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Universal Basic Income: A Tool to Address Poverty

Kyle Marinelli, Cindy Vargas and Rosana Guernica

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As technology improves, global markets expand, and chronic poverty forces societies to contemplate the effectiveness of their welfare state, Universal Basic Income has shown the transformative benefits it can deliver to communities across the world. Universal Basic Income is not a contemporary policy proposal, but has been refined over the past 500 years by some of the brightest philosophers and economists academia has seen. Through the examination of Universal Basic Income's roots and origins, case studies and pilot programs, and public sentiments, brief proposals are laid out to better refine Universal Basic Income. These proposals include research provisions, awareness, and financing.

What is Universal Basic Income?

Universal Basic Income (UBI) can take many forms, from negative income taxes to dividends and grants. However, the widely accepted definition is a non-means-tested regular cash grant given to all members of a community to enable a life free from economic insecurity.¹ Economic security, in this instance, is defined as the essential monetary value one must possess to survive in the modern world.

Across modern UBI policy proposals, five key features are consistent:²

- **Cash Benefit:** UBI is a direct cash transfer that can be spent at the recipient's discretion, encouraging consumption.
- **Individual Benefit:** UBI is not based upon households but is delivered to each person within a household to increase freedom among family units.
- **Unconditional Benefit:** UBI does not apply employment or employment

seeking stipulations and decouples the right to an income from the obligation to work.

- **Universal Benefit:** UBI is a non-means-tested benefit that does not target certain income classes and is available to all within a community, rich or poor.
- **Regular Payment:** Unlike an endowment or Basic Capital, UBI is a recurrent cash payment that ensures economic security throughout an individual's life.

Roots and Origins

UBI was not the result of one astute individual. Since the beginning of the 16th century to the combining of the five key features in the 19th century, UBI is the 350-year product of scholars who have shaped the contemporary policies we see today.

a) 16th Century Renaissance Humanists

The first publication of a guaranteed minimum income came within Sir Thomas

¹ Juliana Uhuru Bidadanure, "The Political Theory of Universal Basic Income," *Annual Review of Political Science* 22, (March 5, 2019): 481-485,

<https://doi.org/10.1146/annurev-polisci-050317-070954>.

² Ibid.

More's 1516 frame narrative *Utopia*. *Utopia* features a traveler, Raphael Nonsenso, who suggests to the Archbishop of Canterbury a remedy to petty thievery. "Instead of inflicting these horrible punishments, it would be far more to the point to provide everyone with some means of livelihood, so that nobody's under the frightful necessity of becoming, first a thief, and then a corpse."³

A close friend of More's, Johannes Ludovicus Vives, first detailed a guaranteed minimum income program. In Vives' memoir to the Mayor of Bruges, *On the Assistance to the Poor*, he writes, "they must not die of hunger, but they must feel its pangs. Whatever source of poverty, the poor are expected to work."⁴ Both More's and Vives' writings are not considered genuine UBI programs as both are means-tested and conditional. However, their publications did inspire social welfare programs.⁵

b) Social Insurance to Basic Endowment

Nicolas de Caritat, Marquis de Condorcet's 1794 *Sketch of a Historical Picture of the Progress of the Human Mind*, describes the basis of social insurance: "...by securing to those who reach old age a relief that is the product of what he saved, but increased by the savings of those individuals who made the same sacrifice but died before the time came for them to need to collect its fruit..."⁶ Like social security today,

Caritat's proposal is not a genuine UBI due to its conditionality of age.

Further detailing Caritat's writings, Thomas Paine proposes, to the French Directoire in 1796, a natural inheritance for everyone based upon the idea of common property. Paine reasons that the property owners owe the community a "ground rent," "...as a compensation in part, for the loss of his or her natural inheritance..."⁷ Even though Paine's notion was conditional upon age, the concept of "ground rent" was used within the first genuine UBI proposal.

c) Joseph Charlier's Territorial Dividend

Within Joseph Charlier's 1848 *Solution of the Social Problem or Humanitarian Constitution, Based Upon Natural Law, and Preceded by the Exposition of Reasons*, the first genuine UBI proposal was formulated. Rejecting both the subsistence conditionality of previous approaches, like Vives', as well as means-tested targeting, Charlier suggests that every citizen should receive an unconditional quarterly payment, fixed annually, based upon the rental value of all real estate.⁸ Adoption of the "ground rent" approach, however, has been abandoned in modern proposals.

d) 20th Century Proposals and Programs

The first person to refer to UBI as "basic income" was British Labour Party economist, George D.H. Cole in 1953.⁹ In

³ Thomas More, *Utopia* (1st Latin edition, Louvain, 1516), English translation by Paul Turner, Harmondsworth: Penguin Classics, 1963, p. 43-44.

⁴ Juan Luis Vives, *De Subventionem Pauperum, Sive de humanis necessitatibus*, 1526; English translation of part II only by Alice Tobriner: *On the Assistance to the Poor*. Toronto & London: University of Toronto Press ("Renaissance Society of America Reprints"), 1998, 62.

⁵ "History of Basic Income," Basic Income Earth Network, Accessed November 19, 2019. <https://basicincome.org/basic-income/history/>.

⁶ Nicolas de Caritat, *Esquisse d'un tableau historique des progres de l'esprit humain* (1st edition, 1795), Paris: GF-Flammarion, 1988, p. 273-274.

⁷ "History of Basic Income," Basic Income Earth Network, Accessed November 19, 2019. <https://basicincome.org/basic-income/history/>.

⁸ Ibid.

⁹ Ibid.

Milton Friedman's 1962 *Capitalism and Freedom*, Friedman suggests a "Negative Income Tax," departing from means-tested social welfare programs and considered a genuine UBI. Notably, from 1974-1979, Canada's Manitoba Basic Annual Income Experiment (MINCOME) program tested Friedman's proposal to analyze changes in the labor market, concluding that hours worked by men fell 1%, married women by 3%, and single women by 4%.¹⁰

Today there is only one permanent UBI program in the world, the Alaska Permanent Fund. Established by the then Republican Governor Jay Hammond, the fund aimed to preserve the oil mining wealth for future Alaskans and was amended to Alaska's constitution in 1976.¹¹ In 2019, the fund paid out \$1,606 to Alaska's 631,000 residents and has \$66 billion in assets under management.^{12; 13}

Case Studies and Pilot Programs

After vanishing from the global scene for a couple of decades, there has been renewed interest in the use of UBI to mitigate developing issues associated with poverty and inequality gaps and economic transformation. Namibia and Kenya have served as testbeds for UBI experimentation with the aid of international entities. European countries like Finland have also

explored ways to ease the effects of industry shifts in their economies, new societal challenges, and overall well-being.

a) *Otjivero - Omitara, Namibia*

The largest civil project aiming to fight poverty was the Basic Income Grant (BIG) project in the village of Otjivero - Omitara, Namibia. The Namibian Tax Consortium (NAMTAX), a government-appointed commission, proposed setting up the BIG pilot project to help lessen the country's high levels of poverty and income inequality.¹⁴ It ran from January 2008 until December 2009 with 1,000 participants.¹⁵ At the time of the experiment, two-thirds of all Namibians lived below the poverty line, and the country exhibited the most unequal distribution of income in the world, stemming from its colonial and apartheid history.¹⁶

Namibia hoped to expand the pilot program at a national level so that all Namibians would receive a monthly cash grant of at least N\$100 until pension age. The program was funded in partnership with the Evangelical Lutheran Church in the Republic of Namibia (ELCRN), other international church groups, and the BIG Coalition.¹⁷ The BIG Coalition consisted of the Council of Churches (CCN), the National Union of Namibian Workers

¹⁰ Derek Hum and Wayne Simpson, 2017, "Income Maintenance, Work Effort, and the Canadian Mincome Experiment," University of Manitoba, 1991, 90, <https://doi.org/10.5203/FK2/JWVHEJ>.

¹¹ "Historical Timeline," Alaska Permanent Fund, 2019, <https://apfc.org/who-we-are/history-of-the-alaska-permanent-fund/history-timeline/>.

¹² Alex DeMarban, "This Year's Alaska Permanent Fund Dividend: \$1,606," Anchorage Daily News, September 28, 2019, <https://www.adn.com/alaska-news/2019/09/27/this-years-alaska-permanent-fund-dividend-1606/>.

¹³ "Balance Annual Report 2019," Alaska Permanent Fund Corporation, 2019, <https://apfc.org/report-archive/#12-annual-reports>.

¹⁴ Claudia Haarmann and Dirk Haarmann. "BIG Coalition Namibia." Basic Income Grant Coalition - Namibia. Accessed November 27, 2019. <http://www.bignam.org/>.

¹⁵ Ibid.

¹⁶ "Basic Income Grant (BIG) in Namibia." Centre for Public Impact (CPI). Accessed November 27, 2019. <https://www.centreforpublicimpact.org/case-study/basic-income-grant-big-namibia/>.

¹⁷ Haarmann, Dirk. "BIG Coalition Namibia." Basic Income Grant Coalition - Namibia. Accessed November 27, 2019. <http://www.bignam.org/>.

(NUNW), NANGOF, the NANASO, the National Youth Service (NYC), the Legal Assistance Centre (LAC), and the Labor Resource and Research Institute (LaRRI), among others.¹⁸ The research was headed by Rev. Dr. Claudia and Rev. Dr. Dirk Haarmann from the Desk for Social Development of the ELCRN and Mr. Herbert Jauch and Ms. Hilma Shindondola-Mote from the Labour Resource and Research Institute.¹⁹

Residents under 60 years of age, living in Otjivero since July 2007, received a Basic Income Grant of N\$100 or about US\$7 per person per month, unconditionally.²⁰ To assess the impact of the grants, the researchers used four methods: (1) Deployment of a baseline survey to identify participants, (2) follow up panel surveys, (3) information gathering from key informants in the area who acted as buffers between the researchers and the villagers, and (4) a detailed series of case studies on Otjivero residents were conducted.²¹ During this time, the village experienced an influx of migration, spurred by the implementation of the program, so data related to the study became slightly distorted to accommodate newcomers.

The results of the experiment were incredibly encouraging to researchers, Namibian officials, and citizens alike. Household poverty dropped significantly. Within the first year of the BIG program, the percentage of citizens below the food

poverty line dropped from 76% in November 2007 to 37%.²² Among households that were not affected by migration, the rate dropped to 16%.²³ The rate of underweight children decreased substantially in the initial months from 42% in November 2007, to 17% in June 2008, and 10% in November 2008.²⁴ Attendance in schools grew by 90% because more parents were able to support the cost of sending their children to school.²⁵ Dropout rates fell from 40% in 2007 to 5% in 2009.²⁶ Overall crime rates reported to local police stations fell by 42%.²⁷

Though 90% of survey respondents to the AFRO Barometer survey cited feeling little trust in the Namibian government, there was a high level of public confidence in the BIG program.²⁸ 78% of Namibians interviewed favored the adoption of the BIG, even if it required new taxes or income tax.²⁹ To run the BIG program at a national level would cost the country between N\$1.2 to N\$1.6 billion or 2.2%-3% of Namibia's overall GDP.³⁰ Despite positive results from the pilot program and support from a majority of citizens, the Namibian government has not yet supported implementation at a national scale as infrastructure projects have taken priority.

b) Rarieda, Kenya

Kenya has partnered with various NGO's to run experiments on UBI. One took place within one of Kenya's poorest districts,

¹⁸ Ibid.

¹⁹ Ibid.

²⁰ Ibid.

²¹ Ibid.

²² "Basic Income Grant (BIG) in Namibia." Centre for Public Impact (CPI). Accessed November 27, 2019. <https://www.centreforpublicimpact.org/case-study/basic-income-grant-big-namibia/>.

²³ Ibid.

²⁴ Ibid.

²⁵ Ibid.

²⁶ Ibid.

²⁷ Ibid.

²⁸ Ibid.

²⁹ Ibid.

³⁰ Claudia Haarmann and Dirk Haarmann. "BIG Coalition Namibia." Basic Income Grant Coalition - Namibia. Accessed November 27, 2019. <http://www.bignam.org/>.

Rarieda, from 2011 to 2013. Researchers from The Abdul Latif Jameel Poverty Action Lab (JPAL) partnered with GiveDirectly, a nonprofit organization operating in East Africa that helps families living in extreme poverty by making unconditional cash transfers (UCT) via mobile phone.³¹ Making the cash transfers unconditional gave participants free rein to meet their individual needs. Researchers from JPAL performed a randomized experiment to gauge the influence of GiveDirectly's UCT program within poor rural households. Their goal was to assess the impact of the UCT program on women's economic and mental well-being.³² Other factors for exploration included changes in feelings of empowerment, household finance management, and shifts in gender attitudes.³³

Researchers focused on the use of UCT rather than conditional cash transfers (CCT) to measure whether fewer restrictions on cash usage would cause recipients to spend funds unproductively.³⁴ If recipients did not spend funds differently compared to CCTs, there would be potential for UCTs to be used in the experimentation of UBI. Additionally, more people could benefit, given that administration costs associated with the distribution of UCTs were lower than those for CCTs.³⁵ Researchers chose 120 villages that exhibited the highest rates

of thatched roofs on their homes, an indicator of extreme poverty. Among this pool, they selected 60 villages that would receive the UCT benefits and 60 as the control group.³⁶

The recipients of UCTs were further broken down by household, where 503 homes received UCTs and 505 served as spillovers.³⁷ Though in proximity to the homes that received UCTs, these spillover homes would not receive funds and were used to assess if the distribution of UCT would alter the economic environment of these villages.³⁸ 432 households were chosen out of the 60 control villages to balance the experiment.³⁹ Design features for the experiments included giving UCTs to female or male household heads at random.⁴⁰ Researchers also wanted to assess the impact of a lump sum versus monthly installments, randomly assigning recipient homes with either a US\$404 lump sum or nine months of US\$45 transfers.⁴¹ To gauge what UCT types were most helpful to households, 137 homes received US\$1,121 more in funds. UCTs were distributed through M-Pesa, a widely used mobile phone-based money transfer service.⁴²

The results of the experiment demonstrated that the program had a significant impact on welfare. Consumption of necessities like food, medicine, and education increased by US\$35.66/month.⁴³ Expenses on

³¹ About GiveDirectly." GiveDirectly. Accessed November 27, 2019. <https://www.givedirectly.org/>.

³² Johannes Haushoffer and Jeremy Shapiro, "The Short-term Impact of Unconditional Cash Transfers to The Poor: Experimental Evidence From Kenya," *The Quarterly Journal of Economics* 131, no. 4 (2016): 1973-2042. doi:10.1093/qje/qjw025.

³³ Ibid.

³⁴ Ibid.

³⁵ Ibid.

³⁶ Ibid.

³⁷ Jeremy Shapiro, Johannes Haushoffer, Charlotte Ringdal, and Xiao Yu Wang, "The Impact of

Unconditional Cash Transfers in Kenya." *The Abdul Latif Jameel Poverty Action Lab*. Accessed November 27, 2019.

<https://www.povertyactionlab.org/evaluation/impact-unconditional-cash-transfers-kenya>.

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ Ibid.

⁴¹ Ibid.

⁴² Ibid.

⁴³ Ibid.

unproductive goods like alcohol did not. Household investments in assets like livestock, furniture, and metal roofs increased by US\$301.51.⁴⁴ Investments in income-generating activities, like non-agricultural businesses, increased, and revenues from these activities increased by US\$16.15 per month.⁴⁵ There were no effects in spillover households, which suggests UCT's minimal impact on the environment.⁴⁶ Psychological well-being was 0.14 standard deviations higher for households with female recipients, but with no other differences in outcomes.⁴⁷

c) Finland

Finland's recent attempt to experiment with UBI was considered the first national experimentation of its kind.⁴⁸ The current government was spearheading many initiatives that would transform the way policy was formulated and implemented in the country by adopting a more "human-centric" approach supported by analysis using the scientific method in policy-making.⁴⁹ One of the areas within the new policy realm focused on UBI experimentation. Government officials and researchers sought to learn what individuals would do if they were provided an unconditional basic income instead of existing conditional benefits.

Researchers made payments universal by selecting participants randomly throughout

the country with no conditions other than the fact that participants had to have been receiving some form of unemployment benefits. To test UBI on a national scale, researchers created a control group of 173,222 unemployed persons to control for a treatment group dispersed throughout the country made up of 2,000 unemployed people.⁵⁰ The treatment group received 560 euros per month to spend on what they needed, while still receiving about 83% of standard conditional benefits.⁵¹ The original premise of the UBI experiment was to test the population, where admittedly, most people are employed. The question answered by the experiments' outcomes instead focused on what unemployed individuals would do if given a partial basic income on top of regular benefits.

The experiment ultimately tested only small aspects of UBI, a reduction in the marginal tax rates and bureaucracy experiences among the unemployed. Since the unemployed were still receiving benefits that were contingent on them remaining unemployed, prospects for an increase in employment, which was a coveted result, were impossible. The treatment group should have no conditional benefits to test whether work disincentives would indeed be removed with the disbursement of UBI funds, which are often encouraged by conditional benefits.⁵² Another shortcoming of the experiment was the lack of saturation sites, since gauging the actual economic

⁴⁴ Ibid.

⁴⁵ Ibid.

⁴⁶ Ibid.

⁴⁷ Ibid.

⁴⁸ Santens, Scott. "What Is There to Learn From Finland's Basic Income Experiment? Did It Succeed or Fail?" Medium. Basic Income, Accessed October 5, 2019. <https://medium.com/basic-income/what-is-there-to-learn-from-finlands-basic-income-experiment-did-it-succeed-or-fail-54b8e5051f60>.

⁴⁹ Ibid.

⁵⁰ Finland's Ministry of Social Affairs and Health, *The Basic Income Experiment 2017-2018. Preliminary Results*, Helsinki: Ministry of Social Affairs and Health, 2019.

<http://urn.fi/URN:ISBN:978-952-00-4035-2>.

⁵¹ Ibid.

⁵² Santens, Scott. "What Is There to Learn From Finland's Basic Income Experiment? Did It Succeed or Fail?" Medium. Basic Income, Accessed October 5, 2019. <https://medium.com/basic-income/what-is-there-to-learn-from-finlands-basic-income-experiment-did-it-succeed-or-fail-54b8e5051f60>.

benefits of UBI on communities with the treatment group dispersed throughout the country did not offer conclusive results like those concentrated sites in the previous cases.

Despite the limitations in discovering the effects of UBI on a national scale, results on citizens' well-being were still promising. Employment rates barely moved since those on unemployment were dis-incentivized to work for fear of losing their benefits.⁵³ Furthermore, due to the lack of saturation sites, it was hard to determine whether the UBI funds worked to increase demand for goods and services, which would have led to an increase in entrepreneurship and the creation of jobs, a common result of UBI experiments.⁵⁴ In contrast, Namibia's UBI experiment led to a jump in entrepreneurship levels by 301%.⁵⁵

Though the treatment group only saw a 20% reduction in their conditional benefits, and a small decrease in bureaucratic conditions, effects of the UBI on participants' well-being were encouraging.⁵⁶ Participants of the treatment group reported a 13% increase in trust towards politicians and a 20% increase in their overall physical and mental wellness since receiving their monthly UBI payments.⁵⁷ This led to a 40% improvement in belief in their financial capabilities and a 36% decrease in their depression rates.

Additionally, 65% of participants became more supportive of a national UBI.⁵⁸

Public Opinion

Historically, UBI has had greater support in European countries and Canada than in the United States. This is attributed to Europe and Canada's tradition of stronger social safety nets.⁵⁹ However, there are varying degrees of support within European countries. An international poll conducted by Ipsos in 2017 showed that support for UBI was lowest in France (29%) and Spain (31%), and highest in Germany (52%) and Poland (60%).⁶⁰ The same poll revealed that support for UBI in the United States was split (38% opposed, 38% in favor, and 24% undecided).⁶¹ A Gallup poll conducted that same year found a similarly even split in UBI support among Americans (48% in support and 52% against).⁶² Several polls conducted in the U.S. have shown that roughly 23 - 25% of the population are undecided and suggest that the American public would benefit from increased awareness about proposed UBI programs, their benefits, and implementation.⁶³

US polling results also exhibit several demographic trends across respondents' gender, age, income, and education level. Supporters of UBI were more likely to be women than men (40%), below the age of

⁵³ Finland's Ministry of Social Affairs and Health, *The Basic Income Experiment 2017-2018. Preliminary Results*, Helsinki: Ministry of Social Affairs and Health, 2019.

<http://urn.fi/URN:ISBN:978-952-00-4035-2>.

⁵⁴ Santens, Scott. "What Is There to Learn From Finland's Basic Income Experiment? Did It Succeed or Fail?" Medium. Basic Income, Accessed October 5, 2019. <https://medium.com/basic-income/what-is-there-to-learn-from-finlands-basic-income-experiment-did-it-succeed-or-fail-54b8e5051f60>.

⁵⁵ Ibid.

⁵⁶ Ibid.

⁵⁷ Ibid.

⁵⁸ Ibid.

⁵⁹ Bourguignon, Francois. *The Globalization of Inequality*. Princeton, New Jersey.: Princeton University Press, 2015.

⁶⁰ IPSOS. "Public Perceptions" 2017.

<https://www.ipsos.com/sites/default/files/2017-06/public-perspectives-basic-universal-income-2017-06-13-v2.p>.

⁶¹ Ibid.

⁶² Reinhart, R.J. "Public Split on Basic Income for Workers Replaced by Robots" Gallup. February, 2018. <https://news.gallup.com/poll/228194/public-split-basic-income-workers-replaced-robots.aspx>.

⁶³ Ibid.

53 (41%), are less likely to be college graduates (37%) and have an above median household income.⁶⁴ Younger respondents may tend to be more supportive than older ones because they are more concerned about the future of work. The threats which make UBI an attractive policy prescription, such as automation, are more threatening to generations who will be in the workforce for the next several decades, than for those who are closely approaching retirement. Older respondents may also be more concerned about preserving the benefits they currently receive, and view UBI as a threat to their status quo. Respondents with higher levels of education and household income may be opposed to UBI because they experience higher degrees of job and financial security, are in less need for assistance programs, and view the program as an added tax rather than added benefit.

Support for UBI in the U.S. has been increasing throughout 2019. In February 2019 support was 43%. Eight months later, in September 2019, support increased by five points to 48%.⁶⁵ This increasing support has been attributed to the campaign platform of 2020 presidential candidate Andrew Yang which highlights the candidate's personal brand of UBI - a 'Dividend Freedom'. Observers argue that this increased support is caused by the campaign informing the public of the proposed UBI program, rather than convincing individuals one way or the other.⁶⁶

Yang's campaign aside, UBI has yet to be a strong point of contention for U.S. political

debates. Priority has been given to other more pressing policy concerns such as health insurance, gun control, and global warming. UBI is expected to gain more traction in political discourse as economic conditions and the labor market change by 2022 and 2024.

Unpacking Perspectives

Both supporters and critics of UBI often have a myriad of unstated assumptions and beliefs which inform their stance. Some stem from the nuanced implementation aspects of UBI - such as whether the program would replace existing welfare systems in their entirety, supplement them, or replace only a select few. Others have argued that automation will replace thousands of domestic jobs in the years to come. There is even divergence within the camp of individuals who believe that automation will replace jobs: some argue that for all the jobs lost to automation, new ones will be created. Another sub-camp believes that automation will replace jobs, but not within their lifetime. Where one stands on job automation can drastically inform their perspective on UBI. However, notable proponents of UBI, such as Larry Summers, the current Director of the National Economic Council and former Chief Economist of the World Bank⁶⁷, argue that UBI is not a policy prescription for what may happen in the years to come, but one to address the decades of economic and racial injustice the economy has already created.

Further debate stems from the cost-effectiveness of UBI. These tie back to assumptions or disagreements about the

⁶⁴ Freedland, Edward. "What Do Americans Think About Universal Basic Income". April, 2019. <https://healthpolicy.usc.edu/evidence-base/what-do-americans-think-about-universal-basic-income/>.

⁶⁵ The Hill. "Voter Support for Basic Universal Income Grows". September, 2019.

<https://thehill.com/hilltv/rising/463055-more-voters-support-universal-basic-income>.

⁶⁶ Ibid.

⁶⁷ Summers, Larry. "Globalization Will Work If We Stop Catering To The Elite". June, 2017. <http://larrysummers.com/2017/06/22/33517/>.

program's implementation. The "tear-it-all-down" camp believes in using UBI to replace the existing welfare system, whereas the "just-add-more" camp believes in adding UBI to the existing welfare programs in order to allow welfare recipients to get off traditional benefits even faster. Even further disagreement stems in the overall effect UBI will have on the economy. Some think tanks, such as the Roosevelt Institute⁶⁸, show that UBI will increase spending, and therefore increase economic output over all - such as prices, employment, and wages. Others cite Finland's inconsequential economic results as evidence that UBI will not idle the demand for social welfare programs.⁶⁹ While UBI's universality does dramatically reduce the traditional administrative costs in welfare programs, the overall cost-effectiveness will depend on the implications UBI has on other social welfare programs.⁷⁰ Will more funding need to be generated? Will funding from terminated programs be rerouted? What will be the economic magnitude on both national and personal wealth?

Recommendations

As shown through this analysis, UBI can have stimulating effects on underdeveloped economies and individuals who suffer from extreme poverty. However, the effect UBI would have on poverty within advanced economies lacks a diverse field of indicative experimental results. Thus, recommendations based upon this analysis are provided, with the goal of cultivating a foundation for meaningful federal programs.

⁶⁸ "Modeling the Macroeconomic Effects of a Universal Basic Income". The Roosevelt Institute. August, 2017. <https://rooseveltinstitute.org/modeling-macroeconomic-effects-ubi/>.

⁶⁹ Santens, Scott. "What Is There to Learn From Finland's Basic Income Experiment? Did It Succeed or Fail?" Medium. Basic Income, October 5, 2019.

a.) Financing and Research

Due to every country's unique economic structure, there is no one size fits all UBI policy; the policy must fit into the financial goals and realities of the country. In Namibia, extreme poverty, or individuals making less than US\$1.90 per day, made up 22.6% of the population in 2009.⁷¹ Thus, BIG's implementation of monthly benefits was tailored to a population and economy that needed more consumption and capital injections to grow. In advanced economies, where economic stimulation is not in dire need, the most effective form of UBI would be contingent upon the nation's current welfare programs and its poverty reduction goals.

Addressing the possible elimination of means-tested benefit programs is critical to yield feasible and effective policies. As shown in Finland's pilot program, unemployment did not decrease because participants were essentially receiving double the benefits, with half of those benefits contingent upon their employment status, this skewed the results. This was not wholly a failure, as it presented an individual's willingness to accept unemployment, or the cut-off in which UBI disincentivizes employment. This begs the question: does a country eliminate means-tested benefit programs in order to free up capital for UBI programs or should the UBI benefit just be smaller?

Karl Widerquist, a founding editor of *Basic Income Studies* and Associate Professor at Georgetown, estimates that a UBI program

⁷⁰ Karl Widerquist. "The Cost of Basic Income: Back-of-the-Envelope Calculations" Basic Income Studies, 2017, Georgetown University, <http://works.bepress.com/widerquist/75/>.

⁷¹ "2009 Namibia Poverty headcount ratio at \$1.90 a day," World Bank, Development Research Group, 2009, <http://iresearch.worldbank.org/PovcalNet/index.htm>.

in the United States would net a total cost of US\$539 billion, 25% of current entitlement spending, and increase family income by \$9,000.⁷² UBI proposals that streamline administrative costs, possess the potential to eliminate the stigma associated with welfare programs, and are both financially prudent and effective, merit proper exploration.

After determining the funding mechanism and status of current means-tested programs, deployment of pilot programs and economic modeling that measures both quantitative and qualitative effects is required to conclude effectiveness. Like Canada's MINCOME, studies should be conducted with participants that are representative of the country's general population, rather than targeting means-tested populations like Finland. Broadening the pool of participants will increase the results generalizability and if large enough, can render the overall effects on an economy.

b.) Public Perception

Political polarization has run rampant throughout the world, trickling down from federal officials to society as a whole.⁷³ It seems that a policy proposal from one party will automatically be dismissed by the other, without consideration of its merits. However, UBI inherently possesses doctrine across the ideological spectrum, presenting an opportunity to shape public perception about UBI in a non-divisive fashion.

From a conservative perspective UBI can be fiscally responsible, increase consumption, create business, and give individuals the opportunity to be self-sufficient. From a

liberal perspective UBI can significantly reduce poverty, increase standards of living, provide financial safety nets, and destigmatize welfare beneficiaries through its universality element. This is why, as shown through Andrew Yang's campaign, public support of UBI increases as public dialogue increases.

Therefore, public awareness of UBI and the way in which it is framed, will be essential to building a broad coalition of support within advanced economies. Awareness can come to fruition through organizing grassroots work, conferences, seminars, and panels that engage the academic and business communities who address the factuality of UBI. Framing UBI to fit across the ideological spectrum will require expansive marketing campaigns and trusted proponents to ensure it does not dwindle due to polarization. The results of UBI programs speak for themselves, and to gain society's support, an explanation is all it requires.

Conclusion

Universal Basic Income (UBI) has developed over five centuries as a policy prescription to address poverty and ignite economies. As the future of work changes, pandemics shut down economies, and global challenges arise, UBI will become an increasingly relevant social assistance program that can be utilized to combat economic woes. Pilot programs conducted throughout Africa, Europe, Canada, and the United States have demonstrated positive effects on not only financial health, but physical health, academic performance, and standards of living. Through the

⁷² Karl Widerquist. "The Cost of Basic Income: Back-of-the-Envelope Calculations" Basic Income Studies, 2017, Georgetown University, <http://works.bepress.com/widerquist/75/>.

⁷³ Thomas Carothers and Andrew O'Donohue, "How to Understand the Global Spread of Political

Polarization," Carnegie Endowment for International Peace, October 1, 2019.

<https://carnegieendowment.org/2019/10/01/how-to-understand-global-spread-of-political-polarization-pub-79893>.

determination of funding mechanisms, expansion of rigorous and generalizable research, and broad-based coalition building, the refinement and full potential of UBI as a tool to combat poverty can be realized.

Discrimination in the U.S. Housing Market: Why Segregation Persists and a Path Forward

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Segregation in the U.S. housing market persists despite the formal end to explicitly discriminatory laws. Analysis indicates that it is the legacy of these discriminatory laws and ongoing discriminatory practices that are responsible for this phenomenon. We, therefore, recommend two policies that are not explicitly race-based, but that will disproportionately benefit minorities: (1) incentives to encourage building in supply-restricted metropolitan areas and (2) an enhanced housing voucher program. The policies aim to unlock existing demand among minorities to access high-opportunity neighborhoods and accelerate integration in U.S. housing markets.

A Primer on Federal Housing Policy and Historical Discrimination

The federal government funds most housing policies: funds are then dispersed to states and localities that maintain considerable discretion in their use. Local control over housing policy means that there is great diversity in housing policies across metropolitan areas – entitlements, benefits, eligibility requirements, and other issues vary between municipalities. The federal government has created policies that attempt to benefit low-income people regardless of state or municipality, with varying success.

Current Policies

Section 8 is likely the most popular and widely known such program. The program is relatively simple: low-income families who qualify for assistance are given a voucher that pays for the remainder of their monthly rent after the family has spent 30% of its income.¹ Families earning up to 50% of local median income qualify for the program, but those earning up to 80% may qualify provided they meet other specifications. The vouchers are dispersed by the Department of Housing and Urban Development (HUD) to local Public Housing Authorities. This gives local

¹ Maggie McCarty, Libby Perl, and Katie Jones, “Overview of Federal Housing Assistance Programs

and Policy,” Congressional Research Service, 2019. <https://crsreports.congress.gov/product/pdf/RL/RL34591>.

municipalities significant control over who gets vouchers.

Low-Income Housing Tax Credits (LIHTCs) and HOME Block Grants are the other two main federal housing initiatives. State housing finance agencies disperse LIHTCs to real estate developers who pledge to include a certain percentage of low-income housing in their developments. At least 20% of developed units must be occupied by households earning less than 50% of area median income (AMI) or at least 40% must be occupied by households earning 60% of AMI to qualify for the tax credits.²

HOME Block Grants are like the Low-Income Housing Tax Credits in that they are focused on increasing the supply of low-income units available. Unlike LIHTCs, however, 100% of HOME Block Grants must be used to benefit low-income families.³ This program is also not completely funded by the federal government – HOME grantees must match 25% of their grants. The federal government awards 60% of funds to “participating

jurisdictions,” which are determined by a funding formula, and 40% to states.

Each of these programs has advocates and critics. Some hail the Section 8 program for giving the recipient freedom to choose the neighborhood that suits their needs. It also appeals to those concerned with government interference in markets since voucher holders rent market-rate units. This freedom to choose a market-rate rental of the recipient’s liking is not always true in practice, however. Shortages of moderately-priced rental housing and unwillingness among many landlords to accept vouchers have made mobility an issue for voucher holders.⁴ It is even more difficult for non-white voucher users that face discrimination.⁵ The main problem, however, is underfunding. Since the benefit is not an entitlement, all those who qualify are not guaranteed to receive it. Underfunding can lead to long waiting periods. The National Low-Income Housing Coalition found in 2016 that the median waiting list period was around 1.5 years and that the majority of those waitlisted were very low-income people.⁶

² Ibid.

³ Ibid.

⁴ Margery Austin Turner, “Strengths and Weaknesses of the Housing Voucher Program,” Urban Institute, June 13, 2003.

⁵ Ibid.

⁶ Andrew Aurand, “The Long Wait for A Home,” *National Low Income Housing Coalition* 6 (2016): 9.

Some affordable housing advocates prefer supply-side alternatives like the LIHTCs and HOME Block Grants, given they produce rental units specifically for low-income individuals. Affordability thresholds in LIHTCs, however, are time-limited to 30 years. They also do not serve the neediest – as the Urban Institute points out, “LIHTC properties often serve households that make an average of 60% of AMI [area median income].”⁷ Further, the program is economically inefficient. Allocating and awarding tax benefits is a time-intensive process; it takes much longer to develop affordable units through this process relative to standard market-rate developments. Critics note that the federal government is subsidizing developers at substantial cost for a low return on low-income units that take too long to materialize. The program cost the federal government around \$9 billion in 2018.⁸

HOME Block Grants face similar criticisms despite being less costly to the government –

in 2018 program costs were \$1.4 billion.⁹ More troubling for the program is that its processes and monitoring have been deemed insufficient to conduct robust evaluations, meaning even this smaller portion of funding can become increasingly difficult to justify.¹⁰

Finally, neither of these supply-side interventions show compelling impacts on integration – LIHTCs may even exacerbate segregation. A 2015 U.S. Supreme Court ruling found the Texas state housing agency guilty of promoting racial segregation by disproportionately awarding LIHTC funding for units in black urban communities versus white suburbs.¹¹

History of Federal Housing Policy and Discrimination

The basic framework above constitutes the major programs the federal government is currently using to make housing more affordable for low-income residents. Local control is a prominent driver of current

⁷ Corianne Scally, Amanda Gold, and Nicole DuBois, “The Low Income Housing Tax Credit: How It Works and Who It Serves,” Urban Institute, July 2018.

⁸ Op. cit. fn 1.

⁹ Ibid.

¹⁰ Brett Theodos, Christina Stacy, and Helen Ho, “Taking Stock of the Community Development Block Grant,” Urban Institute, April 2017.

¹¹ Ingrid Ellen, et al., “Effect of QAP Incentives on the Location of LIHTC Properties: Multi-Disciplinary Research Team” (U.S. Department of Housing and Urban Development Office of Policy Development and Research, April 7, 2015), https://www.novoco.com/sites/default/files/atoms/files/s/pdr_qap_incentive_location_lihtc_properties_050615.pdf.

market dynamics, but as the Texas Supreme Court ruling shows, discrimination also plays a role. Several historic federal policies had a profound impact on how U.S. housing markets developed. Below, we examine these policies and discover how their legacy of discrimination has ramifications for current housing issues.

Discrimination in federal housing policy begins with the Public Works Administration (PWA) and the Federal Housing Administration (FHA). The PWA, which oversaw government-run public housing projects, insisted that housing projects should maintain “racial compositions” of selected neighborhoods.¹² This mandate had the direct consequence of deepening segregation in already segregated communities.

The FHA, which served as a mortgage insurer and lender for new housing developments, followed a similar pattern of discrimination as the PWA by refusing to lend to developers that would include minorities in their communities.¹³ Additionally, the FHA would not lend to nor insure white families who wanted to move

into majority-minority communities. These policies led directly to newly segregated communities. The FHA also pioneered amortized mortgages, which allow homeowners to build equity in a home while still in debt. These useful new loans, however, were not made for homes in industrial zones – areas disproportionately representing African American families due to a history of discriminatory practices that used *prima facie* economic rezoning to force commercial and industrial sites into minority neighborhoods. White families could therefore accrue equity, while many African American families could not.¹⁴ A substantial housing wealth gap between black and white households exists to this day.

A final and significant element in past and present discrimination in U.S. housing policy is the practice of “redlining” by the Home Owners Loan Corporation (HOLC). HOLC, established in 1933, was initially tasked with buying out mortgages that were close to default and offering new payment plans for borrowers that were longer and amortized. Redlining was introduced as a “systematic appraisal process” to assess risk

¹² Richard Rothstein, *The Color of Law: A Forgotten History of How Our Government Segregated America*, 1st ed. (United States: Liveright, 2018), pg. 21.

¹³ *Ibid*, pg. 11.

¹⁴ *Ibid*, pg. 63.

on the mortgages that the FHA was lending. This appraisal process manifested as color-coded maps: green for areas of little to no risk and red for areas of high risk (hence, redlining). If a neighborhood had African American families, it was marked red, even if its residents were solidly middle-class, single-family homeowners.¹⁵ Red areas could not qualify for loans, meaning people of color were again shut out of the wealth-building process.

Discrimination in housing became increasingly clear over time. The Civil Rights movement ultimately put enough pressure on the President and Congress so that in 1968 the Fair Housing Act was passed. The goal of the legislation was to reverse the segregation of neighborhoods and prevent further racial discrimination.¹⁶ The law fell short of this aspiration for multiple reasons: African Americans had been unable to accumulate wealth for multiple generations, so many still did not qualify for FHA loans; African Americans who did own property saw lower appreciation than white homeowners given the neighborhoods they were forced into;

African Americans were more likely to be renters, and so tax deductions for mortgages unequally benefited whites, and; tax credits that encourage low-income housing were most often used by developers to build low-income housing in already segregated areas.¹⁷

The Community Reinvestment Act (CRA) of 1977 attempted to patch some of the holes that the Fair Housing Act had left open. The CRA officially outlawed the practice of redlining and required that banks loan to low- and moderate-income people in the communities in which they were chartered.¹⁸ Some have argued that forcing banks to loan to families with lower credit was a causal factor in the 2008 housing crisis, but the evidence does not bear this out. There is evidence, however, indicating mortgage brokers targeted minority communities with subprime mortgage loans, meaning it is possible that a disproportionate number of minority communities faced hardship in the wake of the crisis.¹⁹

¹⁵ Ibid, pg. 64.

¹⁶ Ibid, pg. 179.

¹⁷ Ibid.

¹⁸ "Community Reinvestment Act (CRA)." Board of Governors of the Federal Reserve System, December

7, 2018.

https://www.federalreserve.gov/consumerscommunities/cra_history.htm.

¹⁹ Op. cit. fn 7, pg. 273.

The Legacy of Discriminatory Policies and Discrimination Today

While the introduction of the FHA and CRA outlawed explicit forms of discrimination, segregation remains an observable reality in the United States. Analysis shows that the legacy of redlining is intrinsic to sustained economic and racial segregation in housing markets. However, the degree to which it persists is also due to prevailing attitudes and practices that are not explicitly discriminatory. Several contemporary studies have identified how implicit attitudes and practices perpetuate segregation in urban centers today.

The past century in the U.S. has seen the rise and decline of segregation in urban areas.²⁰ This is in reference to segregation in the strict sense, however. Indeed, “the average African-American lives in a neighborhood where the share of the population that is black exceeds the metropolitan average by roughly 30 percentage points.”²¹ The reasoning that “every single census tract in Connecticut, Maryland, and New Hampshire has at least one black resident” is not

compelling evidence of the end of segregation.²²

Segregation can be measured on a census block level, a neighborhood level, a city level, or even a national scale, and each will tell a different story regarding the success (or failure) of integration in U.S. housing. A strict segregation measure does not consider racial isolation, which can and does occur, even within census tracts. Although “all-white neighborhoods are effectively extinct,” one or two black residents in a white neighborhood does not constitute true integration.²³ The overall decline in segregation is a marked success, but segregation and isolation are still prevalent in many urban areas.²⁴

Redlining

There were many ways in which redlining negatively influenced patterns of segregation. Aaronson et al. found that the maps led to “reduced credit access and higher borrowing costs, which, in turn, contributed to disinvestment in poor urban American neighborhoods.”²⁵ Further,

²⁰ Edward Glaeser and Jacob Vigdor, “The End of the Segregated Century: Racial Separation in America’s Neighborhoods, 1890-2010.” Civic Report 66 (January 2012).

²¹ Ibid, 4.

²² Ibid, 7.

²³ Ibid, Executive Summary.

²⁴ Ibid, 6-7.

²⁵ Daniel Aaronson, Daniel Hartley, and Bhash Mazumder, “The Effects of the 1930s HOLC ‘Redlining’ Maps (REVISED February 2019),” Federal Reserve Bank of Chicago, February 2019.

receiving a low grade could have made a neighborhood less desirable for *every* household in the area. However, because black households had fewer outside options due to discrimination, they could end up predominantly moving to and staying in low graded areas.”²⁶

These issues have since become generational. Figures 1 and 2 in the appendix show that, nationally, the HOLC maps have had a lasting impact on the economic and racial make-up of the areas drawn by the agency. Over 90% of areas graded “A” or “best” are middle-to-upper income based on the 2016 American Community Survey (ACS), while over 70% of areas graded “hazardous” are low-to-moderate income. Simultaneously, over 80% of areas graded “best” still have a majority white population, while over 60% of “hazardous” areas are majority-minority.²⁷ Besides the national numbers, “cities with less change in the racial and ethnic structure of their neighborhoods over the past 80 years have greater economic inequality today.”²⁸

Redlining was tied to the existing racial make-up of a neighborhood. The above evidence suggests this effectively “locked-in” many black and low-income residents, but the black population shares in these areas increased by both “white outflow” and “black inflow.”²⁹ While these trends could have occurred naturally, there is substantial research suggesting collective action by whites, such as white flight, are a significant driver of persistent segregation. Research by Glaeser and Cutler identified them as the most important factor.³⁰ Their surveys revealed that most whites maintained a preference for living with other whites, but two-thirds of black survey respondents preferred to live in neighborhoods that were either mixed or mostly white as opposed to neighborhoods that were either all or mostly black, all else equal.³¹ This indicates long-standing existence of substantial demand to integrate among black households. The issue is implicitly discriminatory practices used today have nearly the same segregating effect as explicitly discriminatory policies of the past.

²⁶ Ibid, 31.

²⁷ Bruce Mitchell and Juan Franco, “HOLC ‘Redlining’ Maps: The Persistent Structure of Segregation and Economic Inequality.” NCRC, March 20, 2018: 20.

²⁸ Ibid, 4.

²⁹ Ibid, 32.

³⁰ David Cutler, Edward Glaeser, and Jacob Vigdor, “The Rise and Decline of the American Ghetto.” *Journal of Political Economy* 107, no. 3 (1999): 496.

³¹ Ibid, 488.

Sorting and Steering

“Sorting and steering” is another manifestation of a discriminatory practice in residential real estate that has been found to perpetuate patterns of racial segregation. Research indicates that the types of housing and types of neighborhoods presented to buyers of different races through a real estate agent vary enough to be statistically significant. Crucially, “African Americans are recommended homes in neighborhoods with a lower share of white households.” Further, there is evidence of the “steering of African American buyers away from *high-income* white neighborhoods.”³² This implies minority buyers may not be free to select their neighborhood of choice even if they had income commensurate with current residents of the neighborhood in question. Overall, “minority testers are recommended homes in census block groups with higher poverty rates and fewer skilled neighbors.”³³ Such steering can deepen generational inequalities given research demonstrating the importance of “neighborhood effects,” which affect short- and long-run outcomes in the dimensions of poverty, employment,

schooling, criminal activity, and environmental health.”³⁴

Land-use Regulations

A final practice that creates a substantial barrier to entry for minorities is the imposition of land-use regulations that restrict housing types and supply and drive up market prices. Typical manifestations are minimum lot sizes and building height restrictions. There is substantial evidence indicating these regulations are the primary driver of high home prices and that local governments wield them to control the amount, type, and quality of structures in their area.

Zoning laws inflate prices by artificially raising non-construction costs in several ways. Every one-acre increase in the minimum zoning laws, for example, has been associated with a 10% increase in housing prices.³⁵ Such an increase was also associated with a 30% reduction in housing stock in the given community, meaning they have an even greater impact on supply.³⁶ Further, there is a strong positive correlation between housing prices and the land-use regulatory index. Gyourko, Saiz, and

³² Ibid, 23.

³³ Ibid, 24.

³⁴ Ibid, 32.

³⁵ Joseph Gyourko and Edward Glaeser, “Rethinking Federal Housing Policy,” AEI Press, 2008, 67.

³⁶ Ibid, 67.

Summers found a one standard deviation increase in the index is associated with about a \$133,000 increase in house prices.³⁷

The fact that the correlation between population density and the regulatory index is *negative* “supports the view that fundamental land scarcity is not the primary motivation for strict land-use controls.”³⁸

Indeed, localities actively mold communities via local control. For example, regulations have a robust sorting effect given they influence location choices of different types of households.³⁹ Income is one such characteristic – wealthier households are more able to bear the higher costs caused by regulation. But racial effects have also been found.⁴⁰ Several studies show that more regulated communities experience slower growth in minority populations or a drop in the share of minority populations.⁴¹

It is difficult to show an explicitly exclusionary motive for land-use regulations. However, even without confirming such a motive in every highly segregated community, land-use laws and

their impact on housing prices will disproportionately impact minorities.⁴² Many black people, for example, lack the housing wealth required to move into a neighborhood that has been zoned to allow only single-family homes. Whites do not face the same hurdle. Indeed, since whites have generally shown a preference to segregate, overinvesting in a home to secure this preference may be a rational choice. Given disparities in housing wealth, banning certain types of housing, especially multi-unit developments, often equates to banning types of people.

In sum, the repeal of racist housing policies has improved the ability of minority families to access housing both within cities and in more suburban areas to a degree, but segregation persists. Newer, subtler forms of discrimination are now compounding the legacy effects of our explicitly discriminatory past. Our recommendations will not solve housing segregation; instead, they are meant to be policy solutions that will take a definitive step towards furthering

³⁷ Ibid, 75.

³⁸ Ibid, 77.

³⁹ Joseph Gyourko and Raven Molloy, “Regulation and Housing Supply,” *Handbook of Regional and Urban Economics* 6 (2015): 1325.

⁴⁰ Ibid, 1326.

⁴¹ Ibid, 1326.

⁴² Leah Platt Boustan, “Racial Residential Segregation in American Cities,” *The Oxford Handbook of Urban Economics and Planning*, December 15, 2011, <https://doi.org/10.1093/oxfordhb/9780195380620.013.0015>.

housing integration and improving the lot of minorities that have been and continue to be locked out of America's most desirable neighborhoods.

Policy Recommendations

Two policies can be used to facilitate integration and disproportionately benefit minorities. First, incentives contingent on local land-use reform should be used to encourage building in supply-restricted metropolitan areas. Second, the existing housing voucher program should be enhanced and expanded based on the promising model developed in the Creating Moves to Opportunity (CMTO) program.

Note that neither of these policies are explicitly race-based insofar as they do not directly target blacks or any other minority group. This was a conscious choice made for two reasons.

First, the analysis indicates that persistent segregation is due to the combined impact of lingering effects of historically racist policies with current, subtler forms of discrimination. A race-based policy may be ineffective at addressing such practices.

Second, race-based policies can be complicated by legal and political matters. As Leah Boustan points out, "a straightforward assault on racial segregation... would likely be both unconstitutional and politically untenable. Given this legal constraint, any policy designed to combat residential segregation must be formally race-neutral, targeting neighborhoods or individuals on the basis of income rather than race."⁴³ This may sound less than ideal, but these are important considerations. The Affirmatively Furthering Fair Housing (AFFH) rule introduced in the Obama administration provides a telling example. AFFH was meant to proactively desegregate communities by requiring that they scrutinize historic housing patterns for racial bias and adopt plans to address it. While laudable, it proved to be challenging to implement and enforce.⁴⁴ It was also postponed by the Trump Administration in 2018 for several years, meaning issues with enforcement and implementation, even if they were overstated (as some advocates of the AFFH rule suggest), will not be resolved any time soon. Even if a race-based policy

⁴³ Ibid.

⁴⁴ Kriston Capps, "Trump's HUD Just Suspended an Obama-Era Fair Housing Rule," CityLab, January 5,

2018, <https://www.citylab.com/equity/2018/01/the-trump-administration-derailed-a-key-obama-rule-on-housing-segregation/549746/>.

could be designed to pass legal and political hurdles with minimal challenges, it may not be broadly applicable enough to address segregation across major metropolitan areas given the heterogeneity of local laws regarding land-use and housing.

Given there is evidence of demand for further integration among black households, the first step to unlocking such demand can be done without the use of explicitly race-based policies. Our recommendations were chosen for their high potential to collectively address barriers to entry that have stopped further integration to this point despite this demand.

Recommendation 1: Use Incentives to Reform Land-use Regulations and Increase Supply

The federal government should address land-use strictures by offering incentives in the form of matching funds for construction conditional on local reforms that will encourage more permitting and higher density in supply-restricted metropolitan areas.⁴⁵ Funds for this policy will be obtained by eliminating the mortgage interest deduction. The policy will both end

the regressive subsidization of wealthy owners of large, expensive homes and increase supply in high-demand areas. New and differentiated supply (i.e., not only single-family homes), in turn, will help drive down market prices.

An incentive is used as opposed to some form of legal preemption since the elimination of local control could prove politically difficult. While there are also political difficulties in eliminating the mortgage interest deduction, there is reason to believe that its elimination is more politically feasible today than at other times in history. First, it is widely known to be an especially regressive policy. As Glaeser notes, “the home mortgage interest deduction effectively redistributes from taxpayers with low taxes, low incomes, and low house values to those with high taxes, high incomes, and high house values.”⁴⁶ Second, it has been rendered less useful by the Tax Cuts and Jobs Act (TCJA) of 2017 since far fewer households will now choose to itemize their deductions (see Figures 3 and 4). This dual-purpose incentive system is especially progressive since homeowners

⁴⁵ Joseph Gyourko and Edward Glaeser, “Rethinking Federal Housing Policy: How to Make Housing Plentiful and Affordable,” AEI Press, 2008, 127.

⁴⁶ Ibid, 89.

will no longer receive a subsidy relative to renters.

Recommendation 2: Expand the Existing Housing Voucher Program Based on the CMTO Model

The existing housing voucher program should be enhanced and expanded based on the model successfully piloted in the Seattle/King County area known as Creating Moves to Opportunity (CMTO). The program provides search assistance, landlord engagement, and short-term financial assistance along with a voucher to reduce barriers for families seeking to move to high-opportunity areas (HOAs).⁴⁷ HOAs are defined as census tracts that have upward mobility in approximately the top third of the distribution across census tracts in each region.

The results of the pilot program are stark. The intervention increased the fraction of families who moved to high-upward-mobility areas from 14% in the control group to 54% in the treatment group. Importantly, 68% of families in the treatment group reported being satisfied

with their new neighborhood in a post-program survey compared to just 33% for the control group.⁴⁸ This latter finding allays concerns that the treatment may nudge families into neighborhoods that turn out to be a poor fit.

The program is not race-based, but findings regarding specific subgroups have important implications for the recommendations. First, the study found that most low-income families do not have a strong preference to stay in low-opportunity areas; instead, barriers in the housing search process are a central driver of residential segregation by income.⁴⁹ Just over 50% of participants in the CMTO program were black families, so while income may only be a proxy in this case, the finding constitutes further evidence of significant barriers to mobility that prevent black families with vouchers from moving to higher-opportunity areas that they prefer. Second, treatment effects (measured as the difference in the proportion of families in the treatment and control groups that moved to HOAs) for blacks and other non-whites were 34% and 37% higher, respectively.⁵⁰ This suggests that CMTO

⁴⁷ Peter Bergman et al., “Creating Moves to Opportunity: Experimental Evidence on Barriers to Neighborhood Choice,” National Bureau of Economic Research, August 2019, <https://doi.org/10.3386/w26164>.

⁴⁸ Ibid.

⁴⁹ Ibid.

⁵⁰ Ibid.

treatment has substantial effects even in the presence of any racial discrimination that may exist in the housing market.⁵¹

Landlord engagement is a final salient feature of the CMTO program regarding minority populations and the history of housing discrimination. CMTO staff engage landlords to expedite leasing and provide financial incentives, such as mitigation funds that cover damage to units beyond a typical security deposit. Prospective renters are also able to create a rental resumé explaining the circumstances surrounding past barriers to housing, like poor credit histories, evictions, or unemployment.⁵² Minority households that have struggled to maintain a strong rental history due to discriminatory practices or the lingering effects of past policies are often discouraged by the rental-seeking process. Many limit their housing search to certain neighborhoods given their past search experience and the reasonable expectation that most landlords in certain neighborhoods would not even consider them based on their application alone. Landlord engagement helps these households apply for housing in high-opportunity areas they previously may not have.

⁵¹ Ibid.

Conclusion

There is a considerable overlap of HOAs with areas that are supply-restricted across cities, meaning the building incentives can help augment and differentiate housing supply in these areas. Even where there is no perfect overlap, encouraging new and differentiated supply is the first and most crucial step to bringing down market prices for both homeowners and renters. There is growing recognition of the role of land-use regulations and “NIMBY”-ism in housing affordability and segregation and some metropolitan areas are acting. Minneapolis, for example, recently enacted a policy that will end single-family zoning citywide. This policy is unlikely to trigger reforms on the scale of Minneapolis, but incentives for reform can help more localities begin the process.

While the voucher program is not race-based, it can be expanded in a way that targets populations in low-opportunity areas, which are overrepresented in minority-predominated neighborhoods. The policies become complementary and further integration by encouraging the construction of new housing in previously supply-restricted areas and using the CMTO

⁵² Ibid.

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program to ensure those currently facing discrimination and housing difficulties have access to these new units. The critical support systems in the CMTO have shown great promise in facilitating recipients' relocation to the upwardly mobile neighborhoods they prefer. The two policies

outlined are meant to unlock this potential and accelerate integration in U.S. housing markets – something that the current federal policies have failed to do.

APPENDIX

Figure 1: Percentage of areas with HOLC grades that are currently low-to-moderate or middle-to-upper income nationally (Mitchell, 2018)

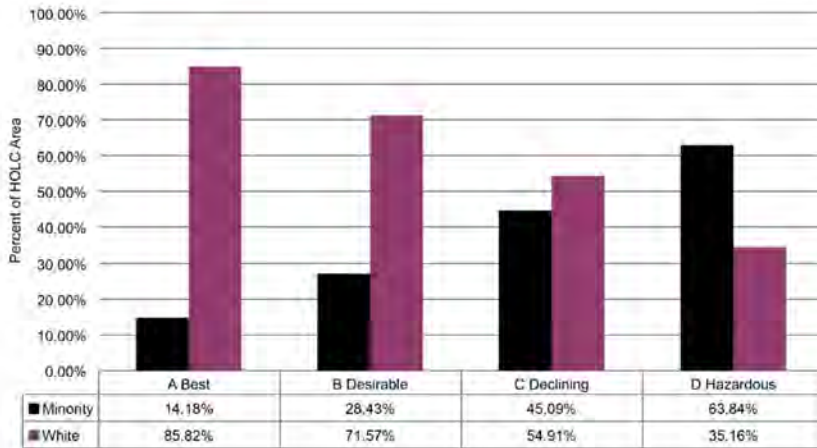


Figure 2: Percentage of areas with HOLC grades that are majority non-Hispanic white, or majority-minority nationally (Mitchell, 2018)

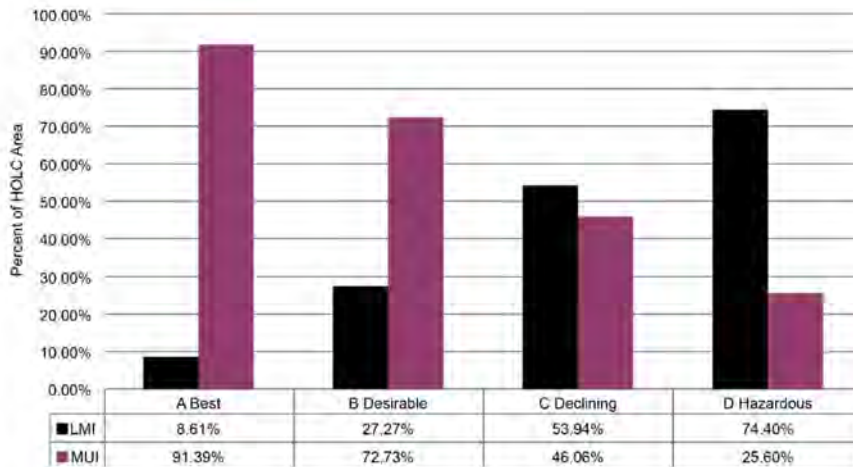


Figure 3:

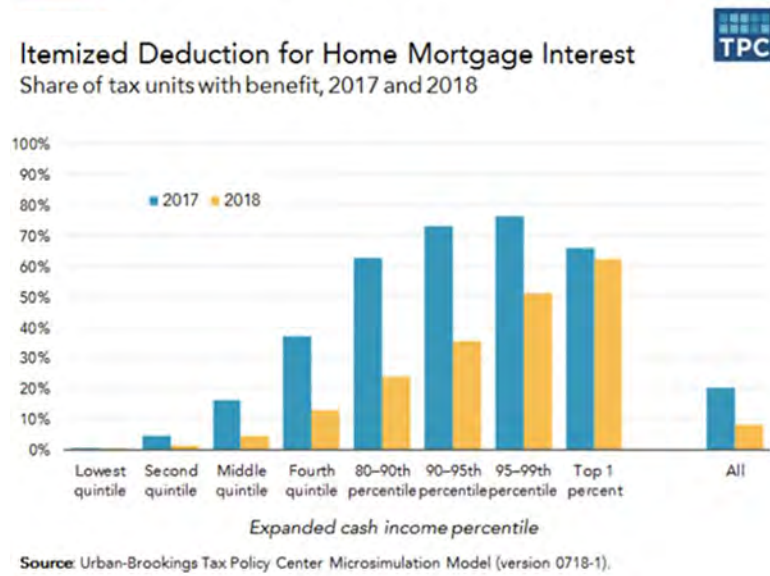
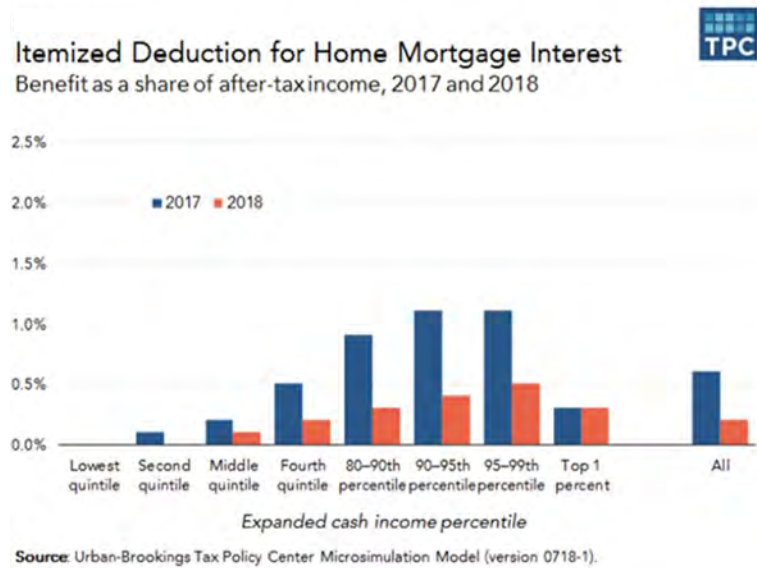


Figure 4:



NoSQL Empowers Wearable Device Market (Fitbit)

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Wearable devices like Fitbit Smartwatch have become increasingly popular over the last few years as the consumers strive to be more health aware. Fitness technology which includes trackers and smartphone applications have become increasingly popular among various age groups for tracking and encouraging physical activities. Within a decade of its first launch, Fitbit had gained over 25 Million Active Users (MAU) by 2017. More than 20 Million people use its fitness application feed to monitor their fitness activities.¹ A decade after its launch, the usage of these devices has increased exponentially and therefore requires dealing with a copious amount of data for recording and monitoring physiological health signals. This paper will discuss how wearable device firms like 'Fitbit' manage the complex type and volume of data using a NoSQL ("Not Only SQL") database. The paper will also discuss challenges related to using traditional databases, the pros and cons of using a NoSQL database and its tradeoffs.

Introduction

In recent years, there has been an exponential increase in public health awareness triggered by the consumers of wearable devices like a smartwatch, fitness band and mobile applications. Fitness monitoring and reminder notifications have eased the process of tracking real-time physiological signals. Also, the data collected is not only being used for self-monitoring and personal health routine improvement, but also as medical records for consultations.

This growing consumption of the health monitoring devices and applications is supported by the strong data storage and analytics capability provided by strategic data models and database systems.² The traditional database systems served the industry while the user base was small and read write operations were in the acceptable range of response time. With a large amount of data, multiple read and write operations had a negative impact on the performance of data storage and retrieval with relational databases (RDBMS). The Database as a Service (DaaS) and cloud

technologies provided a relatively efficient way of handling big data. NoSQL databases like MongoDB and Cassandra have been successful in serving more users by expanding the data handling capability, ability to manage complex data and load balancing multiple user data over servers.

This paper will discuss the big data in Fitbit, the challenges in data storage using RDBMS and why the firm decided on selecting NoSQL to manage user data, its data model and analysis, tradeoffs of using the NoSQL database and proposal of managing those tradeoffs.

Big Data on Websites

A. About Fitbit and its use of big data

Fitbit, Inc. is an American company with the headquarter in San Francisco, California.³ The Fitbit devices measures steps count, steps climbed, have a heart rate monitor, detects the sleep quality and other health data points. Fitbit provides consumers with a mobile application and a website to access these health statistics online. Consumers

¹ "Fitbit Community Grows to More Than 25 Million Active Users in 2017." <https://investor.fitbit.com/press/press-releases/press-release-details/2018/Fitbit-Community-Grows-to-More-Than-25-Million-Active-Users-in-2017/default.aspx>.

² Chang, Hsien-Tsung, and Tsai-Huei Lin. "A Database as a Service for the Healthcare System to Store Physiological Signal Data." *PLoS ONE* 11, no. 12 (December 29, 2016). <https://doi.org/10.1371/journal.pone.0168935>.

³ "Fitbit." In *Wikipedia*, May 1, 2020.

<https://en.wikipedia.org/w/index.php?title=Fitbit&oldid=954280888>.

log their water and calorie intake, activities and weight. The community forum challenges users to burn more calories and run more steps by competing against other users.⁴ Raw data can be unpleasant and may not hold a user's interest for a long period of time. Therefore, the data accessible to the user should be meaningful in order to retain their interest in the app. Fitbit's user dashboard is an intuitive and comprehensive representation of structured and relevant data. Additionally, studies on these data sets may also prevent diseases by providing a statistical inference on user behavior and habits and promote health.

Fitbit's complex data storage and quick data access capabilities provide a seamless experience to its consumers and in return encourages the use of community forums and its apps. The data from apps are also used to analyze fitness trends and user preferences that could be used to make better product decisions or used to come up with interesting ideas on fitness or nutrition for marketing purposes.

B. Big Data and Relational Database

Rapidly changing data such as in Big Data brings in increased volume, variety and velocity which pose a challenge to this system due to complexity in relationships. Therefore there is a need for a robust database system. The paper will discuss the pros and cons of Relational Database Management System, and NoSQL.

RDBMS is primarily based on the following database attributes – ACID:

- Atomicity – indivisible and irreducible transactions. Each transaction is a single unit that either completely succeeds or completely fails.
- Consistency – the transactions make sure that the data is in accordance with the defined constraints. This ensures

consistent data before and after a transaction.

- Isolation – is to ensure that the database is in the same state after concurrent transactions as it would have been had all the transactions been sequential.
- Durability – ensures that a committed transaction will remain in the committed state even if the system fails.

The data captured is stored in tables and RDBMS can tackle large data volume and complex queries as compared to flat file systems. Such large data volume and complex queries consume more memory and are therefore less efficient. However, initially a single server suffices for RDBMS, but once the machine's limit is reached, adding a new machine is required for scaling the capacity.⁵

The challenge of RDBMS with big data can hence be categorized as:

- Scalability: It is challenging for RDBMS to manage the increasing data size (in petabytes, where one petabyte equals 1,024 terabytes).⁶ Expensive and powerful servers will be required to maintain such a volume of data.
- Complexity: The unstructured nature of data and object types – video, audio, images and documents are challenging to this type of DBMS.

RDBMS also expects users to regularly and asynchronously update data. Therefore, it is designed for an environment that has strict data integrity requirements and not performance. The volume, velocity and variety requirement of big data is better addressed by non-structured databases like NoSQL as they are scalable, are open source, server cost and maintenance are less

⁴ Hänsel, Katrin, Natalie Wilde, Hamed Haddadi, and Akram Alomainy. "Challenges with Current Wearable Technology in Monitoring Health Data and Providing Positive Behavioural Support." In *Proceedings of the 5th EAI International Conference on Wireless Mobile Communication and Healthcare - "Transforming Healthcare through Innovations in Mobile and Wireless Technologies."* London, Great Britain: ICST, 2015. <https://doi.org/10.4108/eai.14-10-2015.2261601>.

⁵ Sisense. "Different Types of Databases for Modern Data Challenges | Sisense," June 5, 2019. <https://www.sisense.com/blog/different-types-of-databases-for-modern-data-challenges/>.

⁶ Market Realist. "Why Traditional Database Systems Fail to Support 'Big Data,'" July 25, 2014. <https://marketrealist.com/2014/07/traditional-database-systems-fail-support-big-data/>.

expensive.⁷ Therefore, tools such as Hadoop and NoSQL databases (MongoDB, Redis and Apache SOLR) are providing reliable and efficient data management tools.⁸

C. Data Collection and transfer to Fitbit server(s)

Sensors within the wearable devices capture health data points.⁹ These collected data points are then transferred and stored temporarily to a smartphone or computer until it is transferred to permanent storage.

Wearable device vendors provide their own Software Development Kits (SDK) to allow custom and open source App development. These vendors allow the use of these SDKs to collect and export data to other systems. REST API – provided by cloud services and proprietary warehouses to – allow third parties to access user’s data.

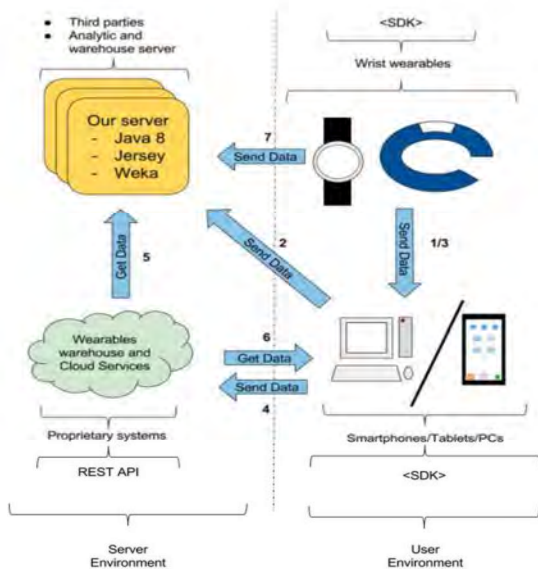


Fig. 1. System architecture for smartwatch data collection

NoSQL for Big Data

Big Data is a collection of techniques used for capturing the data, processing, analyzing and visualizing a large dataset that is not accessible to technologies standard to IT.¹⁰

Following are three properties or dimensions of Big Data that should be balanced by a selected database:

- Volume - the amount of collected data
- Velocity – the data processing speed
- Variety – the types of data

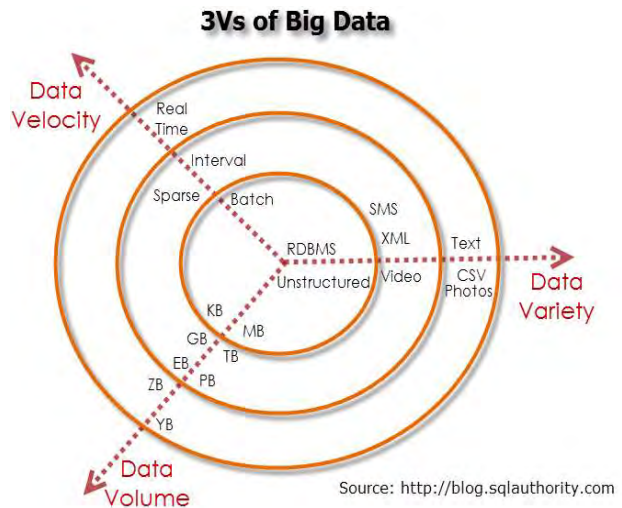


Fig. 2. 3Vs of Big data

NoSQL database is equipped to deal with large volume, variety and velocity of data.¹¹

- Volume – In the case of Big Data, it is expensive to maintain ACID properties and may not be necessary. The system is sometimes flexible with minor inconsistencies in the results. Hence the

⁷ Salehnia, Ali. “Comparisons-of-Relational-Databases-with-Big-Data-a-Teaching-Approach.Pdf.” Organization. asece.org. Accessed May 8, 2020. <https://www.asece.org/documents/zones/zone3/2015/Comparisons-of-Relational-Databases-with-Big-Data-a-Teaching-Approach.pdf>.

⁸ “4. Data Storage for Analysis: Relational Databases, Big Data, and Other Options - Network Security Through Data Analysis [Book].” Accessed May 8, 2020. <https://www.oreilly.com/library/view/network-security-through/9781449357894/ch04.html>.

⁹ Arriba-Pérez, Francisco de, Manuel Caeiro-Rodríguez, and Juan M. Santos-Gago. “Collection and Processing of Data from Wrist Wearable Devices in Heterogeneous and Multiple-User Scenarios.” *Sensors (Basel, Switzerland)* 16, no. 9 (September 21, 2016). <https://doi.org/10.3390/s16091538>

¹⁰ “Big Data and NoSQL.” <http://icsites.juniata.edu/faculty/rhodes/dbms/nosql.htm>.

¹¹ “An Introduction to Big Data: NoSQL - Cracking The Data Science Interview - Medium.” Accessed May 8, 2020. <https://medium.com/cracking-the-data-science-interview/an-introduction-to-big-data-nosql-96b882f35e50>

designers may choose to partition data over multiple sites.

- Variety – In the Big Data environment, the variety in data makes it difficult to restrict to a specific schema. NoSQL caters to such requirements as it does not depend on the schema. Additionally, updating schema in RDBMS can be expensive.
- Velocity – Disk storage can be expensive and may eventually take a toll on performance or throughput. Memory is relatively economical to work with and is faster than storing data in the disk.

In NoSQL, adhering to ACID properties is not guaranteed. Therefore, such a database is only preferred for non-critical transactions. In the wearable device industry, it is acceptable to not have the latest data all the time. The trade-off in consistency is marginally acceptable and compared to the healthcare industry.

However, BASE properties – Basically Available, Soft state, eventually consistent – are properties that are guaranteed. The BASE properties adhere to the Availability and Partition tolerance of the CAP theorem implying a trade-off with the Consistency. makes NoSQL more suitable to the behavior of the data read-write behavior in the wearable device market.

NoSQL provides 4 categories of databases:

- Column: are databases that store data in cells which are grouped into columns instead of rows. Columns are grouped into column families. This design provides faster search and data access. This database should be avoided if the system requires complex queries and if the query patterns change frequently. Cassandra, Apache Hadoop HBase and Vertica Google BigTable are common column stores.
- Document: databases such as MongoDB, MarkLogic, Couchbase

work with a format called JSON (JavaScript Object Notation), which is derived from JavaScript which supports data types such as strings, objects, arrays and Booleans. MongoDB is the most popular, open source among these databases with an advantage of dynamic document creation over time.

- Key-value: are databases that are designed to work with associative arrays or a data structure similar to a dictionary or hash table. The data is stored using a unique key. They provide fast access to data. However, they are more suitable for less complex data sets and query capability supports simple queries. Amazon DynamoDB, ArangoDB etc. are some of the key-value based databases.
- Graph: are databases that leverage unbounded queries where the search is not specific and therefore the result data set is more generic. Queries that do not involve the WHERE clause are suited for this type of database. Neo4J, OrientDB, InfiniteGraph, etc. are some graph databases.¹²

The wearable device data is constantly changing and evolving with every new design launched in the market (like Fitbit versa and iconic). Every new design brings with it a new set of features to the consumers. Column, key-value and graph databases have their trade-offs in the complexity of the queries and complex data handling capabilities as discussed above, hence making document models an appropriate choice for this market.

Among all the databases, MongoDB has been widely used in the wearable device market for its document-oriented storage, auto-sharding, support for rich queries and fast in-place updates. MongoDB is also preferred for data that contains a timestamp in its message. The paper will further discuss an example of how NoSQL – Document based database is used for apps for Fitbit devices.

¹²“NoSQL.” In *Wikipedia*, May 4, 2020.

<https://en.wikipedia.org/w/index.php?title=NoSQL&oldid=954869460>.

NoSQL for Fitbit

A. Integration with Fitbit APIs

Fitbit studio provides APIs that grant access to their data. A common use case is when Fitbit data integration is required with data from other sources for collating medical information or for comparing health statistics. Fitbit provides the data export to its user on its website in the JSON format. This can further be integrated with NoSQL databases (like MongoDB) for further processing or integration.

B. Document database with Fitbit API

The following example is based on a waist measuring app ‘bulker’ by Lauri Hahne (GitHub contributor); that fetch data from the user’s Fitbit device and calculates waist measurement for the user. Below is the dataflow for this app:

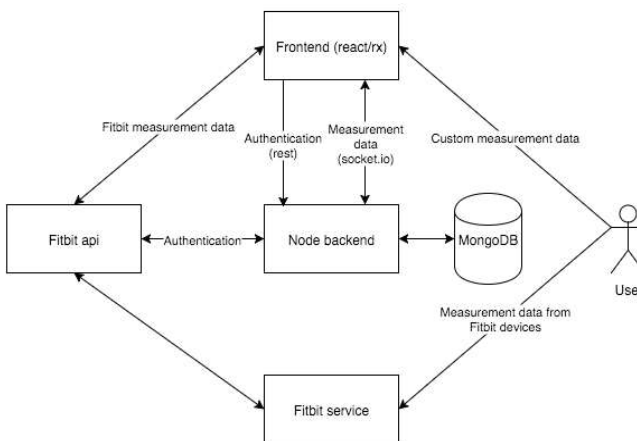


Fig. 3. Dataflow from Fitbit device to MongoDB¹³

Fitbit automatically collects user measurements from their device and then the data is read using Fitbit’s API which is displayed to the user for validation (data sharing consent).

The following Fitbit API demonstrates the user authentication followed by fetching the user's weight. The Authentication code requires to provide API keys and to configure a callback for the authentication:

```

passport.use(new FitbitStrategy({
  clientID: process.env.ID,
  clientSecret: process.env.SECRET,
  callbackURL: host + "/auth/callback"
}),
function(accessToken, refreshToken, profile, done) {
  done(null, {token: accessToken});
});

server.get('/',
  passport.authenticate('fitbit', {scope: ['weight', 'profile']}));

server.get('/auth/callback',
  passport.authenticate('fitbit', { failureRedirect: '/login' })),
function(req, res) {
  console.log(req.user);
  res.redirect('/app.html');
}
);
  
```

Fig. 4. User authentication with Fitbit

A call from API to Fitbit from the client is made through the following code:

```

server.get('/user', (req, res) => {
  res.send({
    token: req.user.token
  });
});

const token$ = rx.Observable.fromPromise(axios.get('/user'))
  .map(response => response.data.token);

const get$ = path => token$.flatMap(token => rx.Observable.fromPromise(axios.get(`https://api.f
  {headers: {Authorization: 'Bearer ' + token}})));
  
```

Fig. 5. Getting data from Fitbit

Finally, the API is used to read the weight information:

```

const weightData$ = get$(`/1/user/-/body/log/weight/date/${today}.json`)
  .map(response => response.data.weight[0]);
  
```

Fig. 6. Read weight information from the API

As seen in the sample code above, the data extraction query targets a JSON file. This implies

¹³“NoSQL.” In *Wikipedia*, May 4, 2020.

<https://en.wikipedia.org/w/index.php?title=NoSQL&oldid=954869460>.

that Fitbit uses a JSON format to store that data in its database. Therefore, a document variety of NoSQL is being used (MongoDB / HBase etc.).¹⁴

C. Data extract from Fitbit – JSON format

Being an open source platform, Fitbit provides third-party developers with a warehouse REST API.¹⁵ This enables developers to get JSON data from their registered websites. Special authentication/permission is required to gain access to specific data like minute by minute heart rate.

These collected data from the wearables are stored in the form of key-value pairs. The data storage model is usually XML (eXtensible Markup Language) or JSON. For example, the following snippet represents a record for a minute by minute sleep data where each minute is tagged with the user's sleep state:

```
1 ("asleep"), 2 ("awake"), or 3 ("really awake")
[
  {
    "dateTime": "23:38:00",
    "value": "1"
  }, ... ]
```

Fig. 7. Sleep segments in Fitbit

A complete data format can be seen in figure 8. A developer can get an extract of this data from Fitbit's website. Freelancers and active developers have been leveraging this transparency to build custom apps. This JSON format in the access layer of the application can be processed and stored in the database objects like MongoDB documents such as:

```
{
  "_id": "-",
  "student_id": "-",
  "date_string": "2015-07-22",
  "date": NumberLong(1437523200000),
  "student_id_api": "-",
  "device": "Microsoft_Api",
  "data": {
    "total_time_data": 394,
    "time_to_sleep_data": 11,
    "temp_mean": 34.56,
    "hr_min": 56,
    "num_awake": 9,
    "awake": 86,
    "light": 221,
    "relaxed": 87,
    "sleep_efficiency": 80,
    "efficiency_proposal": 70,
    "start_hour": "01:26:18",
    "end_hour": "08:00:48",
    "total_time": "06:34:30",
    "time_to_sleep": "00:11:24"
  },
  "list": {
    "awake": [1,0 ... ],
    "light": [0,1, ... ],
    "relaxed": [0,0, ... ],
    "time": ["23012618384","23013200000", ... ],
    "hr": [64,64, ... ],
  }
}
```

Fig. 8. Homogenized sleep data

NoSQL With Other Wearable Devices

MongoDB's Stitch API is a document centric API that is being used for Android app development for Android wear devices. This API handles the communication between the app interface and the backend database. This API is part of Backend as a Service (BaaS), which consists of traditional database operations, service integrations and access control.

The Tradeoff and Proposition of Handling Those Tradeoffs with NoSQL

Deep nested array structures – MongoDB documents are sometimes susceptible to update issues related to the complex nested arrays. In one of the experiments conducted by the author of "Modeling temporal aspects of sensor data for MongoDB NoSQL database", he found that the

¹⁴ Gofore. "Integrating with Fitbit APIs," December 31, 2015. <https://gofore.com/en/integrating-with-fitbit-apis/>.

¹⁵ Arriba-Pérez, Francisco de, Manuel Caeiro-Rodríguez, and Juan M. Santos-Gago. "Collection and Processing of Data from Wrist Wearable Devices in Heterogeneous and Multiple-User Scenarios." *Sensors (Basel, Switzerland)* 16, no. 9 (September 21, 2016). <https://doi.org/10.3390/s16091538>.

second's information stored in the nested array of JSON object was not updated by the database because of the limit in the MongoDB engine.¹⁶ The database engine limits the update of nested arrays after a limited number of positional operators. The solution to this issue was a recommendation to either avoid deeply nested structures.

The trade-off of the BASE model – the eventual consistency of this model has better write performance because the application does not wait for the acknowledgement of the write. However, before the write is committed to the disk, the data store can tell the application to move on to other operations thus boosting the performance but risking the data for a potential inconsistency (if the next operation is an update). This is a trade-off between risk and availability. With the scaling of concurrent users, aiming for eventual consistency will have a trade-off in terms of latency in data updates made by users on their Fitbit (or any other wearable device) community forum. In comparison to financial organizations, this kind of trade-off is acceptable to this kind of market. Hence the NoSQL remains to be preferable fit.¹⁷

Planning for orphaned data – NoSQL database is susceptible to orphaned data. Since there is no concept of foreign keys, there are chances that some data are not related. Although an issue but is not considered as a deal – breaker in most cases.

No stored procedures – since there is no concept of stored procedures, the business logic is mostly dealt with in the application itself rather than handling it in the database.

Lack of triggers – NoSQL databases do not have a concept of triggers. Therefore, constant updates are found challenging in dynamic applications. However, MongoDB allows users to use tail-able cursors to keep track of changes.¹⁸

Conclusion

The wearable device market thrives on extensive data-driven monitoring applications that invite dynamic, rapid and ongoing data collection and consumption. Therefore, the management of such highly scalable and temporal big data requires an equally adaptable database framework. In this paper, we discussed the benefit and trade-offs of choosing NoSQL over traditional RDBMS and how NoSQL supports the big data properties of Volume, Variety and Velocity. Additionally, we investigated how Fitbit and its open source development community leverage the NoSQL database (specially document based databases like MongoDB). These discussions reflect on the fact that NoSQL database has been proficient in encouraging dynamic data creation and collection with the assurance that the overhead of the unstructured data will be handled with marginal tradeoff using this non-relational database.

¹⁶ Mehmood, Nadeem Qaisar, Rosario Culmone, and Leonardo Mostarda. "Modeling Temporal Aspects of Sensor Data for MongoDB NoSQL Database." *Journal of Big Data* 4, no. 1 (March 31, 2017): 8. <https://doi.org/10.1186/s40537-017-0068-5>.

¹⁷ MemSQL Blog. "Why NoSQL Databases Are the Wrong Tool for Modern Application." January 6, 2020. <https://www.memsql.com/blog/why-nosql-databases-wrong-tool-for-modern-application/>.

¹⁸ "The Biggest Challenges of Moving to NoSQL - DZone Database." Accessed May 8, 2020. <https://dzone.com/articles/the-biggest-challenges-of-moving-to-nosql>.

Measuring Transit Accessibility in Allegheny County: Methods and findings from a study of opportunity employment

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Introduction

Allegheny County is the second largest county by population in Pennsylvania. With over one million people living in the county,¹ reasonable and reliable means of transportation are essential. In fact, recent research has found a link between geographic and economic mobility.² The Allegheny County Department of Human Services (DHS) is interested in measuring how the Port Authority of Allegheny County's (PAAC) transit system impacts access to employment in their populations of focus. This led to the research question: How accessible are opportunity occupations in Allegheny County by public transit? Opportunity occupations are defined here as full-time, year-round jobs that offer more than the median annual wage without requiring a bachelor's degree.³

To answer the main research question, the following sub-questions were developed:

1. How can accessibility be defined?
2. How can accessibility measures be quantified, combined and compared?
3. Where are DHS's populations of interest?
4. Which industries have the highest opportunity employment?
5. Where are opportunity occupation zones located?
6. What percent of opportunity occupation jobs are accessible by the existing bus transit system?
7. How can DHS intervene and provide assistance to clients with poor transit accessibility? (e.g., policy recommendations, support programs)

Using multiple data sources (including anonymized data supplied by DHS, real-time historical PAAC service data, American Community Service data, Reference USA, and the Western Pennsylvania Regional Data Center), employment accessibility via public transit was defined through an index tool that

¹ U.S. Census Bureau. "U.S. Census Bureau QuickFacts: Allegheny County, Pennsylvania." (2018). Accessed November 17, 2019. <https://www.census.gov/quickfacts/alleghenycountypennsylvania>.

² Chetty, Raj, Nathaniel Hendren, Patrick Kline, and Emmanuel Saez. "Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States." *The Quarterly Journal of Economics* 129, Issue

4 (November 2014), 1553–1623. <https://doi.org/10.1093/qje/qju022>.

³ Wardrip, Keith. "Identifying Opportunity Occupations in Pennsylvania, New Jersey, and Delaware." Philadelphia: Federal Reserve Bank of Philadelphia, 2015. https://www.philadelphiafed.org/-/media/community-development/publications/special-reports/identifying_opportunity_occupations/identifying_opportunity_occupations_complementary_report.pdf?la=en.

evaluates how public transit serves different opportunity occupation zones of Allegheny County relative to areas of interest. In response to stakeholder input, the index was designed to capture several different aspects of the transit experience, including time, reliability, cost, and physical setting. Finally, ArcGIS visualized key findings of the accessibility index. The results of the study were integrated into a publicly available ArcGIS Operations Dashboard. Accessibility index findings include several surprising origins and destinations that were inaccessible, including zones which were geographically close.

The research concluded that several identified origins were not generally accessible to many opportunity employment zones even when they were geographically close. Examples of specific origins include Brackenridge and Robinson Township. Distance from the county center (downtown Pittsburgh) was associated with lower scores and fewer accessible routes for both origins and destinations. Because of this, high potential opportunity zones on the fringe of the county were oftentimes unreachable.

Additional findings include:

- Access to an opportunity zone does not necessarily imply access to all the occupations within that zone
- Only 6 of the 17 of the identified origins could reach more than 3 opportunity employment zones.
- Of the 14 opportunity “hotspots”, three offered no bus stops to opportunity zones at all.
- Even when opportunity zones were deemed accessible, the bulk of the occupations within that zone were frequently outside of the Port Authority walkshed.

It is recommended for decision-makers to explore last-mile/first-mile solutions for high-potential proximal origins and destinations. The project also encourages the use of the accessibility index and intermediate transit helper tools for advocacy related to expanded transit access. Ultimately, this exploratory analysis can be used to draw insights into key areas of interest and inform possible policy decisions related to accessibility and the bus system. The goal is that this index can provide the foundation for even greater and more granular analysis related to the transit experience in Allegheny County.

Definitions

Census Block Group: U.S. Census Bureau geographic unit of analysis that is a combination of census blocks, the smallest geographic unit of analysis that the Census Bureau uses. Block groups usually have a population between 600 to 3,000 people.

Expected travel time range: The distance between average travel time and an upper-bound of travel times (based on scheduled data).

Opportunity (occupation or employment) zone: Custom geographic area representing a high density of estimated opportunity occupations identified using spatial analysis.

Port Authority “Walkshed”: Map layer indicating 5-minute walking distance from the centerline of the road.

Buffer: Usually a quarter-mile radius around bus stops or geographic locations, a standard found in the literature.

Walkability: An indicator for the presence of pedestrian-friendly intersections.

1. Current Assessment

A literature review and stakeholder interviews were conducted to understand the type of existing analyses and better frame the research to Allegheny County. The assessment provided opportunities to combine findings and methods from different sources. The three areas of research were 1) origin/population selection, 2) opportunity occupations, and, 3) transit accessibility.

Origin Selection

This project explored different sources to understand areas of “high need” in Allegheny County. A few sources to highlight include the PAAC Equity Report and the 412 Food Rescue GIS Study.

412 Food Rescue GIS Study.⁴ In September 2019, 412 Food Rescue, an Allegheny County non-profit, released a study that used Census data to examine the population reached by their services. Of the population studied, they found approximately 277,000 people living in transit deserts. The 412 Food Rescue study

provided maps that demonstrate areas with a high need of public transportation.

PAAC Equity Report.⁵ The 2019 Equity Index of Mobility Need by the Port Authority of Allegheny County was foundational to understanding where the county believes there is opportunity to provide improved service. The PAAC index was constructed considering a number of factors important to equitable transportation-including poverty status, households with persons with disabilities, racial/ethnic minorities, and the elderly. Using several of the PAAC equity index indicators as a starting point for data compilation, our origin team downloaded and processed relevant U.S. Census ACS data for Allegheny County for the use of our project. Moreover, our group leveraged the Final Equity Index of Mobility Need section from the PAAC report to help identify the areas of the county with high transportation needs.

Opportunity Occupations

Opportunity occupations are defined as jobs paying more than the median annual wage; not requiring a bachelor’s degree; offering full employment (50-52 weeks of the year); and offering between 35 - 60 hours per week.⁶

⁴ 412 Food Rescue. “Food Insecurity and Resource Access in Allegheny County, Pennsylvania: Using GIS to Identify High Need Communities and Assess Food Recovery and Redistribution Efficacy.” Pittsburgh: 412 Food Rescue, 2018. Accessed September 23, 2019. <https://412foodrescue.org/wp-content/uploads/2018/04/412-Food-Rescue-GIS-Study-.pdf>.

⁵ Port Authority of Allegheny County. “Equity Index of Mobility Need.” Pittsburgh, PA: Port Authority of Allegheny County, 2019. Accessed September 22, 2019. <https://www.portauthority.org/link/631978a20a6948acb50cb608e4f908c4.aspx>.

⁶ Wardrip. “Identifying Opportunity Occupations in Pennsylvania, New Jersey, and Delaware.”

Computing the number of opportunity occupations is often challenging due to the lack of a publicly available centralized database. Some approaches, like a method by the Federal Reserve Bank of Philadelphia, explore job vacancy information from Burning Glass to detect opportunity occupations and project their growth⁷. When observing occupation-level data, a few trends stand out. A few of the most prevalent jobs which offered more than the median wage included sales representatives, business operations specialists, a number of healthcare related positions, and jobs related to construction, maintenance, and repair.⁸

Importantly, opportunity occupations are strongly associated with specific industries. Industry-related information, combined with ACS information, can approximate opportunity occupation mix in a locality. By coupling this data with information from the Longitudinal Household Employer Dataset, it becomes possible to map this information spatially at the census block level. The main mechanism for this conversion is called an industry opportunity share.⁹

Opportunity Share =

Opportunity Employment

Total Employment

Identifying individuals holding opportunity occupations is possible by sub-setting a random sample of individual responses from the American Community Surveys data set. Importantly, identifying and quantifying these desirable employment opportunities involves understanding the unique industry composition of a particular geographic area.¹⁰

This study followed the second approach, using opportunity shares to understand the unique industry opportunity “mix” for Allegheny County. While borrowing from this initial approach of using ACS data to understand industry trends, the current analysis made an important deviation. The ACS data only provides industry information at the block group level; because our goal was ultimately transit analysis, we needed more granular data that would be conducive to selecting bus stops. The ReferenceUSA business database was used to access specific business location, industry, and employee count information.

Transit Accessibility

Most existing methods for transit accessibility analysis use either time or

⁷ Fee, Kyle, Keith Wardrip, and Lisa Nelson. “Opportunity Occupations Revisited: Exploring Employment for Sub-Baccalaureate Workers Across Metro Areas and Over Time.” Cleveland: Federal Reserve Bank of Cleveland, April 2019. Accessed September 3, 2019. <https://www.clevelandfed.org/~media/content/newsroom%20and%20events/publications/a%20look%20behind%20the%20numbers/albtn%20opportunity%20occupations/opportunity%20occupations%20revisited.pdf?la=en>.

⁸ Ibid.

⁹ DeMaria, Kyle. “Getting to Work On Time: Public Transit and Job Access in Northeastern Pennsylvania.” Philadelphia: Federal Reserve Bank of Philadelphia, 2018. Accessed September 3, 2019. <https://www.philadelphiafed.org/~media/community-development/publications/special-reports/public-transit-and-job-access-in-northeastern-pennsylvania/getting-to-work-on-time.pdf?la=en>.

¹⁰ Ibid.

distance-based metrics. Policy-makers tend to consider accessibility in terms of location-based measures to analyze transit access and land use: “Location-based metrics typically account for the number of opportunities that can be reached from a specific location, based on the travel costs to destinations using a specific mode. Travel costs are generally measured based on travel time or distance.”¹¹ There are three other common metrics of transit performance:

1. Opportunity-based: Relates to how many destinations can be reached from a certain point at a given time using an identified mode of transportation
2. Gravity-based: Modification of opportunity based that considers distance
3. Utility-based: Calculates options the respective value and utility of corresponding destinations.¹²

Of key importance for this study were not only location and time-based factors but also issues of interest to Allegheny County stakeholders. These included metrics related to physical access, trip cost, comparison to car travel time, and reliability of service.

Stakeholder Interviews

Interviews were conducted to gather qualitative information to corroborate against any data collection and further

explain what was found in the data. These interviews were generally concerned with appropriately identifying populations/and origins of interest and perceived barriers to transit accessibility.

Sixteen individuals were interviewed from a variety of organizations. Some of the organizations included:

1. Allegheny County DHS
2. Federal Reserve Bank of Cleveland
3. Southwestern Pennsylvania Commission
4. Pittsburghers for Public Transit
5. Partner4Work
6. PAAC Transit User
7. Port Authority of Allegheny County
8. RideACTA
9. Local Chamber of Commerce
10. Neighborhood Allies
11. Carnegie Mellon University

The interviews were conducted with a set of sixteen questions. There was variability among the interviews depending upon each interviewee’s area of expertise. Many interviewees added additional information based upon their experiences that were outside of the scope of the questions.

The most common themes from the interviews included:

1. Accessibility considerations for public transit including walkability

¹¹ Boijoly, Genevieve, and Ahmed El-Geneidy. “Measuring Performance: Accessibility Metrics in Metropolitan Regions around the World.” August 2017. <https://www.brookings.edu/wp-content/uploads/2017/08/measuring-performance-accessibility-metrics.pdf>.

¹² Deboosere, Robbin, and Ahmed El-Geneidy. “Evaluating Equity and Accessibility to Jobs by Public Transport across Canada.” *Journal of Transport Geography* 73 (2018): 54–63. <https://doi.org/10.1016/j.jtrangeo.2018.10.006>.

(10-15-minute walk or under .5 miles), frequency, reliability, and cost.

2. Underserved populations include single parents, individuals in low-income neighborhoods, and individuals without a car
3. Geographic areas of Allegheny County underserved by public transit include Penn Hills, Northview Heights, and the Mon Valley.

Other key insights include reflections on Allegheny County's unique topography presents additional challenges, the need to keep round-trip times under one hour, and the need to consider alternative transit options.

3. Methodology

As with the literature review, the methodology of completing the index was divided into three parts of origin selection, opportunity employment zone selection, and transit analysis, in addition to stakeholder interviews as incorporated into all of the sections as necessary.

Origins: Identifying Areas of Interest

After identifying populations of interest, data was collected and analyzed to identify U.S. Census Bureau block groups with a potential high need to access opportunity occupations. This analysis determined 17

block groups as areas of focus. Key indicators included poverty, income, car ownership, and employment status. Generally, the block groups had higher numbers of DHS clients than the rest of the county. Given the targeted nature of this project's analysis, specifically the connection of populations of interest to opportunity occupation zones, three primary data sources were considered when identifying block groups where populations of interest are living. The following data sources were analyzed in ArcGIS Pro:

1. The 2019 Equity Index of Mobility Need by the Port Authority of Allegheny County
2. Allegheny County data from the American Community Survey (2013-2017 ACS 5-year estimates) ¹³
3. Proprietary anonymized data about DHS clients - including residence and employment location data aggregated and to the block level-supplied by DHS.

¹³ Note that U.S. Census Bureau ACS estimates at the block group level have a high margin of error.

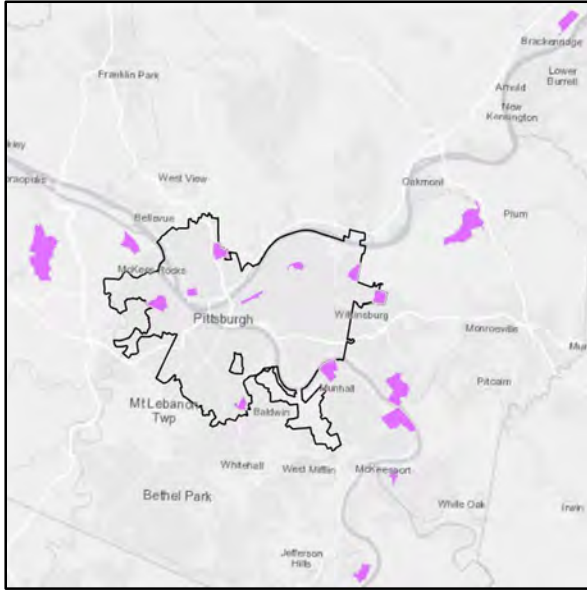


Figure 1: Selected Origins

Note: Neighborhood labels are added to enable interpretation and context to the block groups, although the block groups themselves rarely fully encapsulate an entire neighborhood and may overlap slightly. Generalizations about an entire neighborhood based on these smaller units of analysis are discouraged.

Selected origin block groups in Allegheny County are located in: Clairton, McKeesport, Duquesne, Carrick, North Braddock, Homestead, Crafton Heights, Bedford Dwellings, East Hills, Manchester, Robinson Township, Lincoln-Lemington-Belmar, Garfield, Northview Heights, Stowe Township, Penn Hills, and Harrison Township. See figure 1 for a map of the origin block groups.

Considerations were made for areas with high numbers of DHS clients. For example, while block group 420034591023 in Robinson Township has a relatively high

rate of education and a relatively low rate of poverty, it was selected based on the high number of DHS clients living there.

Destinations: Identifying Opportunity Occupation Zones

Central to the project scope is a pivotal question: Where are opportunity occupations in Allegheny County? Our team used two major methodologies to 1) approximate the proportion of opportunity occupations by industry, and 2) plot this same information spatially for Allegheny County. To do this, the team utilized the method from the Federal Reserve Bank of Cleveland and Philadelphia, mentioned earlier in the literature review. Using this approach, our team produced the map seen in figure 1 of opportunity occupations.

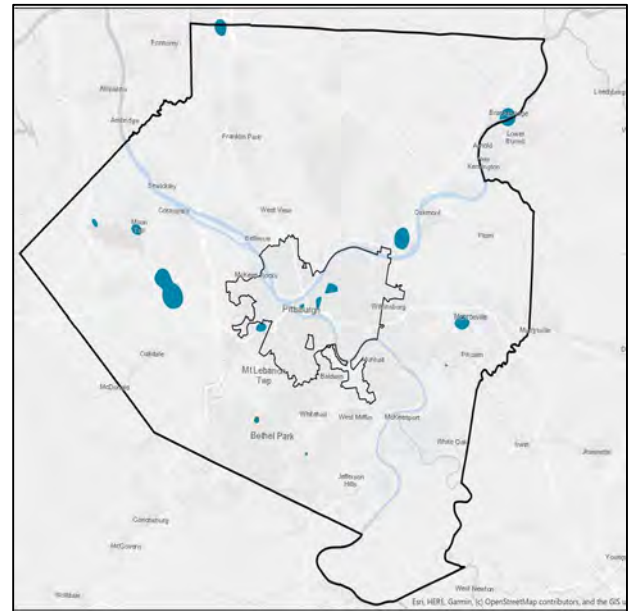


Figure 2: Most Dense Opportunity Occupation Areas (not block groups)

This analysis located high density opportunity occupation in areas such as

Monroeville and the Central Business District (Downtown Pittsburgh). To identify these locations, we used the following process:

Using Industry Opportunity Shares to Approximate Labor Market Composition

We used publicly available Census data to identify opportunity occupation from demographic data and individual responses. Once our team computed the proportion of opportunity occupations observed within Allegheny County industries, these proportions were applied to the Census Bureau's LODES data set, which provides spatial information about job counts. These opportunity shares allowed our team to adjust recorded job counts to roughly approximate the number of jobs that would be eligible for opportunity occupations. This initial analysis allowed the team to preliminarily map Census block groups with high opportunity occupations. A chart of findings is in Appendix 4.

Refining Zones Using Raw Business Data

For a more accurate, local picture of the Allegheny County labor market, the team utilized Reference USA's database to manually download a full record of registered Allegheny County businesses and their employee counts. Because these businesses corresponded with a NAICS code, the same opportunity shares were applied to understand what portion of these jobs might be applicable to the project's population of interest. With this brute force approach, we then mapped the physical location of all registered businesses with 10

or more employees in the applicable 20 industry categories in Allegheny County.

Using a number of spatial analysis tools in ArcGIS, the team used these adjusted job counts to create a Kernel Density map. This jobs-based heat map allowed us to visualize centers which were predicted to be relative hot spots for opportunity occupations. After isolating unique hot spots, we created a threshold for our opportunity occupation density and then created custom polygons that encapsulated the area associated with a high density of opportunity occupations. These polygons became the project's opportunity zones. See figure 2 for the opportunity occupation areas.

Environmental Factors in Opportunity Employment Zones

To translate these destinations for the public transit tool, we then identified bus stops within these areas. The bus stops identified served as the team's "Opportunity Bus Stops." In order to calculate logistics factors for the index, the following analyses were completed:

Walkability: Understanding the environment around the bus stop and how it relates to commuters' ability to safely get to and from the bus stop is an important measure. The EPA has walkability metrics for every block group in the United States. Not all metrics for walkability are relevant to our analysis (for example, the mix of residential and business development does not apply). However, the EPA does score each block group on its density of pedestrian-oriented intersections on a 1-20

scale. Destination “zones” were joined to block groups, and average ‘intersection scores’ for zones were estimated depending on the area of the zone each block group represented.¹⁴

Job Access: To estimate how many jobs within each opportunity zone are within a reasonable walking distance of PAAC bus stops, the PAAC official “walkshed” was overlaid with business location and employee count data to estimate the proportion of jobs accessible within each zone.

Developing and Visualizing Opportunity Shares for Industry

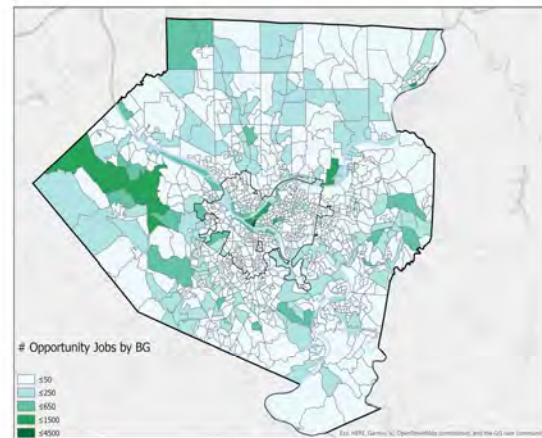
No existing dataset provides spatial information for opportunity occupations at the county level for Pennsylvania. To approximate opportunities within the Allegheny County labor market, our team borrowed the concept of an “industry opportunity share” from the Federal Reserve Bank of Philadelphia.¹⁵ This method uses individual demographic and response data to identify individuals who currently hold opportunity occupations, and then map those roles and individuals out to specific industries to understand the total opportunity compositions. This method utilizes data from two major sources:

1. American Community Survey Public Use Microsample (PUMS) 2017, and
2. U.S. Census Bureau’s 2017 Longitudinal Employer-Household

Dynamics (LEHD) program’s Origin-Destination Employment Statistics (LODES) dataset.

Once we computed industry opportunity shares, we could then adjust job numbers provided from the LODES data set, which supplies for each Census block, the total number of associated jobs by NAICS code.

The Longitudinal Origin-Destination Employees Statistics dataset captures the number of jobs associated with an industry at the block group level. To glean some initial insights into the placement of jobs, we adjusted LODES numbers based on Allegheny County’s industry opportunity shares. This allowed us to understand on average, what proportion of an industry’s jobs can be categorized as opportunity occupations alongside their location. The initial map is crisply defined by the edges of block groups (figure 3) and was an initial step towards the final product.



¹⁴ U.S. Environmental Protection Agency, “National Walkability Index.” United States Environmental Protection Agency. Accessed October 20, 2019. <https://www.epa.gov/smartgrowth/smart-location-mapping#walkability>.

¹⁵ DeMaria, “Getting to Work On Time: Public Transit and Job Access in Northeastern Pennsylvania.”

Figure 3: Top Opportunity Block Groups

Note: It is important to note that the neighborhood labels are added to enable interpretation and context to the areas of interest, although the polygons themselves do not fully encapsulate an entire neighborhood and may even overlap neighborhoods. Generalizations about an entire neighborhood based on these smaller units of analysis are discouraged. For a list of neighborhood overlaps, see Appendix 6.

While this was somewhat informative, block groups may not be an appropriate geographic unit of analysis for understanding transit access because some have much larger areas than others. Because of this, the team looked for alternative methods of quantifying the number and exact location of opportunity occupations.

Bruteforce Data Collection and Custom Polygon Creation with ReferenceUSA

To create spatial areas that were both interesting in terms of opportunity employment but were also small enough to analyze meaningfully, individual business data was acquired from ReferenceUSA. The team plotted some 12,000 businesses by their actual coordinates. A kernel density analysis then established the location of opportunity occupation zones. More detailed information on how this was accomplished is captured in Appendix 5.

As a result of the density analysis, the zones in the following destinations were selected as opportunity occupation zones: South Park Twp, Bethel Park, Wilmerding, Green Tree, Monroeville, Middle Hill, Upper Hill,

Robinson Twp, O'Hara Twp, Brackenridge, and Central Business District.

Destinations which had no bus stops within range and were excluded from O/D pairing include Moon Township, Findlay Township, and Marshall. These pairs would have resulted in an automatic score of zero and would not provide any additional insight to transit accessibility.

Transit Route Analysis

Transit route analysis was conducted by analyzing General Transit Feed Specification (GTFS: scheduled routes) and Automatic Passenger Counter - Automatic Vehicle Locator (APC-AVL: Real-time Data). The analysis sought to answer two key questions:

1. How long does it take for riders to get from origins of need to destinations of opportunity?
2. How reliable is public transit in addressing opportunity zones?

Computing Bus Travel Times

Analysis of transit travel was computed using a variety of R functions and packages (see Appendix 3). Most notable however was the tidytransit open source package. Tidytransit enabled us to efficiently query the GTFS feeds and generate travel time distributions within any two given origins and destinations. Tidytransit uses the RAPTOR-Roundbased Public Transit Optimized Router.¹⁶ More details about

¹⁶ Delling, Daniel, Thomas Pajor, and Renato F. Werneck. "Round-Based Public Transit Routing."

2012 Proceedings of the Fourteenth Workshop on Algorithm Engineering and Experiments (ALENEX),

RAPTOR information can be found in Appendix 3.

Analyzing APC-AVL data required some custom code to approximate the RAPTOR algorithm and specifically to handle the case of transfer transit riders. Our methodology in this analysis followed the steps:

1. User selects an origin and destination
2. Program defines a catchment area as the region within 0.25 miles (1320ft) of a transit stop, and the area within which transfers are most possible
3. Program identifies unique routes from origin to destination identifying possible transfers along the way
4. Compute the travel times of the prior identified unique routes
5. Compute a distribution of travel times and compare to GTFS computed travel times

Observed Time Windows

Morning Peak	6am - 10am
Morning Off-Peak	10am - 3pm
Evening Peak	3pm - 7pm
Evening Off-Peak	7pm - 10pm
Night	Midnight - 6am
Weekend	6am - 6pm

Computing Car Travel Times

Origin to destination car travel times were calculated using the Google Maps API. The API was accessed through the gmapsdistance package in R. The package required latitude/longitude coordinates, and

the origin and destination centroids were used as proxies for origin and destination bus stops. Using the API, travel times were extracted for O-D at hourly intervals for the selected time slots and averaged to estimate the expected travel time within the time window. Car travel time matrices were then exported into the index spreadsheet for incorporation into the final index worksheet.

Accessibility Index Development

Data was collected from different sources to capture four unique aspects of the transit experience: 1) Cost, 2) Time, 3) Reliability, and 4) Physical Environment. These components are further broken down into six distinct metrics in order to evaluate performance (figure 4):

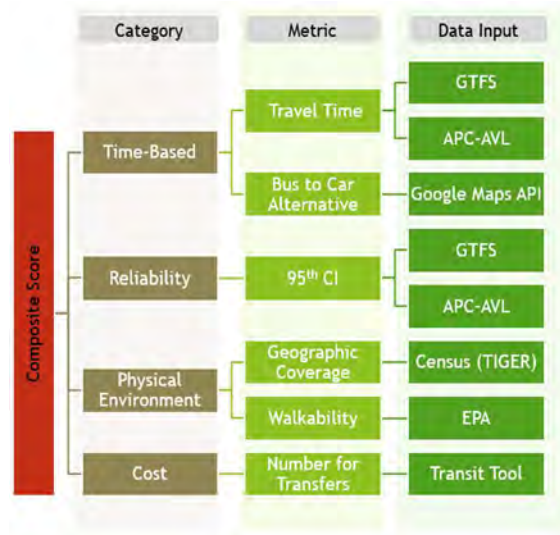


Figure 4 Mapping the inputs

Cost, time, and reliability information were gathered from the custom transit tool mentioned earlier in this paper. Due to the nature of transit and how access may be

2012, 130–40.
<https://doi.org/10.1137/1.9781611972924.13>.

dependent on time windows, these metrics were captured at unique times of day. These categories were further broken-down into the below measures:

Key Measures

- **Travel Time:** Captures the average travel time from an origin and destination. This includes wait time and time between stops. This is captured at all six time windows.
- **Bus/Car Alternative:** Captures the opportunity cost of riding the bus. This is simply the bus travel time divided by the car travel time and communicates how much longer (or shorter) a car ride would be if an individual had the option to use a car instead of riding a bus. This is captured at all six time windows.
- **Reliability:** Captures variation by extracting the 95th Confidence Interval for expected travel time. This value communicates the spread of the data, so this information was captured at all six time windows.
- **Geographic Coverage:** Captures how much of the area (proxy for population) lives within 0.25 miles of the bus stops.
- **Walkability:** Captures if a location has pedestrian-friendly intersections.
- **Cost:** Captures how much a trip will cost on average in dollars for a person who does not have a ConnectCard, especially if there are

multiple transfers. This is captured at all six time windows.

Creating Weights

To reflect stakeholder and rider preference, we assigned weights based on Port Authority Ridership Customer Satisfaction surveys and internal discussion from client feedback.¹⁷ The top priorities for riders include:

1. On-Time Performance
2. Fares
3. Travel Time

Categories were weighted as closely as possible to the survey results, given the overlap observed between metrics (table 1). While on-time performance was the top factor in customer importance, it was deemphasized in scoring due to the scheduled nature of GTFS and the data not providing the real-time performance. Instead, bus-car ratio was selected to communicate the opportunity cost associated with riding the bus compared to other options.

Table 1

Category	Factors	Weight
Cost	Trip Cost	30.0
Time	Travel Time	20.0
	Bus/Car Ratio	20.0
Availability	95th CI	15.0
Physical Environment	Geographic Coverage	7.5

¹⁷ Port Authority of Allegheny County. “Port Authority Rider Satisfaction Survey.” Pittsburgh, PA: Port Authority of Allegheny County, June 2018.

<https://www.portauthority.org/siteassets/inside-the-pa/surveys-and-reports/ridersatisfactionsurveybus.pdf>

	Walkability	7.5
Final Score		100.0

Scoring and Normalizing

These raw values were normalized based on the performance of all other pairings. Importantly, a high score does not mean a origin-destination pair is intrinsically favorable. A high score does capture that a specific pairing performed well relative to other pairings the team identified for analysis. Once these scores are computed, the values are weighted by the above table and then summed to create a time-window score.

Origin-Based Community Scores

Scores for a particular origin were calculated by understanding all possible pairings related to that origin, and weighing those scores based on the number of opportunity occupations associated with the respective destinations. Therefore, if one route connects to 400 opportunity occupations and another connects to 4000, the score for the larger amount of jobs will be weighed proportionately.

Validating the Index with DHS Data

Observations on Status-Quo Transportation Patterns of DHS Clients

Anonymized DHS data allowed our project to analyze where DHS clients, many of whom are low-income individuals, work relative to where they live. The visualization of this data provided several insights on the

employment-related transportation patterns of DHS clients.

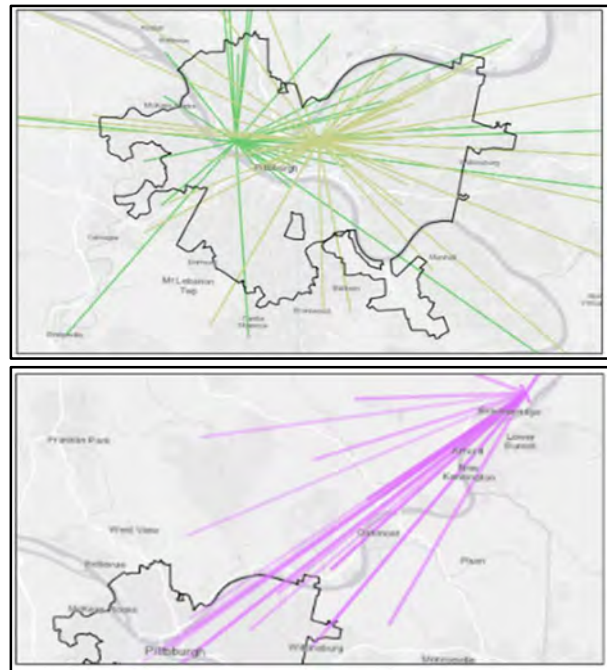


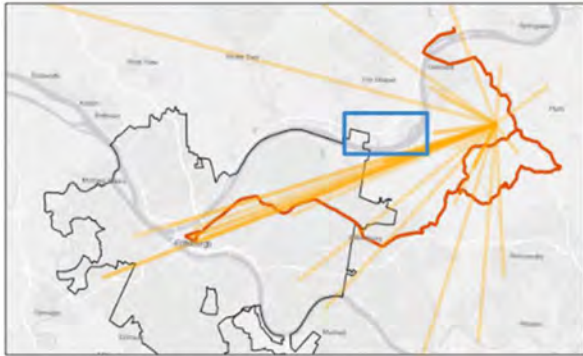
Figure 5: Work/transit pattern from Manchester, Bedford Dwellings origins

Figure 6: Work/transit pattern from Harrison Township origin

Many observations obtained from the data are intuitive, such as DHS clients who live in the city center also have greater access to public transportation (figure 5). Individuals who live near downtown Pittsburgh are able to travel to work locations throughout the county. Meanwhile, DHS clients who live on the edges of the county (see Harrison Township, figure 6) are traveling in narrow corridors in higher numbers. This may be a function of 1) limited public transportation access (in the direction of downtown Pittsburgh) and 2) higher numbers of jobs are generally located downtown.

The Penn Hills origin is a particularly interesting case. This origin, like Harrison

Township above, displays transit patterns (orange) focused towards downtown Pittsburgh (figure 7). The red line marks the only easily accessible Port Authority bus service. This bus option only provides direct travel towards downtown. Most notably, no individuals in the dataset seem to travel to the blue box - the opportunity occupation



zone of O'Hara Township. Although geographically close to this opportunity zone, no DHS clients work there.

Figure 7

DHS clients living in the Garfield and Lincoln-Lemington origins have transit access to the O'Hara Township opportunity zone. Accordingly, many of these clients reported having employment within the opportunity zone. Altogether, this observation suggests there may be an opportunity to connect Penn Hills to a nearby opportunity zone.

This is just one isolated example - similar DHS client transit observations were used to inform findings from the index and our policy recommendations.

4. Findings

Once we had values for all origin-destination pairs, analysis was conducted to discover general trends. Some key findings from the accessibility index are:

- Only 6 of the 17 of the identified origins could reach more than 3 opportunity employment zones.
- Of the 14 opportunity “hotspots”, three offered no bus stops to opportunity zones at all.
- Even when opportunity zones were deemed accessible, the bulk of the occupations within that zone were frequently outside of the Port Authority walkshed.
- While it is relatively easy to reach opportunity occupations in the Central Business District, there is huge latent opportunity in geographic areas that are currently underserved by the public transit system.

Opportunity Employment Zones

Origins

Only 6 of the 17 identified origins could reach more than 3 opportunity employment zones. A consistently high performer was Crafton Heights. Most of this was related to the Busway nearby and the availability of some trips between 12am to 6am. Clairton was a low performing origin, which offered no bus stops at all. Duquesne and Harrison Township have some bus routes within their general neighborhoods, but none in the direction of our identified opportunity zones for any of our selected time windows.

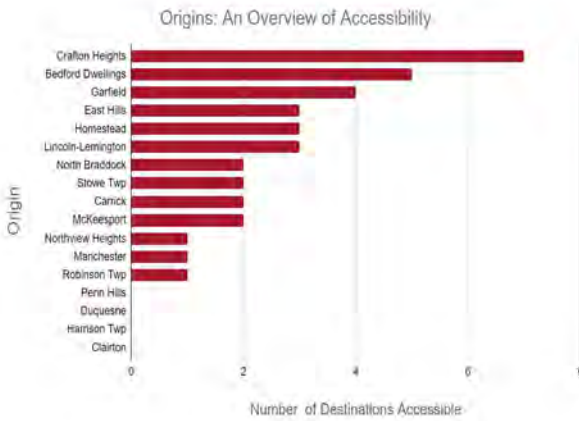


Figure 8 Origin Accessibility

Origin-Based Scores

Each origin received a composite score based on the jobs associated with each origin-destination pair. Essentially, those scores were weighted by the opportunity represented at the end of the route. These scores closely follow the rankings in the above image. The Crafton Heights block group, associated with the West Busway, performs admirably. Meanwhile, the bottom four in accessibility (Harrison Township, Penn Hills, Duquesne, and Clairton), remain lowest on community-based rankings. Origin scores can be found in Appendix 1.

Destinations

Of the 14 opportunity occupation “hotspots”, three offered no bus stops to opportunity zones at all. Most high-scoring origin-destination pairs described routes heading downtown, as the Central Business District had the most connections to origins. Six of our opportunity zones had no connections at all based on the quarter-mile buffer described in the literature. While these weights could be adjusted, they nevertheless communicate either the absence of bus stops or the absence of bus stops

within the reasonable quarter-mile distance from residential areas.

Origin-Destination Pairs

Top Performing Pairs

The majority of high-performing origin-destination pairs describe routes close to the Central Business District. Middle Hill describes the area between the Strip District and the University of Pittsburgh, with Upper Hill just north of downtown. All three of the locations frequently recur within the top rankings. Importantly, these centrally located business centers are also relatively well-connected to many geographies even on the fringe of Allegheny County. A table of top pairs is seen in figure 9.

Best COMPOSIT O-D SCORE					
ARCGIS Join Columns		Pairing	Polygon	Polygon	O - D Index
Origin BG	DEST_ID	ID	Origin	Destination	Composite
420032814002	14	84	Crafton Heights	Central Business I	85
420032814002	8	85	Crafton Heights	Robinson Twp	80
420035619002	7	150	Garfield	Upper Hill	76
420035619002	6	147	Lincoln-Lemington-E	Middle Hill	74
420030509001	7	100	Bedford Dwellings	Upper Hill	76
420030509001	14	97	Lincoln-Lemington-E	Upper Hill	70
420030509001	6	96	Bedford Dwellings	Middle Hill	68
420031016001	7	163	Manchester	Central Business I	67
420032904002	14	47	Bedford Dwellings	Central Business I	70
420032609001	14	173	Northview Heights	Central Business I	70

Figure 9

Bus / Car Ratio

Many of our origins are geographically close to the destinations that can offer them the most numerous opportunity occupations. Unfortunately, trips that represent only a 15-minute car ride can take as much as 7.5 times longer using the public transit bus system. One such example is the connection between McKeesport and Monroeville.

According to Google Maps, this destination is roughly a 20-minute drive by car but takes two hours on average by bus. These locations represent huge opportunities because they are already in such proximity to the opportunity employment areas. See figure 10 for bus to car ratio.

Origin	Destination	Bus / Car Ratio
McKeesport	Monroeville	7.5
Crafton Heights	Upper Hill	5.8
Bedford Dwellings	O'Hara Twp	4.9
Crafton Heights	Middle Hill	4.5
Bedford Dwellings	Robinson Twp	4.0
Homestead	Monroeville	3.6
Garfield	Green Tree	3.5
Crafton Heights	Wilmerding	3.4
Homestead	Central Business District	3.3
Bedford Dwellings	Wilmerding	3.2

Figure 10

Opportunity Occupations

Ultimately, the purpose of our study is to understand where opportunity occupations are in Allegheny County and ascertain if their locations are accessible to our populations of interest. Unfortunately, many

of these high potential jobs which do not require a college degree do not appear to be accessible to individuals who may lack a college degree. Figure 11 demonstrates this finding.

Destination	Polygon Job Count	Walkshed Job Count	% Jobs Inaccessible
South Park Twp	370	0	100.0%
Brackenridge	747	19.52	97.4%
Wilmerding	332	13.7	95.9%
Robinson Twp	2124	407.71	80.8%
O'Hara Twp	822	296.24	64.0%
Monroeville	513	367.06	28.5%

Figure 11

A few opportunity occupation zones, such as the Central Business District, received perfect scores in the opportunity occupation metric. This indicates that every opportunity occupation resided within the Port Authority's walkshed, an indicator of an accessible distance from a bus stop. In the above table, however, we see that for at least 5 of the 11 destinations with bus stops, the majority of opportunity occupations reside beyond the Port Authority's walkshed. In short, almost half of our opportunity zones cannot provide reasonable access to half of that zone's available opportunity occupations. This represents another challenge to decision-makers; even if a route exists between two pairs, are the desired jobs within a reasonable distance from those

bus stops? Our findings suggest that this may not be the case.

Finding and maintaining employment for those who are able is an essential part of someone's self-sufficiency and well-being.¹⁸ Although it is understood that DHS is not directly assisting someone in finding employment, DHS is very interested in understanding vulnerable populations' access to employment and how that impacts their overall livelihood. Below are case studies detailing immediate actions DHS can take for the specific locations detailed as well as.

Brackenridge: A Case Study

One outcome of the accessibility index was identifying opportunity employment zones in which many jobs fell outside of the Port Authority's walkshed. Brackenridge (in the blue area inside the red rectangle) was one such opportunity zone. Brackenridge is interesting because it is in a far corner of the county and adjacent to one of the selected origins of interest (Harrison Township). Although geographically close at only three miles apart, the pair has a score of zero due to low transit frequency as well as walkability. There is only very early morning service (approximately 5:00am – 7:30am), and no weekend or nighttime service. The image in figure 12 shows the existing route between Harrison Township (orange area) and Brackenridge (blue area).

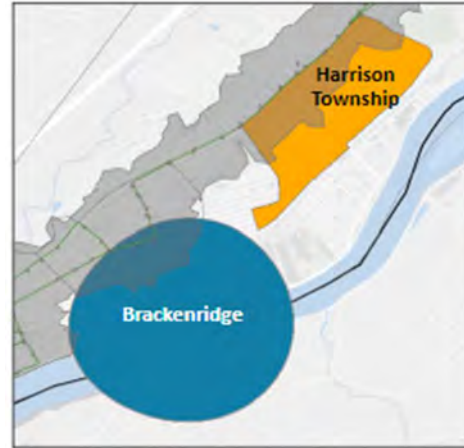


Figure 12

It is unfortunate that the area is relatively inaccessible because in Brackenridge has approximately 750 opportunity occupation jobs (primarily manufacturing) within the zone and only 20 jobs fall within the walkshed. This means that 97.4% of the opportunity occupation jobs are not accessible to someone arriving via transit.

As another point of interest, Harrison Township and Brackenridge DHS data was analyzed. It was found that approximately nine DHS clients with high school degrees travel into Brackenridge from the Pittsburgh area. There are approximately twenty-five total observations of DHS clients in the Harrison Township area. About nine people are traveling from areas south of Brackenridge and the other sixteen are coming from surrounding areas.

Few people traveled from around the county to get to Brackenridge. Initially this finding is logical in that the region is remote relative

¹⁸ Allegheny County Department of Human Services. "2016 Allegheny County DHS Local Government Case Competition Improving Systems to Help People with Barriers Gain and Sustain Employment," 2017.

<https://www.alleghenycountyanalytics.us/index.php/2017/05/05/2016-allegheny-county-dhs-local-government-case-competition-improving-systems-help-people-barriers-gain-sustain-employment/>.

to the rest of the county. However, the lack of DHS clients traveling to the area in addition to the index's identified inaccessibility led to a hypothesis that it may be transit inaccessibility that is preventing people from getting to these regions.

Robinson Township: A Case Study

An obvious solution to increasing accessibility to this region is improving the frequency of transit. However, this is an expensive solution¹⁹ that DHS does not have control over. Thus, a first-mile/last-mile solution²⁰ may improve the accessibility in this region to supplement the existing transit system. The following case study identifies an area in which many jobs fall outside of the walkshed but an existing first-mile/last-mile solution is already successfully implemented in the area, and an optimal approach to duplicate.

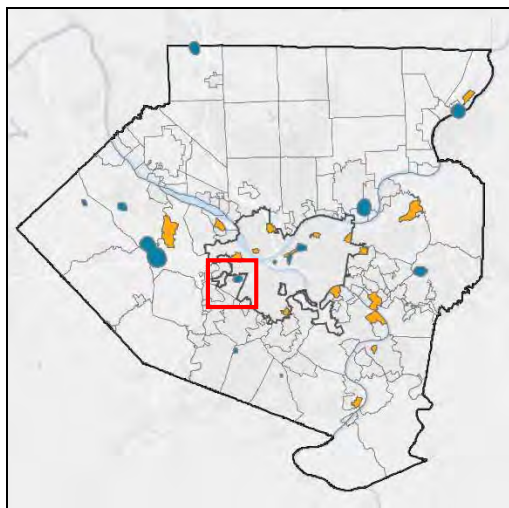


Figure 13

¹⁹ Port Authority of Allegheny County. "Annual Service Report 2017." Pittsburgh, PA: Port Authority of Allegheny County, 2018. Accessed September 22, 2019. <http://www.portauthority.org/paac/portals/0/ServiceGuidelines/2017/2017ASR.pdf>.

Robinson Township (the large blue area in the red rectangle in figure 13) was identified as an opportunity employment zone. The top industries in the area are tourism/hospitality, food service, and retail. Similar to Brackenridge, 80% of jobs were outside of the walkshed. However, as seen on the map below, there is an existing service covering these areas called RideACTA.

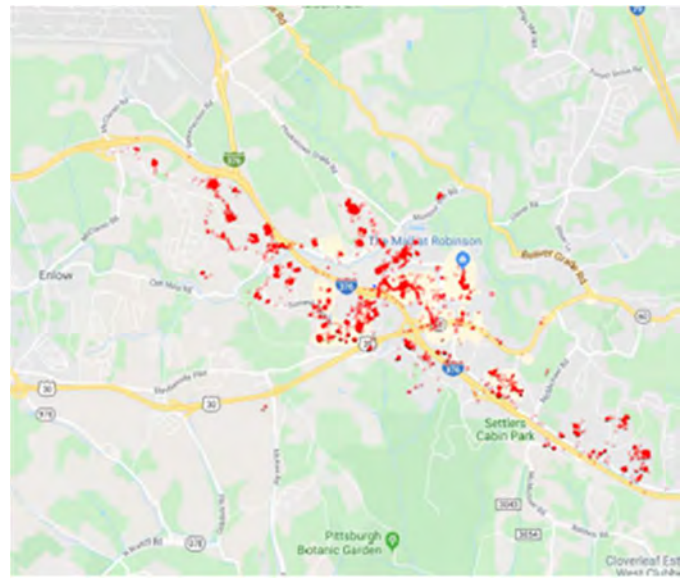


Figure 14

About RideACTA

RideACTA (ACTA) is a non-profit transportation management association started in 2009.²¹ It is a "flex-route" shuttle service that primarily serves the airport corridor. One of the core reasons for its inception was to better connect the existing

²⁰ LA Metro. "Metro First/Last Mile." LA Metro Home. Accessed December 12, 2019. <https://www.metro.net/projects/first-last/>.

²¹ Airport Corridor Transportation Association. "About ACTA." Accessed November 13, 2019. <https://actapgh.org/about-acta/>.

transit infrastructure with employment opportunities.²²

RideACTA stops

RideACTA offers membership, and members receive transportation-related information as well as the ability to contribute to conversations with RideACTA. Examples of members are those organizations within the airport corridor such as businesses and local government.²³ In order to best serve all the businesses, there are different route frequencies for different routes. The uniqueness of a small transportation service is its customizability to fit the needs of the specific region, especially when considering employment: night shifts, weekend shifts. ACTA also continues to expand routes and stops every year.²⁴ RideACTA's stops are seen in figure 14.

RideACTA Funding and Collaboration

The shuttle is funded from PA Section 1513 program.²⁵ This program supplements transportation activities, and applicants must be a transportation organization, non-profit, or government agency.²⁶ Additionally, the shuttle collects a fare of twenty-five cents per trip, but fares are cheaper for those with

disabilities, Medicare ID, children, and senior citizens.²⁷

Benefits of RideACTA and Last-mile/First-mile Solution

The 2017 – 2018 annual report stated that 292 rides are provided per day, servicing an average of 250 businesses.²⁸ There are also savings of vehicle miles traveled, gasoline, and CO₂ emissions.²⁹ Most importantly, over 80% of the riders said they would not be able to get to work if they did not have RideACTA.³⁰

Last-mile/First-mile Solution for Brackenridge or other Opportunity Employment Zones

A robust model like RideACTA may not be feasible for DHS. However, depending on DHS' desire and future plans for services, small-scale last-mile/first-mile solutions may have a large impact on opening up opportunities for geographically close areas. Additionally, these types of programs are great examples of collaboration among a variety of organizations. A partnership similar to RideACTA may allow DHS and other stakeholders to most effectively serve the populations of focus.

²² Airport Corridor Transportation Association. "Ride ACTA." Accessed November 13, 2019. <https://actapgh.org/rideacta/>.

²³ "About ACTA - Airport Corridor Transportation Association," Airport Corridor Transportation Association, accessed April 13, 2019, <https://actapgh.org/about-acta/>.

²⁴ Ibid.

²⁵ Airport Corridor Transportation Association. "RideACTA Fare Information." Accessed December 12, 2019. <https://actapgh.org/rideacta/rideacta-fare-information/>.

²⁶ Pennsylvania General Assembly. "Consolidated Statutes: Title 74: Transportation, Section 1513: Operating program." Accessed December 12, 2019. <https://www.legis.state.pa.us/cfdocs/legis/LI/consCheck.cfm?txtType=HTM&ttl=74>.

²⁷ Airport Corridor Transportation Association. "RideACTA Fare Information - Airport Corridor Transportation Association."

²⁸ Airport Corridor Transportation Association. "ACTA by the numbers: Annual Report 2017 - 2018."

²⁹ Ibid.

³⁰ Ibid.

5. Conclusion

This research utilized a variety of analyses that concluded in an index that measures transit accessibility from select origins and destinations of interest in Allegheny County. The research found that many areas, such as Brackenridge and Robinson Township, were geographically close to one another (within a few miles) but took an excessive amount of time via transit to arrive at those locations. This led to the conclusion that intentional transit considerations such as first-mile/last-mile solutions lead by the Department of Human Services may bridge these gaps in transit but with relatively low-cost and high-impact. These findings are the first step towards more robust research and developing concrete recommendations.

The following are suggestions on future use cases to advance and build off of this research within DHS with their target populations and interests; research limitations experienced that may be remedied in future renditions; and broader future research suggestions for the topic at large.

Future Use Cases

In addition to the use cases above, and influenced by conversations with DHS employees, the following are opportunities for DHS to further customize and use the tool:

1. Change the index from opportunity employment to another area of interest and measure transit access to childcare, grocery stores, or DHS services.

A common theme in stakeholder interviews was the desire to know more about access to places other than employment hubs. The index was constructed in such a way that opportunity employment factors may be removed without affecting any of the transit accessibility measures. Then, the destination and appropriate weighting metrics of any other area of interest may be inputted. This process does take some intermediate data analysis and manipulation.

2. Analyze Affordable Housing
Affordable housing is a key concern within DHS. This tool may be used to understand if people are living in accessible areas and where those participating in any of the voucher programs are living. In addition to other affordable housing research and organization knowledge, the transit accessibility information may be used to inform future decisions at DHS regarding affordable housing programming.
3. Analyze Family Support Centers
Currently, the DHS Family Support Center system is undergoing a reevaluation process. These centers provide a variety of services and seek to be more grassroots in approach to assisting families; there are multiple centers, including “lite” centers, in order to best serve clients. This index may be used in order to inform transit accessibility, including walkability and frequency of routes, from where clients are living to the current support centers. It can also inform DHS response to accessibility, such as van service options.

4. Advocate for Transit Change and Collaboration

The final and most extensive use case for the transit accessibility index is to advocate for transit change. This tool could quantify the issues different riders are facing, such as lack of routes, insufficient busses, and expensive transfers, and be another source of information for advocates and decision-makers. Although the index is not providing profound results, it is able to quantify the anecdotes that many riders and/or transportation advocates express.

Research Limitations

This project covered a wide breadth of material and data sources. To ease computation and incorporate metrics from the literature, several demarcations or assumptions were utilized. Limitations of the research are discussed below.

Future of Work

The tool captures current areas of estimated opportunity employment and does not make any projections about the future of work or if current jobs will exist beyond five years.

Relative Scoring and Geography Sampling

All scores between an origin and destination are based on how that pairing ranks relative to selected pairings in this study between 0 and 100. This project only looked at connections between identified areas of interest. Methodology would have to be replicated for different origin/destination pairs. Similarly, a high score does not necessarily reflect the greatest route pairs in Allegheny County, but rather the highest performing pairs among those we observed for this study.

Boundaries and Buffers

At several points of analysis, the project performed calculations based on membership in or outside a given boundary. A quarter-mile buffer from a bus stop means that a job or unit of area a few feet beyond that buffer will not be captured. Different definitions of a reasonable boundary would affect index scores.

Work Sites versus Business Locations

Using granular business data including business addresses allowed for a more nuanced assessment of the transit experience. However, business addresses are single points which may not correspond to where employees report to work. For example, airport-related jobs were mapped to two specific locations which scored poorly on the index because the nearest bus stops were outside the .25 mile buffer and there was no overlap with the PAAC walkshed. However, realistically airport workers are not reporting to work at only these specific locations within the airport complex.

Opportunity Occupations. This study utilized one of the latest techniques in approximating the location of opportunity employment. The team does acknowledge that estimates based on industry mix involve some error. While we have raw company and business information, exact numbers for each business are expected to deviate reasonably.

Other Methods of Transit. This study and the accessibility index only used data on Port Authority of Allegheny County busses although PAAC also operates a light rail system and two funicular lines. The Red and Blue light rail lines run through or close to some chosen origins and destinations. People could theoretically reach the Central Business District and Bethel Park zones or the Carrick origin block group via light rail.

A Snapshot in Time. This study only captures data from a specified period of time. All public or open data sources are from the years 2017 to 2019, except for U.S. Census Bureau ACS 5-year data, for which we used the 2013-2017 estimates. Based on the relative recency of each data source, we do not believe this variation invalidates our results. Nevertheless, the team recognizes that the unique combination of the various data sources complicates interpretation of our results.

Future Research

There are also several promising areas for future work.

Topography and Terrain. While the team received sidewalk data late in the analysis, additional topographical layers could be

utilized to provide even more nuanced understanding of the terrain around unique origins and destinations. Pittsburgh has a uniquely hilly topography, which could provide an initial dimension to the index. More granular information about the unique context and setting around specific bus stops could also be helpful to decision-makers, though outside the scope of this project.

First-Mile / Last-Mile Solutions. The proposed recommendations need additional information in order to be best implemented. For example, no financial feasibility or program evaluation was done for a specific location. Very specific parameters of the program would need to be decided in order to develop any sort of estimations and/or cost-benefit analysis. These specifics are heavily dependent upon DHS' desires for program expansion and specific populations they wish to serve.

Appendix

1. Methodology - Origin Selection

Identification and Processing Method

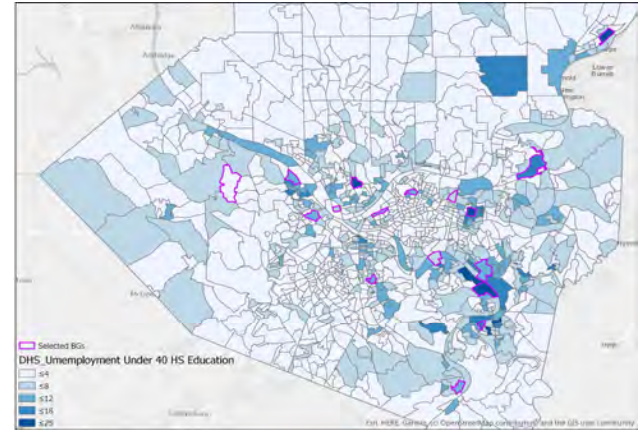
Census American FactFinder Data:

1. Identified populations of interest
 - Based on stakeholder interviews and a research review, we determined populations of interest. These included:
 - Low-income individuals
 - Individuals with low educational attainment (particularly less than a bachelor's degree)
 - Single mothers
 - Low car ownership rates
2. Downloaded data from U.S. Census Bureau American FactFinder
 - Educational Attainment For The Population 25 Years And Over³¹
 - Means of Transportation To Work by Travel Time to Work³²
 - Poverty Status in the Past 12 Months by Household Type by Age of Householder³³
 - Poverty Status in the Past 12 Months of Families by Family Type by Presence of Related Children Under 18 Years by Age of Related Children³⁴
 - Tenure by Vehicles Available³⁵
3. Processed data using R and RStudio
4. Processed data and visualized key metrics using ArcGIS:
(draft working visualization)
5. Cleaning DHS client data
6. Mapping DHS client data (summaries)

2. Analyzing DHS Client Data - Relevant visualizations:

Count - Number of DHS Clients (block group level) - if home block identified. Selected block groups also visualized.

DHS Client Data - Working-Age Individuals with High School Education Who Reported Unemployment (Under Age 40)



3. Methodology - Transit Route Analysis General Transit Specification Feed (GTFS)

Publicly available through PAAC, the GTFS, provides detailed schedule information. The dataset is delivered as a zip file containing up to 15 individual files .csv files with standardized field names and descriptions. The files delivered include:

1. Agency
2. Route
3. Trips
4. Stop_times
5. Stops
6. Transfers
7. Frequencies
8. Calendar.dates
9. Calendar
10. Shapes
11. Fare_rules
12. Fare_attributes

³¹ United States Census Bureau, Educational Attainment For The Population 25 Years And Over (B15003), (ACS 2013-2017), <https://factfinder.census.gov/> (accessed October 5, 2019)

³² United States Census Bureau, Means of Transportation To Work (B08134), (ACS 2013-2017), <https://factfinder.census.gov/> (accessed October 5, 2019)

³³ United States Census Bureau, Poverty Status in the Past 12 Months by Household Type by Age of Householder (B17017), (ACS 2013-2017), <https://factfinder.census.gov/> (accessed October 5, 2019)

³⁴ United States Census Bureau, Poverty Status in the Past 12 Months of Families by Family Type by Presence of Related Children Under 18 Years by Age of Related Children, (B17010), (ACS 2013-2017), <https://factfinder.census.gov/> (accessed October 5, 2019)

³⁵ United States Census Bureau, Tenure by Vehicles Available (B25044), (ACS 2013-2017), <https://factfinder.census.gov/> (accessed October 5, 2019)

- 13. Feed_info
- 14. Pathways (not used in PAAC)
- 15. Levels (Not used in PAAC)

APC-AVL (Acquired from PAAC 10/2019)

Real-time transit feeds acquired from PAAC spanned March 2016 through July 2019 in quarterly files.

Field Name	Short Description	Data Type
DOW	Day of week code	Integer
dir	Direction of trip along route	Integer
ROUTE	Route Code	Integer
TRIPA	Trip Number	String
BLOCK A	Block Number	Integer
VEHNO A	Vehicle Number	Integer
DAYMOYR	Day/Month/Year of run	String
STOPA	stop sequential number	Integer
QSTOP A	PAAC stop alpha numeric ID number	String
ANAME	Stop Name	String
HR	Arrival Hour	Integer
Min	Arrival Min	Integer
SEC	Arrival Sec	Integer
DHR	Departure Hour	Integer
DMIN	Departure Min	Integer
DSEC	Departure Sec	Integer
ON	Observed Number of Passengers Boarding	Integer
OFF	Observed Number of Passengers Alighting	Integer
LOAD	Number of Passengers on Bus	Integer

DLMILES	Miles travelled from last stop	Float
DLMIN	Minutes travelled from last stop	Float
DLPML S	Change in passenger miles from last stop	Float
DWTIME	Dwelling time (min)	Float
DELTA	Distance in feet from observed GPS coordinates of the record to GPS coordinates for the stop	Integer
SCHTIM	Scheduled arrival time	Integer
SCHDEV	Difference in arrival time with schedule time if a timepoint	Float
SRTIME	Scheduled run time from previous time point to current timepoint	Float
ARTIME	Actual travel time from previous time point to current timepoint	Float

4. Methodology - Opportunity Occupation Destination Zones

Identifying Opportunity Employment Using ACS Data

To identify employees of opportunity occupations, we filtered ACS PUMS data to Pennsylvania. Following this, we filtered responses to those that fit a number of criteria. We restricted respondents to those aged between 16 and 40, to capture working age population without conflating wages with natural gains due to years of experience. We removed individuals enrolled in school. Using this information, we observed the total number of jobs in the dataset associated with a specific industry. We isolated individuals who worked 50-52 weeks in the year, and for each of these weeks worked 35-60 hours per week. Finally, we restricted respondents those with less than a bachelor’s degree but made more than the median annual wage in Pennsylvania (at the time of the study, this is roughly \$59,195). With opportunity occupations defined, we then recomputed the number of opportunity jobs associated with an industry. With total industry occupation sums and opportunity occupations sum

computed, we created an industry opportunity share for each of the observed industries in the NAICS category.

Top Opportunity Occupations in Allegheny County

Top Industries for Opportunity Employment by Count for Allegheny County				
Industry Code	Total Count	Opportunity Count	Percent Opportunity	Description
23	975	196	20%	Construction
31-33	1844	163	25%	Manufacturing
44-45	1396	87	11%	Retail Trade
48-49	566	83	27%	Transportation and Warehousing
92	659	80	12%	Public Administration
62	2194	77	4%	Health Care and Social Assistance
54	1112	68	6%	Professional, Scientific, and Technical Services
22	171	54	32%	Utilities
42	426	45	11%	Wholesale Trade
52	822	40	5%	Finance and Insurance
56	480	33	7%	Administrative and Support and Waste
81	556	33	6%	Other Services
21	95	24	25%	Mining & Quarrying
51	240	24	10%	Information
72	645	17	3%	Accommodation and Food Services
61	1047	14	1%	Educational Services
53	182	10	5%	Real Estate and Rental and Leasing
11	152	6	4%	Agriculture, Forestry, Fishing and Hunting
71	192	6	3%	Arts, Entertainment, and Recreation
55	17	2	12%	Management of Companies and Enterprises

- Plot all businesses by latitude and longitude on to map of Allegheny County
- Create kernel density Raster map based on the number of opportunity occupation jobs estimated to be at each business address (based on the business's industry code) to uncover job hotspots.
 - Include .25-mile buffer around each zone to capture relevant bus stops
- Identify polygons of high opportunity employment density
 - Redefine opportunity zones based on job density center of mass
- Use Intersect to connect Zone polygons to bus stops to identify Opportunity Bus Stops for destination analysis
- Add Walkability Index layer (by census block group) to estimate ease of access to and from bus stops
 - Summarize average Walkability Index score by area of each block group contained in each Zone

5. Bruteforce Data Collection and Custom Polygon Creation with ReferenceUSA

Information about how business data was acquired from ReferenceUSA follows below.

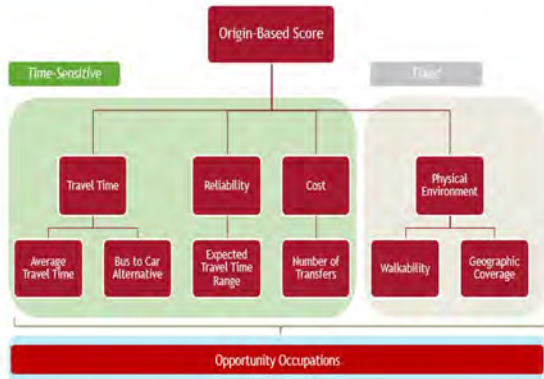
- Data Collection: From ReferenceUSA database, download every registered business in Allegheny County fitting the following criteria:
 - Under Number of Employees, select all except 1-4 and 5-9 (leaving out these very small businesses reduces the number of records returned from over 60k down to 12k)
 - Limit industry codes to
 - 11, 21, 22, 23, 31, 32, 33, 42, 44, 45, 48, 49, 51, 52, 53, 54, 55, 56, 61, 62, 71, 72, 81,92
 - Industries selected based on Method 1 results.
 - Select "Show More Options" and select "Location Only".

Steps are outlined below, although more information is available in the User Guide supplement to this project.

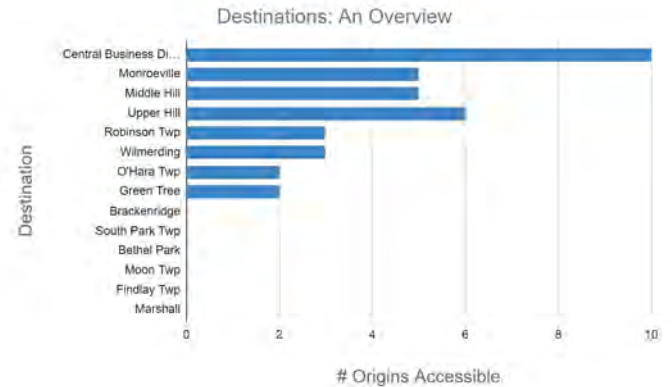
6. Neighborhood Alternative Labels

BlockGroup	Neighborhood Label	Other Associated Neighborhoods
42003490003	South Park Twp	
42003475101	Bethel Park	
42003508000	Wilmerding	
42003469000	Green Tree	East Carnegie/Oakwood, Ridgmont/Westwood
42003521200	Monroeville	
42003050100	Middle Hill	Bluff, West Oakland/Terrace Village, Crawford-Roberts, Terrace Village, Middle Hill, Bedford Dwellings
42003050600	Upper Hill	North Oakland, Bedford Dwellings, Bloomfield, Middle Hill, Polish Hill, Strip District, Lower Lawrenceville,
42003459201	Robinson Twp	North Fayette
42003421100	O'Hara Twp	Blawnox
42003451105	Moon Twp	
42003452000	Findlay Twp	
42003402000	Brackenridge	Tarentum
42003411000	Marshall	Bluff, Strip District
42003020100	Central Business District	Other Names: Golden Triangle-Civic Arena, Downtown

7. Methodology - Accessibility Index Development Community-Based Scores for Origins



Count of Destination Connections



The chart represents the process for normalizing routes based on the number of opportunity jobs at a given destination. Those values are below.

Origin Scores	
Origin Scores	Score
Crafton Heights	72.48
Bedford Dwellings	50.28
Manchester	48.01
Northview Heights	47.28
Carrick	48.58
Homestead	45.15
Stowe Twp	18.77
McKeesport	14.57
East Hills	11.41
Lincoln-Lemington-	8.95
Garfield	3.99
Robinson Twp	3.52
North Braddock	3.17
Clairton	0.00
Duquesne	0.00
Penn Hills	0.00
Hamison Twp	0.00

Single-Use Plastic in Pittsburgh

Brian Bayer

University of Pittsburgh

Single-use disposable plastics are a major threat to health and the environment, especially in cities like Pittsburgh that sit at the confluence of three major rivers. Plastic waste infiltrating marine and terrestrial ecosystems is a well-documented environmental threat, and more research has shown that the presence of photodegraded microplastics are posing a greater health risk to the public, who unknowingly consume them. Though some private businesses have independently taken action in respect to this dangerous form of pollution, a significant number of national and international municipalities have shown that local legislation could address this issue more effectively in a number of ways – including a tax, a ban, or mandated recycling programs. In June 2019, Pennsylvania Governor Tom Wolf signed a one-year ban on any legislation against single-use plastic bags until more impact studies can be performed and evaluated. Meanwhile, as the status quo (lack of) policy stagnates, the harmful effects of plastic bags in the environment are compounding. Once the ban on legislation expires in July 2020, Pittsburgh should implement a 5-cent plastic bag tax whose proceeds will benefit local environmental cleanup projects.

Introduction

The prolific presence of single-use plastics in our daily lives has become a major threat to the environment and public health. While plastics serve a vital purpose in modern life, many single-use plastics – like straws and shopping bags – are not a necessity as much as they are a convenience. There are many settings where the use of plastics, even for single use, is imperative: health care, manufacturing, and research, to name a few. Beyond these settings where disposable plastics are indispensable, their use in daily life could be drastically reduced. Since single-use plastics are designed to be thrown away, after very limited use they will either occupy space in a landfill for centuries or

escape the waste disposal process and contaminate the environment.

There are two primary risks that the disposal of single-use plastics pose: environmental and health. The environmental impact of rogue plastic making its way into terrestrial and marine ecosystems has been well documented. Newer research on microplastics – the tiny particles of plastic that are left when the sun has photodegraded larger plastic objects – suggests that plastics have made their way into even the lowest levels of the food chain, which translates to other animals, including humans, ingesting these plastics when consuming them.¹

¹ Center for Biological Diversity. n.d. 10 Facts About Single-Use Plastic Bags. <https://www.biologicaldiversity.org/programs/popula>

[tion_and_sustainability/sustainability/plastic_bag_facts.html](https://www.biologicaldiversity.org/programs/population_and_sustainability/sustainability/plastic_bag_facts.html).

The impacts of single-use plastics on human and environmental health cannot be overlooked, especially in Pittsburgh. Just 130 miles south of the largest bodies of freshwater in the world, and built on three rivers that all flow ultimately into the Mississippi and then the Gulf of Mexico, Pittsburgh should consider policies that control single-use plastics.

Status Quo: No public policies are currently in place to control, tax, or eliminate single-use plastic products in Pittsburgh or Pennsylvania.² However, it is notable that several firms – driven by standards of responsibility and the desire to improve their reputations – have independently chosen to institute their own private policies to reduce their use of single-use plastic.

Potential Policy Responses:³

- Make recycling centers, re-use programs more comprehensive and accessible; improve labeling;
- Ban single-use plastic products, especially plastic bags;
- Place a tax on single-use plastic products.

Contrary to popular belief, replacing plastic bags with paper bags is not an environmentally friendly alternative. It is true

that paper bags will biodegrade completely in terrestrial and marine environments, making them a better alternative to plastic bags if they happen to escape the waste stream and litter the natural environment. Otherwise, paper bags are less environmentally friendly than plastic bags for a couple reasons. In the production and transportation of the relatively heavier paper bags, more water is used and more CO₂ is emitted. Furthermore, in the anaerobic conditions of a landfill, even a paper bag can take centuries to decompose.⁴

The Problem with Single-Use Plastics

Environmental Hazards

The durability and longevity of plastics makes them an attractive consumer material, but it also means that no matter where they end up after disposal, they are an environmental hazard. Much plastic waste escapes the waste stream and ends up in oceans via local waterways; when the remaining plastic ends up in a landfill, it could take between decades and centuries to degrade depending on the type of plastic.⁵

Lightweight plastics like straws and grocery bags are easily carried by the wind towards the waterways, where they can float into bigger bodies of water. In coastal environments, this is how plastics make their

² National Conference of State Legislatures. 2019, April 30. State Plastic and Paper Bag Legislation. <http://www.ncsl.org/research/environment-and-natural-resources/plastic-bag-legislation.aspx>.

³ Although all single-use disposable plastics pose major environmental and health threats, this paper focuses primarily on analysis of single-use plastic bag policies in Pittsburgh; as has been the case in other cities, states, and countries, plastic bag regulation has been an origin point for further plastic

regulation and in Pittsburgh could serve as a thermometer to determine the feasibility of more aggressive policies in the future.

⁴ Rosalsky, Greg. 2019, June 19. Are Plastic Bag Bans Garbage? April 9.

<https://www.npr.org/sections/money/2019/04/09/711181385/are-plastic-bag-bans-garbage>.

⁵ WWF. 2018. The lifecycle of plastics.

<https://www.wwf.org.au/news/blogs/the-lifecycle-of-plastics#gs.m4pecd>.

way into the oceans. In inland urban centers like Pittsburgh, these watersheds lead to bigger rivers or lakes. The Pennsylvania Department of Conservation and Natural Resources identifies four major watersheds in the state: the Ohio River Basin (where Pittsburgh is located), the Erie Watershed/Great Lakes Basin, the Delaware River Basin, and the Susquehanna River Basin, in addition to several other corners of other neighboring watersheds.⁶ Watersheds are an important natural resource to protect because of the many functions they serve: supplying water for drinking, manufacturing and agriculture, recreational areas, and serving as habitats for plants and animals.⁷ If plastics contaminate the watershed, it poses grave environmental and health risks for every living creature who resides there. Even in inland cities, the storm drains - designed to manage rainwater - give plastics a direct conduit to the creeks, rivers, and ultimately the lakes and oceans, and the grates fail to filter most small plastics. In 2017 in Philadelphia, 67 tons of litter were removed from the storm water system and 12 tons of trash was cleaned out of the rivers.⁸

The environmental hazards posed by plastics in general are far-reaching and many, but the scope of this paper will focus primarily on the hazards posed by single-use disposable plastic bags. Australia's Northern Territory Environment Protection Authority outlines a few of the threats plastic bags pose to the environment:⁹

- Danger to animal life when they are mistaken for food;
- Getting trapped floating in oceanic trash vortexes;
- Costly programs to remove terrestrial litter;
- Costly recycling efforts;
- Higher greenhouse gas emissions.¹⁰

Though there is a growing movement of individuals who are doing what they can to speak on behalf of the environment and employ greener practices in their own lives, the threat posed by plastic contamination will not be sufficiently solved unless governments take decisive action. Plus, the environmental threats are just one side of the coin - on the

⁶ PA Dept. of Conservation and Natural Resources. 2014. Pennsylvania's Major River Basins. PADCNR.

⁷ The Nature Conservancy. n.d. Journey with Nature: Watersheds 101. <https://www.nature.org/en-us/about-us/where-we-work/united-states/indiana/stories-in-indiana/watersheds-101/>.

⁸ Jaramillo, Catalina. 2018, July 11. "Looking to cut plastics pollution in the ocean? Start upstream, experts say." State Impact Pennsylvania. <https://stateimpact.npr.org/pennsylvania/2018/07/11/looking-to-cut-plastics-pollution-in-the-ocean-start-upstream-experts-say/>

⁹ NT EPA. n.d. Environmental Impacts. <https://ntepa.nt.gov.au/waste-pollution/plastic-bag-ban/environmental-impacts>.

¹⁰ Note that regarding the emission of greenhouse gases, there are tradeoffs when plastic disposable bags are replaced by reusable bags. First, for the CO2 emissions resulting from the production of a "green" reusable bag to be offset by its use, the bag must be used over 100 times; also relevant is the fact that "starch-based biodegradable (or 'compostable') bags consume less than one-third of the energy to produce as plastic alternatives, but emit marginally more carbon dioxide (CO2 - a greenhouse gas) as they decompose. However, unlike single use plastic bags, biodegradable bags will completely breakdown."

other are a host of negative public health risks posed by plastics.

Health Risks

While the environmental hazards posed by plastics are clear, the health risks present less noticeably, but just as dangerously. The environmental scientists who have studied this explain that it is a question of how the plastics degrade. Unlike organic substances that decompose naturally through biodegradation, plastics degrade in a very different way; in a process known as *photodegradation*, “when exposed to sunshine, polyethylene’s polymer chains become brittle and crack, eventually turning what was a plastic bag into microscopic synthetic granules.”¹¹ These *microplastics* are consumed at the lowest levels of the food chain and could infiltrate the whole process, all the way up to human consumption. Plastics can also cause other health problems, including impaired immunity, developmental and birth defects, cancers, and reproductive issues to name a few¹².

Zooming out on the issue, plastics are not just a threat to health once they enter the waste stream - the Center for International and Environmental Law¹³ emphasizes the importance of examining the health impacts

of plastics at every stage of their lifecycle. Since plastics are petroleum-based, the extraction, manufacturing, and refining processes emit toxic fumes. Therefore, transportation of plastics via standard shipping produces harmful carbon dioxide, a greenhouse gas that traps ultraviolet heat and causes warming.¹⁴ This holistic view of the life cycle of single-use plastics highlights the many other health threats posed by their mass use.

Policy Analysis

Environmental awareness and consequent action has been growing around the world and has proven to be an issue that transcends socioeconomic constraints in terms of priority, as even some middle income and developing countries have committed to reducing their negative impact with legislation that regulates plastics. While it might not be a surprise that progressive cities like San Francisco and Seattle have taken regulatory action against the use of plastics, it is notable that Kenya, Chile, Rwanda, and India have all implemented policies – nationally or locally – to combat single-use plastic bags.¹⁵

The policies that these cities and countries have implemented can serve as case studies

¹¹ Business Ethics. 2010, September 17. Plastic Grocery Bags: How Long Until They Decompose? <http://business-ethics.com/2010/09/17/4918-plastic-grocery-bags-how-long-until-they-decompose/>.

¹² Neeti Rustagi, S. K. 2011. Public health impact of plastics: An overview. Retrieved from National Institutes of Health: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3299092/>

¹³ Center for International Environmental Law. 2019, February 19. Plastic Threatens Human Health at a

Global Scale. Retrieved from Press Room: <https://www.ciel.org/news/plasticandhealth/>

¹⁴ Warming trends lead to melting ice caps which raises sea levels, reduces freshwater resources, and can cause flooding in the highly populated coastal cities; flooding is itself a health risk but also spreads disease more easily.

¹⁵ Strand, Brynna & Kerr, Charlie Ann. 2018. 10 Cities and Countries Confronting Plastic Bag Pollution Head-On. <https://www.earthday.org/2018/04/20/10-cities-and-countries-confronting-plastic-bag-pollution-head-on/>.

of the effectiveness of each alternative policy. The most common forms of regulation are either bans or taxes on the use of disposable plastic bags. These are aggressive alternatives to the status quo in Pittsburgh, which currently has no regulations against the use of disposable plastic bags. This paper will also analyze another alternative as well, which is to institute more accessible and comprehensive recycling programs for plastic bags without explicitly banning or taxing them.

The following policies will be evaluated based on four criteria: 1) **Preservation** of the natural environment; 2) **Political feasibility**; 3) **Economic efficiency**; and 4) **Equity** (i.e. fairness) to the taxpayers, to the consumers, and to the supply chain (the producers and sellers).

When evaluating policies for regulation of single-use plastic bags, there are four stakeholder groups that should be considered separately: taxpayers, consumers (buyers), stores (sellers), producers (packagers). While there is clear overlap between these groups – for example, stores which sell plastic products also buy plastic products – this paper analyzes the policy from their perspectives independently of one another.

Status Quo

Currently, there are no policies in Pittsburgh (or Pennsylvania) explicitly regulating the use of disposable plastic bags, though the Philadelphia City Council has unanimously

voted to move forward with a bill banning all single-use plastics effective July 2, 2020, championed by Councilmember Mark Squilla. Despite the lack of legislation at the state level¹⁶, however, many grocery stores have independently decided to not offer plastic bags at the checkout counter for various reasons.

At a glance, some store policies that local retailers have implemented include discontinuing the availability of plastic bags in checkout lines, offering inexpensive bags for purchase, encouraging shoppers to carry groceries by hand or use empty cardboard shipping boxes, or even giving shoppers redeemable in-store perks for bringing and using their own reusable shopping bags.

The fact that many retailers are already taking actions demonstrates not only their own commitment to corporate social responsibility but also the fact that this issue is something that consumers value. At least among the grocery stores, it is clear that even without government intervention, there is a definite desire to address the use of disposable plastic bags in some way.

The status quo is a highly efficient economic model on the front end: stores are free to decide if they will offer plastic bags or not; if they choose to offer plastic bags to the buyers, then stores can each determine what the marginal cost of the plastic bag is to them and choose whether or not to pass that marginal cost onto the buyers by raising the prices of their products. Consumers can then

¹⁶ Jaramillo, Catalina. 2019, December 6. "Philadelphia's ban on single-use plastic bags moves toward passage into law." State Impact Pennsylvania.

<https://stateimpact.npr.org/pennsylvania/2019/12/06/philadelphias-ban-on-single-use-plastic-bags-moves-toward-passage-into-law/>.

demonstrate whether or not that marginal increase in the price of the product is worth it to them by choosing to shop at those merchants or not.

Diving deeper, however, the status quo might not be as efficient as it seems. While consumers can freely choose to shop where they please and have the choice to use plastic bags or not, there is an impact that the general population must pay for in taxes: plastic bag waste. Since plastic bags are so light and prone to escaping the waste stream, the Sierra Club¹⁷ reports that public agencies in the U.S. spend approximately 500 million USD annually to clean up litter. In California, the plastic bags that do manage to stay in the municipal waste collection system contribute to an approximately 25 million USD bill to transport them to landfills.¹⁸ Assuming that the status quo is perfectly efficient because the cost of the plastic bags is entirely negotiated between the consumers and sellers, this would fail to include the externality of the unnecessary public resources spent on cleanup of plastic bags.

In terms of equity, the status quo is also fair for all parties: consumers, producers, taxpayers, and stores. Consumers would not have to remember to bring their own reusable bags; producers and sellers would not have to change their current setup unless they were independently motivated to do so; and the taxpayers would not have to pay any additional taxes (unless the negative

externalities of plastic bags contaminating the environment – like those mentioned above – somehow led to a related health policy borne by the taxpayers).

As the status quo policy, it also has high political feasibility. Any intervention by the government – in the form of a ban or a tax – would be met with some level of resistance by the consumers, who would bear the majority of the burden of the policy alternative.

Most importantly, the status quo policy falls far short of the preservation criteria. While some retailers might choose to implement internal policies against single-use plastic bags (presumably as a way to show commitment to sustainability to their shoppers), other retailers might decide that it is not in their best interest to invest in that kind of a shift and simply continue to use the environmentally hazardous plastic bags.

Recycling Programs

In 1991, the state of Maine “became the first state to enact legislation requiring recycling efforts at retail stores. The law prevents retailers from supplying plastic bags unless they provide a convenient storefront receptacle to ensure used bags are collected and recycled.” California, Delaware, New York and Rhode Island have also instituted similar policies.¹⁹

¹⁷ The Sierra Club is an activist environmental advocacy organization.

¹⁸ Jenner, Olin. 2017, April 5. The True Costs of Single-Use Plastic Bags. <https://www.sierraclub.org/maine/blog/2017/04/true-costs-single-use-plastic-bags>.

¹⁹ National Conference of State Legislatures. 2019, April 30. State Plastic and Paper Bag Legislation. <http://www.ncsl.org/research/environment-and-natural-resources/plastic-bag-legislation.aspx>.

Among the local grocery stores that advertise recycling programs for plastic bags are Aldi²⁰, Giant Eagle²¹, and Walmart. Since recycling programs are already in place in some stores, it seems that it would be highly politically feasible to mandate these programs by regulatory policy, as evidenced by the precedent set by the other states that have enacted mandated recycling programs. It would not require consumers to pay any upfront costs for the bags (as a tax or fee would) and it would still allow consumers the convenience of having bags at checkout for their optional use.

This process however, can be costly to recycle plastic bags when considering the collection and cost-intensive sorting process.²² Plus, there are additional costs that would come with the establishment of recycling programs. The producers would have to pay the initial costs of developing the programs, which would be passed on to the consumers; the only alternative would be a state-sponsored recycling program that would also pick the pockets of the consumers who would have to pay higher taxes to support the program. For this reason, it is not a very efficient option.

No matter how it would be implemented, all consumers or taxpayers would be unfairly charged for the program, and in certain models the producers and sellers might also share that cost; since even those consumers and taxpayers who independently choose to

not use plastic bags would be charged for the establishment and maintenance of these programs, this is not a particularly equitable solution.

On the criteria of preservability, this also ranks low thanks to its low rates of participation by the consumers.²³ Most single-stream recycling centers do not accept plastic bags and they can even cause problems in the machinery, hence most times that a bag is recycled in curbside programs, it ends up in a landfill; that means that the only viable recycling programs for plastic bags are collection containers outside of certain retailers.

While these collection bins do help keep the plastic bags out of the waterways, there is not a lot that can be done once this low-grade plastic is collected, other than shipping it to a very limited number of companies that are able to turn the bags into plastic pellets that can then be used for an equally limited number of applications. Furthermore, if the bags turned in do not meet an extensive list of criteria for recycling (which they often do not), they are sent to a landfill.

Ban on Plastic Bags

City-wide bans are a more common policy approach than the subsequent policy alternative of a plastic bag tax, having been

²⁰ ALDI. 2019. Food Waste & Recovery. <https://corporate.aldi.us/en/corporate-responsibility/environment/food-waste-recovery/>.

²¹ Giant Eagle. 2020. Sustainability. <https://www.gianteagle.com/about-us/sustainability>.

²² Plastic Bag Laws. Don't be fooled - plastic bag recycling laws are not the answer. <https://www.plasticbaglaws.org/get-involved/plastic-bag-recycling>.

²³ Waste Management Northwest reports that just about one percent of the bags used are recycled.

implemented in over 300 U.S. cities and counties.²⁴

Plastic bag bans are a very efficient solution. A ban on plastic bags could result in gains by the consumer: Most rational consumers would acknowledge that when they shop at stores that offer plastic bags, they are already paying an additional fee for the bags (built into the price of their product) whether or not they as individual consumers bring their own bag. In fact, it is estimated that it actually costs U.S. retailers over 4 billion USD annually to offer “free” bags to their consumers, a cost that is surely calculated back into the retail price of the products.²⁵ A ban would allow the producers and sellers to lower their costs (much like Aldi or Sam’s Club) and possibly drive in more business.

The benefits of a plastic bag ban would be shared by all stakeholders, so this is a highly equitable plan. Transitioning to a plastic bag-free shopping experience could lower the cost of products, allowing consumers to buy more for less, benefiting the buyers and sellers; in the long term, a ban would incur virtually no cost to the consumers or vendors. Of course, policymakers must also consider that in the short term a ban might unfairly disadvantage lower income families who would be forced to either buy only what they can carry without a bag or invest in reusable bags upfront. However, because bags would

no longer be offered at all, these families would simply have to acquire reusable bags at the onset, which would save them money in the long run.

The greatest outcome of a plastic bag ban is environmental preservation. While a tax or fee on a bag paternalistically discourages people from using the bags, a ban would not give consumers the choice. Considering that a “green” reusable bag would have to be used at least an average of 100 times for it to be a more sustainable alternative to single-use plastic bags, by banning plastic bags completely, consumers would quickly reach that usage floor rather than using their “green” bags when they remember them but falling back on plastic bags if they forget.

In places where bans have been implemented, the environmental results have been positive with a significant reduction in plastic bag waste. California became the first U.S. state to implement a statewide ban in 2016, which resulted in a 72 percent drop in plastic bag litter, according to California Coastal Cleanup Day.²⁶ Inspired by these results, Governor Andrew Cuomo has enacted a plastic bag ban in the state of New York, effective March 1, 2020. This law aims to eliminate much of the waste generated from

²⁴ Nace, Trevor. 2018, September 20. Here's A List Of Every City In The US To Ban Plastic Bags, Will Your City Be Next? <https://www.forbes.com/sites/trevornace/2018/09/20/heres-a-list-of-every-city-in-the-us-to-ban-plastic-bags-will-your-city-be-next/#b1862f73243c>.

²⁵ Waste Management Northwest. Bags by the Numbers.

<http://www.wmnorthwest.com/guidelines/plasticvspaper.htm>.

²⁶ Hamblin, Abby. 2018, April 23. "New York plastic bag ban? Here's what happened after California's ban." The San Diego Union Tribune.

<https://www.sandiegouniontribune.com/opinion/sd-new-york-plastic-bag-ban-california-20180423-htmlstory.html>.

the estimated 23 billion plastic bags that New Yorkers use each year.²⁷

The major obstacle to a ban is the political feasibility. As recently as June 26, 2019, Pennsylvania Governor Tom Wolf “signed legislation barring Pennsylvania’s municipalities from taxing or banning the sale or distribution of plastic bags and other containers, wrappings and bags.” The ban will remain in place “for one year while legislative agencies study the economic and environmental impact.”²⁸

Philadelphia’s aggressive interest in single-use plastic regulation shows that there is a base of support for regulatory policies against plastic bag use, but the veto and consequent temporary embargo on plastic regulations indicates that Pennsylvania is not yet ready for such a drastic about-face in policy at the state level. Therefore it will be up to the major cities in the state to prove that there are efficient, equitable, and feasible paths to regulating plastics. Like councilmembers in Philadelphia, the Pittsburgh City Council has vehemently and unanimously denounced the state’s ban on plastic regulation.²⁹

Tax on Plastic Bags

A tax or fee on plastic bags has been a popular policy approach by many municipalities, including but not limited to: Breckenridge, CO; Boulder, CO; Washington, D.C.; Chicago, IL; Cape Elizabeth, ME; Topsham, ME; Falmouth, ME; South Portland, ME; Portland, ME; Bedford, NY; Long Beach, NY; New York City, NY; Sea Cliff, NY; and Teaneck, NJ.³⁰ The taxes are generally either 5 or 10 cents per bag and are levied against the consumers.

In the short term, this approach appears less efficient than the status quo because it would create a deadweight loss that reduces the consumer and producer surplus. However, compared to no regulation, it could realistically reduce the cost of plastic cleanup efforts in the long term. When Chicago implemented a plastic bag tax to replace their largely unsuccessful 2014 ban³¹, a 2017 study sponsored by the city and conducted by ideas42³² showed that the tax had more efficiently reduced plastic bag use – especially when cashiers asked customers if they would like to purchase the plastic bags.³³

²⁷ Barnard, Anne. 2020, February 28. "Get Ready, New York: The Plastic Bag Ban Is Starting." *The New York Times*.
<https://www.nytimes.com/2020/02/28/nyregion/new-york-state-ban-plastic-bags.html>.

²⁸ Associated Press. 2019. Pa. blocks plastic bag bans for at least a year. June 28.
<https://www.pennlive.com/news/2019/06/pa-blocks-plastic-bag-bans-for-at-least-a-year.html>.

²⁹ Bauder, Bob. 2019, June 28. "Pittsburgh council opposes state budget measure preventing local plastic bag bans." *TribLive*.
<https://triblive.com/local/pittsburgh-allegheeny/pittsburgh-council-opposes-state-budget-measure-preventing-local-plastic-bag-bans/>.

³⁰ Nace, Trevor. 2018, September 20. Here's A List Of Every City In The US To Ban Plastic Bags, Will Your City Be Next?

<https://www.forbes.com/sites/trevornace/2018/09/20/heres-a-list-of-every-city-in-the-us-to-ban-plastic-bags-will-your-city-be-next/#b1862f73243c>.

³¹ The ban was considered a failure because many stores decided to switch to less environmentally friendly alternatives, like paper bags or thicker plastic bags.

³² ideas42 describes itself as a “non-profit design and consulting firm that uses insights from the behavioral sciences to address complex social problems.”

³³ Cherone, Heather, and Patty Wetli. 2017, April 24. *Chicago's Plastic Bag Tax Is Working Big Time, Study Shows*.

If this tax can successfully nudge consumers to change their behavior and bring their own bags, then it will be highly efficient in the long run.

One report from the Department of Energy & Environment³⁴ indicates that Washington, D.C.'s 2009-10 legislation instituting a fee for plastic bag use – the first of its kind in the country at the time – returned compelling results, including “a 60 percent decrease in household bag use, 80 percent of residents using fewer disposable bags, [and] 79 percent of businesses providing fewer disposable bags to customers.”³⁵

But the United States is not alone in the successful implementation of plastic bag taxes, and in fact it is not even the progenitor of these fees: In 2002, Ireland implemented a 33-cent charge for plastic bags in checkout lanes along with an awareness campaign that drastically and rapidly shifted the culture around and attitude towards plastic bags, precipitating a 94 percent drop in plastic bag usage within weeks and almost universal acceptance within the year.³⁶ Prior to instituting the tax, plastic bags constituted five percent of the total litter in Ireland, but

after less than two years of the tax, that figure had decreased to just 0.3 percent.³⁷ With similarly powerful results at a lower tax rate, Israel's 3-cent fee on plastic bags, instated in 2017, caused bag use to plummet by 80 percent, saving the country 7,091 tons of plastic waste.³⁸

In terms of equity, policymakers should be aware of the potential consequence this could have on the buyers and sellers at the onset of this policy. In the short term, it could drive sales down if consumers buy less per trip knowing they will not have access to plastic bags at the checkout. By extension, this could affect the whole supply chain, making this an inequitable solution initially. In the long term, however, once consumers can remember to bring enough reusable bags for their typical purchases, it would likely bring sales back to their original levels.

Another short-term drawback of plastic bag taxes is their impact on lower income families who might have to pay marginally more at checkout than they would have without a bag fee; this burden might be exacerbated if the buyer needs to double-bag heavier items.³⁹ Of course, reusable bags are

<https://www.dnainfo.com/chicago/20170424/lincoln-square/were-using-42-percent-fewer-bags-since-7-cent-tax-started-city-study-says>.

³⁴ Department of Energy & Environment. 2020. Bag Law FAQs. Retrieved from DC.gov:

<https://doee.dc.gov/page/bag-law-faqs>

³⁵ Power, Lillian. n.d. "Purpose and Impact of the Bag Law." Department of Energy & Environment. <https://doee.dc.gov/service/purpose-and-impact-bag-law>.

³⁶ New York Times. 2008, February 2. "Motivated by a Tax, Irish Spurn Plastic Bags." NYT Online. <https://www.nytimes.com/2008/02/02/world/europe/02bags.html>.

³⁷ Federico-O'Murchu, Sean. 2003, August 4. Irish Take Lead with Plastic Bag Levy.

http://www.nbcnews.com/id/3070942/ns/us_news-environment/t/irish-take-lead-plastic-bag-levy/#.XRlqVuhKg2w.

³⁸ Kane, Hadar. 2018, July 19. "Israel Sees 80% Drop in Plastic Bag Consumption After 2017 Law Implementing Bag Fee." Haaretz.

<https://www.haaretz.com/israel-news/premium-israel-sees-80-drop-in-plastic-bag-consumption-after-bag-fee-1.6291136>.

³⁹ Zaretsky, Renu. 2018, September. The Case of the Plastic Bag Tax: Why don't we all carry that weight? April 4.

usually very inexpensive, and the cost of purchasing enough for weekly groceries would quickly be offset over the course of several trips to the grocery store, as long as the shopper remembers to use them rather than opting for the taxed plastic bag at checkout. Plus, reusable bags are frequently offered as giveaway items at community events. For the low-income families, a tax would be more equitable than a flat out ban, because it would offer them a chance to accumulate enough reusable bags over time by using both re-usable and plastic bags at checkout until they can completely phase out their use of plastic bags.

The most tangible benefit of this policy option is its environmental preservability and its political feasibility. Politically it is more tenable than an all-out ban as it would still give consumers the option to use plastic bags, albeit at their own marginal expense. But it would at the same time discourage consumers from using plastic bags and push them towards more eco-friendly options like reusable bags, which would help people feel more comfortable choosing the more sustainable option for themselves.⁴⁰ This also could function as a way to prepare the city's population for more comprehensive plastic regulation in the future.

For these reasons, a plastic bag tax should be analyzed in both the long and short term to determine its efficacy. In the short term, it does create a deadweight loss, though the magnitude of the deadweight loss depends on

the size of the tax and the price elasticities of supply and demand. Thus, if the tax is low and the supply and demand are relatively inelastic, the deadweight loss may be low. Plus, the tax revenue raised would be re-invested in environmental efforts that could benefit the health of the whole community. It could put a temporary strain on lower income families, but this could quickly be resolved with minimal planning and investment. In the long term, the efficiency and equity would return close to their status quo equilibrium once consumers adapt to the tax. The most compelling part of this policy option is the potential positive environmental impact it could have. In so many cities and countries where tax policies have been implemented, the persuasive power of the tax has been enough impetus to significantly reduce single-use plastics in those areas.

Policy Recommendation

Although certain retailers in Pennsylvania have independently chosen not to offer plastic bags and many consumers are independently making the switch to more environmentally sustainable options, it is not a reasonable expectation that all consumers will make environmentally sustainable decisions. Therefore, there must be some level of regulation if change is to happen at a large enough scale.

Plastic bag bans have proven to be effective and feasible policy options in certain cities, states, and countries and they are certainly the

<https://www.taxpolicycenter.org/taxvox/case-plastic-bag-tax-why-dont-we-all-carry-weight>.

⁴⁰ Homonoff, Tatiana, Lee-Sien Kao, and Christina Seybolt. 2018. *Skipping The Bag*.

https://urbanlabs.uchicago.edu/attachments/a2bdfd83de8279fa83d9b2ab2d7fd38c926e3ab6/store/3a763ff7774ea3a6547be38d253c958248bcfb0573c436cc5409d4b82f69/142-1033_BagTaxPaper_final.pdf.

most comprehensive form of regulation to limit waste caused from single-use plastic bags. Unfortunately, as we have seen over the past year in the form of resistance to regulation of single-use plastics across the state of Pennsylvania, this is not politically realistic in the short term at the state level. However, a city like Pittsburgh seems perfectly poised to take action, and the most realistic action they can and should take is a tax on plastic bags. This will still allow consumers to choose plastic bags, but it puts the cost on them, causing them to consider more carefully whether or not it is necessary. Where fees for bags have been instated, the environmental results in litter and waste reduction present strong cases for this policy option.

The plastic bag tax established in Washington, D.C. would serve as an excellent framework for a similar policy in Pittsburgh. In Washington, D.C., there is a 5-cent fee charged per disposable plastic and paper bag. As the District of Columbia's Department of Energy & Environment (DOEE) explains: "The business retains 1 cent (or 2 cents if it offers a rebate when customers bring their own bag), and the remaining 3 or 4 cents goes to the Anacostia River Clean Up and Protection Fund." The Anacostia River Clean Up and Protection Fund is managed by the DOEE and uses the

money to "implement watershed education programs, stream restoration, trash collection projects, and to purchase and distribute reusable bags."⁴¹

In Pittsburgh, a 5-cent tax would also be suitable - even if a consumer were to use 20 plastic bags at checkout, this would only add a dollar to their total price; but if the consumer does not switch to reusable bags for future visits, the cost could quickly add up. Even so, the proceeds of this tax could go towards environmental initiatives that would benefit local ecosystems, similar to the Anacostia fund in D.C. This policy could dovetail with Pittsburgh Mayor Bill Peduto's OnePGH development plan, which he said will cost about 4 billion USD and will feature 47 projects that align with 17 of the United Nations' Sustainable Development Goals.⁴²

In terms of policy implementation, there will always be friction from the general public when shifting the status quo, and social media can amplify public resistance (or at least the feeling of public resistance); wherever plastic bag policies in any form have been implemented there have been voices of dissent. Nevertheless, plastic bag regulations have proven themselves over and over again – they do not weigh down the economy or the market and they do net overwhelmingly positive results for the environment.⁴³ A plastic bag tax would be

⁴¹ Department of Energy & Environment. 2020. The Anacostia River Clean Up and Protection Fund. Retrieved from DC.gov: <https://doee.dc.gov/service/anacostia-river-clean-and-protection-fund>

⁴² Bauder, B. 2019, October 4. Pittsburgh adopts United Nations Sustainable Development Goals. Retrieved from TribLive: <https://triblive.com/local/pittsburgh->

[allegheeny/pittsburgh-adopts-united-nations-sustainable-development-goals/](https://triblive.com/local/pittsburgh-allegheeny/pittsburgh-adopts-united-nations-sustainable-development-goals/)

⁴³ Quirk, Kendall. 2017, November 27. "A Nationwide Plastic Bag Tax and the US Economy." William & Mary Policy Review. <https://www.wmpolicyreview.com/energy-environment/2017/11/27/a-nationwide-plastic-bag-tax-and-the-us-economy>

politically feasible, socially equitable, economically efficient, and environmentally sustainable for the city of Pittsburgh.

Conclusion

Single-use plastics indisputably pose major environmental threats that lead to health hazards for the entire food chain, including humans. In the few decades since plastic bags have become a part of the consumer shopping experience, their negative impact has grown in tandem with their rising production and use. As a major metropolitan area with three rivers that flow ultimately into the Mississippi River and one of the largest bodies of freshwater just north, Pittsburgh is a prime candidate for plastic regulation.

Legislation passed in June 2019 has effectively prohibited any bans or taxes from being levied against the use of plastic bags until July 2020, but in the areas where plastic bag policies have been implemented, the positive effect on the environment is clear.

Recycling programs are not an effective way to manage single-use plastic bags and the status quo is not sustainable, so the only question is whether a ban or a tax would be more politically feasible. The ban would provide the best outcome for preservation, but a tax (which still has fair preservation outcomes) would be more feasible to implement as only those who use a bag would bear the cost and those who do not want to pay the tax could choose to bring their own bag. Additionally, a tax could be a behavior control mechanism that helps prepare the public for a complete ban at a later point. Once Pennsylvania's ban on plastic

regulation expires in July 2020, Pittsburgh must implement a 5-cent tax on plastic bags at all retailers to benefit environmental initiatives.

Analysis of the Proposed Lifelong Learning and Training Account Act of 2018

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Introduction

The Lifelong Learning and Training Account Act of 2018 (LLTA) is a bill proposed to amend the U.S. Internal Revenue Code to establish a training incentive program. When Senators Mark Warner (D-VA) and Chris Coons (D-DE) introduced it to the Senate,¹ Senator Warner’s office published a press release describing the intent and general structure of the program.² Congresswoman Suzan DelBene (D-WA 1st District) introduced the same bill to the House of Representatives later that year with another, similar press release.^{3, 4} Based on the press releases, this whitepaper interprets the direct targets or the intended beneficiaries of the program to be “low- and moderate-income workers.”⁵ Based on our qualitative analysis of the legislative text and our quantitative research and analysis of publicly available data, this whitepaper disaggregated the expected impact of the bill by income level to assess the claims made in the press releases. Specifically, the whitepaper makes two key contributions for Congress to consider: (1) the legislation will likely unintentionally subsidize those who already pay for and consume training opportunities; and (2) a subset of the eligible population will be structurally prohibited from

participating due to the “cash up front” provision.

First, we assert that if enacted, the bill will likely attract participation from a relatively young, highly-educated demographic who already consume retraining. Analysis of federal survey data show that there already exists a group of people who take up retraining in the absence of the incentives proposed under this bill. Second, we assert that if enacted, the bill will have limited impact on low-income Americans due to the bill’s “cash-up front” provisions. Broadly, participation in the program is predicated upon the ability of workers to save. Our observations of financial habits in the US show that low-income earners are not accumulating significant savings. Therefore, the benefits of the program may not effectively incentivize eligible individuals to save up and pay for training.

There are several key terms that we will reference throughout the paper. Broadly, lifelong learning accounts are referred to as various worker-owned, post-tax savings account models intended for worker training. We will refer to the LLTA as “the bill”. The “press release” or “LLTA press release” refers to

¹ U.S. Congress, Senate, Lifelong Learning and Training Account Act of 2018, S.6, 115th Cong., 2nd sess., introduced in Senate, November 26, 2018, <https://www.congress.gov/bill/115th-congress/senate-bill/6>

² Warner & Coons to Introduce Bill to Promote Lifelong Learning & Worker Training. 2018. <https://www.warner.senate.gov/public/index.cfm/2018/11/warner-coons-to-introduce-bill-to-promote-lifelong-learning-worker-training>

³ DelBene and Sewell Introduce Legislation Establishing Worker Access to Lifelong Learning and

Training, 2018. <https://delbene.house.gov/news/documentsingle.aspx?DocumentID=2409>

⁴ U.S. Congress, House, Lifelong Learning and Training Account Act of 2018, HR 7235, 115th Cong., 2nd sess., introduced in House, December 10, 2018, <https://www.congress.gov/bill/115th-congress/house-bill/7235>

⁵ Warner & Coons to Introduce Bill to Promote Lifelong Learning & Worker Training. 2018. <https://www.warner.senate.gov/public/index.cfm/2018/11/warner-coons-to-introduce-bill-to-promote-lifelong-learning-worker-training>

Senator Warner's press release as cited, unless otherwise noted. In the absence of a direct quantitative definition of "low- and moderate-income" individuals referenced in the press release, this whitepaper will use the standards of the Survey of Household Economics and Decision-making (SHED) to define "low" and "moderate" income.⁶ The terms "retraining" and "training" are used interchangeably without specification of whether an individual is continuing additional training within an industry or training outside of an industry.

This paper is divided into two parts. Part One is a discussion of LLTA. It includes three sub-sections: (1.1) Legislative and historical context, (1.2) Mechanical summary of the LLTA structure, and (1.3) Preliminary observations. Part Two is the analysis of the demographic profile of likely participants. Sub-sections of Part Two include: (2.1) Current retraining policy participant profiles, (2.2) Study of retraining behavior of potential LLTA participants, and (2.3) Financial health analysis based on Income.

Part 1. Legislative Context and Lifelong Learning and Training Account Act of 2018

1.1 Legislative and Historical Context of Lifelong Learning and Training Account Act

Lifelong learning accounts is one type of model used to address the barriers to training

throughout a worker's career lifecycle. The strategy aims to promote joint responsibility for worker education and training among the various beneficiaries, by pooling contributions from the participant, the employer (optional), and the government.⁷ Historically, many bipartisan proposals for establishing lifelong learning accounts have been presented in the Congress. In the Senate, Lifelong Learning Accounts Acts were proposed in 2007, whereas similar bills were introduced in the House in 2008 and 2010. Each time, the bills failed to pass the committees they were referred to. This legislative history is outlined in Appendix A.

The Lifelong Learning and Training Account Act of 2018 (LLTA), which is the focus of our study, is very similar in structure to the historic lifelong learning acts aforementioned. The most recent bills for LLTA were introduced to the Senate and the House on two separate occasions. On November 26, 2018, Democrat Senator Mark Warner introduced the bill to the Senate.⁸ December 10, 2018, Democrat Congresswoman Suzan DelBene introduced the same bill to the House.⁹ At time of writing, the latest action this bill took place on February 25, 2019 when it was "read twice and referred to the Committee on Finance."¹⁰

⁶ "Report on the Economic Well-Being of U.S. Households in 2018." Board of Governors of the Federal Reserve System, Federal Reserve Board, May 2019. <https://www.federalreserve.gov/publications/files/2018-report-economic-well-being-us-households-201905.pdf>

⁷ "Lifelong Learning and Training Accounts: Helping Workers Adapt and Succeed in a Changing Economy." The Aspen Institute, May 29, 2018. <https://www.aspeninstitute.org/publications/lifelong-learning-and-training-accounts-2018/>.

⁸ U.S. Congress, Senate, Lifelong Learning and Training Account Act of 2018, S.6, 115th Cong., 2nd

sess., introduced in Senate, November 26, 2018, <https://www.congress.gov/bill/115th-congress/senate-bill/6>

⁹ U.S. Congress, House, Lifelong Learning and Training Account Act of 2018, HR 7235, 115th Cong., 2nd sess., introduced in House, December 10, 2018, <https://www.congress.gov/bill/115th-congress/house-bill/7235>

¹⁰ U.S. Congress, House, Lifelong Learning and Training Account Act of 2018, HR 7235, 115th Cong., 2nd sess., introduced in House, December 10, 2018, <https://www.congress.gov/bill/115th-congress/house-bill/7235>

1.2 The Mechanics of the LLTA

The Lifelong Learning and Training Account Act of 2018 proposes an entitlement program where individuals who meet the program eligibility would qualify for benefits, without restriction of a federal budgetary cap.^{11, 12} The eligibility criteria includes those between the ages of 24 and 57 years old, who earn under \$82,000 a year as a single adult or \$164,000 a year as a married couple.¹³ This whitepaper acknowledges that the press release from Senator Warner’s office describes the eligibility to be “workers aged 25 to 60,”¹⁴ which differs from the explicit age criteria to receive benefits as set by the bill’s language and may cause confusion. *Table 1* may be referred for a better understanding of the eligibility restrictions.

This whitepaper aims to clarify further how this program would be structured through four key provisions, including those mechanisms not clearly explained in the press releases. The term “contribution” will mean cash amounts that are deposited by or on behalf of the individual account holder, whereas the term “matched funds” will refer to

government-sourced funds received by individuals in their accounts.

Table 1. Matched Funds and Eligibility Criteria by Income for Single Individuals

Matched Funds	Single Contribution ¹⁵
Dollar-for-dollar match up to \$1,000	\$0 to \$72,000
Gradual phase-out ¹⁶	\$72,000 to \$82,000
\$0	over \$82,000

1.2.1 Cash up front

First, what can be summarized as the “cash up front” provision requires eligible individuals to deposit their own money in order to trigger the matched funds benefit. Specifically, the bill states that account owners or someone on their behalf may deposit post-tax dollars up to a cumulative \$2,000 per year. Dollar-for-dollar matching funds of up to \$1,000 a year would be available for single individuals earning less than \$72,000 or married couples earning less than \$144,000

¹¹ DelBene and Sewell Introduce Legislation Establishing Worker Access to Lifelong Learning and Training, 2018. <https://delbene.house.gov/news/documentsingle.aspx?DocumentID=2409>

¹² Warner & Coons to Introduce Bill to Promote Lifelong Learning & Worker Training, 2018. <https://www.warner.senate.gov/public/index.cfm/2018/11/warner-coons-to-introduce-bill-to-promote-lifelong-learning-worker-training>

¹³ U.S. Congress, House, Lifelong Learning and Training Account Act of 2018, HR 7235, 115th Cong., 2nd sess., introduced in House, December 10, 2018, <https://www.congress.gov/bill/115th-congress/house-bill/7235>

¹⁴ Warner & Coons to Introduce Bill to Promote Lifelong Learning & Worker Training, 2018. <https://www.warner.senate.gov/public/index.cfm/2018/11/warner-coons-to-introduce-bill-to-promote-lifelong-learning-worker-training>

¹⁵ For married couples filing jointly, double every value in the table. The gradual phase-out calculation is further explained for both single and married couples in footnote 14.

¹⁶ Gradual phase-out of matched funds is calculated using the following method. Total benefit from the government is reduced by the following proportion: (AGI or EI - \$72,000)/\$10,000 for single individuals and (AGI - or EI \$144,000)/\$20,000 for married couples filing jointly. For example, if a single participant contributes \$1,000 whose Annual Gross Income or Earned Income is \$81,500, the participant faces a phase-out calculation. The government benefit will be reduced by $(\$81,500 - \$72,000)/\$10,000$ which is 95%, resulting in matched funds of $(100\% - 95\%) * \$1,000$ which is \$50.

annually. For those earning more, matching of funds will be progressively phased out to zero percent at \$82,000 annual income for single individuals or \$164,000 for married couples.¹⁷ The Department of Treasury would be responsible for depositing the matched funds.

1.2.2 Use it or lose it

Second, what we call the “use it or lose it” provision states that individuals would be able to use the matched funds until December 31 of the applicable calendar year. If unused, the matched funds will be reduced to \$0 on January 1 of the following year. The individuals’ contributions will still remain. In addition to this restriction, the total balance on the account may never exceed \$15,000.¹⁸ Structurally, these details deter the accumulation of material assets and encourage individuals to spend on training expenses.

1.2.3 Skin in the game

Third, the disbursement calculation includes what this whitepaper will name the “skin in the game” provision. It states that for the total qualified expense, up to half of that amount will be drawn from the matched funds, if available. The remaining balance is drawn from the individual contribution. For example, if a training program costs \$1,000 and an individual has enough in the account, \$500 of the contribution will be spent down and an additional \$500 from the matched funds will be spent.¹⁹ This provision precludes the possibility of an individual spending only the government matched funds, rather than

spending contributions in conjunction with matched funds.

1.2.4 Qualify or forfeit

Fourth, the “qualify or forfeit” provision states that the individual may use the matched funds for qualified expenses only. Qualified expenses broadly cover tuition and materials and may be either reimbursed to the individual with proper documentation and reporting or disbursed directly to the training provider. The individual may use contributed amounts for non-qualifying expenses. In this case, the individual forfeits the matched funds by a dollar-for-dollar reduction of the matched funds (H.R.7235).²⁰ For a line-by-line analysis of these four high-level provisions as well as others that structure the proposed program, see Appendix B.

1.3 Preliminary Observations

The language of the press release seems to indicate a fundamental assumption: the eligible population has money to invest in retraining and needs to be financially incentivized to participate. Senator Warner’s office described this program as one that would “incentivize” in the 2018 press release.²¹ An incentive structure assumes that the targeted population has the resources but are unwilling to take up training at the current cost. This assumption is also structurally embedded in the bill, as materialized by the “cash up front” provision that triggers the matched funds benefit. If this assumption does not hold, then there will be a subset of the population that is

¹⁷ U.S. Congress, House, Lifelong Learning and Training Account Act of 2018, HR 7235, 115th Cong., 2nd sess., introduced in House, December 10, 2018, <https://www.congress.gov/bill/115th-congress/house-bill/7235>

¹⁸ Ibid.

¹⁹ Ibid.

²⁰ Ibid.

²¹ Warner & Coons to Introduce Bill to Promote Lifelong Learning & Worker Training, 2018. <https://www.warner.senate.gov/public/index.cfm/2018/11/warner-coons-to-introduce-bill-to-promote-lifelong-learning-worker-training>

excluded from benefitting due to financial constraints.

Furthermore, the press release does not quantitatively define the financial boundaries between the “low- and moderate-income” individuals and treats the eligible population as a largely homogenous group. The bill itself extends the income eligibility of single individuals up to \$82,000 with a gradual eligibility phase-out for those earning above \$72,000; these maximum thresholds are doubled for married couples. To understand the expected impact of this bill across the eligible population, disaggregation of impact by tighter bands of income level is necessary. Again, this disaggregation approach is particularly needed given that the mechanism triggering the benefit (matched funds) is a financial one: the “cash up front” provision. If this bill is enacted, lawmakers will likely see a varied distribution of participants and benefits across the eligible group at large.

Part 2: Analysis of Participant Demographics

In order to understand the demographic profile of an average LLTA participant, we took three approaches. First, we examined the demographics of participants in current retraining programs. By understanding differences in policy structure between the LLTA and current retraining policies, First, we examined the demographics of participants in current retraining programs. Next, we analyzed who is currently training in the US without government assistance. By understanding

this population, we learn who is likely to directly benefit from the LLTA. Last, we evaluate financial health by income status. This evaluation allows us to understand the appropriateness of a “skin in the game” policy for those who have less expendable income.

2.1 Current Federal Training Programs and Understanding of their Participant Profile

The economic environment has driven the necessity for retraining programs over the years. Examples include the Trade Adjustment Assistance Program (TAA) and the Individual Training Account (ITA) voucher system. When policymakers were concerned about manufacturing production jobs being lost to new global trade agreements in the 1960’s and 1970’s, the Trade Adjustment Assistance program was introduced.²² As the emergence of a skills gap became increasingly apparent in the 1990’s, retraining programs were expanded. This expansion included the Individual Training Account, which was introduced in Title I of the Workforce Investment Act (WIA) of 1998.²³ Today, we see an exacerbation of the skills gap in the current economy.²⁴ As technology continues to shape job availability, the types of people who are interested in retraining programs may also change.

2.1.1 Brief Overview of TAA

The Trade Adjustment Assistance (TAA) for Workers Program was originally introduced under the Trade Expansion Act of 1962.²⁵ The purpose of the program is to provide aid

²² “Special Message to the Congress on Foreign Trade Policy.” The American Presidency Project, January 25, 1962. <https://www.presidency.ucsb.edu/documents/special-message-the-congress-foreign-trade-policy>.

²³ “Individual Training Account.” Individual Training Account (ITA). Accessed December 14, 2019. http://help.workworldapp.com/wwwwebhelp/individual_training_account_ita_.htm.

²⁴ “Lifelong Learning and Training Accounts: Helping Workers Adapt and Succeed in a Changing Economy.” The Aspen Institute, May 29, 2018. <https://www.aspeninstitute.org/publications/lifelong-learning-and-training-accounts-2018/>.

²⁵ Trade Expansion Act of 1962. Accessed November 19, 2019. <https://www.govinfo.gov/content/pkg/STATUTE-76/pdf/STATUTE-76-Pg872.pdf>.

to workers who have lost employment, or experienced reduced wages as a result of increased global trade and imports. The program includes compensated training, extended unemployment insurance benefits, and job seeking assistance.²⁶

The Trade Adjustment Assistance for Workers Program FY 2018 Report relays demographic information of its 2018 participants.²⁷ Aggregate information on age, education, and industry of participants is provided. The median age of TAA participants was 52. About 38 percent of participants in 2018 were 50-59 years old, 23 percent of these participants were 40 to 49 years old, 17 percent were 30 to 39 years old, and only 9 percent were younger than 30 years old.²⁸ The highest participation and graduation rate from 2018 TAA-sponsored retraining (47.1 percent) came from those who had a high school degree or less prior to taking the training. Only 9.7 percent of the participants had a bachelor's degree or higher prior to enrolling in TAA. The manufacturing industry reflected the highest participation rate at 35 percent. The four industries that followed manufacturing were: administration, waste management, and remediation (12 percent), healthcare and social assistance (8.1 percent), retail trade (5.4 percent), and wholesale trade (5 percent).

2.1.2 Brief Overview of Individual Training Accounts

Individual Training Accounts were introduced in 1998 as part of the Workforce Investment Act (WIA) of 1998 to assist individuals in funding occupational training activities.²⁹ Each state has great flexibility to decide on the specific structure of ITA services and eligibility.³⁰ For example, a state can only allocate training funds to occupations they deem “in demand” or determine specific categories of customers who have priority to receive an ITA voucher.

According to Mathematica Policy Research, the characteristics of the ITA experiment's participants across the three models were similar in terms of earnings, age, and level of education (see Appendix C). First, the participants' earnings in the year prior to receiving retraining under the three models, on average, were \$20,696. Second, the average age for individuals across all three models was 41 years old. Third, the majority of the participants had at least a high school diploma or GED. Lastly, while information on occupation prior to retraining was not mentioned in the paper, the authors found that the majority of the people who chose to retrain across all three models were training for specific occupation types, such as computer and mathematical, health care support, and office and administrative support.³¹

²⁶ "Trade Adjustment Assistance for Workers Program: FY 2018 Annual Report." Employment and Training Administration, Department of Labor. <https://www.doleta.gov/tradeact/docs/AnnualReport18.pdf>.

²⁷ Ibid.

²⁸ Perez-Johnson, Irma, Quinn Moore, and Robert Santillano. "Improving the Effectiveness of Individual Training Accounts: Long-Term Findings from an Experimental Evaluation of Three Service Delivery Models." Mathematica Policy Research, Inc., October 2011. https://wdr.doleta.gov/research/FullText_Documents/ETAOP_2012_06.pdf.

²⁹ "Workforce Investment Act." Association for Career and Technical Education. Accessed October 10, 2019. <https://www.acteonline.org/workforce-investment-act/>.

³⁰ Perez-Johnson, Irma, Quinn Moore, and Robert Santillano. "Improving the Effectiveness of Individual Training Accounts: Long-Term Findings from an Experimental Evaluation of Three Service Delivery Models." Mathematica Policy Research, Inc., October 2011. https://wdr.doleta.gov/research/FullText_Documents/ETAOP_2012_06.pdf.

³¹ Ibid.

2.1.3 Key Takeaways: Side by Side Comparison of LLTA, ITA, and TAA

This whitepaper already explored participant profiles of individuals in the TAA and ITA programs. We believe programmatic differences between these two current policies and

the LLTA are likely to make LLTA more appealing to a different demographic group. Specifically, there are four key structural programmatic differences: Financial Barrier to Entry, Benefit Type, Additional Services, and Eligibility. The table below summarizes these differences.

Table 2. Comparison of LLTA and Current Policies by Key Features

	LLTA	Current Policies: TAA and ITA
Financial Barrier to Entry	Yes	None
Benefit Type	Contribution match	Vouchers for training
Extra Services	None	Counseling and unemployment insurance extension
Eligibility	Broad	Strict

In the following paragraphs, the phrase “current policies” refer to TAA and ITA.

Financial Barrier to Entry: Current policies do not require any financial contribution from the participant. The LLTA requires the participant to deposit their own money, or money contributed on the participant’s behalf, to be deposited into a savings account in order to participate in the program. This feature will make those who have very little excess cash less able to participate.

Benefit Type: In a similar vein, the benefit type is also quite different between the LLTA and current policies. In the LLTA program, the size of benefit received is in direct proportion to the amount the participant is able to contribute to the savings account. For example, an individual's benefit would only be equal to the size of their contribution and is

limited to \$1,000 per year. TAA and ITA, on the other hand, provide richer benefits by either paying all costs for retraining or providing retraining vouchers valued up to \$5,000.

Additional Services: The LLTA does not offer any additional services to assist participants with selecting retraining programs. This may be undesirable as it places a burden on the individual to understand what type of retraining is most effective. This is also an area where TAA and ITA offer richer benefits. These programs offer additional services ranging from guidance counseling, extensions to receive unemployment benefits, and access to studies on the local economy.

Eligibility: The last key difference is eligibility requirements. While both TAA and ITA offer richer benefits to assist workers in retraining both also have stricter eligibility requirements. A participant cannot access

TAA without their previous employment being deemed lost to international trade. This can be a complex process. The ITA eligibility requirement changes by state and region and can be limited to a finite amount of training programs depending on what is deemed as a growing field in the area. In contrast, the LLTA offers eligibility to all citizens between the ages of 25 and 57 earning less than \$82,000. Abiding by the American Community Survey data provided through the US Census, roughly 50 percent of US Households meet these criteria.³²

These differences are significant because the likely LLTA participant will have the following characteristics: they will have expendable liquid assets and actionable knowledge of the current training market.

2.2 Study of Retraining Behavior of Potential LLTA Participants

2.2.1 Data on Retraining in 2013-2018 from Current Population Survey

To better understand who would be willing to retrain under LLTA, we look at who is currently retraining voluntarily. We use data from the IPUMS Current Population Survey (CPS) for the period 2013-2018, which is a monthly U.S. household survey administered to over 65,000 households.³³ The survey is widely used amongst researchers and serves as the basis for federal unemployment statistics.³⁴ An Education Supplement to IPUMS-

CPS includes a variable recording participation in “any business, vocational, technical, secretarial, trade, or correspondence courses,”³⁵ other than on-the-job and college training. This is our response variable.³⁶ We argue that if people retrain in the absence of the proposed incentive program, they will also retrain when offered a matching fund. Two plausible assumptions support this argument: (1) retraining is a normal good, and (2) introduction of LLTA would not result in a drastic change in demand and supply of training.

While this data may provide insight on who is already consuming training at current costs, there are some limitations. Because respondents are funding retraining themselves, this survey only captures those who are interested in retraining *and* paying for it; it does not provide information on those who are interested in retraining, yet are constrained due to costs. Consequently, we do not infer conclusions for those who currently do not retrain on their own.

The response variable has 332,369 observations with 327,163 ‘No’ entries for voluntary retraining and only 5,206 ‘Yes’ entries. We rename them as ‘Group 1’ and ‘Group 2’ respectively. Hence, we can say that the overall interest in retraining occurs at a low percentage of observations, less than two percent. However, differences can be seen between the two groups when we look at within-group means for various characteristics. Table 3

³² “U.S. Census Bureau, 2012 American Community Survey, Table: AGE OF HOUSEHOLDER BY HOUSEHOLD INCOME IN THE PAST 12 MONTHS (IN 2017 INFLATION-ADJUSTED DOLLARS), TableID: B19037.” Washington, D.C., 2017

³³ “What Is IPUMS CPS?”, IPUMS CPS. Accessed December 14, 2019. <https://cps.ipums.org/cps/intro.shtml>.

³⁴ *Ibid.*

³⁵ The text of the survey question is “Excluding / Excluding regular college courses and on-the-job training, (are/is) (you/name) taking any business, vocational, technical, secretarial, trade, or correspondence courses?”

³⁶ In this analysis we focus on those who responded, including any allocated information the IPUMS determined should the information be missing or illegible. We trust the IPUMS allocation process and wanted to use as much data as possible in the regression analysis for more robust results.

provides a summary of some of these characteristics. This table presents the mean and standard errors for select variables and their corresponding subcategories

Table 3. Summary Statistics of characteristics within ‘Yes’ and ‘No’ subgroups of the Response Variable

	Those who responded ‘No’ for retraining ³⁷ , Group (1) Mean (SE)	Those who responded ‘Yes’ for retraining, Group (2) Mean (SE)
Age	40.36 (0.0072)	37.75 (0.0168)
Female	0.5175 (0.0009)	0.5499 (0.0069)
Is married	0.5642 (0.0009)	0.4987 (0.0069)
Is black	0.1207 (0.0006)	0.1494 (0.0052)
Lives in a metro	0.8203 (0.0007)	0.8487 (0.0050)
Education level		
- Less than High School	0.0880 (0.0005)	0.0380 (0.0027)
- Equal to High School	0.2767 (0.0008)	0.1825 (0.0054)
- More than High School	0.6354 (0.0008)	0.7795 (0.0057)
Occupation		
- Transport	0.0606 (0.0005)	0.0347 (0.0028)
- Agriculture	0.0081 (0.0002)	0.0021 (0.0007)
- Financial Specialist	0.0241 (0.0003)	0.0333 (0.0028)
- Computer Science & Math	0.0118 (0.0002)	0.0183 (0.0021)
- Healthcare	0.0883 (0.0006)	0.1245 (0.0051)
- Social Services	0.0965 (0.0006)	0.1200 (0.0050)
- Protective Services	0.0217 (0.0003)	0.0302 (0.0026)
- Personal & Food Services	0.1201 (0.0006)	0.1190 (0.0050)
- Construction	0.0593 (0.0005)	0.0568 (0.0036)
- Maintenance	0.0354 (0.0004)	0.0366 (0.0029)

From this table, we see that Group 2 has characteristics defined by a relatively younger population, and a higher number of females, blacks, and metro-residents, compared to Group 1. We also see that a highly-educated population (more than high school) wants to retrain more than one that is lowly-educated

(less than high school). This retraining desire is evident by the change in the sign of the inter-group difference-of-the-means as we move up the education ladder. Additionally, where the population working in transport and agriculture is not interested in retraining, one working in computer science, financial

³⁷ The text of the survey question is “Excluding / Excluding regular college courses and on-the-job

training, (are/is) (you/name) taking any business, vocational, technical, secretarial, trade, or correspondence courses?”

services, and healthcare shows considerable interest indicated by the higher means in Group 2 than in Group 1.

2.2.2 Determinants of participating in a re-training program

We explore these data further by applying a logistic regression. We study the relationship between the response variable (which we treated as the predicted value) and ten supporting characteristics: (1) education level, (2) occupation, (3) age, (4) gender, (5) race, (6) marital status, (7) unemployment, (8) metropolitan-residency(Y/N), (9) family income, and (10) region.

The results from the regression confirm most of the observations made from Table 3. We find statistical significance confirming that people currently retraining tend to be more highly educated, younger, and work in industries that require higher education such as financial services, computer science and mathematical fields, and healthcare. There is also evidence of people retraining in occupations such as construction, maintenance, and protective services fields. Training is not very prevalent among the older male population working “production” occupation in the model, representing manufacturing jobs. These characteristics diverge from the participation traits we see for TAA and ITA programs. The results of the regression, in the form of marginal changes, can be found in Appendix D, Table D.2.

To further demonstrate the point, we use an example of two cohorts of individuals from the data. The first is a population in the 25 to 37 years old age group. This group has individuals with the highest education level and work in the following fields: finance, computer science, social service, or healthcare. They are single and live in a metropolitan area. In our data, we have 8,109 out of

332,369, or 2.44 percent of responses who fall in this category. Of those responders, 2.49 percent are currently involved in some sort of training program.

We contrast this with a second population which falls in the 40 to 50 years old age range with the medium education level (high school only). They work in the production or transportation fields, are married, and do not live in a metropolitan area. There are 835 representatives, or 0.25 percent, in our data who fall in this group. The proportion of people training in this group is 0.48 percent, or another way, the younger cohort is training four times as much as the older cohort. Upon conducting a test for the significance of the difference in the participation rate in these cohorts, we found that the younger cohort was statistically more likely to participate. The t-statistic was 14.05, with a p-value 0.000 at the 95 percent confidence interval. Please refer to Table D.1 in Appendix D for details.

2.2.3 Findings

This exercise suggests that a young, highly educated individual is likely to participate in a retraining program. From our analysis of the IPUMS-CPS data, we found that 1.57 percent of all the eligible individuals were willing to retrain on their own. According to the American Community Survey table: “Age of Householder by Household Income in the past 12 Months” for 2017, there are about 60 million heads of households that are eligible for the LLTA (60 million out of a total of 118

million U.S. households).^{38, 39} Income level information is aggregated at household-level data, not individual-level data. Presuming the IPUM-CPS survey can be projected to represent the retraining interests of the entire United States population, we find that an estimated 950,000 households would be eligible and willing to take up retraining.⁴⁰ Table 3 informs us that 77.95 percent of this group would come from highly-educated backgrounds.

This group differs sharply from the traditional profile of the TAA or the ITA participants. We would like policymakers to be aware of this growing interest in on-going retraining from this younger, more highly educated cohort when considering passing this bill.

2.2.4 Additional support for findings regarding a potential LLTA participant

Other sources support the findings discussed above. In 2002, the Council for Adult and Experiential Learning (CAEL) conducted a pilot of a lifelong learning account program called the Lifelong Learning Accounts (LiLA) Demonstration, thanks to the Ford Foundation's financial sponsorship⁴¹ The lifelong savings program implemented by the pilot was very similar to the LLTA model proposed by the bill. Their five-year study engaged four sectors: restaurants, manufacturing, public sector, and healthcare. The

³⁸ACS Survey provides age brackets from 25 to 44, then 45 - 64. These two bracket groups were included in the estimate despite the LLTA having a cut-off at age 57. Income brackets were used for households earning up to \$100,000 as the LLTA does allow married individuals with joint income excess of \$100,000.

³⁹"U.S. Census Bureau, 2012 American Community Survey, Table: AGE OF HOUSEHOLDER BY HOUSEHOLD INCOME IN THE PAST 12 MONTHS (IN 2017 INFLATION-ADJUSTED DOLLARS), TableID: B19037." Washington, D.C., 2017

characteristics of voluntary participants were as follows. 82.5 percent had a higher than high school education. 71.0 percent came from a household income between \$30,000 and \$100,000. 48.0 percent fell between 26 to 40 years old. Average deposits were higher in the public sector and healthcare sectors.⁴²

A 2016 Pew Research Center study explored workplace changes as the economy shifts further into a knowledge-focused age.⁴³ Their results showed that 63 percent of adults with a bachelor's degree want to retrain, compared to 45 percent of those with no college experience. Young adults are more likely to see skills and training as essential (61 percent among those ages 18 to 29). Adults in STEM-related industries are most likely to say that on-going training is essential.⁴⁴ This further support reaffirms our claim a new demographic is emerging, which is eager to retrain and would likely use this bill.

2.3 Financial health analysis based on income

Federal datasets, including the Survey of Household Economics and Decision-making (SHED) and the US Financial Health Pulse Survey, provide insight on savings behavior of those earning less than \$60,000. SHED standards define low-income earners as those earning less than \$30,000 and moderate-income earners as those earning between \$30,000 and \$60,000. This paper would like

⁴⁰ Ibid.

⁴¹ "Lifelong Learning Accounts Demonstration: Interim Report One (Final)." Public Policy Associates, September 2004. http://publicpolicy.com/wp-content/uploads/2017/04/LiLA_First_Interim.pdf

⁴² Ibid.

⁴³ "The State of American Jobs." Pew Research Center's Social & Demographic Trends Project. Pew Research Center, October 10, 2017. <https://www.pewsocialtrends.org/2016/10/06/the-state-of-american-jobs/>.

⁴⁴ Ibid.

to assess ability to participate in LLTA by characterizing these financial landscapes in three areas: (1) savings, (2) debt, and (3) overall financial health.

The median liquid savings for low-income earners were \$300, while the median savings for moderate-income earners was \$3,500 in 2018. The term “liquid savings” includes any funds deposited into an account with a financial institution, such as checking or savings accounts.⁴⁵ Additionally, the US Financial Health Pulse asked for how long a household can survive on their liquid savings, if their income were to be immediately seized. To this question, 45 percent of low-income earners responded as being able to survive for less than one week. In contrast, 83 percent moderate-income earners responded by saying less than three months.⁴⁶

On debt patterns, it was reported that both income groups had acquired significant mean debt. Consequently, 56 percent of low-income households and 27 percent of moderate-income households lacked retirement savings due to debt. Additionally, 23 percent of low-income and 11 percent of moderate-income households reported that their debt was a contributing challenge to change jobs.⁴⁷

The US Financial Health Pulse assesses one’s overall financial health based on a household’s frequency of struggles related to (1)

spending, (2) borrowing, (3) savings, and (4) future financial planning. For instance, a financially healthy household would face no struggle with any of these aspects throughout the year. The 2018 Baseline Survey Results showed that 92 percent of low-income and 79 percent of moderate-income households significantly struggled with at least one of these four indicators within the year.⁴⁸

In light of these findings, this whitepaper challenges the assumption that the low-income LLTA eligible population would have the financial resources to participate in the program. Specifically, the “cash upfront” provision will likely serve as a financial barrier to entry for individuals in low-income brackets. According to the American Community Survey data, about a third of the eligible population would fall into this cohort.⁴⁹

Conclusion

The Lifelong Learning and Training Account Act of 2018 is a piece of legislation that seeks to support the US workforce by incentivizing lifelong retraining. We believe if the bill were to be enacted it (1) will subsidize an already highly educated cohort who currently pay for and consume training opportunities; and (2) will not incent a third of the eligible population who are prohibited from participating due to the “cash up front” provision.

⁴⁵ “Report on the Economic Well-Being of U.S. Households in 2018.” Board of Governors of the Federal Reserve System, Federal Reserve Board, May 2019. <https://www.federalreserve.gov/publications/files/2018-report-economic-well-being-us-households-201905.pdf>

⁴⁶ “Spikes and Dips: How Income Uncertainty Affects Households.” Center for Financial Services Innovation. <https://finhealthnetwork.org/research/financial-health-measurement/>.

⁴⁷ “U.S. Census Bureau, 2012 American Community Survey, Table: AGE OF HOUSEHOLDER BY

HOUSEHOLD INCOME IN THE PAST 12 MONTHS (IN 2017 INFLATION-ADJUSTED DOLLARS), TableID: B19037.” Washington, D.C., 2017

⁴⁸ Ibid.

⁴⁹ “U.S. Census Bureau, 2012 American Community Survey, Table: AGE OF HOUSEHOLDER BY HOUSEHOLD INCOME IN THE PAST 12 MONTHS (IN 2017 INFLATION-ADJUSTED DOLLARS), TableID: B19037.” Washington, D.C., 2017

We urge policymakers to consider closely the intention of the bill and define the target group for the LLTA in greater detail. In the press release, the policy is discussed as a measure to help low-to-moderate income workers adapt to a fast-paced, rapidly-changing work environment. Upon closer inspection, the bill contains a number of provisions that suggest it would disproportionately benefit a subset of the eligible population. If the LLTA is to assist the 'low income' cohort, a stronger enabling provision should be provided to those currently struggling to save. If the intention of the bill is to reach a larger population to combat technological advances in the workforce, there would be great interest in this from a growing educated population. In its current form, the LLTA policy does not provide an equitable opportunity to retrain for all potential participants.

APPENDICES

Appendix A. Timeline of Previous Lifelong Learning Account Proposals and Outcomes

1. **2007:** Senator Maria Cantwell (D-WA) introduced the Lifelong Learning Accounts Act of 2007, cosponsored by Senator Olympia Snowe (R-ME). The bill was authorized to start demonstration program across 10 states engaging up to 200,000 participants.¹ The bill was referred to the Committee on Finance and no further action was taken.
2. **2008:** The next year, Representatives Rahm Emanuel (D-IL-5) and Jim Ramstad (R-MN-3) introduced the Lifelong Learning Accounts Act of 2008. The bill was written as a nationwide program for those below age 71.¹ The bill was referred to the committees on Ways and Means, and Education and Labor and no further action was taken.
3. **2010, 2011:** Representatives John B. Larson (D-CT-1), Jared Polis (D-CO-2), Peter Roskam (R-IL-6), and Erik Paulsen (R-MN-3) introduced the Lifelong Learning Accounts Act of 2010. This act was strikingly similar to the Lifelong Learning Accounts Act of 2008. The bill was referred to the committees on Ways and Means, and Education and Labor and got as far as being referred to the Subcommittee on Health, Employment, Labor, and Pensions but it once again no further action was taken. The same representatives submitted the same bill in the next congress as the Lifelong Learning Accounts Act of 2011, where it once more died in committee.

Appendix B. Analysis of Lifelong Learning and Training Account of 2018

Column Layout: This section lays out the line-by-line reading and analysis of the bill. Exact organization and wording of the bill is shown in the first two columns. The third column contains our interpretation of the text where applicable.

Hierarchical Emphasis: The highest level of hierarchy or the high-level sections are noted as “SEC.” followed by the number. For increased readability, new sections within these high-level sections are introduced by a row header. Paragraphs within these smaller sections are highlighted in yellow where the paragraph starts.

H.R.7235 - Lifelong Learning and Training Account Act of 2018

Section Name	Language of the bill	Annotation
SEC. 1. SHORT TITLE	This Act may be cited as the “Lifelong Learning and Training Account Act of 2018”.	
SEC. 2. LIFELONG LEARNING AND TRAINING ACCOUNT PROGRAMS.	In General. --Part VIII of subchapter E of chapter 1 of the Internal Revenue Code of 1986 is amended by inserting after section 530 the following new section:	This bill proposes to amend the tax code by adding Section 531 as defined in this bill.
Section (a)	General	
“SEC. 531. LIFELONG LEARNING AND TRAINING ACCOUNT PROGRAMS. Section (a): General	“(a) In General. --A Lifelong Learning and Training Account program shall be exempt from taxation under this subtitle. Notwithstanding the preceding sentence, such program shall be subject to the taxes imposed by section 511.	
Section (b)	Lifelong Learning and Training Account Program	
Paragraph 1: General	“(b) Lifelong Learning and Training Account Program. -- For purposes of this section-- “(1) In general. --The term ‘Lifelong Learning and Training Account program’ means a program established and maintained by a State or agency or instrumentality thereof-- “(A) under which the designated beneficiary of the account or their employer may make contributions to an account which is established for the purpose of meeting the qualified training expenditures of such beneficiary, and “(B) which meets the other requirements of this section.	Lifelong Learning and Training Account is run by the state. It allows beneficiaries and their employers to contribute to a training savings account that follow rules set in this bill.
Paragraph 2:	“(2) Qualified trust.--Except to the extent provided in	In order to be an LLTA

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<p>Qualified trust</p>	<p>regulations, a program shall not be treated as a Lifelong Learning and Training Account program unless such program provides that amounts are held in a qualified trust and such program has received a ruling or determination by the Secretary that such program meets the applicable requirements for a Lifelong Learning and Training Account program. For purposes of the preceding sentence, the term 'qualified trust' means a trust which is created or organized in the United States for the exclusive benefit of designated beneficiaries and with respect to which the requirements of paragraphs (2) and (5) of section 408(a) are met.</p>	<p>program, its funds must be held in a qualified trust and the program must be approved by the Secretary.</p>
<p>Paragraph 3, Part A: General requirements</p>	<p>“(3) Requirements. --</p> <p>“(A) In general. --A program shall not be treated as a Lifelong Learning and Training Account program unless it provides--</p> <p>“(i) that contributions may only be made in cash,</p> <p>“(ii) separate accounting for each designated beneficiary,</p> <p>“(iii) that no interest in the program or any portion thereof may be used as security for a loan,</p> <p>“(iv) that no contributions may be made on behalf of a designated beneficiary--</p> <p>“(I) in excess of \$2,000 during any calendar year,</p> <p>“(II) if the total amount in the account of such beneficiary is in excess of \$15,000, or</p> <p>“(III) during any calendar year which begins after such beneficiary attains 57 years of age,</p> <p>“(v) that any distribution shall be made in accordance with the requirements under subparagraphs (B) and (C), and</p> <p>“(vi) that required distributions shall be made in accordance with paragraph (6).</p>	<p>LLTA accounts must be individual accounts. Contributions must be made in cash. Contributions made on behalf of the account holder must be less than or equal to \$2,000 a year. The account total will max out at \$15,000 total. The account holder must stop contributing after turning 57 years old.</p> <p>Distributions rules apply (see paragraph B, C, and paragraph 6)</p>
<p>Paragraph 3, Part B: Method of distribution requirements</p>	<p>“(B) Method of distribution. --</p> <p>“(i) In general. --For purposes of any distribution from the account of a designated beneficiary under a Lifelong Learning and Training Account program--</p> <p>“(I) the applicable amount of such distribution shall be drawn from amounts transferred to the account of the designated beneficiary pursuant to paragraph (4) and any earnings thereon, and</p> <p>“(II) after application of subclause (I), the remainder of such distribution shall be drawn from amounts contributed by the designated beneficiary or their employer and any earnings thereon.</p> <p>“(ii) Applicable amount. --For purposes of clause (i)(I), the applicable amount shall be an amount equal to the lesser of--</p> <p>“(I) 50 percent of the amount of the distribution, or</p> <p>“(II) the total amount of any available funds in the account of the designated beneficiary which were transferred pursuant to paragraph (4) and any earnings thereon.</p> <p>“(iii) Other methods. --The Secretary may amend, alter, or supplement the distribution requirements under this subparagraph in such manner as the Secretary deems appropriate.</p>	<p>See paragraph 4 on the amount that should be distributed to the beneficiary.</p> <p>Once the amount is determined, “the remainder of such distribution” drawn from \$ contributed by the beneficiary or employer and earnings.</p> <p>The applicable amount must be the smaller of Z₁ or Z₂ where Z₁ equals 50% of distribution and Z₂ equals any available funds in the account that were transferred “pursuant to paragraph (4).</p> <p>Secretary can change rules as Secretary deems</p>

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		appropriate.
Paragraph 3, Part C: Reporting requirements	<p>“(C) Reporting.--For purposes of any distribution from the account of a designated beneficiary under a Lifelong Learning and Training Account program, the administrator shall provide the beneficiary and the Secretary with such information as the Secretary deems appropriate, including--</p> <p>“(i) the amount of such distribution, including the applicable amount of such distribution (as described in subparagraph (B)(ii)), and</p> <p>“(ii) whether such distribution was provided--</p> <p>“(I) directly to the program described in clauses (i) through (iii) of subsection (e)(5)(A) which provides training to the beneficiary, or</p> <p>“(II) to reimburse the beneficiary for any qualified training expenditures incurred by such beneficiary.</p>	Program administrator must report to Secretary amount of money distributed to accounts, and whether distribution was directly to the program or as reimbursement.
Paragraph 4, Part A: Transfer to beneficiary account	<p>“(4) Matching funds.--</p> <p>“(A) Transfer to beneficiary account. --</p> <p>“(i) In general.--Out of any moneys in the Treasury not otherwise appropriated, the Secretary shall transfer to the account of any designated beneficiary under a Lifelong Learning and Training Account program an amount equal to any amounts contributed to such account by such beneficiary or their employer which occur during any calendar year which begins after the date on which such beneficiary attains 24 years of age.</p> <p>“(ii) Limitation. --Any amounts transferred by the Secretary to the account of any designated beneficiary pursuant to clause (i) during any calendar year--</p> <p>“(I) shall not exceed \$1,000, and</p> <p>“(II) shall not be subject to the limitation under paragraph (3)(A)(iv)(I).</p>	Secretary shall transfer money from the Treasury to the LLTA program. The amount shall “equal” to beneficiary or employer contribution, to start after beneficiary turns 24 years old for the first \$1,000.
Paragraph 4, Part B: Deposit of matching funds	<p>“(B) Deposit of matching funds.--Any amounts required to be transferred to the account of a designated beneficiary under subparagraph (A) shall be transferred by the Secretary as soon as is practicable following any contribution to such account by such beneficiary or their employer.</p>	Matched funds shall be deposited by the Secretary when individual contributions are made to the LLTA in a timely manner.
Paragraph 4, Part C: Reduction in matching funds	<p>“(C) Reduction in matching funds. --</p> <p>“(i) In general. --For each applicable taxable year, the dollar amount in subparagraph (A)(ii)(I) shall be reduced (but not below zero) by an amount equal to the greater of--</p> <p>“(I) an amount which bears the same ratio to such dollar amount as--</p> <p>“(aa) the amount (not less than zero) equal to the adjusted gross income of the taxpayer for the applicable taxable year minus \$72,000, bears to</p> <p>“(bb) \$10,000, or</p> <p>“(II) an amount which bears the same ratio to such dollar amount as--</p> <p>“(aa) the amount (not less than zero) equal to the earned income (as described in section 32(c)(2)) of the designated</p>	Total benefit from the government is reduced by the following proportion: $(AGI - 72,000)/10,000$. Therefore, if the participant’s Annual Gross Income is \$81,500, and they have contributed \$1,000 to their savings account. Instead of matching the full \$1,000, the government benefit will be reduced by: $(\$81,500 - 72,000)/10,000 = 95\%$. Therefore, the government

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	<p>beneficiary for the applicable taxable year minus \$72,000, bears to</p> <p> “(bb) \$10,000.</p> <p> “(ii) Married individuals. --In the case of a designated beneficiary who is married (within the meaning of section 7703)--</p> <p> “(I) if such beneficiary has filed a joint return for the applicable taxable year, each of the dollar amounts under clause (i)(I) shall be doubled for such year, or</p> <p> “(II) if such beneficiary has not filed a joint return for the applicable taxable year, the dollar amount in subparagraph (A)(ii)(I) shall be reduced to zero for such year.</p> <p> “(iii) Applicable taxable year. --For purposes of this subparagraph, the term ‘applicable taxable year’ means the taxable year in which the transfer described in subparagraph (A)(i) is made to the account of the designated beneficiary.</p> <p> “(iv) Excess transfers.--If the total amount of any transfers made to the account of a designated beneficiary pursuant to subparagraph (A)(i) during an applicable taxable year exceeds the dollar amount under subparagraph (A)(ii)(I) (after application of clauses (i) and (ii)) for such taxable year, the tax imposed by this chapter for such taxable year shall be increased by the amount of such excess.</p>	<p>match will be: (1-95%) *\$1,000 = \$50.</p> <p>For married couples filing jointly, the matched funds maximum is doubled from \$1,000 to \$2,000. If the married couple does not file jointly, the matched funds maximum is reduced to \$0. That is, married couples must file jointly to access the matched funds.</p> <p>Applicable taxable year refers to the year Secretary transfers the matched funds from to LLTA.</p> <p>If any amount is transferred in excess, the excess amount will be returned to the Secretary by way of taxation.</p>
<p>Paragraph 4, Part D: Distribution of matching funds</p>	<p>“(D) Distribution of matching funds. --</p> <p> “(i) In general. --Any distribution under a Lifelong Learning and Training Account program made from amounts transferred pursuant to this paragraph shall be made by the administrator--</p> <p> “(I) directly to the program described in clauses (i) through (iii) of subsection (e)(5)(A) which provides training to the designated beneficiary, or</p> <p> “(II) to reimburse the designated beneficiary for any qualified training expenditures incurred by such beneficiary, provided that the beneficiary has provided the administrator with such documentation as is deemed necessary to ensure compliance with clause (ii).</p> <p> “(ii) Prohibition.--No amounts transferred pursuant to this paragraph to any account of a designated beneficiary under a Lifelong Learning and Training Account program may be distributed for any purpose other than for payment or reimbursement of qualified training expenditures.</p>	<p>The program administrator will distribute funds from LLTA accounts. Funds must only be disbursed as payment to qualified training program or reimbursement to the beneficiary for qualified training expenditures. Beneficiary must produce proper documentation for disbursement.</p>
<p>Paragraph 4, Part E: Additional reduction for non-qualified distribution:</p>	<p>“(E) Additional reduction for non-qualified distributions.--For purposes of any amount of a distribution under a Lifelong Learning and Training Account program which is includible in the gross income of the designated beneficiary, any available funds in the account of such beneficiary which were transferred pursuant to this paragraph (and any earnings thereon) shall also be reduced by such amount.</p>	<p>Use the money for non-qualified expenses and the “matched transfer” will be reduced by the same amount. For example, I put in \$500 and get matched \$500 from government. I spend money \$300 on shoes. The match is now reduced by \$300.</p>

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Section B, Paragraph 4, Part F: Rescission of matching funds	<p>“(F) Rescission of matching funds.--On January 1 of the applicable calendar year, any available funds in the account of such beneficiary which were transferred pursuant to this paragraph (and any earnings thereon) shall be reduced to zero.</p>	<p>Matched funds and any earnings are reduced to \$0 on January 1 of the applicable calendar year. That is, the program benefit and earnings on it do not carry over year to year.</p>
Paragraph 5: Investment	<p>“(5) Investment.-- “(A) In general. --Any contributions or transfers to a Lifelong Learning and Training Account program (and any earnings thereon) shall be invested by the administrator in United States Treasury securities with a maturity date of not greater than 10 years. “(B) Secretarial authority. --The Secretary may prescribe such regulations, rules, or other guidance as may be necessary or appropriate for purposes of applying this paragraph.</p>	<p>The U.S. Treasury will invest the LLTA amount with maximum maturity date of ten years. Secretary may prescribe further rules to make this happen.</p>
Paragraph 6: Required distributions	<p>“(6) Required distributions.--On January 1 of the applicable calendar year, the total amount of available funds in the account of the designated beneficiary which were contributed by the designated beneficiary or their employer (and any earnings thereon) shall be distributed to such beneficiary.</p>	<p>On January 1, remaining contributions are returned to the party that contributed (e.g. beneficiary or employer).</p>
Section (c)	Tax Treatment	
Paragraph 1: General tax treatment	<p>“(c) Tax Treatment. -- “(1) In general.--Except as otherwise provided in this subsection, no amount shall be includible in gross income of-- “(A) a designated beneficiary under a Lifelong Learning and Training Account program, or “(B) an employer of such beneficiary that contributes to such program on behalf of such beneficiary, with respect to any distribution or earnings under such program.</p>	<p>Contributions and earnings on them made by beneficiary or by employer will not be included in gross income. That is, contributions are not taxable.</p>
Paragraph 2: Distributions Subsection A: General	<p>“(2) Distributions.-- “(A) In general.--Any distribution under a Lifelong Learning and Training Account program shall be includible in the gross income of the distributee in the manner as provided under section 72 to the extent not excluded from gross income under any other provision of this chapter.</p>	<p>When LLTA funds are distributed, the funds will be included in gross income for the distributee. For example, the training program provider’s gross income will increase by the amount received from distribution. If beneficiary gets reimbursement, the distributed amount will be included in gross income.</p>
Subsection B: Distributions for qualified training expenditures	<p>“(B) Distributions for qualified training expenditures. -- “(i) In general. --In the case of any distributions, if such distributions do not exceed the qualified training expenditures of the designated beneficiary, no amount shall be</p>	<p>If qualified distribution amount falls under qualified training expenditure, the distributed amount will never</p>

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	<p>includible in gross income.</p> <p>“(ii) Coordination with other credits and deductions.--For purposes of determining the credit allowed under section 25A or the deduction allowed under section 222, no distribution under a Lifelong Learning and Training Account program shall be included as qualified tuition and related expenses under such sections.</p>	<p>be included in the beneficiary's gross income.</p> <p>LLTA does not qualify as education credit (qualified tuition and related expenses).</p>
<p>Subsection C: Change in beneficiaries or programs</p>	<p>“(C) Change in beneficiaries or programs. --</p> <p>“(i) Rollovers.--Subparagraph (A) shall not apply to that portion of any distribution which, within 60 days of such distribution, is transferred--“(I) to another Lifelong Learning and Training Account program for the benefit of the designated beneficiary, or</p> <p>“(II) to the credit of another designated beneficiary under a Lifelong Learning and Training Account program who is a member of the family of the designated beneficiary with respect to which the distribution was made.</p> <p>“(ii) Change in designated beneficiaries.--Any change in the designated beneficiary of an interest in a Lifelong Learning and Training Account program shall not be treated as a distribution for purposes of subparagraph (A) if the new beneficiary is a member of the family of the old beneficiary.</p> <p>“(iii) Limitation on certain rollovers.--Clause (i)(I) shall not apply to any transfer if such transfer occurs within 12 months from the date of a previous transfer to any Lifelong Learning and Training Account program for the benefit of the designated beneficiary.</p> <p>“(iv) Matching funds forfeited.--In the case of any transfer described in clause (i)(II) or any change in the designated beneficiary of an interest in a Lifelong Learning and Training Account program (with the exception of any change due to the death of the old beneficiary), any amounts transferred to the account of the designated beneficiary under subsection (b)(4), and any earnings thereon, shall be reduced (but not below zero) by an amount equal to the total amount transferred to any account of any other beneficiary.</p>	<p>Beneficiaries have 60 days to “roll over” the distributed amount to (I) another LLTA program for beneficiary; or (II) a family member’s LLTA.</p> <p>These “roll over” distributions are not included in gross income of the distributee.</p> <p>If LLTA beneficiary changes ownership of LLTA to another family member, LLTA will not be included in gross income for the new beneficiary.</p> <p>Rollover to another family member gross income exclusion is only allowed once a year.</p> <p>When transferring LLTA to a family member within 60 days, matching funds from government is forfeited in the transfer. Exception is granted in the case of a death of a beneficiary</p>
<p>Subsection D: Special rule for contributions of refunded amounts.</p>	<p>“(D) Special rule for contributions of refunded amounts.--In the case of a beneficiary who receives a refund of any qualified training expenditures from any program described in clauses (i) through (iii) of subsection (e)(5)(A), subparagraph (A) shall not apply to that portion of any distribution for the taxable year which is recontributed to a Lifelong Learning and Training Account program of which such individual is a beneficiary, but only to the extent such recontribution is made not later than 60 days after the date of such refund and does not exceed the refunded amount.</p>	
<p>Paragraph 3: Estate tax treatment</p>	<p>“(3) Estate tax treatment.--</p> <p>“(A) In general. --No amount shall be includible in the gross estate of any individual for purposes of chapter 11 by</p>	<p>Except for in the death of a beneficiary, LLTA funds are not includible in an</p>

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	<p>reason of an interest in a Lifelong Learning and Training Account program.</p> <p>“(B) Amounts includible in estate of designated beneficiary in certain cases. --Subparagraph (A) shall not apply to amounts distributed on account of the death of a beneficiary.</p>	individual’s gross estate calculation.
Section (d) Reports		
Section (d): Reports	<p>“(d) Reports. --Each officer or employee having control of the Lifelong Learning and Training Account program or their designee shall make such reports regarding such program to the Secretary and to designated beneficiaries with respect to contributions, transfers, distributions, and such other matters as the Secretary may require. The reports required by this subsection shall be filed at such time and in such manner and furnished to such individuals at such time and in such manner as may be required by the Secretary.</p>	Those who run the program must report the following to the Secretary: contributions, transfers, distributions, and other requirements deemed necessary by the Secretary.
Section (e) Other Definitions and Special Rules		
Paragraph 1: Administrator	<p>“(1) Administrator.--The term ‘administrator’ means the entity which established the Lifelong Learning and Training Account program and maintains such program, as described in subsection (b)(1).</p>	For this, see subsection (b)(1).
Paragraph 2: Applicable calendar year	<p>“(2) Applicable calendar year.--The term ‘applicable calendar year’ means the calendar year beginning after the date on which a designated beneficiary attained 60 years of age.</p>	Applicable calendar year = the year beginning after beneficiary’s 60th birthday
Paragraph 3: Designated beneficiary	<p>“(3) Designated beneficiary.--The term ‘designated beneficiary’ means--</p> <p>“(A) the individual designated at the commencement of participation in the Lifelong Learning and Training Account program as the beneficiary of amounts paid (or to be paid) to the program, or</p> <p>“(B) in the case of a change in beneficiaries described in subsection (c)(2)(C), the individual who is the new beneficiary.</p>	Designated beneficiary is the individual participating in LLTA or the new participant who received LLTA from another individual (new account holder in family).
Paragraph 4: Member of family	<p>“(4) Member of family.--The term ‘member of the family’ means an individual--</p> <p>“(A) who has attained 25 years of age, and</p> <p>“(B) who is, with respect to any designated beneficiary--</p> <p>“(i) the spouse of such beneficiary,</p> <p>“(ii) an individual who bears a relationship to such beneficiary which is described in subparagraphs (A) through (G) of section 152(d)(2),</p> <p>“(iii) the spouse of any individual described in clause (ii), or</p> <p>“(iv) any first cousin of such beneficiary.</p>	LLTA can be transferred to “member of family” who is at least 25 years old and spouse of beneficiary; or F = A-G of 152(d)(2) or Spouse of F or any first cousin of beneficiary
Paragraph 5:	<p>“(A) In general. --The term ‘qualified training expenditures’</p>	Qualification for eligible

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<p>Qualified training expenditures</p>	<p>means any expenditures for training which results in the attainment of a recognized postsecondary credential and which is provided through--</p> <p>``(i) a program of training services which is listed under section 122(d) of the Workforce Innovation and Opportunity Act (29 U.S.C. 3152(d)),</p> <p>``(ii) a program which is conducted by an area career and technical education school, a community college, or a labor organization, or</p> <p>``(iii) a program which is sponsored and administered by an industry trade association, industry or sector partnership, or labor Organization.</p> <p>``(B) Related definitions. --For purposes of subparagraph (A)--</p> <p>``(i) Area career and technical education school.--The term `area career and technical education school' means such a school, as defined in section 3 of the Carl D. Perkins Career and Technical Education Act of 2006 (20 U.S.C. 2302), which participates in a program under that Act (20 U.S.C. 2301 et seq.).</p> <p>``(ii) Community college.--The term `community college' means an institution which--``(I) is a junior or community college as defined in section 312(f) of the Higher Education Act of 1965 (20 U.S.C. 1058(f)), except that the institution need not meet the requirements of paragraph (1) of that section; and</p> <p>``(II) participates in a program under title IV of that Act (20 U.S.C. 1070 et seq.).</p> <p>``(iii) Industry or sector partnership. --The term `industry or sector partnership' has the meaning given such term under section 3 of the Workforce Innovation and Opportunity Act (29 U.S.C. 3102).</p> <p>``(iv) Industry trade association. --The term `industry trade association' means an organization which--</p> <p>``(I) is described in paragraph (3) or (6) of section 501(c) and exempt from taxation under section 501(a); and</p> <p>``(II) is representing an industry. ``(v) Labor organization.--The term `labor organization' means a labor organization, within the meaning of the term in section 501(c)(5).</p> <p>``(vi) Recognized postsecondary credential. --The term `recognized postsecondary credential' means a credential consisting of an industry-recognized certificate or certification, a license recognized by the State involved or Federal Government, or an associate or baccalaureate degree.</p> <p>``(C) Exclusion. --The term `qualified training expenditures' shall not include any amounts paid for meals, lodging, transportation, or other services incidental to any training described in subparagraph (A).</p>	<p>expenses are detailed and defined in this paragraph.</p>
<p>Paragraph 6: Application of section 514</p>	<p>`` (6) Application of section 514.--An interest in a Lifelong Learning and Training Account program shall not be treated as debt for purposes of section 514.</p>	<p>LLTA will not be treated as debt.</p>

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Section (f)	Public Awareness	
Public Awareness	<p>“(f) Public Awareness. --</p> <p>“(1) In general.--The Secretary shall conduct a public information campaign, utilizing paid advertising, to inform the public of the availability of Lifelong Learning and Training Account programs.</p> <p>“(2) Authorization of appropriations.--</p> <p>“(A) In general. --There is authorized to be appropriated such sums as are necessary to carry out this subsection.</p> <p>“(B) Availability. --Any sums appropriated under the authorization contained in this subsection shall remain available, without fiscal year limitation, until expended.</p>	<p>Secretary is required to use paid advertising to publicize LLTA to public.</p> <p>The program budget will not be limited by year. This is an entitlement program.</p>

Appendix C. ITA Materials

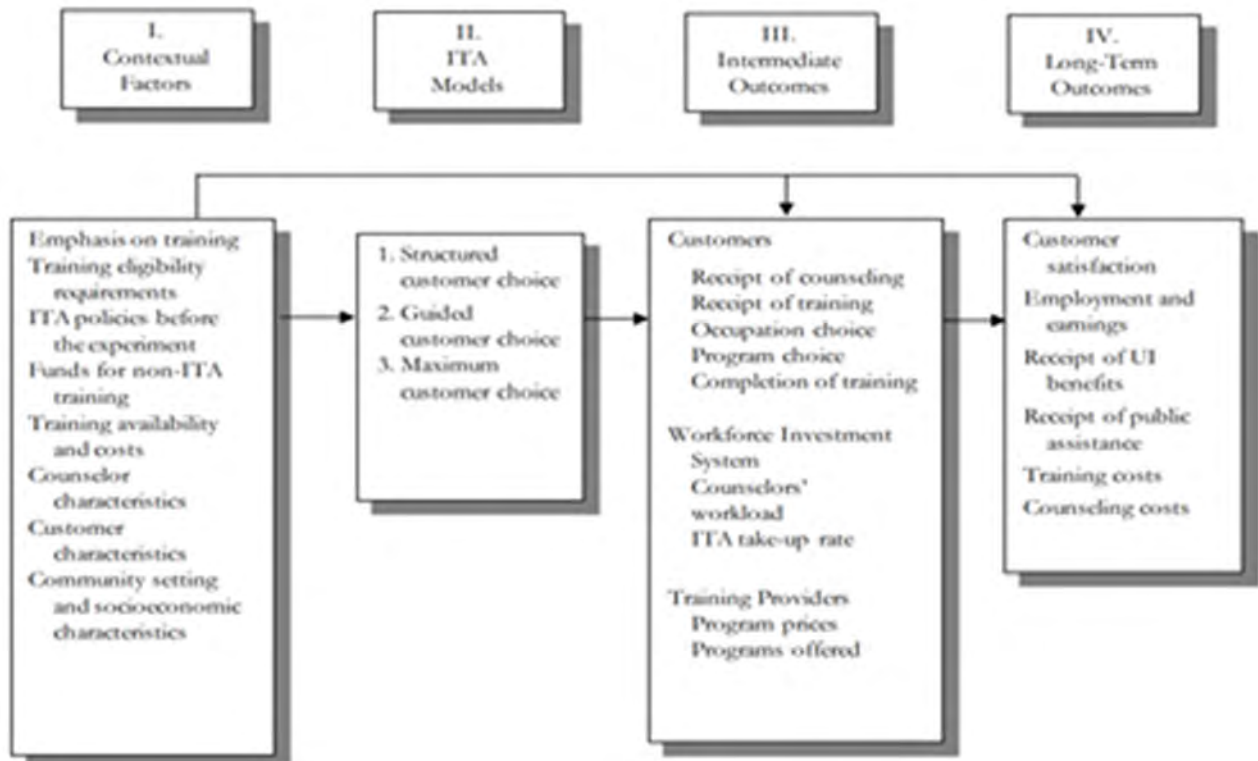
To analyze the effectiveness of various program structures workforce development boards have chosen to implement, Mathematica Research conducted an experimental evaluation of three different models for delivering ITA services by randomly selecting approximately 8,000 customers in nine different local sites. ¹The individuals were “followed six to eight years after program enrollment” (Mathematica Policy Research). The three service delivery models tested during this experiment were (1) structured choice, (2) guided choice, and (3) maximum choice. It is important to note that guided choice was regarded as the control option (meaning this would be the model that states would have adopted in the absence of the experiment).

Table C.1 The Three Service Delivery Models of the ITA Experiment

	Model 1: Structured Choice	Model 2: Guided Choice	Model 3: Maximum Choice
ITA Award Structure	Customized	Fixed	Fixed
Required Counseling	Mandatory, most intensive	Mandatory, moderate intensity	Voluntary
Counselor Discretion to Reject Customer's Program Choice	Yes	No	No

Source: Perez-Johnson, Irma, Quinn Moore, and Robert Santillano. “Improving the Effectiveness of Individual Training Accounts: Long-Term Findings from an Experimental Evaluation of Three Service Delivery Models.” Mathematica Policy Research, Inc., October 2011. https://wdr.doleta.gov/research/FullText_Documents/ETAOP_2012_06.pdf.

Table C.2 The ITA Framework



Source: Perez-Johnson, Irma, Quinn Moore, and Robert Santillano. “Improving the Effectiveness of Individual Training Accounts: Long-Term Findings from an Experimental Evaluation of Three Service Delivery Models.” Mathematica Policy Research, Inc., October 2011. https://wdr.doleta.gov/research/FullText_Documents/ETAOP_2012_06.pdf.

The three major stakeholders in the ITA models were (1) workers, (2) the local workforce investment system, and (3) training providers (Source 1). The figure below shows the framework of the ITA at-a-glance.

Table C.3 The ITA Framework

Characteristics	Structured Choice	Guided Choice	Maximum Choice
Dislocated Worker	67%**	71%	69%
Earnings in Year Before RA	\$21,192	\$20,608	\$20,289
Receiving Public Assistance at Baseline	17%	16%	16%
Employment			
Working at time of RA	11	9	9
Worked within month prior to RA	20	20	19
Worked within one year prior to RA	65	66	69
Worked over one year prior to RA	15	14	11*
Duration of Last Job (Months)	54	52	50
Age (Years)	41	41	41
Female	55	55	56
Married	42	41	40
Has Children	53	54	54
Race/Ethnicity			
White non-Hispanic	43	45	44
Black non-Hispanic	37	39	38
Hispanic	9	8	10*
Primary Language Is English	91	92	92
Highest Level of Education			
Less than high school degree	5	6	5
High school diploma or GED	59	58	63**
Associate's degree	7**	10	8
Bachelor's degree	22*	19	19
Graduate degree	7	7	5*
Has Vocational or Business Degree or Certificate	23	26	24
Sample Size	2,644	2,649	2,627

Source: Perez-Johnson, Irma, Quinn Moore, and Robert Santillano. "Improving the Effectiveness of Individual Training Accounts: Long-Term Findings from an Experimental Evaluation of Three Service Delivery Models." Mathematica Policy Research, Inc., October 2011. https://wdr.doleta.gov/research/FullText_Documents/ETAOP_2012_06.pdf.

Appendix D. Data Analysis Results

Table D.1 ttest Result Notes

Paired t test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
cohort~g	5,206	.0388014	.0026768	.1931398	.0335537	.0440491
cohort~d	5,206	.0007683	.0003841	.027711	.0000154	.0015213
diff	5,206	.038033	.0027064	.1952704	.0327275	.0433386

mean(diff) = mean(cohort_young - cohort_old) t = 14.0532
 Ho: mean(diff) = 0 degrees of freedom = 5205
 Ha: mean(diff) < 0 Ha: mean(diff) != 0 Ha: mean(diff) > 0
 Pr(T < t) = 1.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 0.0000

Table D.2 Marginal change in retraining across select characteristics, for three specifications.

	Specification 1 Marginal Change (p-value)	Specification 2 Marginal Change (p-value)	Specification 3 Marginal Change (p-value)
Age (delta = +5 years)	-0.002 (0.000)	-0.002 (0.000)	-0.002 (0.000)
Education*			
- 1 to 2	0.003 (0.000)	0.003 (0.000)	0.003 (0.000)
- 1 to 3	0.012 (0.000)	0.011 (0.000)	0.011 (0.000)
- 2 to 3	0.008 (0.000)	0.008 (0.000)	0.008 (0.000)
Gender			
- Male to Female	0.001 (0.002)	0.002 (0.000)	0.002 (0.000)
Occupation			
From Production to			
- Financial Specialist		0.009 (0.000)	0.009 (0.000)
- Computer Science		0.006 (0.000)	0.006 (0.000)
- Healthcare		0.006 (0.000)	0.006 (0.000)
Metro			0.001 (0.000)

* 1, 2, 3 stand for less than High School, High School and More than High School, respectively.