payments alone are insufficient to sustain improvements to representation and economic mobility. A comprehensive reparations package necessitates multigenerational programming that targets the environmental determinants of patenting until African-Americans are represented in innovative spheres at the same rates they appear in the general population and gaps in earning and economic mobility are undone.

A reparations program would first require the USPTO to track the race and ethnicity of inventors.⁸⁷ Additionally, the program would have to facilitate: "(1) greater STEM exposure and education; (2) mentorship and social networking; (3) institutional changes in academia and industry so that [B]lack inventors have much-needed support; (4) greater exposure to inventors and innovation; (5) access to financial resources; and (6) public policy changes that prevent and remedy discrimination."⁸⁸ Educational initiatives would recruit African-American students into the patent-intensive university and graduate programs; support STEM education in primary and secondary schools; and promote exposure to STEM fields via private programming.⁸⁹ Academic and professional institutions should implement

⁸⁶ See *Historical Income Tables: Households, Table H-5. Race and Hispanic Origin of Householder—Households by Median and Mean Income*, U.S. CENSUS BUREAU, <https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-income-households.html> [https://perma.cc/2BC4-W39Y].

⁸⁷ See Johnson, *supra* note 48, at 19-20 (discussing various ways to address the racial gaps created by the patent system in the United States).

⁸⁸ *Id.* at 20.

⁸⁹ Fechner & Shapanka, *supra* note 7, at 730.

bias training and inclusion programs to foster mobilizing relationships.⁹⁰ Lastly, to facilitate institutional changes in academia, research institutions should include patents as a key part of tenure and promotion decisions for STEM faculty to encourage more African-Americans to patent.⁹¹

Because the Transatlantic Slave Trade has indirectly harmed other Black American groups who are tightly comingled with African-Americans, these ethnicities might benefit from programmatic reparations where it is impractical or undesirable to target African-Americans specifically. In short, while resources awarded to individuals would always target African-Americans,⁹² resources awarded to schools might not. For example, programs increasing student interest in STEM at schools with high numbers of Black students might not target African-Americans but instead the school community as a whole. Similarly, resources given to Historically Black Colleges and Universities to support STEM education and research would be available to all students at the institution rather than discern only African-American students. Regardless, African-American mobility would remain the relevant metric for success, as African-Americans are the direct victims of enslavement in the United States.

While static income gaps between whites and African-Americans are a stark consequence of the Transatlantic Slave Trade, the disparity in upward and downward intergenerational economic mobility is even more concerning. In their article *Race and Economic Opportunity in the US: An Intergenerational Perspective*, Raj Chetty and his coauthors explore economic mobility between white and Black Americans in an experiment.⁹³ The authors measure participants' mean household income in their mid-thirties and retrospectively measure the mean household income of the participants between ages eleven and twenty-two.⁹⁴ On average, white children born in the twenty-fifth percentile of the income distribution reach the forty-fifth percentile.⁹⁵

⁹⁰ *Id.* at 731.

⁹¹ *Id.* at 730-31.

⁹² Excluding Black immigrants and their descendants from this reparations initiative is not to deny collective experiences of racism. It is a reminder that reparations are a response to historic events that constitute human rights violations, not the general experience of racism (as racism is not an historical event). Black Americans collectively experience racism, but not do not share the history of being enslaved and disenfranchised in the United States. Collapsing reparations for the Transatlantic Slave Trade into broader racial justice initiatives would further deny the explicit historical significance of over five-hundred years of enslavement and the legacies, like Jim Crow, that followed and targeted African-Americans.

⁹³ Raj Chetty, Nathaniel Hendren, Maggie R. Jones & Sonya R. Porter, *Race and Economic Opportunity in the United States: An Intergenerational Perspective* (Nat'l Bureau Econ. Rsch., Working Paper No. 24441, 2019). Note the authors do not distinguish between African-American and Black Immigrant ethnicities.

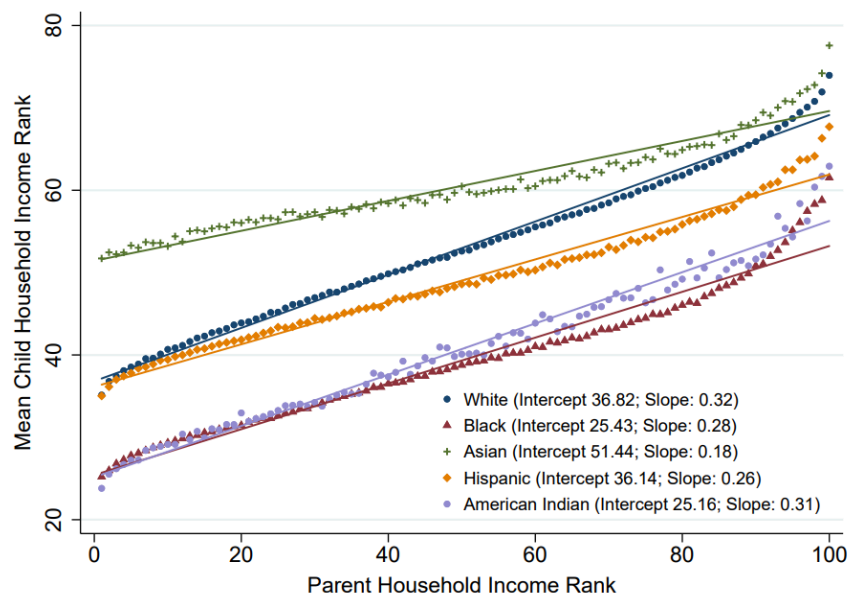
⁹⁴ *Id.* at 2.

⁹⁵ *Id.*

African-American mobility curves are shifted down relative to those of white families across the entire distribution by approximately thirteen percentiles. Among Black families, children in the top quintile are “roughly as likely” to plummet to the bottom family income quintile as they are to remain in the top quintile. By contrast, children from white families are nearly five times more likely to stay in the top quintile as they are to drop to the bottom quintile.⁹⁶ The authors conclude, “Black and American Indian children have substantially lower rates of upward mobility and higher rates of downward mobility than white children.”⁹⁷ Figure 5 below from Chetty and his coauthors simplifies this conclusion, displaying the relationships across the mean “child’s” household income and the mean parent’s household income across racial groups.

Figure 5: Intergenerational Mobility by Race⁹⁸

A. All Children



Disparities in economic mobility between whites and African-Americans are meaningful because they predict environments that shape a community’s propensity to innovate and perpetuate low rates of innovation among African-Americans. Alex Bell and his coauthors identify environmental

⁹⁶ *Id.* at 3.

⁹⁷ *Id.* at 38.

⁹⁸ *Id.* at Fig.IIIA.

determinants of innovation.⁹⁹ First, they find that children who grow up in neighborhoods with higher patenting rates are significantly more likely to become inventors as adults.¹⁰⁰ Then, they conclude that having inventor parents increases a child's probability of inventing in the same class by at least a factor of five.¹⁰¹ Across all levels of productivity, a lack of exposure (e.g., awareness of innovation as a potential career) is likely to reduce the probability that children pursue innovation.¹⁰² Consequently, a lack of exposure prevents some individuals from pursuing a career in innovation, even though they could have contributed impactful inventions—the authors refer to these stymied children as “lost Einsteins.”¹⁰³ The authors conclude that improving opportunities for minorities and improving the allocation of talent could improve both individual earnings and national economic growth.¹⁰⁴

Understanding the value of intellectual property as a corporate asset sheds light on how those with strong intellectual property remain the wealthiest in the nation. Venture capital investors overwhelmingly report that they weigh patents in funding determinations.¹⁰⁵ Filing just one patent application can considerably increase the rate at which a company receives venture funding from banks, angel investors, and even friends and family.¹⁰⁶ It follows that “if inventors are drawn largely from richer families, to the extent that their inventions are successful, intergenerational mobility will worsen rather than improve.”¹⁰⁷

One logical formulation for a budget to close gaps in innovation and intergenerational economic mobility is the product of the entire value of the U.S. patent system and the percentage of African-Americans currently unrepresented in patent awards. If African-Americans comprise around 14%

⁹⁹ Bell et al., *supra* note 10, at 678 (“One explanation for [the disparities in test scores demonstrated by a study] is that differences in childhood environment—for example, in the quality of schools or the degree of exposure to science and innovation—affect the amount students learn or the amount of time they study).

¹⁰⁰ *Id.* at 651.

¹⁰¹ *Id.* at 685.

¹⁰² *Id.* at 708.

¹⁰³ *Id.*

¹⁰⁴ *Id.* at 709-10.

¹⁰⁵ Fechner & Shapanka, *supra* note 7, at 732.

¹⁰⁶ *Id.* at 733.

¹⁰⁷ Richard V. Reeves & Nathan Joo, *Inventions and Inequality: Class Gaps in Patenting*, BROOKINGS INST.: SOC. MOBILITY MEMOS (Dec. 4, 2017), <https://www.brookings.edu/blog/social-mobility-memos/2017/12/04/inventions-and-inequality-class-gaps-in-patenting> [<https://perma.cc/N5ZA-JSRC>].

of the U.S. population,¹⁰⁸ but account for only 2% of current patent awards,¹⁰⁹ and the value of the U.S. patent system is \$8 trillion dollars,¹¹⁰ then the budget for a proper reparations package would include \$960 billion [$\$8,000,000,000,000 \times (.14 \cdot .02)$] in response to lost patent wealth, and tally additional line items for real property and other reparations concerns.

A \$960 billion line item just for lost patenting opportunities is staggering but properly corresponds to the Transatlantic Slave Trade's duration, violence, and enduring harm to African-Americans. The United States built the most powerful economy in the world by violently exploiting Black people for hundreds of years, and it must pay full cost for that historic and repugnant wrongdoing. Importantly, this total would support reparations programming for multiple generations, whereas the United States spends several billion dollars on policing each year. In 2016 alone, the federal government "directly spent \$29 billion on police, \$7 billion on corrections, and \$15 billion in courts,"¹¹¹ adding to the hundreds of billions of dollars that state and local government contribute.¹¹² To fund reparations programs, the United States might consider defunding institutions, such as policing, that have most

¹⁰⁸ This figure traditionally represents the number of all Black Americans, not African-Americans specifically, but African-Americans nonetheless constitute the overwhelming majority of Black Americans. See Christine Tamir, Abby Budiman, Luis Noe-Bustamante & Lauren Mora, *Facts About the U.S. Black Population*, PEW RSCH. CTR. (Mar. 25, 2021), <https://www.pewresearch.org/social-trends/fact-sheet/facts-about-the-us-black-population> [<https://perma.cc/2V2T-MQ5Q>] ("In 2019, there were 46.8 million people who self-identified as Black, making up roughly 14% of the country's population. . . . More than 4.6 million Black people in the U.S. were born outside the country . . . meaning that 10% of the Black population was foreign born.")

¹⁰⁹ See Lisa D. Cook & Chaleampong Kongcharoen, *The Idea Gap in Pink and Black* 39 tbl.1A (Nat'l Bureau of Econ. Rsch., Working Paper No. 16331, 2010) (identifying African-American patents per million at 5.9, which is 2.5% of the 234.9 patents per million awarded to all Americans).

¹¹⁰ Fechner & Shapanka, *supra* note 7, at 728 ("Economic activity from patents is estimated at over \$8 trillion, more than one-third of the U.S. gross domestic product (GDP).")

¹¹¹ *Criminal Justice Expenditures: Police, Corrections, and Courts*, URB. INST. <https://www.urban.org/policy-centers/cross-center-initiatives/state-and-local-finance-initiative/state-and-local-backgrounders/criminal-justice-police-corrections-courts-expenditures> [<https://perma.cc/T938-VDHE>].

¹¹² State and local policing budgets are substantial:

Figures from the U.S. Census of Governments indicate that state and local governments together expended \$115 billion on police in 2017. They spent another \$127 billion on courts and corrections. As such, this is one of the biggest expenses for local governments. The money goes almost entirely to operational costs. In 2017, for instance, 96% of police spending at the state and local levels went to salaries and benefits, and 97% of state and local corrections and courts spending went toward salaries and benefits.

Daniel Thomas Mollenkamp, *How Are Police Departments Funded?*, (Mar. 15, 2021) <https://www.investopedia.com/how-are-police-departments-funded-511578> [<https://perma.cc/MF7G-X9LJ>].

harm the African-American community and repurposing them for multigenerational reparations programming.

The first premise for this formula is that the United States' performance in today's global economy, including its \$8 trillion patent system, results from the Transatlantic Slave Trade and racist legacies that appropriated Black inventions. Next, disparities in white and African-American patenting rates do not reflect an inconsistent ability between the two races to innovate: all races are equally primed to innovate. Instead, enduring harm from the Transatlantic Slave Trade shapes the environmental factors responsible for ongoing gaps in white and African-American patenting.

CONCLUSION

In 1794, Eli Whitney noted the formidable inventive contributions of Black people in America, and he did not hesitate to capitalize on the revolutionary cotton gin. In 1857, Ned's slaver saw similar value in Ned's cotton scraper. The value of African-American innovation is present today as it was in 1794 and 1857, but so is the harm from the Transatlantic Slave Trade. The United States must pay reparations to African-Americans that meaningfully acknowledge the Transatlantic Slave Trade as a human rights violation and correct persistent gaps between white and African-American innovation, income, and economic mobility. A thoughtful reparations package will include cash payments to African-Americans and multigenerational programming that increases exposure to inventive activity, balances their economic opportunities, and restores their inventive contributions to the nation.