COG Round 10 Cooperative Forecast Technical Assistance

Technical Memo

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1 Introduction

In 2020, the COVID-19 pandemic spawned a global health catastrophe. Subsequent travel restrictions enacted in the United States in March 2020 resulted in the "largest remote working experiment" in modern history. In the Washington region, this resulted in cascading impacts to the population, economy, and average household size. Economically, while the effects of the pandemic may ultimately be a two-year "blip," the implications will have long-term impacts to the region's commercial real estate and housing markets.

The pandemic prompted a reevaluation of how and where work is conducted, altered residential preferences and daily travel patterns, and is reshaping the region's commercial real estate market. Regionwide, short- and long-term impacts include shifts in commuting patterns and travel modes, the design and function of office space, and significant effects to central business districts.

Objectives

The primary objective of this effort is to provide informational background to underpin the development of the Metropolitan Washington Council of Governments' (COG) Round 10 Cooperative Forecast. COG's Cooperative Forecasts serve as the official employment, population, and household projections for member local governments, based on common assumptions about future growth. COG first produced a regional Cooperative Forecast in 1976 (Round 1), and most recently updated Round 9.2 of the Cooperative Forecast in 2021.

To support COG's Round 10 preparations, the report's research and analysis focuses on the following:

- Better understand the impact of the COVID-19 pandemic on utilization, density, and development of commercial office space in the region
- Summarize variables creating economic forecast uncertainties and develop long-term regional economic model forecasts
- Assess emerging trends in regional housing location and choice
- Increase understanding of future regional household size trends

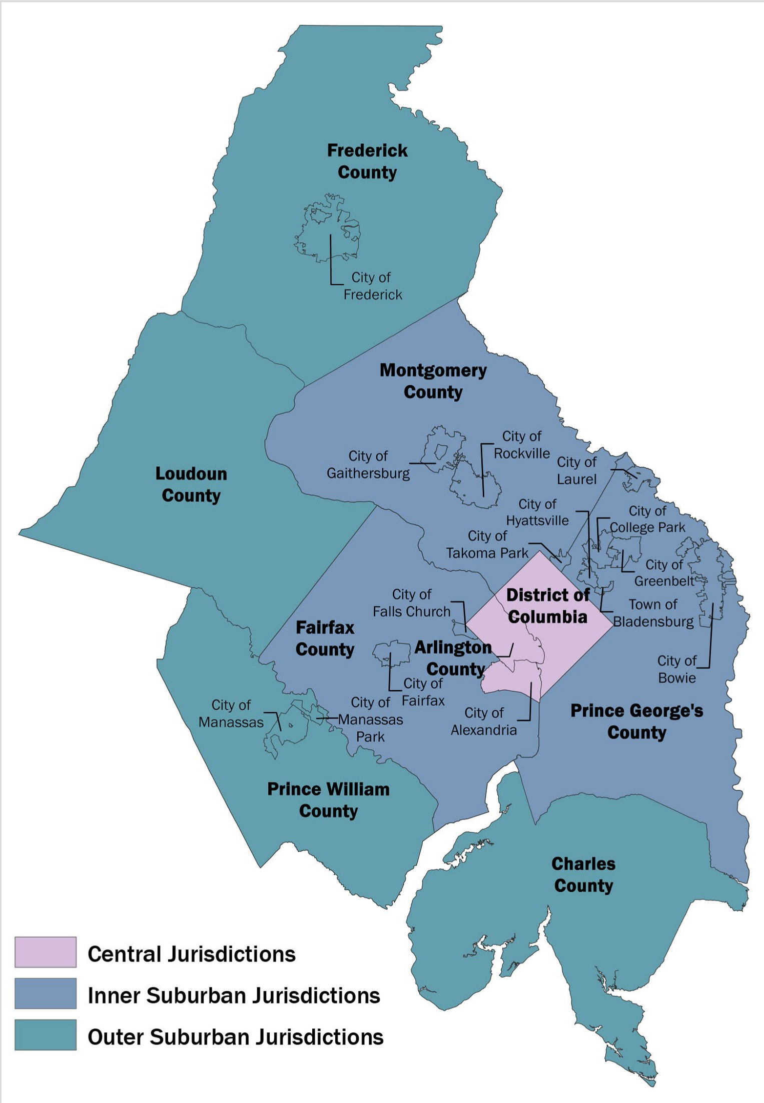
This research and analysis is divided across three tasks:

- Task 2: Estimating changes to commercial space use
- Task 3A/3B: Development of a "range" of regional economic model forecast; assessment of potential changes to timing, location, and among of future housing in the region
- Task 4: Project changes to future average household size

The timeline for this research and analysis was condensed over a three-month period. The literature review and background research were conducted in March and April, interviews were conducted with regional experts in April and May, and the independent analysis was conducted in April and May. Findings from this memo were shared with COG's Cooperative Forecasting and Data Subcommittee and the Planning Directors Technical Advisory Committee in June 2022.

Figure 1: Process and Approach

Figure 2: COG Planning Area



1.1.1 Considering Influences on Land Use Forecasting

The need to establish a sense of the region's econometric future is an element of every new round of MWCOG Cooperative Forecasts. However, the influence of COVID-19 as a disruptive event is new to the Round 10 forecasts and prompted the examination of COVID-19 effects described in this technical memorandum. COVID-19 is absolutely a unique, and global, exogenous variable with wide implications for public health, public opinion, and both market and policy responses. The challenge is to separate the effects of COVID-19 from other exogenous forces, nearly all of which are connected to some degree to the effects of the pandemic.

Figure 3 presents a summary of the generalized effects on the pace and pattern of growth for many exogenous forces typically considered in scenario planning. While all of the forces listed may be connected to COVID-19 to some degree (i.e., the degree of investment in Metrorail system reliability could be viewed as less important in the near term from a market perspective simply based on the reduced ridership or viewed as more important as a policy tool to help restore consumer confidence in an urban existence). Throughout this technical memorandum, the direct effects of COVID-19 are separated from other forces to the extent practical. Among the considerations listed in Figure 3, the acceleration of virtual connectivity is likely the single greatest force that has been influenced by COVID-19. Therefore, the evaluation of future trends incorporates some of the same ideas that have influenced telework/telecommute patterns over time.

Figure 3: Forces Affecting the Pace and Pattern of Growth

	Acceleration of Element Would Affect MWCOG Growth:	
Element	**Pace**	**Pattern**
Immigration (job producers)	More jobs/population, attracted from emigrant locale	No notable effect
Regional competitiveness: "one-company town" versus new markets (i.e., creative media)	More jobs/population associated with subject industry	Dependent on subject industry (i.e., Amazon HQ versus ecotourism)
Connected/Autonomous Vehicles (CAV)	None	Slight increase in dispersion
Virtual communications	None	Slight increase in dispersion
Mobility as a Service (MaaS)	None	Slight increase in compactness
COVID	Fewer jobs/population	Slight increase in dispersion
Inflation	Risk of boom/bust	Dependent on segments affected (i.e., real estate versus mobility costs)
Transit system unreliability	Fewer jobs/population	Slight increase in dispersion

1.1.2 Context from the 1918 Flu Pandemic

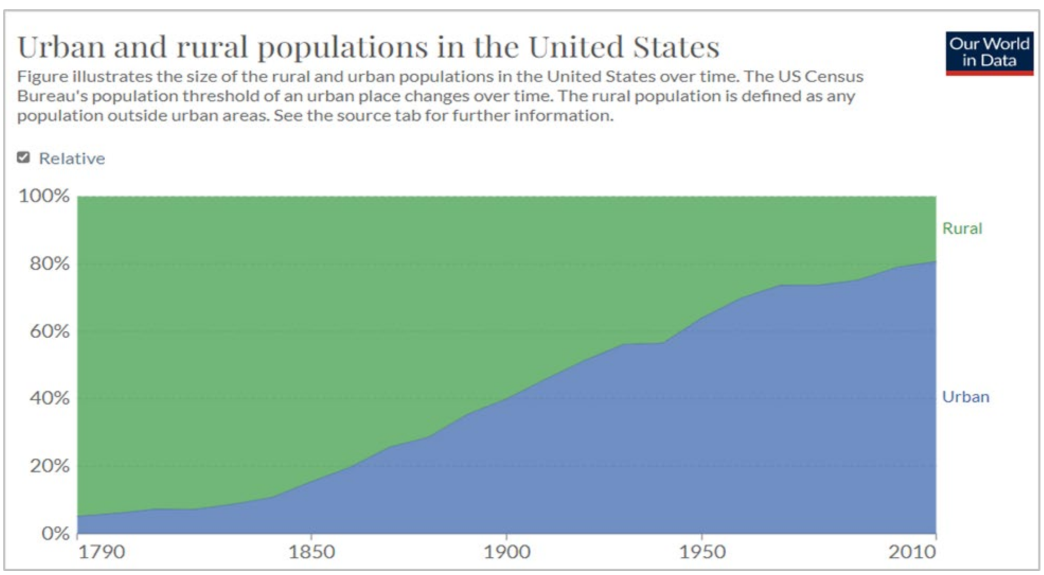
While the way in which both the market and policymakers will respond to the COVID-19 pandemic is unknown, we have a historical precedent that suggests the long term effects on land use may not be as substantial as perhaps suggested by media coverage of the volatility in employment and residential patterns during the first two years. The national experience during the 1918 flu pandemic which claimed the lives of approximately 675,000 US residents (roughly two-thirds of the current COVID-19 deaths at a time when the national population was about one-third of the present value). As with COVID-19, there were many concurrent social and political forces, perhaps most notably World War I, but also the 18th and 19th amendments to the Constitution banning manufacture or sale of alcohol and extending the right for women to vote nationwide.

Transportation technology was also rapidly changing the nature of cities. Streetcars, bicycles, and motor vehicles were all in their infancy. Virtual communication was accelerated by the invention and market penetration of the telephone (which theoretically eliminated the need to travel for the purpose of communications). City governance was also evolving, largely in response to public health concerns, with zoning established in Los Angeles in 1904, notably affecting city design with New York City's 1916 laws establishing setbacks, and culminating in the 1926 Supreme Court decision upholding the constitutionality of zoning in Euclid, Ohio v. Amber Realty Co.

As with COVID-19, the initial response to the 1918 pandemic was associated with the public health of individuals through actions (such as closing public schools and the wearing of masks) designed to address the immediate threat of the virus itself. But the longer-lasting effects of the pandemic were more subtle, such as the advent of socialized medicine (in various forms and extents around the world) and the establishment of epidemiology as a mainstream science.1

Yet public concerns about public health prompted by the 1918 flu pandemic did not have a notable effect on dampening urbanization trends, as indicated in Figure 4. From 1900 to 1930 the percentage of the US population defined by US Census results as living in urban areas (admittedly, Census definitions changed during that time) increased steadily from 39.6% to 45.6% to 51.2% to 56.1%. Notably the trend toward urbanization slowed during the depression: the 1940 value of 56.5% was only marginally higher than the 1930 value.

Figure 4: National Historic Urbanization Trends



[1] Spinney, Laura, "How the 1918 Flu Pandemic Revolutionized Public Health", *Smithsonian Magazine*, September 27, 2017

2 Estimating Changes to Commercial Space Use

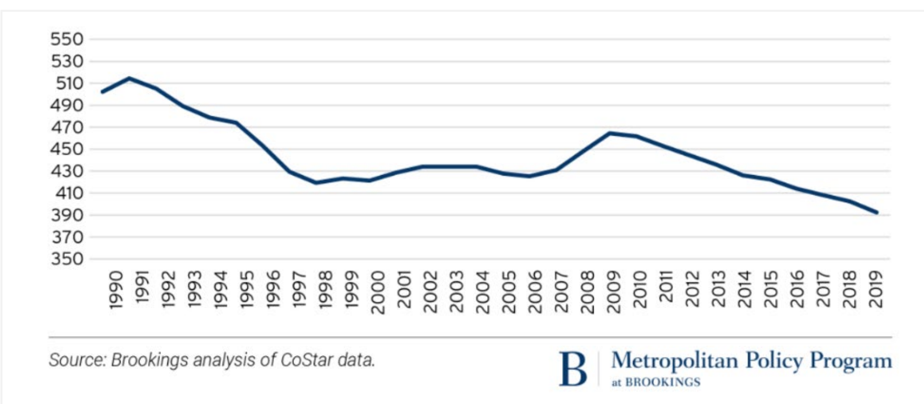
Overview

The COVID-19 pandemic significantly altered the commercial office space market and central business districts in the Washington, D.C. region. ICF conducted a scan of available information to understand how lasting these impacts may be, and how new work trends and behaviors are likely to shape the utilization of commercial office space moving forward (such as remote working policies for office workers during the pandemic). The first step in this effort was a comprehensive literature scan, followed by interviews with subject matter experts. As part of this analysis, ICF also reviewed current assumptions of workers per square foot for office use, including a review of data centers.

Demand for and utilization of office space evolved significantly during the 20th century. Historically, office building construction has been concentrated in central business districts (CBDs). However, this began shifting in the second half of the 20th Century following the development and population growth of inner suburbs. During the 1980s office space construction outside of CBDs boomed throughout the United States. Between 1979 and 1984, completions of new floor spaced reached an annual average of 97.8 million square feet.

Subsequently, the functionality of office space began to radically change with the development of the personal computer and the transition away from an industrial-based economy.[2] Overbuilding of office space in the 1980s led to rising vacancy rates in the early 1990s as office space demand plunged due to the national recession of 1990-1991, and as corporate downsizing, mergers, and consolidation became more common in the service sector. As a result of these forces, office space per employee has steadily declined since the 1990s, with exceptions corresponding with national recessions.[3] This illustrated by Figure 5, which shows a 22% decline of square feet per office worker from 1990 to 2019, among the top 10 U.S. metropolitan areas. Since the 2000s, urban cores have experienced a population resurgence, generally attributed to the growth of creative industries, the entry of Millennials into the work force, and the proliferation of paper-saving technologies.

Figure 5: Median office square feet per worker (top 10 US metropolitan areas)



2 https://www.fdic.gov/bank/historical/history/137_165.pdf

3 https://www.brookings.edu/essay/the-nature-of-office-work-is-shifting-and-so-must-downtowns/

A critical factor in projecting future office space utilization is when and to what degree office employees return to the physical office. As such, charting the impact of the COVID-19 pandemic on the region's economy, transportation patterns, and housing market is integral to this analysis. For a high-level frame of reference to the pre-pandemic period, we reviewed office activity rate, daily Metrorail boardings, office vacancy rates in downtown D.C., and regional traffic levels (Figure 6). These indicators illustrate an uneven return to normal: office activity (measured by Kastle Systems based on building access by app, keycard, and fob usage), and daily Metrorail boardings are still lagging, both in the mid-30-percentile of pre-pandemic rates, while office vacancy rates in downtown D.C. are up by more than 50%. However, regional traffic levels have nearly rebounded to pre-pandemic levels (91% of pre-pandemic levels in March 2022).[4]

Figure 6: Regional Economic Recovery Indicators

37.3%

Regionwide office activity rate (6/1/2022)

~99% in February 2020

228,200

Average daily Metrorail boardings (April 2022)

638,790 average daily Metrorail boardings in February 2020

17.5%

Office vacancy rate in downtown D.C. (March 2022)

11.1% in 2019

91%

Regional traffic levels compared to 2019 levels (March 2022)

Findings

Research identified several high-level findings that will share office utilization and functionality in the short- and long-term in the Washington region:

Square footage per office worker is decreasing and will continue to decline, especially with the rise of hybrid working arrangements and shared workspaces.[5] From 1990 to 2019, median office square feet per worker decreased by 24% in the top 10 metropolitan areas in the United States.

[4] https://www.kastle.com/safety-wellness/getting-america-back-to-work/#workplace-barometer

[5] Hadden Loh, Tracy. December 2020. *The Great Real Estate Reset - The office, reimagined: The nature of office work is shifting, and so must downtowns.* Brookings Institute. Retrieved from: https://www.brookings.edu/essay/the-nature-of-office-work-is-shifting-and-so-must-downtowns/

During this period, square footage per worker peaked at 515 SF/worker in 1991, rebounded slightly in 2008 and 2009 due to the global recession, and declined to 390 SF/worker in 2019. Historically this has been due to changes such as the rise of open office spaces and the increase in collaborative and team-oriented space. Office models with fully assigned workstations have made way for unassigned workstations and shared spaces. The office space is also expected to change after the COVID-19 pandemic with the rise hybrid work, office hoteling, and shared workspaces, further decreasing square feet per worker.[6]

Telework and hybrid schedules have become the new norm for office workers. Only 9% of current teleworkers in the metropolitan Washington region prefer to return to their work location full time, while the remaining 91% would rather telework either full time or a few days a week.[7] The Washington metro region is especially affected by this due to estimates that 51% of jobs in the Washington metropolitan area can be done from home according to a report from the Becker-Freidman Institute for Economics at the University of Chicago.[8]

Investments in resilient industries such as biotechnology or data centers have been reinforced during the pandemic. The biotechnology sector drew a lot of attention and investment over the last two years, especially with the development of the COVID-19 vaccine. Data centers have thrived due to the COVID-19 pandemic due to the increased need for digital commerce and online meetings has made digital infrastructure even more important than it has been in the past.

Overall job density within the region has increased and urban and inner suburban counties have experienced the largest increases in density compared to outer suburban counties over the last 10 years. Since 2010, Washington D.C. and inner suburban counties have seen the largest share of job growth in the region (29% in Washington D.C. and 33% in inner suburban counties). Outer suburban counties accounted for 29% of job growth in the region.

If workers continue to work from home, economic activity could shift towards mixed-use and university-based neighborhoods and away from downtown Washington, D.C. The continuation of remote work would mean that the demand for transportation to the downtown core would decrease and the need for economic activity in areas where remote workers live would increase. Examples of these neighborhoods in D.C. include Navy Yard, NoMa, and areas around Howard University and George Washington University. Outside of D.C. economic activity could shift to districts such as National Landing, near the new Virginia Tech campus.

[6] JLL Research. June 2020. The future of global office demand. Retrieved from: https://www.us.jll.com/en/trends-and-insights/research/future-of-office-demand#:~:text=Over%20the%20longer%20term%2C%20occupier,the%20longer%20term%20seems%20likely.

[7] MWCOG. February 2022. Regional Impacts of the COVID-19 Pandemic.

[8] McConnell, Bailey. April 2022. "Chart of the week: How will the region's geography of work change if remote work continues?". D.C. Policy Center. Retrieved from: https://www.dcpolicycenter.org/publications/geography-of-work/

Interviews

To gain insights on national factors, regional market forces, and trends impacting office space in the Washington region, ICF interviewed the following regional experts:

- Dr. Terry Clower, George Mason University Center for Regional Analysis
- Mina Wright and Eliza Voigt, U.S. General Services Administration
- Joe McAndrew, Greater Washington Partnership
- Deborah Kerson Bilek, Urban Land Institute - Washington

Questions for these discussions focused on emerging trends shaping long-term utilization of office space, short- and long-term impacts of remote working policies, as well as COVID impacts on commuting patterns and commercial uses. The regional experts we interviewed were largely consistent in their expectations for the future of office space.

These interviews identified the following findings and factors that will impact office density in the Washington, D.C., region:

- **Hybrid work schedules:** Hybrid/remote work policies are being adopted regionwide, by nearly all office sectors, representing the "new normal." The broad consensus is that flexible/hybrid working arrangements will be a permanent change that will prompt long-term shifts in commuting and office space utilization.
- **Decreased employee density:** Overall, consensus is that remote working policies and space-saving approaches will decrease demand, need, space requirements for office space. While office space per worker will continue to decrease, shared office resources and physical and programmatic uses of space will vary by sector and industry.
- **Federal policy direction:** Federal agencies are now focusing on employee "seats" instead of "population", to maximize office space flexibility. Long-term, experts expect policies adopted by the Office of Personnel Management (OPM) to have a significant impact on office utilization in the region, due to the tendency of the private sector, as well as Federal contractors, to follow the lead set by OPM.
- **Public transit tolerance:** It remains unclear when and to what degree commuters will return to Metro. As workers regionwide return to the office, several short-term questions will shape short-term commuting behaviors. First, how comfortable are commuters returning to Metrorail following the pandemic, as opposed to commuting via personal vehicles? The second factor is Metro's ongoing crisis related to recurrent rail safety issues. As a result, Metrorail is operating reduced service levels during peak weekday periods. As of late April 2022, Metrorail averaged 223,000 daily trips, 35% of pre-pandemic ridership levels. Metro does not expect rail ridership to return to pre-pandemic levels until 2024 (626,000 daily

boardings).[9] Additionally, commuters may be more willing to drive personal vehicles (and pay associated costs) if they're only traveling to the office 2-3 times per week.

- **Mixed-use supremacy:** Diverse, mixed-use communities are more attractive for economic activity and office workers, while single-use neighborhoods will struggle. Experts broadly expect communities that feature a mix of residential, commercial office, and retail spaces, such as COG's Activity Centers, will become more dynamic and desirable long-term for office tenants. Alternatively, neighborhoods that depend primarily on office space to generate commercial activity will struggle to remain attractive to tenants. Post-pandemic, experts expect the implications of this trend will result in higher vacancy rates among Class B and Class C office space. This is prompting renewed interest in office-to-residential conversion. Since the fourth quarter of 2021, 2.3 million square feet of office space in the Washington, D.C., region is being targeted for conversion to residential space.[10]
- **Retail regression:** The pandemic accelerated shifts in preexisting retail trends and consumer preferences, such as the divestment in brick-and-mortar stores and increased demand for home delivery services. Long-term, these trends may result in fewer retail stores in central business districts (CBDs), depressing tax receipts. Experts interviewed expect fewer conferences and corporate travel, resulting in a slower recovery for the hospitality industries and lower hotel occupancy rates, short-term. As a result, the economic recovery of the hospitality industry in the region is lagging other core industries.

2.1.1 Office Utilization Trends

As noted above, office square feet per employee has been declining nationally for decades, due to open floor plans, and more recently, the rapid expansion of coworking spaces, which feature extremely tight densities (in the range of 65-100 SF/employee). Based on the research included in this memo, the impacts of the COVID-19 pandemic are expected to accelerate the decline in office space per employee. This is due to several factors:

- With fewer employees returning to the office full-time, private sector companies are reevaluating space needs and the location of offices.
- Remote work is firmly established as the "new normal" and will have permanent effects on both office space use and travel patterns in the region.
- With fewer employees in the office full-time, companies are shifting to "hotel" models where space is collectively shared and reserved when employees are in the office.

Functionally, office spaces are now being designed to accommodate a mix of in-person and remote participants. To accommodate the shift away from dedicated personal offices, features like sound-proofed cubicles to handle Zoom, Teams, or private calls are now standard features of redesigned offices. Long-term, while it's clear this trend will shape D.C.'s office and housing market, specific implications are still evolving.

[9] "Metro says ridership is outpacing transit agency projections" https://www.washingtonpost.com/transportation/2022/05/09/dc-metro-transit-riders/?emci=d5428f66-a3cf-ec11-997e-281878b83d8a&emdi=3f9ee159-a5cf-ec11-997e-281878b83d8a&ceid=5767042

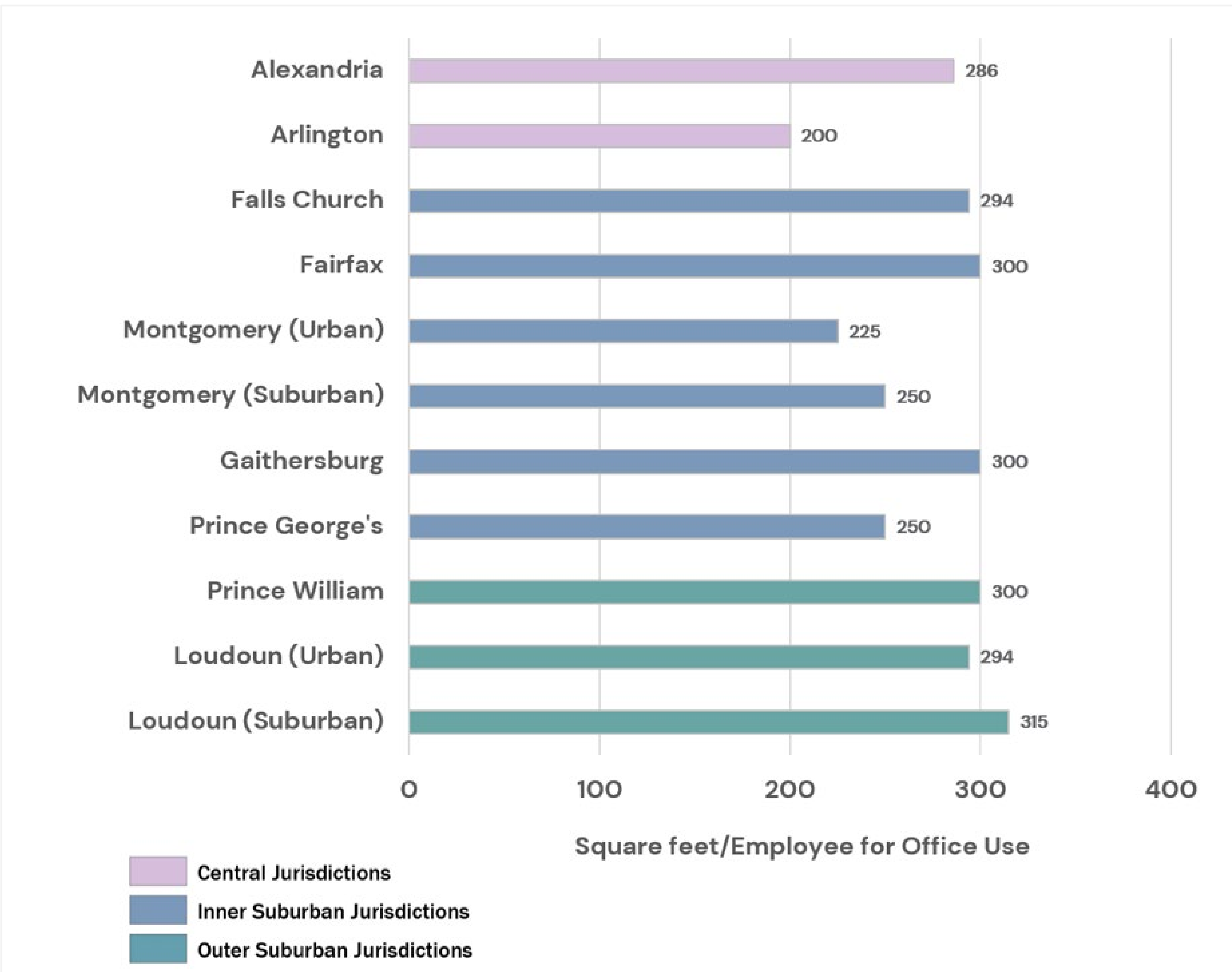
[10] JLL Office Insights Q1 2022: https://www.us.jll.com/en/trends-and-insights/research/office-market-statistics-trends/washington-dc

2.1.2 Regional Office Space Density

To establish a baseline comparison for commercial office space density in the Washington region, ICF reviewed square footage per employee data provided by COG members during the Round 8 Cooperative Forecast in 2010 (Figure 7). (Definitions such as “Urban” and “Suburban” were determined and provided by member jurisdictions).

Not surprisingly, office density is higher in the Central Jurisdictions (Arlington and Alexandria) and Inner Suburban Jurisdictions, specifically Montgomery and Prince George’s Counties in Maryland. Among the dataset provided, Arlington County reported the highest density (200 SF/employee). It’s important to note that this data set did not include square footage per employee data for Washington, D.C. For comparison, a 2018 Cushman & Wakefield report calculated D.C.’s office density at 118 SF/per employee.

Figure 7: Regional Office Space Density (COG Round 8, 2010)



2.1.3 Return to Office + Impact on Central Business Districts

Kastle Systems measures national office activity based on building access by app, keycard, and fob usage. In April 2020 at the onset of the COVID-19 pandemic in the United States, national office activity rates plummeted to 14.6% of pre-pandemic activity levels (January 2020). Since then, office activity rates have struggled to surpass 40% nationally, with noticeable dips correlating with the emergence of novel COVID variants (Figure 8).[11] In the Washington region, office activity rates in late May and early June 2022 hovered between 37.3%-39.1% (Figure 9).

Figure 8: Weekday Office Activity Relative to 2019 (Kastle Systems)

Low office activity rates portend long-term consequences for downtown Washington and other office-dominant districts in the region. In February 2022, the office vacancy rate in downtown D.C. jumped to 17.5% (compared to 14.6% regionwide), up from 11.1% in 2019 (Figure 10). Among a subset of 10 CBDs analyzed by *The Washington Post*, the average increase in vacancy rate from 2019 to 2022 was 35%; during that period Phoenix experienced the highest vacancy rate increase (66%), followed by the Washington region (58% increase) (Figure 11). Additionally, the DowntownDC Business Improvement District (BID) reported 9.7M square feet of vacant office space in February 2022.[12]

[11] https://www.kastle.com/safety-wellness/getting-america-back-to-work/#workplace-barometer

[12] https://www.washingtonpost.com/business/2022/05/04/central-business-district-dc-pandemic/

Figure 9: Weekly Office Activity Rates (May 25 and June 1, 2022)

	5/25/22	6/1/22	% Change
Chicago metro	40.0%	37.2%	2.7% ▼
Austin metro	58.5%	56.1%	2.4% ▼
Houston metro	56.0%	53.8%	2.1% ▼
San Francisco metro	33.6%	31.6%	2.0% ▼
Washington D.C. metro	39.1%	37.3%	1.8% ▼
San Jose metro	33.9%	32.1%	1.8% ▼
Average of 10	**42.9%**	**41.2%**	**1.7%** ▼
Philadelphia metro	38.1%	36.7%	1.4% ▼
New York metro	38.0%	36.6%	1.4% ▼
Dallas metro	51.3%	50.2%	1.1% ▼
Los Angeles metro	41.0%	40.5%	0.5% ▼

Figure 10: Office Vacancy Rates by CBD (2019-2022)

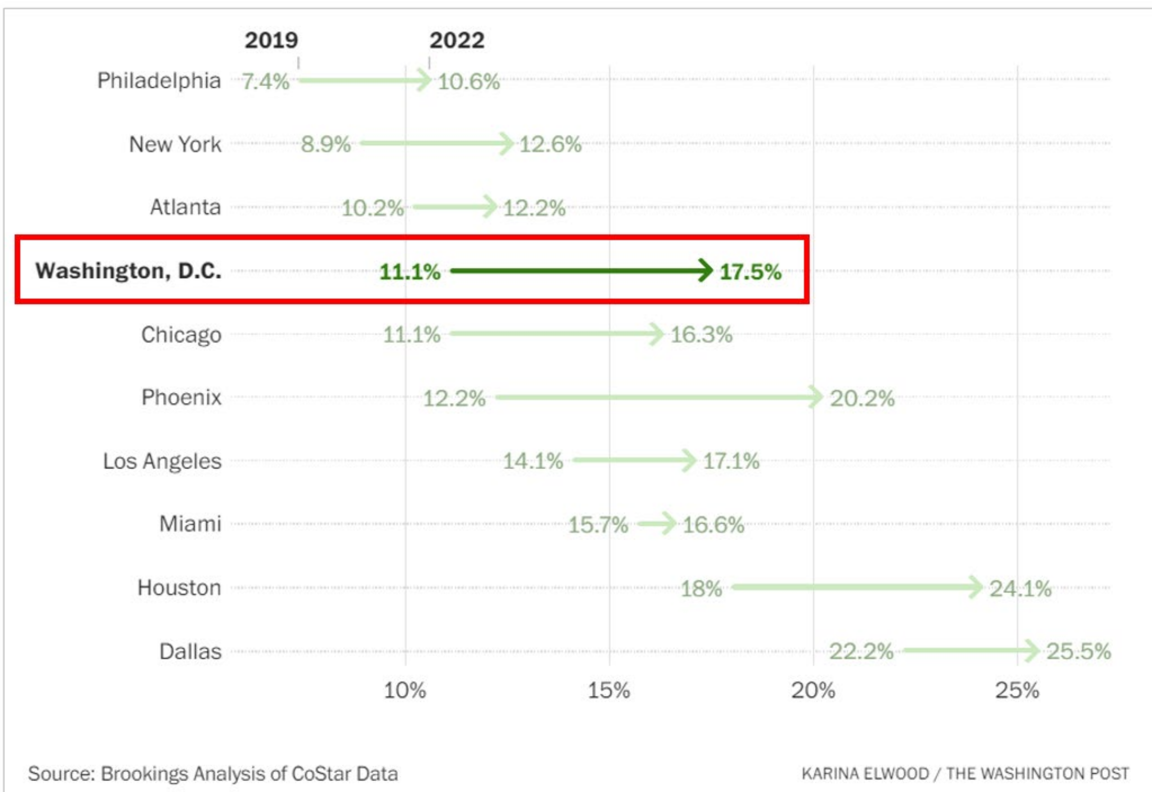


Figure 11: Change in Office Vacancy Rates (2019-2022)

Region	2019 Vacancy Rate (%)	2022 Vacancy Rate (%)	% Change
Atlanta	10.2	12.2	20%
Chicago	11.1	16.3	47%
Dallas	22.2	25.5	15%
Houston	18	24.1	34%
Los Angeles	14.1	17.1	21%
Miami	15.7	16.6	6%
New York	8.9	12.6	42%
Philadelphia	7.4	10.6	43%
Phoenix	12.2	20.2	66%
Washington, D.C.	11.1	17.5	58%

2.1.4 Office-to-Residential Conversion

Due to the significant increase in vacant commercial office stock, converting office space to residential units is a potential opportunity for CBDs. While historically these conversions have not been economically viable, office to residential conversions are being considered regionwide.

In 2020, the DC Office of Planning (DCOP) conducted an assessment of commercial to residential conversions in the District.[13] Three types of conversion approaches are most typical in D.C.: office conversion (reuse of an existing office building), site redevelopment (partial or full removal of existing commercial buildings), and hotel conversions. The analysis found that the potential for office-to-residential conversion is highest in areas with older office buildings where demand for office and hotel uses are declining, such as in the Dupont Circle office submarket. Short-term, there's an expected excess supply of Class A residential space, which may limit conversion potential.

The analysis also notes the extreme high demand for Trophy Class office space. Outside of the CBDs, areas with high rates of older and less desirable Class B and Class C office space may see increased desire for commercial to residential conversions. A quarterly report in 2021 by Jones Lang LaSalle noted that the Class B office market in the Washington region is focusing on residential conversions, with 2.3M square feet in the D.C. region being targeted or considered for conversion.

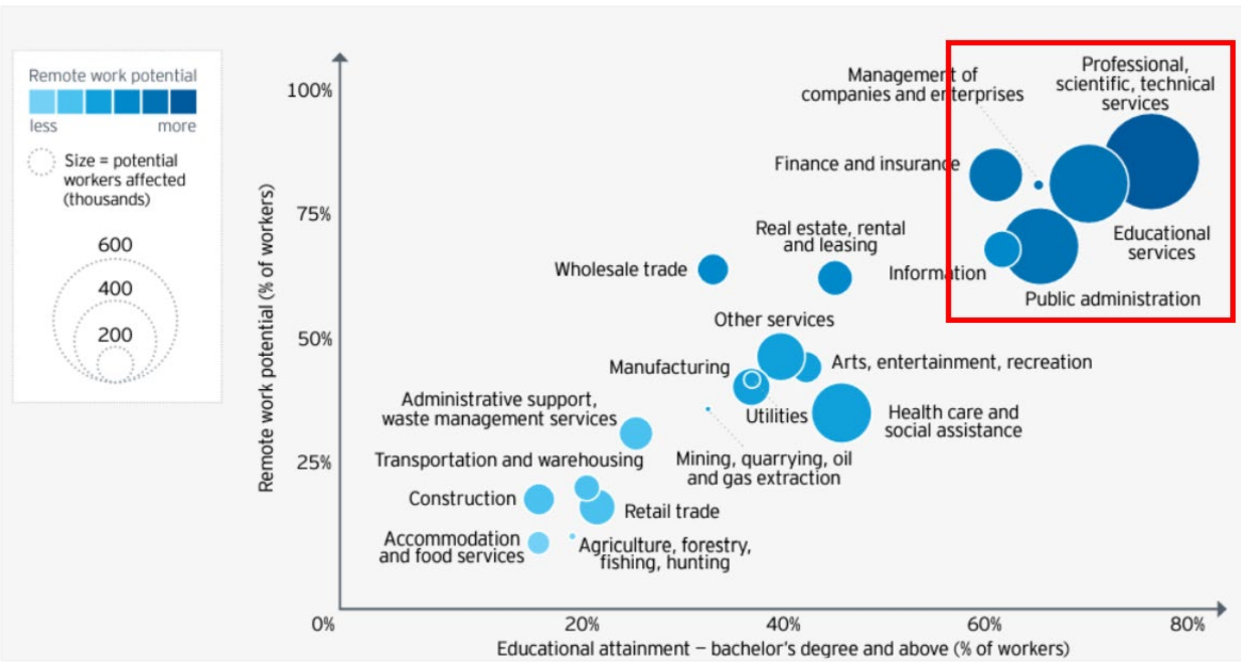
As a result of office space and transportation trends, CBDs nationwide are facing increased competition from developments in inner and outer suburban jurisdictions.

13 https://planning.dc.gov/sites/default/files/dc/sites/op/page_content/attachments/Assessment%20of%20Commercial%20to%20Residential%20Conversions%20in%20the%20District%20of%20Columbia_Q2%202020.pdf

2.1.5 Remote Work Potential

An exacerbating factor impacting office space utilization is the shift to remote work. This shift is especially significant given the highly educated population of the Washington region and the potential for knowledge-sector jobs to be conducted remotely. The Greater Washington Partnership's 2021 report, "Remote Work in the Capital Region" illustrates the high correlation between educational attainment and remote-work potential (Figure 12).[14] Sectors with the highest remote work potential are historically the industries that have driven the Washington region's economy, including professional, scientific, and technical services, public administration/government, and educational services. The degree to which these industries embrace remote or hybrid working schedules will drive demand for office space and determine how offices are utilized and functioned moving forward.

Figure 12: Correlation of remote work potential and education attainment (Washington region)



2.1.6 Data Centers

A secondary objective of this research is to understand the impact of data centers in the Washington region's suburbs. Northern Virginia is the largest data center market in the world and based on power consumption is twice the size of London, the second largest market.[15] Data centers are an integral use to the region's hyperconnected and data-dependent economy. The need for these services intensified due to social distancing policies implemented during the COVID-19 pandemic.

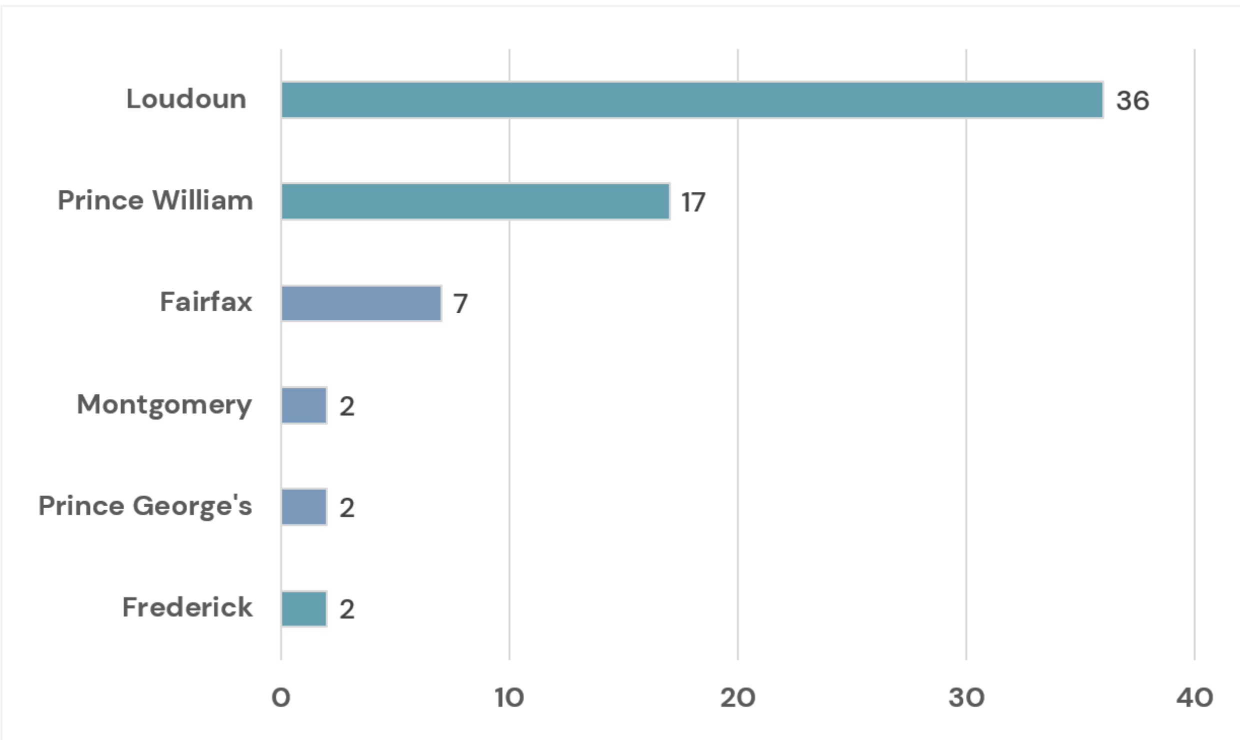
[14] https://greaterwashingtonpartnership.com/wp-content/uploads/2021/02/Remote-work-in-the-Capital-Region-Report_Final.pdf

[15] https://cushwake.cld.bz/2022-Global-Data-Center-Market-Comparison/10/

Data centers are a significant source of tax revenue. A report by the Northern Virginia Technology Council estimated that in 2021, data centers were responsible for nearly $1.2 billion in state and local tax revenues in Virginia.[16] Full-time job creation, however, is minimal. Data center workforces typically range from 20-50 employees, consisting of data operations managers, network/computer system engineers, and facilities technicians; security is generally provided by contractors.

Since 1990, 44 data centers have been constructed in the Washington region, with two under construction and planned to open in 2023. During this period, all new data centers are in either Loudoun or Prince William Counties (Figure 13). Since 2016, the region has experienced an uptick in growth, with 29 data centers built and operational and 4 under construction.

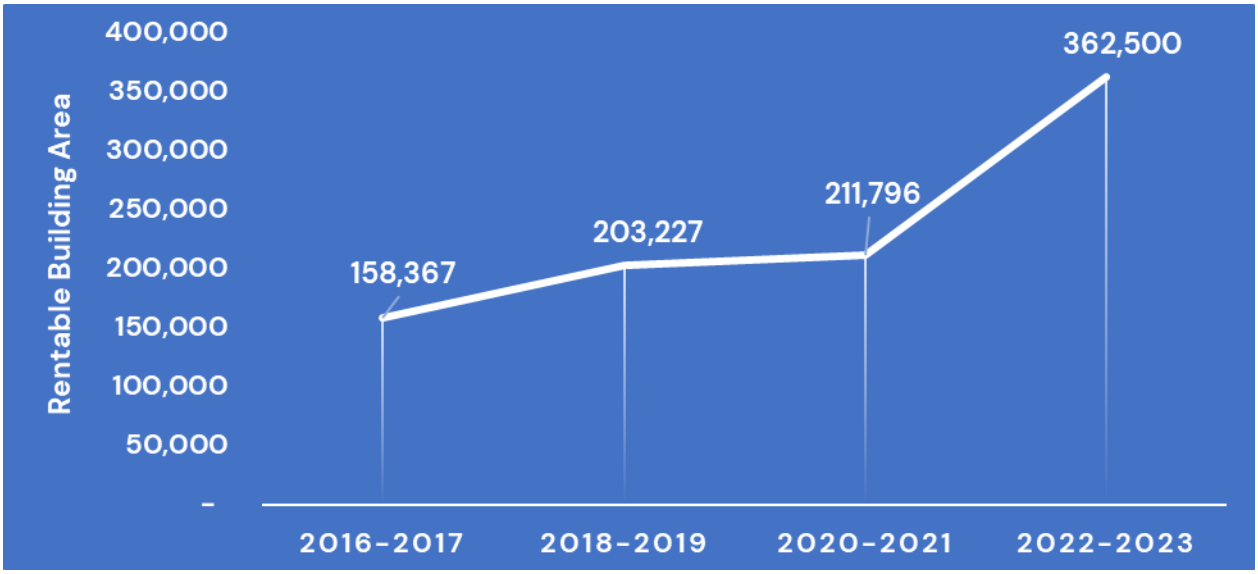
Figure 13: Location of data centers in the Washington region (1974-2023)



Since 1990, the average square footage (rentable building area) per data center in the region is 190,023. From 2016 to 2023, the size of data centers in the Washington region rapidly increased. In 2016-2017, the average RBA was approximately 158,000 SF; for data centers coming online in 2022-2023, the RBA increased by 129%, to approximately 362,000 SF (Figure 14). In response to these expanding footprints, a recent trend in Loudoun County is multi-level data centers.

[16] https://nvtcawards.formstack.com/forms/2022_data_center_report

Figure 14: Average Size of Data Centers (2016-2023)



3 Range of Forecasts and Assessment of Housing Amount, Timing, and Location

Task 3 consists of two related subtasks. Task 3A develops a range of forecasts for the MWCOG region as whole, with a focus on the effects of COVID-19. Task 3B assesses the degree to which the pace and pattern of housing within the region is affected by COVID-19. The two subtasks were combined for the purposes of literature review, analysis, and the development of regional implications described in the following paragraphs.

Literature

A wealth of literature exists on the recent past experience with COVID-19 and its disruptive effects on economic conditions during the past two years. These "backward-looking" studies are useful to document the degree to which both the economic and social environments created impacts in terms of unemployment as well as stated preference surveys regarding desire to return to work.

The focus of most studies that are "forward-looking" rather than backward-looking has evolved during the pandemic. Most studies conducted during the first few months of the pandemic in 2020 focused on the public health effects of the pandemic and the uncertainty associated with vaccine production and effectiveness. As vaccine effectiveness shifted from hypothetical to observable in 2021, the shift of forward-looking literature evolved from public health to economic recovery, and then the effects of near-term federal deficit spending on longer-term GDB effects. There is a wealth of literature regarding the philosophical aspects of technological and societal trends, and the possible policy actions that could facilitate those aspects that most serve community objectives while ameliorating adverse effects.

The literature is robust on the topic of how the market reacted to the first two years of COVID-19. Examples of the effect of COVID on historic patterns are distributed throughout this technical document.

Looking Forward - Qualitatively

The literature is rich in papers that address societal implications of the pandemic and its related societal effects (notably related to communications technology and the effects of governmental investment in private sector economic recovery). Yet most of this literature focuses (not inappropriately) on hypothetical concerns and potential approaches that governments might take toward addressing adverse effects.

In general, COVID-19 is viewed as accelerating many societal trends already underway. Notably, technology advancements have been accelerating the ability to replace physical travel with virtual connectivity for the purposes of information exchange. The same technology tools have facilitated e-commerce; while physical travel is still needed for goods movement, it can be made more efficient (particularly from the view of the consumer). On the other hand, COVID-19 drastically curtailed travel for experiential purposes. The common view of experiential trip purposes include dining, performing arts (e.g., movies, plays, sporting events), and other social events (e.g., at social clubs, places of worship). However, the challenge in assessing potential long-term changes due to the pandemic is defining the boundaries between information exchange, goods movement, and experiences. One who dials in remotely to a hybrid meeting can likely conduct the information exchange that is the primary meeting purpose, but may miss (both literally and emotionally) the experience of idle chatter before and after the formal meeting.

A Richard Florida study[17] is typical of the type of information in the qualitative literature and provides a useful means of organizing both some key concerns and possible countermeasures. COVID-19 concerns facing all cities include:

- Social scarring: the degree to which a fear of crowds (enochlophobia) remains in the populace after the direct threat of COVID-19 has been addressed
- Changes in built form: COVID-19 has accelerated some land use trends, particularly related to retail which is increasingly reliant on e-commerce distribution centers, with brick-and-mortar retail spaces not going away, but becoming increasingly experiential in nature.
- Changes in real estate and urban functions: to the extent that social scarring reduces the interest in city living and working for some current urban residents and employees, a reduction in attractiveness for the current market will likely reduce urban real estate prices which in turn will increase attractiveness to a slightly different marketplace that possessed the interest but not the means to occupy that urban space.

Looking Forward - Quantitatively

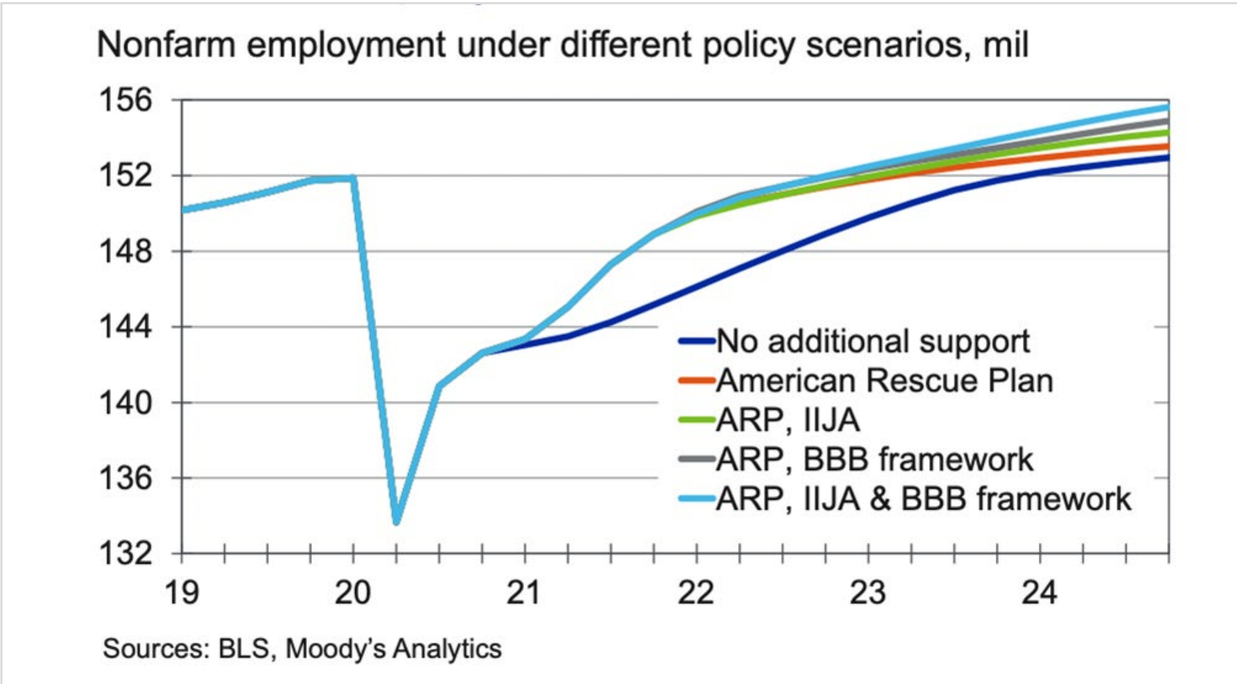
In 2021, Congress passed two major pieces of legislation: the American Rescue Plan (ARP) and the Infrastructure Investment and Jobs Act (IIJA -- also known as the Bipartisan Infrastructure Framework, BIF). In addition, Congress and the White House were at the time deliberating on a third: the Build Back Better infrastructure/social spending plan (BBB). Independent estimates of the effect of the three bills show some considerable variation, partially based on varied assumptions regarding the size of the bills.

In November 2021, Moody's Analytics published an assessment of the near-term effects of deficit spending based on the historic and baseline near-term projections of national non-farm employment developed by the Bureau of Labor Statistics.[18] Figure 15 shows the estimated effects of alternative investment scenarios on the total employment levels. The left side of the chart shows the pre-pandemic growth rate in employment and the fact that the pandemic caused national employment levels to drop from about 152 million to about 134 million, about a 12% drop at the start of the pandemic in the first quarter of 2020. About half of the jobs had been recovered by the third quarter of 2020, with alternative recovery predictions affecting the speed of jobs recreation/expansion by a range of about 4 million jobs by the end of 2024. At the right side of the graphic, the growth rates are roughly at pre-pandemic levels, but the upshot of the pandemic is that the precise year at which any total job level is attained has been delayed (i.e., shifted to the right on the chart) by about five years.

[17] Florida, Richard; Rodriguez-Pose, Andres; and Storper, Michael, "Cities in a Post-Covid World", Urban Studies Journal, DOI: 10.1177/00420980211018072, published April 2021.

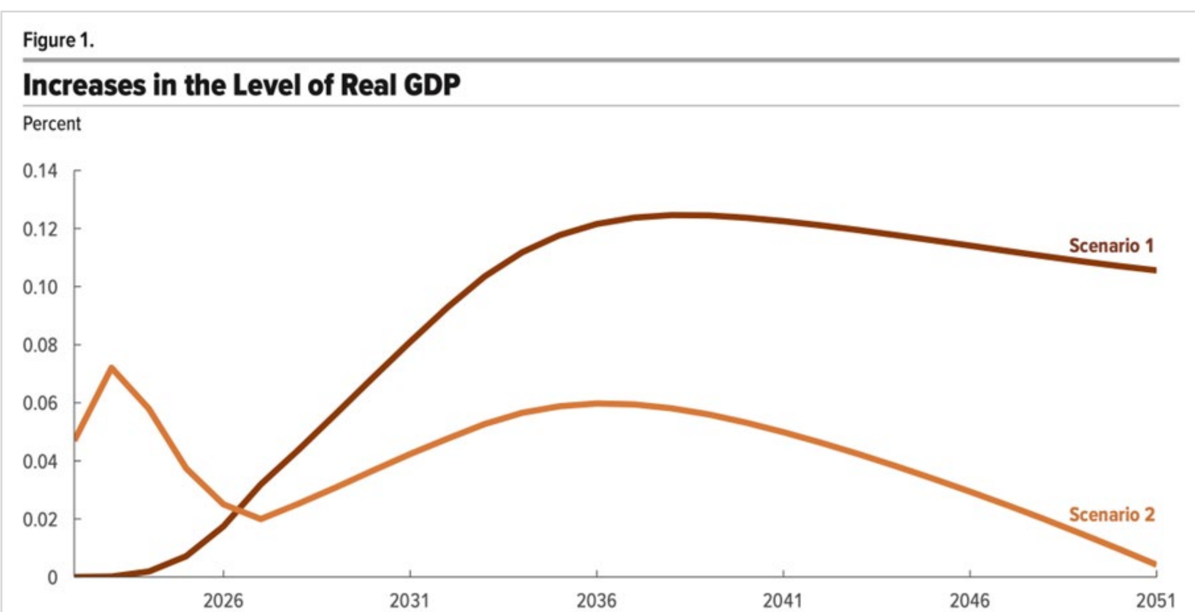
[18] Zandi, Mark and Yaros, Bernard, "Macroeconomic Consequences of the Infrastructure Investment and Jobs Act and Build Back Better Framework", Moody's Analytic Briefs, November 4, 2021.

Figure 15: National Perspective on Pandemic Recovery



The Congressional Budget Office (CBO) conducted a scenario test on a potential $500 billion infrastructure bill in August 2021, shown in Figure 16. Under a deficit-neutral scenario, CBO estimates a more gradual, sustained positive effect on long term Gross Domestic Product (GDP). For example, they found that a deficit-neutral bill would increase GDP and lower the national debt, 2030 raising GDP by 0.09 percent by 2030 and 0.10 percent by 2050. Under a deficit scenario, the CBO estimates a much more immediate bump in GDP by 2022 (+0.09%), but one that quickly falls, rising somewhat in 2030 only to taper again and falling nearly to zero by 2050.

Figure 16: Effect of Deficit Spending on Long-Term GDP



The ICF team found two studies that proposed methods to quantify the effect of replacing physical travel to the workplace with virtual job performance. Both studies examined the propensity of work-from-home (WFH) to increase due to both technological and societal expectations advanced during the pandemic. Both studies approached the concept of WFH agnostic to whether the work requires virtual connectivity to the traditional workplace or was a full shift to a home-based business.

Davis, Ghent, and Gregory developed an equilibrium model to examine the effect of work-from-home (WFH) technology on income, equity, and city structure. Their model suggests that there will be a slight shift from higher cost, higher density neighborhoods to lower cost locations within the same metropolitan area, but not a shift to remote rural locations. This paper establishes a theoretical model structure with statistical assessment of several independent variables, but does not apply the model to any specific metropolitan area but rather assemble the US data into a prototypical CBD with two nearby counties; one surrounding the CBD and another further away. The premise of their analyses includes an assumption that long-term pandemic effects will include a market penetration for work-from-home that is four times pre-pandemic levels.

Delventhal and Parkhomenko developed a spatial model to examine the substitution of on-site work effort with work performed from home. This model examined the Census Public Use Microdata Area (PUMA) geography which subdivides the nation some 4,500 zones and considered a change in telework patterns described as removing the aversion to remote work by employers and employees alike. The results of the study are described in greater detail in the subsequent discussion on Value of Time analyses that compares the Delventhal/Parkhomenko results to independent analysis conducted by the ICF team.

Analysis

The ICF Team conducted three independent analyses to further the development of a range of forecasts for the MWCOG region:

- An assessment of third-party forecasts, to test the hypothesis that if the pandemic is widely expected to contribute to a dispersal of population, that effect would be demonstrated in forecasts prepared by agencies that prepare updated forecasts on a routine basis.
- A Monte Carlo simulation of past regional growth, randomized, to create a sense of the variability inherent in forecasts, and
- An independent "value of time" assessment of the degree to which more distant jurisdictions may become more attractive as virtual travel replaces physical travel over time.

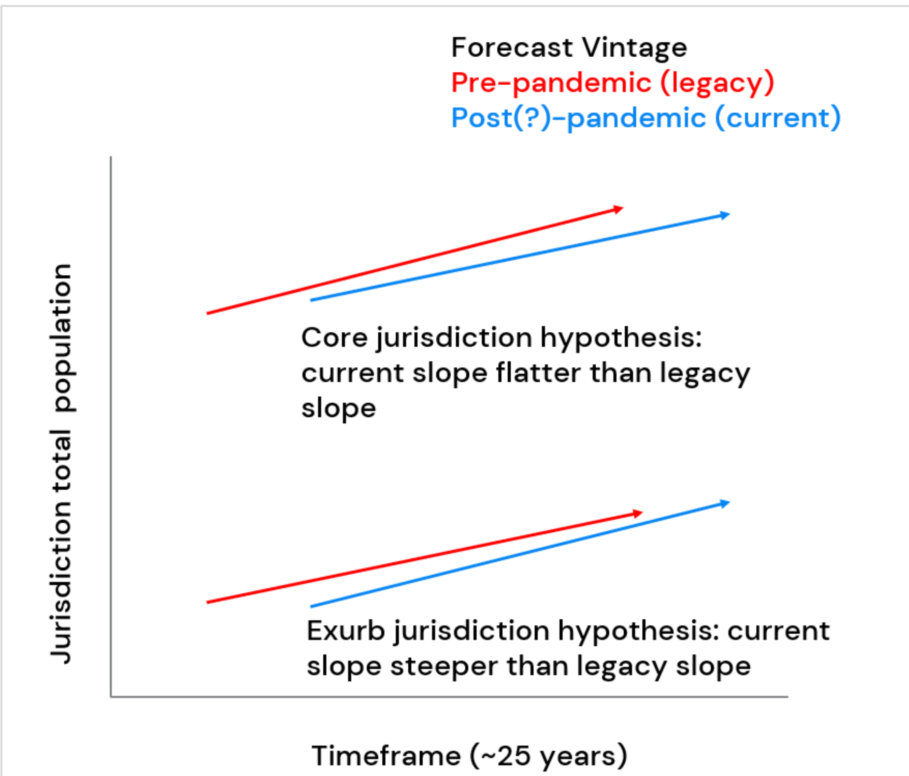
Assessment of Third-Party Forecasts

The study team considered that, to the extent that COVID-19 may have effects on population or jobs dispersal, these trends might be evident in comparing forecasts of pre-pandemic and most-recent vintages from third-party sources that make regular updates to their forecasts. Figure 17 provides a graphic depiction of what we might expect to see if other groups making projections see the pandemic as a force accelerating the dispersal of population from close-in to more exurban locations. The hypothesis is that:

- Core jurisdictions (shown as being more populous than Exurban jurisdictions simply for the sake of graphic presentation although there are certainly exceptions that prove that general rule) would tend to see population growth rates slightly lower in current forecasts than in their legacy forecasts of pre-pandemic vintage. So the growth as described by the slope of the population forecasts over time would be expected to have a slightly flatter trajectory in the current forecasts than in the legacy forecasts, regardless of the differences between the precise horizon year and total amount of development.

- Exurban jurisdictions, on the other hand, might be expected to have the reverse trend. If they are becoming more attractive to residents after our pandemic experience (which is still too soon to describe as fully post-pandemic without the parenthetical question mark), the current forecasts might be expected to show a slightly steeper slope of growth as compared to the legacy, pre-pandemic forecasts.

Figure 17: Third Party Forecast Hypothesis



The ICF Team examined both the Standard and Poors Global Insight (S&P_GI) forecasts typically used by MWCOG, as well as the forecasts prepared by both Maryland and Virginia state data centers for all jurisdictions in their respective states. Neither set of examinations support the hypothesis that the pandemic would meaningfully accelerate population dispersal.

Figure 18 compares the Average Annual Growth Rate (AAGR) for the S&P_GI forecasts prepared in 2015 with those from 2022, using the MWCOG definition of jurisdiction type. The 2022 vintage forecasts are slightly more bearish on growth rates overall, but the pattern of the changes in growth rates is the opposite of that which would support the hypothesis that the pandemic increases population dispersal from the core: the outer jurisdictions and exurbs are relatively less attractive for growth than the core and inner jurisdictions for both population and employment.

Figure 18: Legacy/Current Forecast Comparison: S&P_GI

	Average Annual Growth Rate - S&P Global					
	Population			Employment		
	2015	2022	Change	2015	2022	Change
Core	0.26%	0.39%	0.13%	0.58%	0.56%	-0.02%
Inner	0.26%	0.34%	0.08%	0.65%	0.57%	-0.08%
Outer	2.27%	1.47%	-0.80%	2.58%	1.46%	-1.12%
Exurb	0.94%	0.63%	-0.31%	1.20%	0.70%	-0.50%

Figure 19 compares the Average Annual Growth Rate (AAGR) for forecasts prepared in pre-pandemic timeframes with those most recently available from 2022, using the county-level typology from the Centers for Disease Control (CDC) shown on the map to distinguish different classifications of counties as related to their metropolitan areas. Note that Washington DC was excluded from this analysis simply because the state-level and regional-level forecasts are already functionally connected for the one-to-one correlation between statewide and local forecasting. As with the S&P_GI forecasts, the state data center forecasts are also more bearish on growth in current forecasts as compared to legacy forecasts. While the growth rates by classification do not as starkly refute our hypothesis that the pandemic is thought to promote population dispersal as the S&P_GI forecasts do, neither do they support the hypothesis: the large metro jurisdictions are shown to have become slightly more attractive when comparing legacy forecasts to current forecasts.

Figure 19: Legacy/Current Forecast Comparison: State Data Centers

	Weldon Cooper AAGR			MDP AAGR		
County Class (CDC)	Legacy (2017)	Current (2021)	Change	Legacy (2018)	Current (2020)	Change
Large central metro	0.51%	0.42%	-0.09%	0.15%	0.05%	-0.10%
Large fringe metro	1.17%	1.04%	-0.13%	0.55%	0.52%	-0.03%
Medium metro	0.43%	0.30%	-0.14%	0.92%	0.78%	-0.15%
Micropolitan Counties	-0.45%	-0.66%	-0.20%	0.62%	0.47%	-0.15%
Noncore Counties	0.08%	-0.08%	-0.16%	0.74%	0.64%	-0.10%
Small metro Counties	0.86%	0.75%	-0.11%	0.98%	0.80%	-0.18%

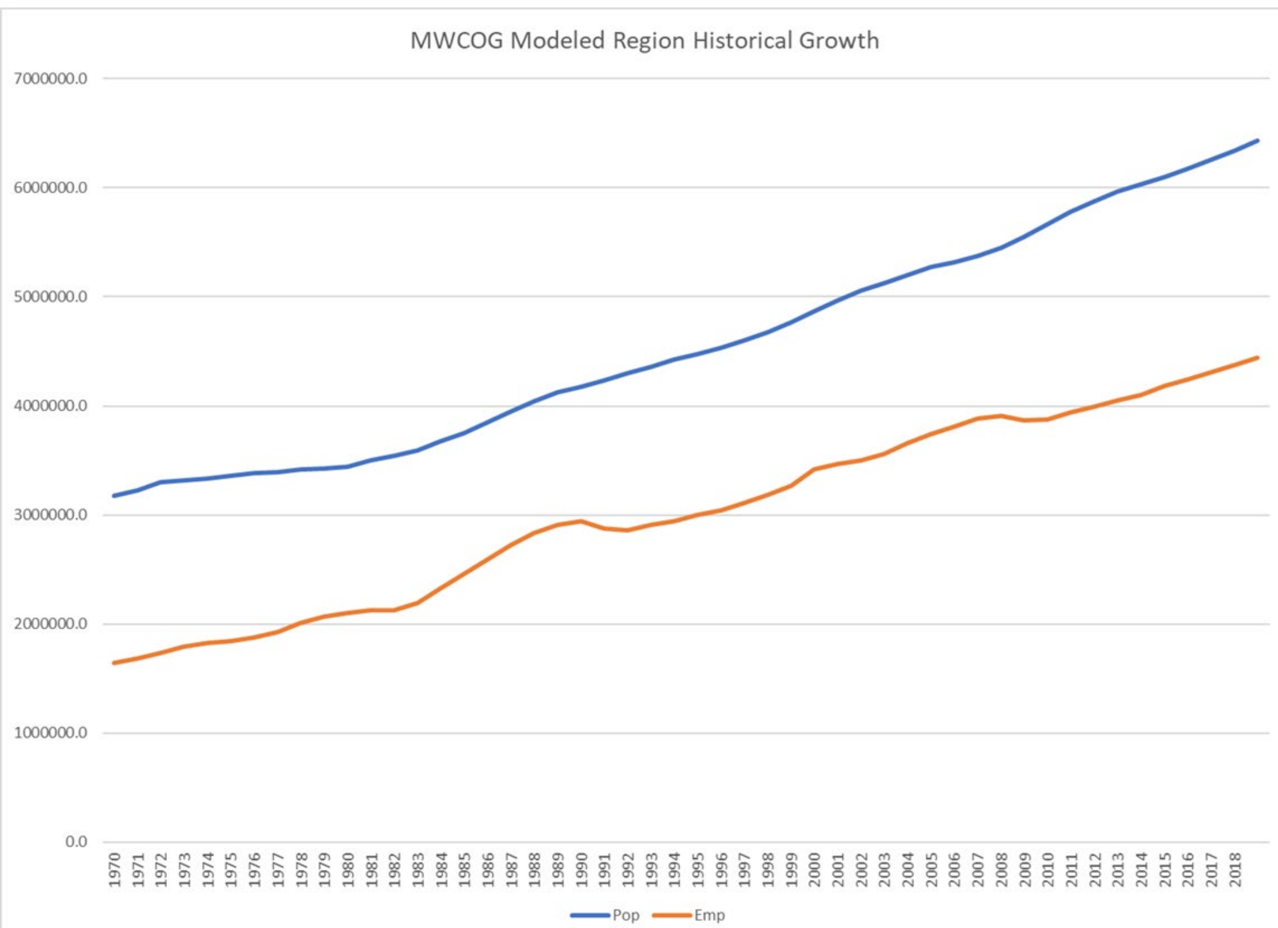
Independent Analysis

The ICF team developed two quick-response independent analyses to assess variability associated both with historic growth trends (a Monte Carlo method) and the effect of increased virtual connectivity (a Value-of-Time analysis). The following paragraphs provide details of both analytic exercises.

Monte Carlo Method

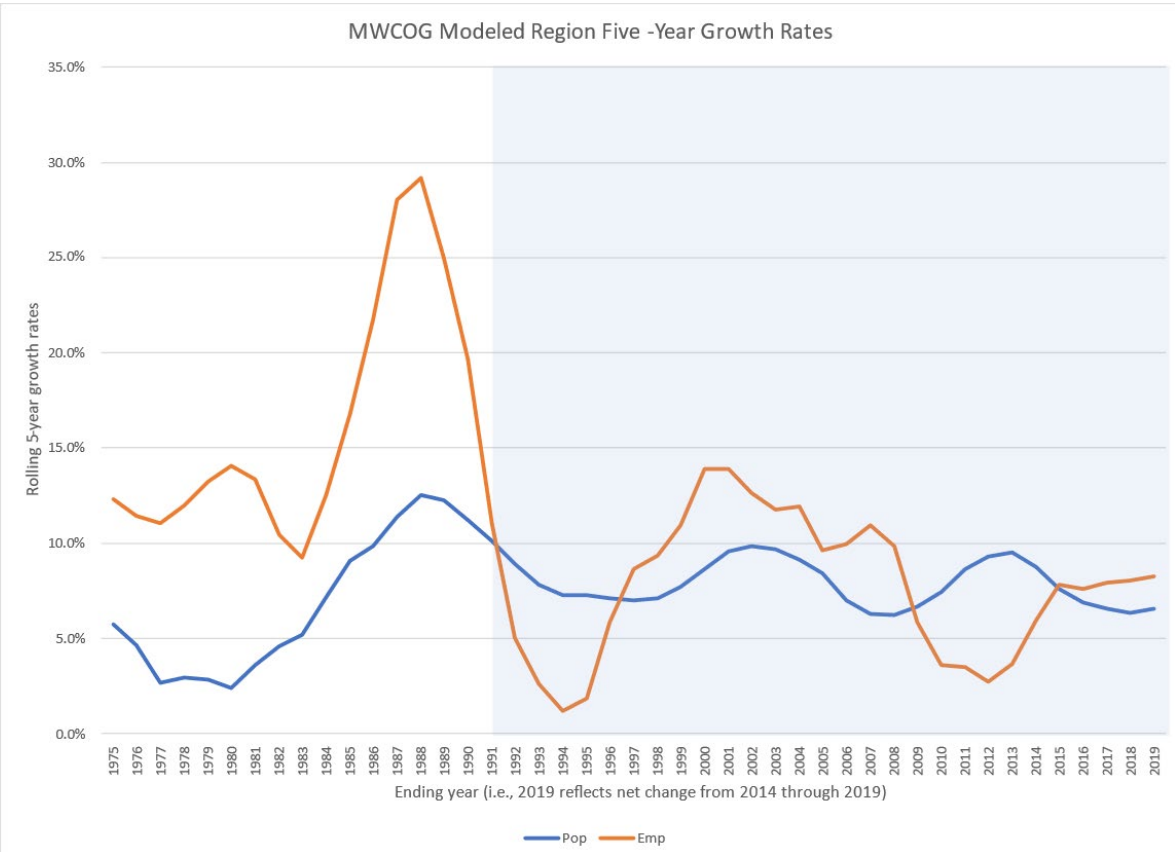
All forecasts are uncertain. It is challenging to put appropriate bounds on a margin of error, particularly for longer-range forecasts. When legacy forecasts from several decades in the past are compared to contemporary land uses, specific reasons for the patterns of actual growth are readily observable. Particularly in examining growth totals for an entire region, the growth patterns tend to be related to national economic growth patterns. Figure 20 shows the historic growth patterns for both population and jobs for jurisdictions in the TPB modeled region from 1970 through 2019. The Washington DC region is generally less susceptible to the effects of national or global recessions due to the stabilizing force of the federal government (and its influence on indirect and induced development). Yet substantial recessions are visible in the variability of job growth (1990-1992 and 2008-2009 are the only time periods when the broader modeled region actually lost jobs from one year to the next). Employment growth is more variable than population growth, as jobs growth or losses tend to drive regional attractiveness for residents but for most residents a change in job status is not as disruptive as a household relocation to another region. The population growth history therefore shows a slightly smoother trend that mirrors the job growth patterns but in a dampened manner; the modeled region has never shown a decrease in population from year to year.

Figure 20: Historic Population and Jobs Totals for MWCOG Modeled Region



When the assessment of growth turns from regional totals to growth rates, the historic patterns of boom and bust become more visible. Figure 21 shows the rolling five-year growth rates for the same 1970-2019 time period. The relative volatility of employment growth as contrasted with residential growth is emphasized in this graphic portrayal, although with a rolling five-year period of evaluation, all time periods show at least some positive growth.

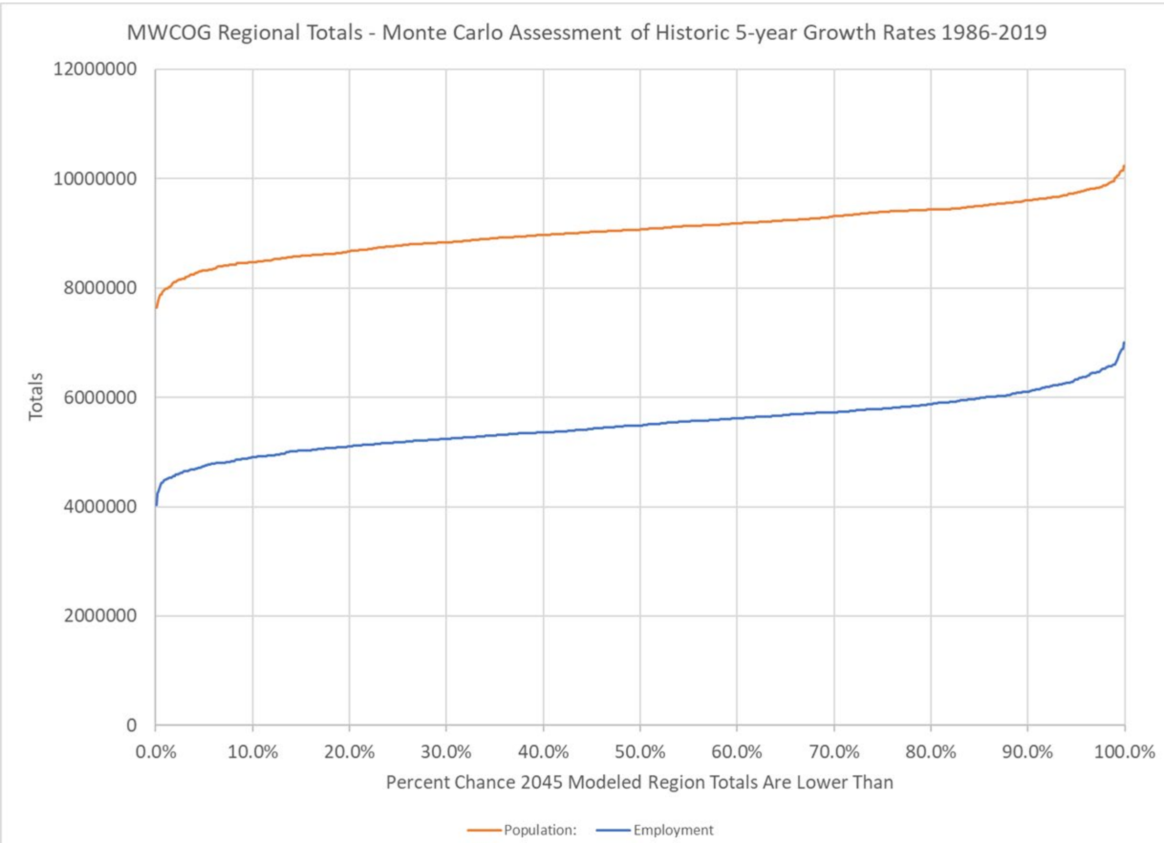
Figure 21: Historic Growth Rates for MWCOG Modeled Region



Growth variability was examined by conducting a Monte Carlo scenario that randomized the sequence of five-year growth rates from the past 25 years in 5-year increments (in other words, starting with the growth rates between 1986 and 1991 and concluding with the growth rates between 2014 and 2019). The late 1980s was selected as a starting point to avoid including the region's boom years during the early 1980s when growth rates were at their highest. A five-year window was selected to dampen the results of historic recessions and recoveries and to facilitate application to the five-year forecast periods that are standard increments for MWCOG Cooperative Forecasts. The twenty-five groups of five-year growth rates range from 1.4% to 13.9% for jobs and 6.3% to 10.0% for population.

The Monte Carlo method was used to randomly order the five year growth rates into sets of six (to address the roughly thirty year period between 2019 and 2050) and then run a thousand simulations to identify variability in historic growth rates and obtain a distribution of the population and employment growth rates for those periods. Figure 22 shows the resulting range of forecasts for total 2045 modeled region population and employment for the Round 9.1 forecasts, with the horizontal axis indicating the likelihood of occurrence based on the historic levels of variability. By definition, the extreme ends of the curve show low risk of great levels of variability. For example, the lowest point on the employment growth would indicate that the region would have fewer jobs in 2045 than were present in 2020, which seems unplausible, yet there is only a 0.3% chance of that occurrence.

Figure 22: Monte Carlo Results for MWCOG Round 9.1 in 2045



A typical range of confidence is to consider results that are within one standard deviation of the mean, or roughly between the 15% (or p15) and 85% (or p85) locations on the y-axis. For both population and jobs, the overall span of 2045 forecasts within that range are about 0.9 million for both jobs and population (with a higher total but lower historic variability). For employment, that implies roughly a 9% range on either side of the p50 forecast totals.

Value of Time Analyses

The literature review demonstrated that tradeoffs between housing costs and transportation costs (long recognized as connected in location decisions for both residents and employers and popularized in the term “drive to qualify”) remains the primary quantitative variable in considering the effects of replacing physical travel with virtual connectivity. In particular, the journey-to-work has been viewed as the primary variable influencing transportation costs as employment typically provides the income for both housing and transportation and journey-to-work trips are the longest trips taken on a daily or near-daily basis compared to other trip purposes.

While many sources describe this theoretical construct, the ICF Team only found one example, the aforementioned Delventhal/Parkhomenko study, that applied the results to specific geographic areas.

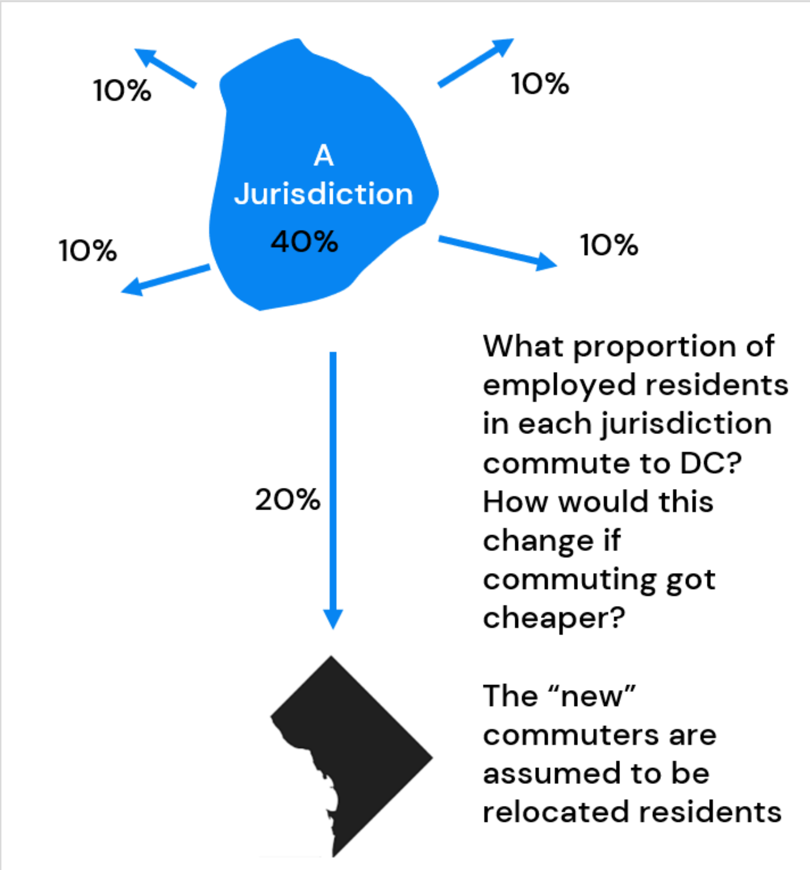
The ICF team conducted a quick-response "Value of Time" analysis to consider the degree to which longer commutes might become more acceptable under different scenarios where telework increasingly replaced the need for employees to go to their places of employment on a daily basis.

The linkage between housing and transportation costs and how they affect residential location choice and commute patterns has a long history. For county-level jurisdictions in Maryland and Virginia that send at least 100 residents to workplaces in Washington DC, we examined the relationship between monthly rent costs, the monetary value of commuting times, and the extent to which the jurisdiction's employed residents worked in DC or in other locations.

We found a strong relationship between the ratio of transportation and housing costs ($t/$h) and the percentage of employed residents who commute to DC. Figure 23 shows the conceptual framework for this analysis:

- Suppose "Jurisdiction A" sends 20% of its employed residents to workplaces in DC on a typical basis. For the sake of argument, we considered this typical basis to reflect five days a week, recognizing that the actual number is probably more like 4.5 days per week. Yet this level of precision is not integral to the approach, since the key is considering relative changes rather than absolute changes.
- We examined four additional scenarios where we assumed that for all those employees, the typical five days per week would drop down, one day at a time, to one day per week. This simply describes an analysis of 80%, 60%, 40%, and 20% multipliers applied to the value of time for commuting.
- For each of those scenarios, it's reasonable to assume that as virtual connectivity increasingly replaces physical commuting, then Jurisdiction A becomes a less costly location overall for residents commuting to DC (assuming housing prices and all other elements that make Jurisdiction A attractive remain unchanged).
- In that case, we might expect the number of Jurisdiction A residents who are associated with a D.C. workplace but don't need to travel there every day to increase.

Figure 23: Conceptual Framework for ICF Value of Time Analysis



We found a strong correlation between the ratio of the monthly transportation and housing costs in the subject jurisdictions and the percentage of employed residents with a D.C. workplace, with the data points listed in Figure 24 shown graphically along with the relationship shown in Figure 25.

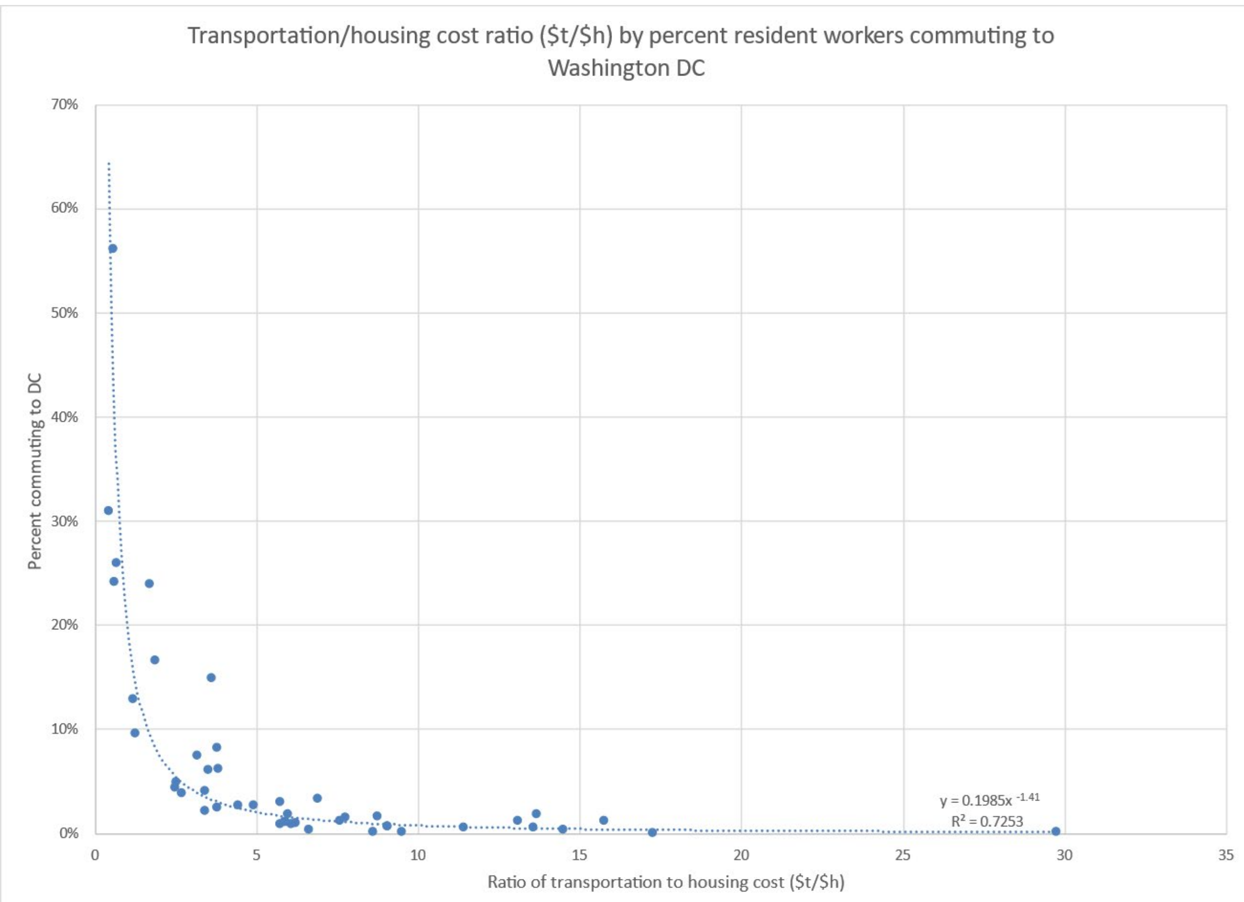
The observed relationship for existing conditions sets up the assessment of replacing some or most of the physical journey-to-work with virtual travel. As physical travel is replaced incrementally (by increments of 20% as described above), the housing cost for each jurisdiction stays constant but the value of time for commuting drops by those 20% increments, so the ratio of transportation to housing costs ($t/$h) also drops proportionately. One way to visualize this relationship is to think of all the dots representing jurisdictions as moving 20% closer to the vertical axis with each increment of virtual travel replacing physical travel (so that by following the regression curve, the percentage of residents commuting to DC would increase as the transportation/housing cost ratio decreases.

Figure 24: Data: Transportation/Housing Cost Ratios and Residents Commuting to DC

Jurisdiction	2020 Population	2020 Median Housing Price	Minutes Commuting to DC	Number of Commuters to DC	Percent of Employed Residents Commuting to DC
District of Columbia, DC	701974	$618,100	15	252256	56%
Arlington County, VA	249298	$731,700	14	49463	31%
Alexandria city, VA	166261	$572,700	16	27707	26%
Falls Church city, VA	14988	$810,900	21	2318	24%
Prince George's County, MD	911140	$319,600	23	139856	24%
Montgomery County, MD	1051990	$491,700	39	111756	17%
Charles County, MD	164540	$326,800	50	15719	15%
Fairfax County, VA	1162504	$576,700	29	96224	13%
Fairfax city, VA	25047	$587,000	31	1543	10%
Calvert County, MD	93310	$364,800	58	4951	8%
Prince William County, VA	478134	$390,500	53	22904	7%
Stafford County, VA	154093	$356,000	58	6119	6%
Manassas Park city, VA	17086	$299,700	45	669	6%
Anne Arundel County, MD	582880	$370,100	39	18474	5%
Howard County, MD	327990	$464,500	49	9226	4%
Manassas city, VA	43099	$338,100	49	1126	4%
Loudoun County, VA	430584	$534,600	61	10600	4%
Spotsylvania County, VA	136192	$289,200	85	2939	3%
St. Mary's County, MD	115150	$318,500	78	2234	3%
Frederick County, MD	264780	$341,800	65	4549	3%
Queen Anne's County, MD	50810	$363,300	76	870	3%
Fredericksburg city, VA	29403	$376,700	61	472	3%
Fauquier County, VA	71395	$420,600	61	983	2%
Essex County, VA	10725	$196,500	114	127	2%
King George County, VA	26429	$315,100	80	307	2%
Orange County, VA	36119	$261,000	97	383	2%
Warren County, VA	40164	$251,600	83	393	2%
Page County, VA	23838	$167,900	113	193	1%
Baltimore city, MD	595030	$167,300	54	4765	1%
Westmoreland County, VA	18047	$201,000	112	138	1%
Clarke County, VA	14509	$366,100	92	105	1%
Talbot County, MD	37550	$334,000	83	271	1%
Culpeper County, VA	52422	$310,700	82	357	1%
Baltimore County, MD	830310	$267,400	69	5120	1%
Carroll County, MD	169000	$343,400	84	934	1%
Frederick County, VA	90115	$265,700	102	416	1%
Washington County, MD	151800	$221,700	85	668	1%
Dorchester County, MD	32110	$187,300	108	121	1%
Shenandoah County, VA	43233	$214,900	104	151	1%
Harford County, MD	257680	$302,900	85	712	0%
Worcester County, MD	52500	$267,400	165	130	0%
Cecil County, MD	103100	$250,400	101	131	0%
Lynchburg city, VA	82791	$162,900	206	104	0%
Albemarle County, VA	111039	$376,000	137	102	0%
Virginia Beach city, VA	457699	$287,400	211	123	0%

We applied a few judgement calls in the analysis of this relationship. First, we simplified the regression curve to be represented by two linear lines to avoid unrealistic results beyond the range of current data points. Second, we assumed that there would never be a condition in which physical travel to a workplace was fully replaced by virtual travel. This assumption is based on the hypothesis that no matter how virtual an employee is, there is still some expectation for occasional travel to the workplace such as for certain critical meetings or other activities. Finally, we recognize that as virtual travel replaces physical travel, all places theoretically become more attractive relative to the base case (no increased telecommuting). Yet we don't expect the total number of employees across all jurisdictions to increase, so we assumed that jurisdictions sending more than the average percentage of employees to DC would be "donors" of relocating residents and all other jurisdictions would be "recipients".

Figure 25: Graphic: Transportation/Housing Cost Ratios and Residents Commuting to DC



The results of the most aggressive telework assumption (80% of current physical travel is replaced by virtual travel) are summarized in Figure 26, organized into tiers for MWCOG jurisdictions (with “outer” jurisdictions separated based on whether they are MWCOG members or only included in the regional travel demand model) and categorizing all other jurisdictions as “more distant”. The core jurisdictions in this model would lose about 3.5% of their population due to the relative attractiveness of more distant jurisdictions, and the outer/more distant jurisdictions would gain residents, although to a much smaller degree (over a much larger candidate audience). The difference between the two (the 14,400 loss of commuters in the “other” category were assumed to be dispersed to other jurisdictions (not just those that currently send at least 100 resident workers to DC).

Figure 26: Estimated Effect of Increased Telework to DC on Residential Location Choice

Stage 2. Assemble effect on population by geography using DC as destination

Jurisdiction	Population	Median Housing Price	Commute Time to DC (minutes)	Max Population Shift	Shift as percent of 2020 Population
Core	1,133,000	$ 639,000	15	-39100	-3.5%
Inner	3,168,000	$ 473,000	30	200	0.0%
Outer (Member)	1,217,000	$ 429,000	56	7000	0.6%
Outer (Model)	1,722,000	$ 378,000	50	10600	0.6%
More Distant	3,240,000	$ 254,000	76	6800	0.2%
TOTAL	10,480,000	$ 403,000	28	-14400	-0.1%

One interpretive challenge with the results so far is that they assess the likelihood of a job in DC being reasonably able to be filled by residents in more distant jurisdictions. Yet virtual connectivity will have benefits for jobs throughout the region, not just in DC. We applied one more judgment call to assess the degree to which the benefits that would accrue in DC would be transferable across other places in the region, recognizing that the further one travels from the DC core, the less likely it becomes that travel in the peak period, peak direction (i.e., inbound AM, outbound PM) contributes significantly to the time cost of commuting. We therefore applied two judgement calls to assess the expansion of the results to the rest of the region (Figure 27). First, we assessed the proportion of jobs in activity centers and clusters (using a circa 2002 definition, but estimates of relatively current employment) of different activity center types as contrasted with jobs in D.C. Second, we applied a value of time judgment on the relative degree of congestion to access those activity centers. When the weighted effect of each of the types of activity center jobs were aggregated, the overall multiplier (relative number of jobs for activity center type multiplied by the value of time judgment), the total for the full region was a multiplier of 1.96.

Figure 27: Approach to Expand ICF Value of Time Approach to Full Region

Stage 3. Estimate expansion effect associated with all activity centers

Note: From 2002 report, rough sense of activity center employment (Round 6.2)
Regional_Activity_Centers_Report.pdf

Location	2000 Jobs	2025 Projected Jobs	Relative Weight Based on 2025 Employment	Relative Weight Based on Value of Time (judgment)	Multiplier
DC Core	493,700	605,600	100%	100%	1.00
Mixed-Use Centers	316,900	440,200	73%	50%	0.36
Employment Centers	282,200	383,000	63%	50%	0.32
Suburban Employment Centers	312,000	485,000	80%	25%	0.20
Emerging Employment Centers	87,400	182,900	30%	25%	0.08
TOTAL	1,492,200	2,096,700			1.96

We then applied the multiplier (rounded to 2 for simplicity's sake) for all jurisdictions. Figure 27 shows the results of this analysis compared to the Delventhal/Parkhomenko study for the same sets of jurisdictions. In general, the results show similar directions and orders of magnitude. The primary difference is in the degree of change expected in the core jurisdictions. There are two explanations for the difference between the two studies in the magnitude of the effects in the core jurisdictions. The first is that the effect of the DC jobs is probably double-counted to some extent with the multiplier of 2 applied to all jurisdictions. Applying judgment to the blend of science and art in this analysis would lead to the conclusion that a 3.5% reduction in population due to the effect of increased virtual connectivity for jobs in D.C. is more likely than the 6.9% after the regional multiplier is applied. The second is that even after adjusting for jobs in the Washington region, we are not considering national effects; it's plausible that someone who no longer needs to live in the New York City region to be close to their job in Manhattan may choose to live in one of the Washington area core jurisdictions instead.

Figure 28: Comparison of Value of Time Approach Results

Jurisdiction	Population	Shift in 2020 population: Value of Time analysis	Shift in 2020 population: Delventhal / Parkhomenko
Core	1,133,000	-6.9%	-0.4%
Inner	3,168,000	0.0%	-0.6%
Outer (Member)	1,217,000	1.2%	0.8%
Outer (Model)	1,722,000	1.2%	2.5%
More Distant	3,240,000	0.4%	0.9%
TOTAL	10,480,000		

Regional Implications

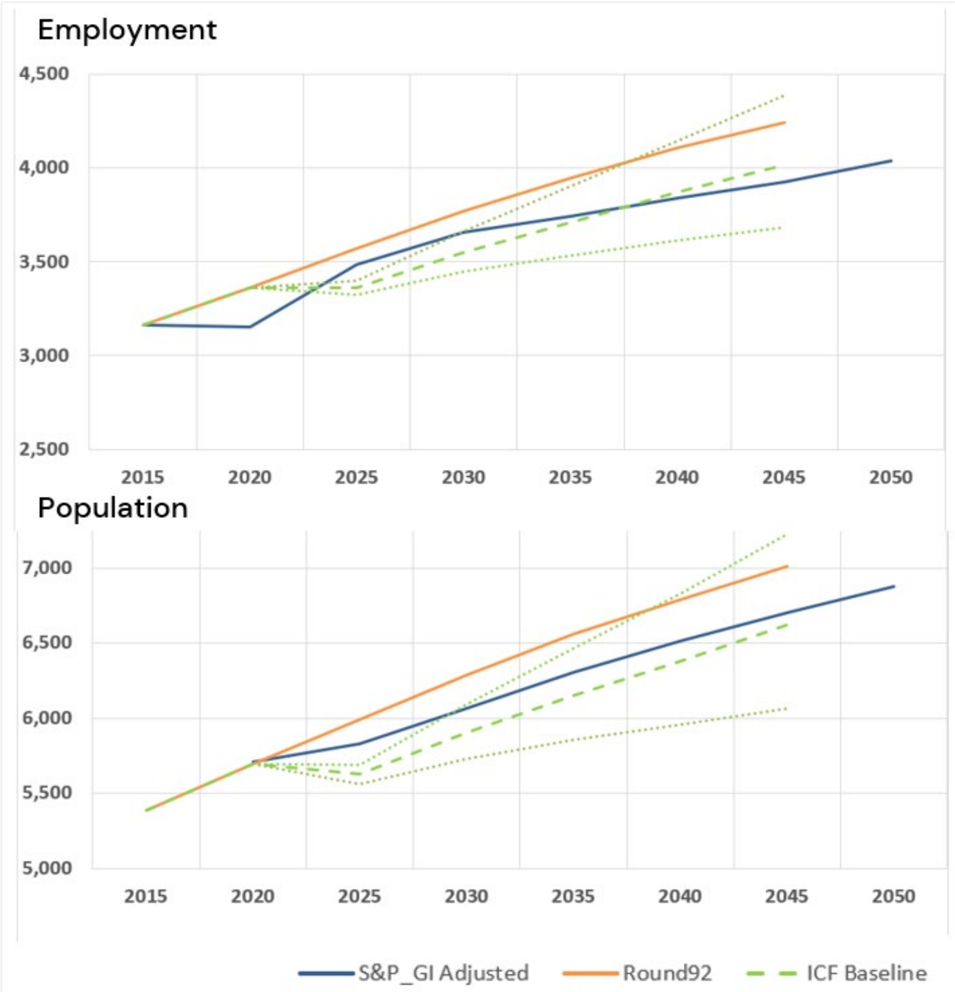
Figure 29 compares three sources for the pace of growth in regional employment and population, with forecasts for each of the five-year intervals shown connected by straight lines between those years:

- COG's Round 9.2 forecasts (approved in early 2021), were largely developed prior to the pandemic, shown in orange.
- The February 2022 S&P_GI forecasts (with a technical note that the forecasts have been proportionally adjusted to match the Round 9.2 forecasts for 2015 to reconcile definitional differences), that have the benefit of being informed by the pandemic, shown in the blue.
- The ICF Team estimate baseline in the dashed green line, with high and low scenarios the "cone of uncertainty" and suggested high/low estimates prepared in May 2022, so also having been informed by the pandemic.

This figure reinforces, and builds upon, several of the considerations presented in previous paragraphs, including:

- The ICF baseline forecasts reflect the effect of the pandemic as a slight reduction from the trajectory established in Round 9.2 between the previously forecast 2020 levels for Round 9.2 and the updated effect of COVID in 2025.
- The ICF baseline forecasts and the S&P_GI forecasts are fairly similar between 2025 and 2045 for both population and employment:
    - For employment, the S&P_GI forecasts are slightly more conservative (i.e., a slightly flatter slope)
    - For population, both forecasts have similar growth rates; the ICF baseline forecasts are consistently lower than the S&P_GI forecasts in part due to the Value of Time effect of a slightly increased residential demand for jobs in the MWCOG being satisfied by housing units outside the MWCOG region.
- The effect of the pandemic on employment as described previously as having a net effect of delaying growth by about five years is evidenced by the horizontal slope between 2015 and 2020 on the S&P_GI curve (accounting for 2015-2020 growth plus the drop in jobs during the start of the pandemic) as well as the horizontal slope between 2020 and 2025 on the ICF baseline curve (accounting for the both the COVID drop from the levels Round 9.2 expected for 2020 and the expected rebound to the same levels of employment by 2025.
- The effect of the pandemic on population as described previously as resulting in a slight loss of population from within the region to beyond the region.
- By 2040 the "cone of uncertainty" between the ICF p15 (low) and p85 (high) forecasts encompasses the totals for both the Round 9.2 totals and the S&P_GI forecasts.

Figure 29: ICF Estimate of the Pace of Regional Growth



Note that the value of this exercise is seen to be in terms of relative pace and pattern of growth, rather than the precision of any one given value. Partly this is due to the fact that continuing development regarding the Round 10 forecasts over the next several months will include MWCOG purchasing updated S&P_GI forecasts which will be expected to be slightly different from the February 2022 edition used in this analysis. Given that context, Figure 29 shows the estimated ICF forecast population and job totals for the horizon years 2025 through 2050 showing the values in Figure 30 extended through 2050.

Figure 30: ICF Estimated Regional Forecasts

Employment (000)

	2025	2030	2035	2040	2045	2050
High	3400.5	3661.2	3902.9	4146.7	4385.2	4513.1
Baseline	3360.6	3548.9	3712.0	3871.0	4019.4	4136.6
Low	3323.8	3445.2	3535.7	3616.5	3681.8	3789.2

Population (000)

	2025	2030	2035	2040	2045	2050
High	5691.4	6090.3	6465.6	6830.7	7223.8	7410.1
Baseline	5624.7	5903.5	6149.3	6376.6	6621.3	6792.0
Low	5563.0	5731.0	5857.3	5957.4	6065.1	6221.5

Households (000)

	2025	2030	2035	2040	2045	2050
High	2155.8	2315.7	2467.8	2617.1	2778.4	2861.0
Baseline	2130.6	2244.7	2347.1	2443.1	2546.6	2622.4
Low	2107.2	2179.1	2235.6	2282.5	2332.7	2402.1

Conclusions

Key takeaways for Tasks 3A and 3B include:

- From the perspective of a long-range (one to three decades typically associated with Cooperative Forecasts), the direct effects of the COVID-19 pandemic can be characterized primarily as a loss of three to five years of growth; future totals for any given horizon year are expected to be lower in future forecasts than they were in past forecasts, but due to the timespan required to implement economic recovery rather than a paradigm shift in land uses due to the pandemic.
- Examination of current third-party sources (S&P Global, Maryland and Virginia State Data Centers) with the same source's legacy data pre-pandemic indicate slightly less optimism for growth in general under current conditions.
- Within the MWCOG region, the societal trends leveraging virtual connectivity as a replacement for some physical travel is expected to shift residential preferences within the region, with slight reductions in core jurisdictions and increases in more distant jurisdictions.

4 Projecting Changes to Future Average Household Size

Overview

Task 4 reviews historical average household size in the Washington region, identifies factors and trends that will impact future average household sizes, and defines high-level regional implications. The ICF team conducted a scan of national literature, reviewed Census forecasts and projections, and consulted with regional demographic experts to gather perspective that increase COG's and its members understanding of future household trends.

Findings

The following trends and factors were identified as high-level indicators that directly impact average household size in the Washington region:

The capital region's population is getting older. Since 1970, the region has seen sharp declines in the share of children under 18 and young adults (ages 18 to 29). The Washington region is following a similar trend to the U.S. population overall as the population continues to grow older. The share of the population over the age of 59 has increased to nearly 20% from 10% since 1970. Suburban and exurban jurisdictions in the region have seen the largest increases in the share of population over the age of 59 while urban jurisdictions have remained stable.

Population growth in the region has shifted from net in-migration to natural growth (births minus deaths). Since the early 2000's D.C.'s growth can primarily be attributed to young adults moving into the city. Populations aged 20-24 and 25-24 have seen the highest percentage each year. This population increase had a domino effect, as the younger school-age population began to arise. Births alone do not outweigh the loss of residents due to death and domestic out-migration.[19]

Births and international in-migration have outweighed losses through death and domestic out-migration. In 2020 there was a net migration of 1,485 residents into D.C. which was largely driven by a gain of 2,413 residents through international in-migration.[20] Fairfax and Prince George's County saw the largest increase of international in-migration but also saw the highest losses due to domestic out-migration. D.C., Prince William County, and Arlington County also saw high levels of international in-migration though not to the same extent.

4.1.1 Household Size Trends

The Washington region largely mirrors national demographic trends. The primary factors impacting the average household size in the region are declining birth rates, an aging population, and International in-migration. Two additional factors are complicating average household size projections: the COVID-19 pandemic and concerns of inaccurate reporting as part of the 2020 Census.

[19] https://www.dcpolicycenter.org/publications/demographic-shifts-dc-following-covid-pandemic/#easy-footnote-bottom-3-8155

[20] https://www.dcpolicycenter.org/publications/births-in-migration-maintain-district-population-growth/

Nationally, average household size steadily declined throughout the 20th Century, from an average of 4.76 in 1900 to 2.59 in 2000. As of 2021, single-person households represented nearly 30% of all households (Figure 30). In the Washington region, the average household size decreased by 16% from 1970 (3.10) to 2000 (2.60), before increasing in 2010 (2.63) and 2020 (2.65) (Figure 31). The region's average household size is slightly higher than the national average (2.60 in 2020). Due to density and house typologies, average household size for COG's Central Jurisdictions was 2.10 in 2020, compared to 2.69 for Inner Suburban and 2.99 for Outer Suburban jurisdictions. The most dramatic decreases in average household size in the Washington region between 1970 and 2020 occurred in Charles County (29%) and D.C. (24%).

Figure 30 – Historical Average Household Size Trends

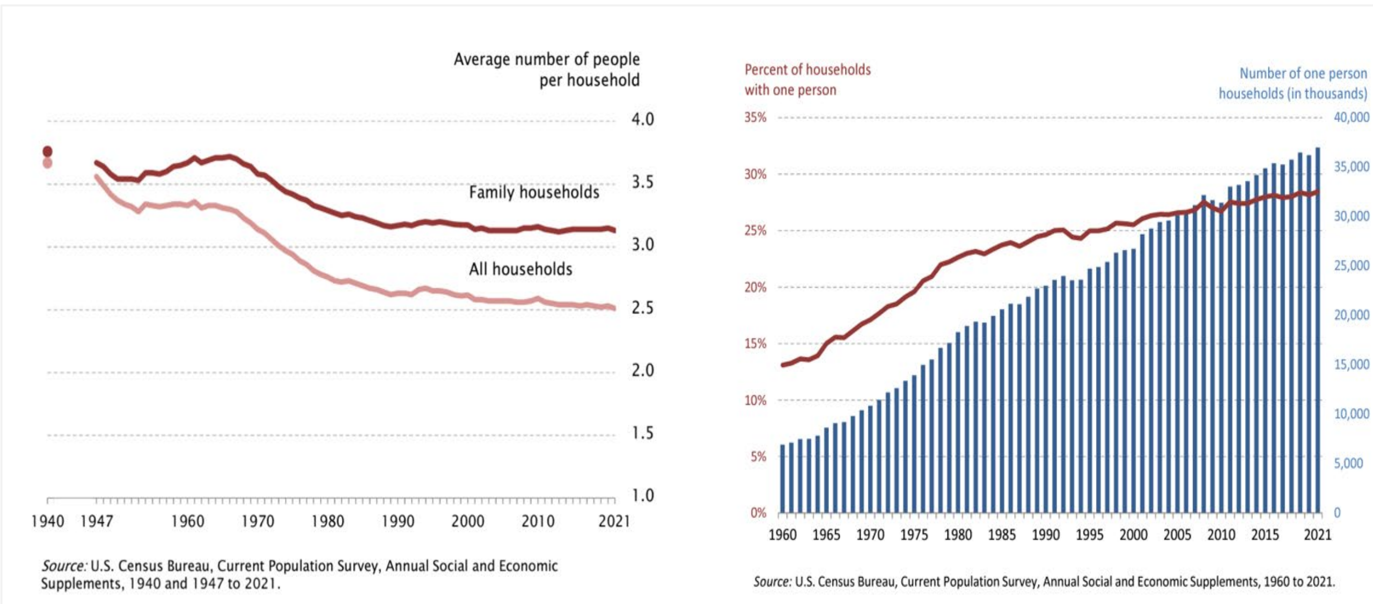
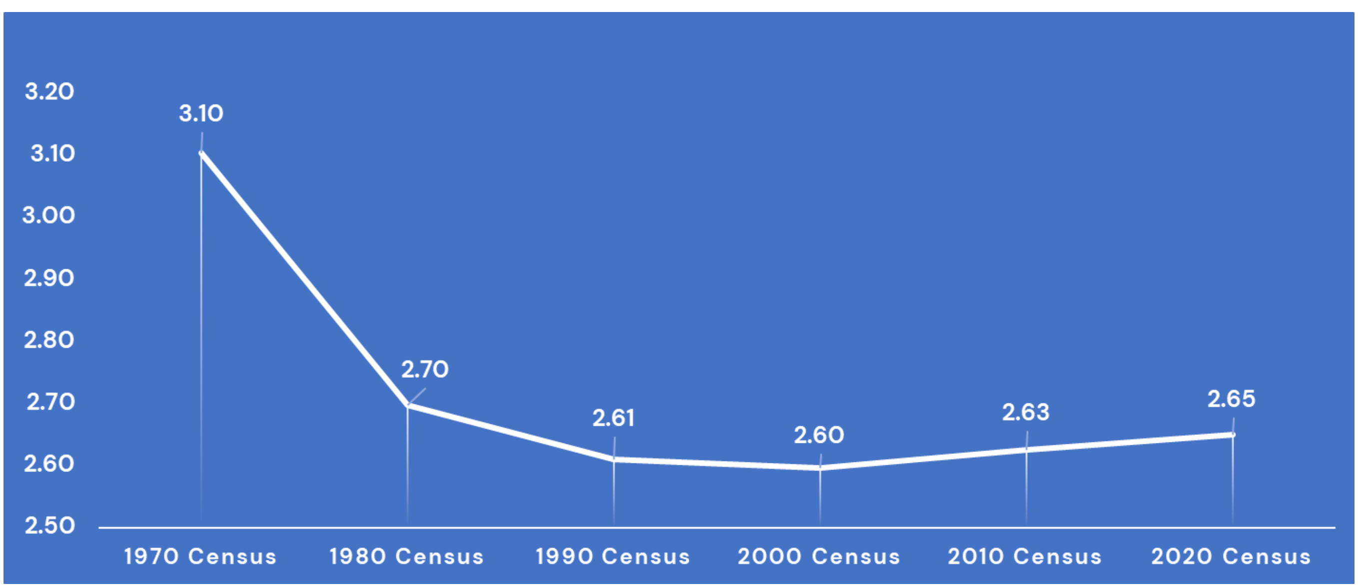


Figure 31 – Average Household Size in the COG Region (1970-2020)



Interviews

To gain a deeper understanding of household trends and demographics in the Washington region, we interviewed the following demographic experts, which represent perspectives from D.C., Maryland, and Virginia:

- Qian Cai, Weldon Cooper Center (UVA)
- Alfred Sundara, Maryland State Data Center
- Joy Phillips, DC Office of Planning
- Jenny Schuetz, Brookings Metro
- Peter Tatian, Urban Institute

Questions for these discussions focused on demographic and migration trends, long-term factors and trends are impacting household formation and average household size in the Washington region, and demographic shifts in the Washington housing market caused by the COVID-19 pandemic.

Findings from the literature scan and interviews with demographic experts were largely consistent. The primary factors impacting future average household size are:

- Declining birth rates
- Aging population
- Insufficient housing supply regionwide
- International migration

4.1.2 Declining Birth Rates and Aging Population

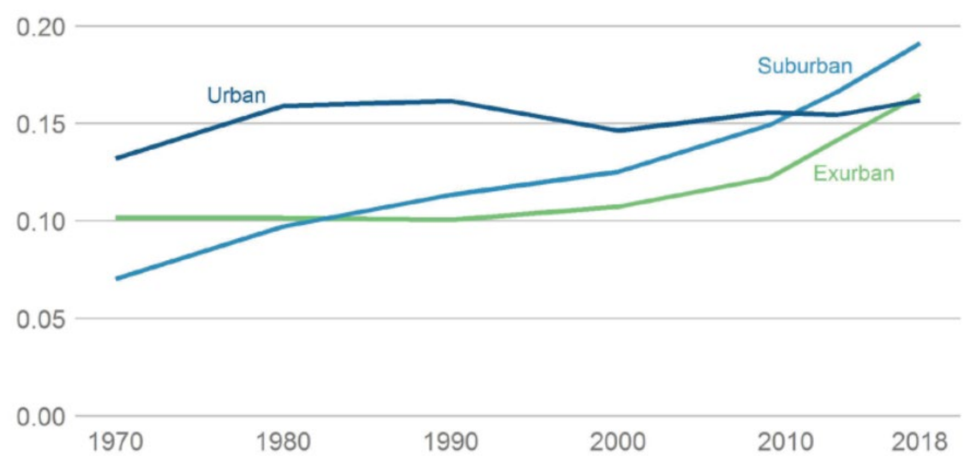
Between 2007 and 2020, the birth rate in the U.S. declined by 20%. Experts pointed to an ongoing trend in Virginia of younger women (ages 20-29) having fewer children or waiting until they're older and more financially stable. In the region, Washington, D.C., was an exception to this trend, as population growth between 2011-2020 was driven by high-natural birth rate (along with domestic in-migration). However, increased birth rates among "older" women are not offsetting the decrease within the younger cohort. Demographic experts interviewed for this research birthrates to continue at current rates, leading to a smaller domestic workforce and population.

Simultaneously, the share of older adults (59+) in the Washington region is rising. Since 1970, the region has seen sharp declines in the share of children under 18 and young adults (ages 18 to 29). During the same period, the share of the population over the age of 59 has increased to nearly 20% from 10% since 1970. In Virginia, the share of the population over age 65 is expected to increase from 12% in 2010 to 18% in 2030.

This trend is especially pronounced in the region's suburbs. As shown in Figure 32, suburban and exurban jurisdictions in the region have experienced the largest increases in the share of population over the age of 59 while urban jurisdictions (defined as D.C, Arlington, and Alexandria) have remained stable.

There are several effects of this trend. First, older adults historically have smaller households, with one expert estimating 25% of older adults live alone. Long-term, the increased share of older adults in the Washington region will drive average household sizes lower.

Figure 32: Share of Older Adults in the Washington Region (1970-2018)



Note: Urban jurisdictions include District of Columbia, Arlington County, Va., and Alexandria, Va. Suburban jurisdictions include Montgomery and Prince George's counties, Md., Fairfax County, Va., and the independent cities of Fairfax and Falls Church, Va. All other counties and cities in the Washington, D.C. metro area are counted as exurban jurisdictions.

Source: Decennial census 1970 to 2000; American Community Survey 2009, 2013, 2017, and 2018.

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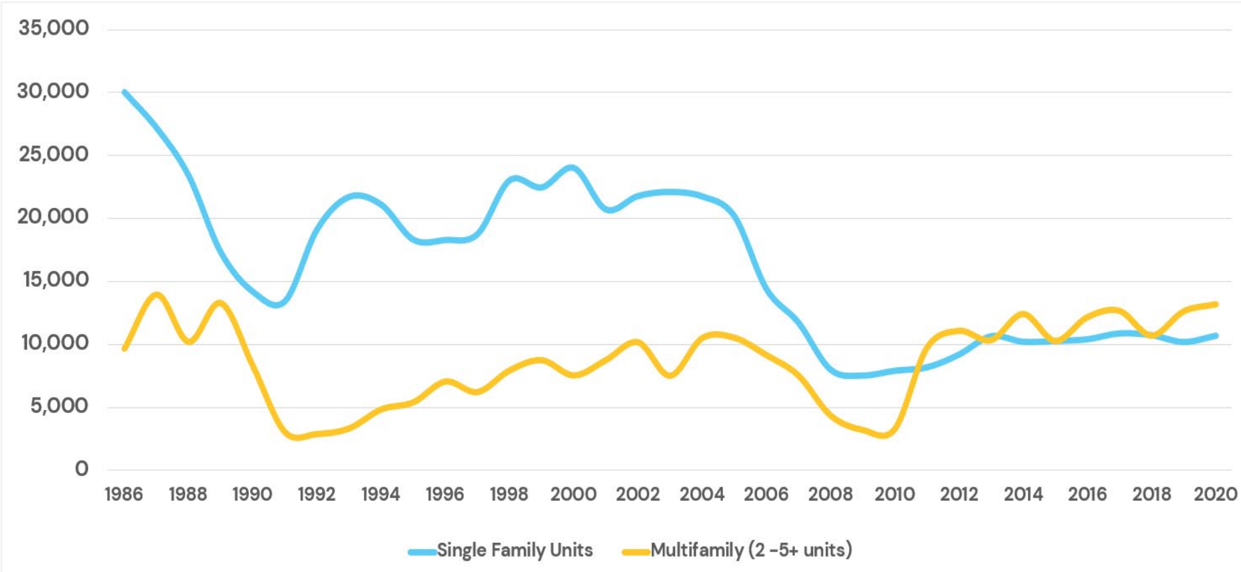
4.1.3 Insufficient Housing Supply

As COG and its members are acutely aware, in recent decades the Washington region has not constructed new housing at a rate to match the pace of the population growth, resulting in higher housing costs. Regionwide, residential construction decreased by 40% from 1986 (39,721 units constructed) to 2020 (23,848 units constructed). During that period residential construction peaked in 1987 (41,158 units) (Figure 33). From 1986 to 2011, single family units were the predominant house type constructed in the region.

A shift in preferences between single family and multifamily units began following the Great Recession (2008-2009). Construction of multifamily units increased starting in 2010 and surpassed construction of single-family units in 2012, when 11,057 multifamily units were produced. By 2020, when 23,848 total residential units were constructed in the COG footprint, construction of multi-family units outpaced single family units by 2,500.

Figure 33: Housing Construction in the COG Region (1986-2020, by unit)

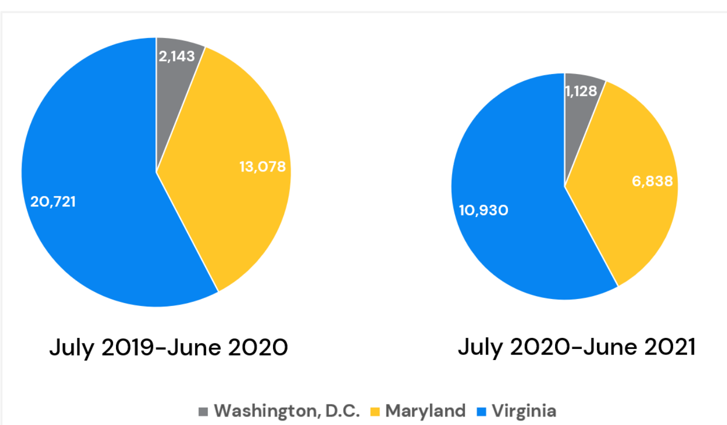


4.1.4 International Migration

International in-migration, specifically from Central American and Asian countries, was cited as a positive differentiator for the Washington region by multiple experts we spoke with. However, depressed international in-migration due to the COVID-19 pandemic has been evident regionwide and has tertiary impacts on average household size. Starting in March 2020, international migration to the United States was significantly impacted by pandemic travel restrictions.

As a result, at the state level, international in-migration decreased by 47% combined between D.C., Maryland, and Virginia. From July 2019 to June 2020, D.C., Maryland, and Virginia recorded a combined 35,942 new international residents; from July 2020 to June 2021, international in-migration was slashed by nearly half (18,896) due to travel restrictions (Figure 34).[21]

Figure 34 – International In-Migration Rates (2020 vs. 2021)

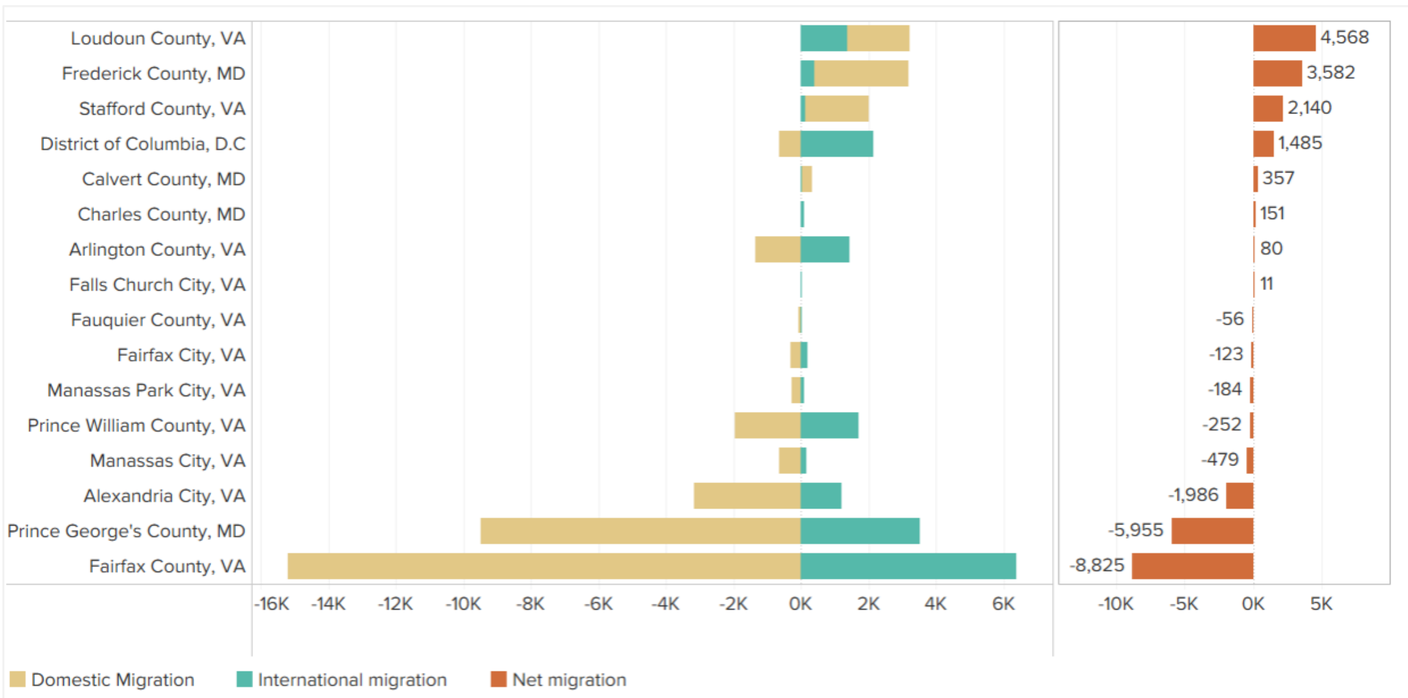


[21] https://www.usnews.com/news/best-states/articles/2022-02-07/census-international-migration-to-the-u-s-plummeted-in-2021

Figure 35, produced by the D.C. Policy Center, illustrates the drastic domestic out-migration of several inner suburban jurisdictions in 2020. Regionally, the populations of only four counties increased by 1,000 people or more in 2020. Demographic fallout from the pandemic has not been limited to 2020. In 2021, D.C. experienced significant domestic out-migration, as 23,000 residents departed the city.[22]

Regionally, the return of international in-migration is expected to balance short-term domestic out-migration, which short-term will help maintain the average household size at current rates.

Figure 35 – Migration by Municipality (2020)



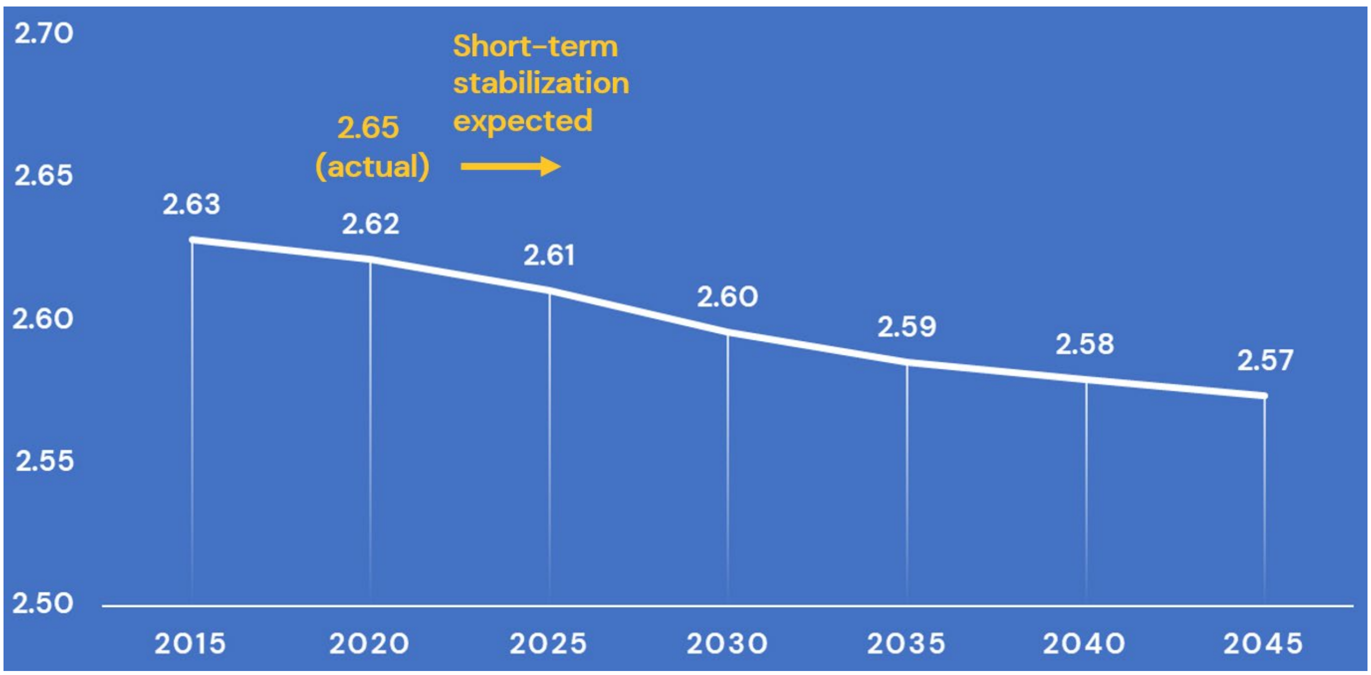
22 https://www.dcpolicycenter.org/publications/census-shows-pandemic-exodus-has-broken-dc-population-growth/

4.1.5 Future Average Household Size

Per the 2020 Census, the actual average household size in the Washington region was 2.65. Based on this research and findings, ICF expects average household size to remain stable through 2025, before gradually correctly to historical trends (smaller household size) (Figure 36). This is due to several factors:

- Economic uncertainty as a result of the COVID-19 pandemic and inflation
- Domestic outmigration is being supplanted by international in-migration, which historically feature larger and multi-generational households
- Ultimately in the Washington region, increased multifamily construction will result in greater household formation regionwide, but smaller average household sizes long-term.

Figure 36 – COG's Average Household Size 9.2 Forecast (2021)



Conclusions

These findings have several implications for the future of the region's housing market. First are implications to income. Among higher-income households, average household size is trending smaller, especially in the region's inner suburbs. This is compounded by the region's expensive housing market, which reduces overall household formation.

From a development perspective, the Washington region is relatively mature. As a result, land capacity constraints likely play a role in the shift from single family to multifamily unit construction. As illustrated by the shift in residential units constructed in the last decade, multifamily structures are now more cost-effective for developers to construct, while demand for these units has risen in the region's Central Jurisdictions and Inner Suburbs.

Cultural preferences among ethnic groups also impact household size. Temporary increase in average household size in the inner and outer suburban jurisdictions is being driven by growth of Hispanic/Latino communities, along with high housing costs, inflation, decreased housing construction, and uncertainty related to the pandemic. This was especially noted in the Maryland suburbs, where international population growth is primarily composed of people from countries in Asia and Central America. Historically, people of Hispanic and Latino descent are more likely to live in multigenerational households, which raise the average household size.

Additionally, the full impact of hybrid and remote work on the region's population, prompted by the COVID-19 pandemic, remains to be seen. Because of the high cost of housing and living, multiple experts interviewed for this research foresee a rise in people accepting jobs based in the region but working fully remote, and not physically relocating to the region. Ultimately, correlations between remote/hybrid working policies and the long-term impact on household formation/size remains to be seen and may vary by municipality.

Lastly, experts expect increases in household size will have implications for national economic growth. One cited example postulates that larger household size will result in lower demand for housing, depressing residential construction and the need for home goods and services (e.g., appliances and furniture).[23]

[23] "The Number of People in the Average U.S. Household Is Going Up for the First Time in Over 160 Years": https://www.pewtrusts.org/en/trust/archive/winter-2020/the-number-of-people-in-the-average-us-household-is-going-up-for-the-first-time-in-over-160-years

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