2022-2060 Population Forecasts

LONG-TERM PROJECTIONS FOR CLARK COUNTY, NEVADA

June 2022

Prepared by
Center for Business and Economic Research

Prepared for
Regional Transportation Commission of Southern Nevada,
Southern Nevada Water Authority,
Southern Nevada Regional Planning Coalition,
and members of the Forecasting Group

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Executive Summary

Each year, the Regional Transportation Commission of Southern Nevada (RTC), the Southern Nevada Regional Planning Coalition (SNRPC), the Southern Nevada Water Authority (SNWA), a group of community demographers and analysts, and the Center for Business and Economic Research (CBER) at the University of Nevada, Las Vegas work together to develop a long-term forecast of Clark County's population and its growth that is consistent with the structural economic characteristics of the county. Toward this end, CBER employs a general-equilibrium demographic and economic model developed by Regional Economic Models, Inc. (REMI), specifically for Clark County.

We recalibrate the REMI model to incorporate the most recent available information regarding local employment and its growth and local public and private investment projects. The resulting long-term forecast predicts positive population growth throughout the range of the forecast. SNRPC estimates that Clark County's population was 2.33 million in 2021, an unexpected decrease of 1.8 percent from 2021, which largely reflects the 2020 Decennial Census result. We expect that Clark County's population will reach approximately 2.94 million by 2035 and nearly 3.39 million by 2060.

Table 1 summarizes the Clark County population forecast, which CBER predicts will grow robustly in the short term at rates of 1.8 in 2022 and 2.2 percent in 2023 as the Clark County economy recovers from the COVID-19 recession. The population growth rate will reach 2.4 percent in 2024 with continued strong economic activity, boosted by infrastructure investment, including the high-speed rail project and new hotel room additions. In the medium term, CBER expects the population growth rate to show modest growth, but the growth rate in 2025 will begin to decline over time with decreases in natural growth and net migration. That is, its growth rate tapers off as Clark County's maturing economy attracts fewer "net" economic migrants (i.e., in-migrants minus out-migrants) and the population ages over time. In addition, Clark County expects no gain in net international migrants. As a result, the rate of growth, which exceeded the national average over the past 50 years, moderates and eventually moves below the national rate of growth in the long run. That is, by 2055, the population growth rate falls marginally below the projected long-term national population growth rate.[1] As the Clark County economy continues to mature, the population growth stabilizes around 0.3 percent after 2056.

As with any forecast, potential risks exist that could lead to either an over- or under-forecast of population and its growth rate. CBER judges that the downside risk to our employment forecast exceeds

[1] Source: https://www.census.gov/data/tables/2017/demo/popproj/2017-summary-tables.html

the upside risk. That is, the risk of over-forecasting population and its growth rate exceeds the risk of under-forecasting in the near term due to ongoing economic uncertainty. The U.S. economy has experienced significant shocks recently with high inflation, labor shortages, and supply disruptions amid strong demand and the Russian invasion of Ukraine. In addition, the fear still exists that a COVID-19 variant may emerge and spread in the near future. Our long-term forecasts, however, exclude business-cycle, seasonal, and irregular events, which respond to short-run risks. In summary, our forecast primarily provides a long-term planning tool that addresses the trend movements in population, excluding the short-run business-cycle, seasonal, and irregular effects.

Table 1. Clark County Final Population Forecast: 2010-2060

Year	*Population Forecast*	*Change in Population Forecast*	*Growth in Population Forecast*
2010	1,951,269*	-55,078	-2.7%
2011	1,966,630**	15,361	0.8%
2012	2,008,654**	42,024	2.1%
2013	2,062,253**	53,599	2.7%
2014	2,102,238**	39,985	1.9%
2015	2,147,641**	45,403	2.2%
2016	2,205,207**	57,566	2.7%
2017	2,248,390**	43,183	2.0%
2018	2,284,616**	36,226	1.6%
2019	2,325,798**	41,182	1.8%
2020	2,376,683**	50,885	2.2%
2021	2,333,092**	-43,591	-1.8%
2022	2,375,000	41,908	1.8%
2023	2,427,000	52,000	2.2%
2024	2,485,000	58,000	2.4%
2025	2,540,000	55,000	2.2%
2026	2,593,000	53,000	2.1%
2027	2,644,000	51,000	2.0%
2028	2,691,000	47,000	1.8%
2029	2,733,000	42,000	1.6%
2030	2,773,000	40,000	1.5%
2031	2,810,000	37,000	1.3%
2032	2,845,000	35,000	1.2%
2033	2,879,000	34,000	1.2%
2034	2,910,000	31,000	1.1%
2035	2,940,000	30,000	1.0%
2040	3,073,000	25,000	0.8%
2045	3,181,000	20,000	0.6%
2050	3,266,000	16,000	0.5%
2055	3,334,000	12,000	0.4%
2060	3,387,000	9,000	0.3%

*2010 U.S. Census.

** SNRPC consensus population estimate.

Note: The changes and growth rates in population forecasts after 2035 are not cumulative. The forecast changes and growth rates represent the annual values. See Table D2 for the complete set of forecasts.

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CBER thanks the members of the Population Forecasting Group for comments on earlier drafts of this report.

I. Introduction

Each year, the Regional Transportation Commission (RTC), the Southern Nevada Regional Planning Coalition (SNRPC), the Southern Nevada Water Authority (SNWA), a group of community demographers and analysts, and the Center for Business and Economic Research (CBER) at the University of Nevada, Las Vegas work together to provide a long-term forecast of economic and demographic variables influencing Clark County. The primary goal is to develop a long-term forecast of the Clark County population and its growth that is consistent with the structural economic characteristics of the county. Toward this end, CBER employs a general-equilibrium demographic and economic model developed by Regional Economic Models, Inc. (REMI), specifically for Clark County.

The REMI model is a state-of-the-art econometric forecasting model that accounts for dynamic feedback between economic and demographic variables. Special features allow the user to update the model to include the most current economic information. CBER recalibrates the model using information on recent local employment levels, the most recent national Gross Domestic Product (GDP) forecast, and spending on local capital projects.

The model employed divides Nevada into five regions: Clark County; Nye County; Lincoln County; Washoe County; and the remaining counties, which are combined to form a fifth region. These regions are modeled using the U.S. economy as a backdrop. The model contains over 100 economic and demographic relationships that are carefully constructed to represent concisely the Clark County economy. The model includes equations to account for migration and trade between Nevada counties and other states and counties in the country.

The demographic and economic data used to construct the model begin in 2001 and end in 2019. The most important variables include the aggregate totals of employment, the labor force, and population. The economic data for the most recent version of the model (REMI PI+ v2.5) are consistent with the North American Industry Classification System (NAICS). The REMI PI+ v2.5 model was released in 2021. Hence, the model's most recent data come from 2019, since the Bureau of Economic Analysis (BEA) personal-income data only become available with a two-year lag. The availability of the most recent income data sets the last year of history with each release of an updated model.

The REMI model is the best model available for describing how economies interact geographically.[2] These interactions may take place within a single economy (such as the interaction

[2] See Schwer, R. K. and D. Rickman (1995), "A comparison of the multipliers of IMPLAN, REMI and RIMS II: Benchmarking ready-made models for comparison," *The Annals of Regional Science,* 29(4), 363-374.

between house-price growth and employment growth in Clark County) or between two economies (such as the interaction between Southern Nevada and Southern California through migration flows). These and over 100 other interactions contained within the model are too complex to consider modeling on our own. Rather, we turn to the REMI model because it has a solid foundation in economic theory and the principles of general-equilibrium-based growth and distribution theory, yet it still offers the flexibility required to model a regional economy like Clark County.

To guarantee that the model incorporates the most recent data, we make a series of adjustments to the model. These adjustments ensure that the forecast model includes the most up-to-date information when generating the final forecast. First, we update the model's national GDP forecast using the latest available national economic forecast from the University of Michigan's Research Seminar in Quantitative Economics (RSQE). Second, we rebase the population forecast to the most recent population estimate for Clark County available from SNRPC. Third, we update the model with current employment data from the Bureau of Economic Analysis (BEA) and the Nevada Department of Employment, Training and Rehabilitation (DETR). Fourth, we adjust future hotel employment based on the expected number of hotel rooms that will be added in the near future. Fifth, we incorporate planned new investment in public and private infrastructure in the model using information, for example, from the RTC and the Las Vegas Convention and Visitors Association (LVCVA). Lastly, we rebase the international migration forecast in the model with an assumption that negative net international migration will not likely occur based on its past history.

This report proceeds as follows. Section II examines the changes in the REMI model (out-of-the-box benchmark forecast) from the prior years' models. Section III presents sequentially the changes made to update the model and tailor it to more recent Clark County information. Section IV reports the population forecast and gives a brief discussion of the economic environment surrounding the forecast. Section V compares the population growth rate forecast with the previous years' forecasts. Section VI discusses the risks to the forecast. Finally, section VII concludes.

II. Comparison of REMI Models: Current and Previous Year

Based on our past practice, we begin by comparing the most recent REMI out-of-the-box benchmark forecast prior to any model adjustments with the corresponding out-of-the-box benchmark forecasts from the REMI models used in prior reports. This gives us the opportunity to examine how the new model differs from previous versions and to explore the basis of these differences.

The most recent data used to develop this year's model end with data from 2019. Thus, we refer to the current model by its last historical year 2019 (LHY2019) and the previous model by its last historical year 2018 (LHY2018).

Each year, the REMI staff and users discuss how the model works and propose adjustments and changes for improvement. The newest REMI model, PI+ v2.5, offers two major improvements: it includes a recent BLS employment projection from 2019 to 2029[3] as well as new estimates of consumption equation parameters. In addition, the new REMI model contains the most recent data history for 2019 and a revision of historical data back to 2001.

REMI uses the BLS employment projections, which provide insight to guide its employment and labor force growth rates in the future. The combination of employment growth by industry generated more positive growth for Clark County with the 2019-2029 projections compared to the 2018-2028 projections, which were incorporated into the previous REMI model. That is, the 2019-2029 BLS projections expect that professional, scientific, and technical services; arts, entertainment, and recreation; accommodation and food services; and transportation and warehousing will grow by 10.8, 9.6, 6.2, and 5.8 percent, respectively, from 2019 to 2029, which exceeds the total employment growth rate projection of 3.7 percent. As a result, the Clark County employment projection for LHY2019 from 2026 to 2060 exceed that of LHY2018, leading to a difference between LHY2018 and LHY2019 of about 53,000 jobs by 2060. Higher job opportunities also brought higher relative employment opportunity forecasts for the LHY2019 model as the labor force forecasts did not change much from the LHY2018 model, which contributed to higher economic migration[4] forecasts between 2024 and 2060 for the LHY2019 model.

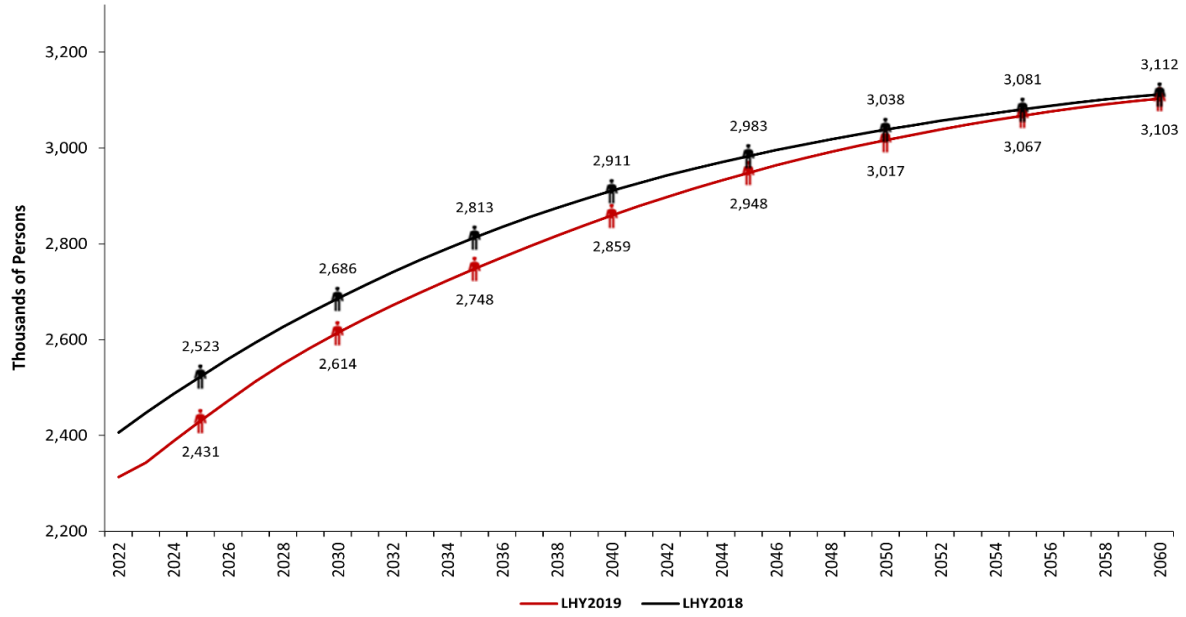
REMI also updated and improved their consumption equation specification and estimated new consumption equation parameters with the LHY2019 model. The income and price elasticities were re-estimated for consumption commodities with updated age-composition and regional effects. This update produced higher real relative compensation rate forecasts for the period between 2024 and 2060 compared to those from the LHY2018 model. Higher relative compensation rate forecasts partly resulted

[3] https://www.bls.gov/news.release/archives/ecopro_09012020.pdf

[4] Economic migrants, under 65, emigrate from other regions to improve their living standards and seek better job opportunities. There are three major components that attract these interstate migrants according to REMI: relative employment opportunities, relative compensation rates, and amenity values. Relative employment opportunity captures employment opportunities in the region compared to the U.S. average. The relative compensation rate measures the real compensation (adjusted for taxes and housing prices in the region) rate compared to the national average level, while amenity values include factors such as climate, community safety, education, and so on. Economic migrants are working-age migrants who not only contribute to local human capital resources but also boost the development of local businesses.

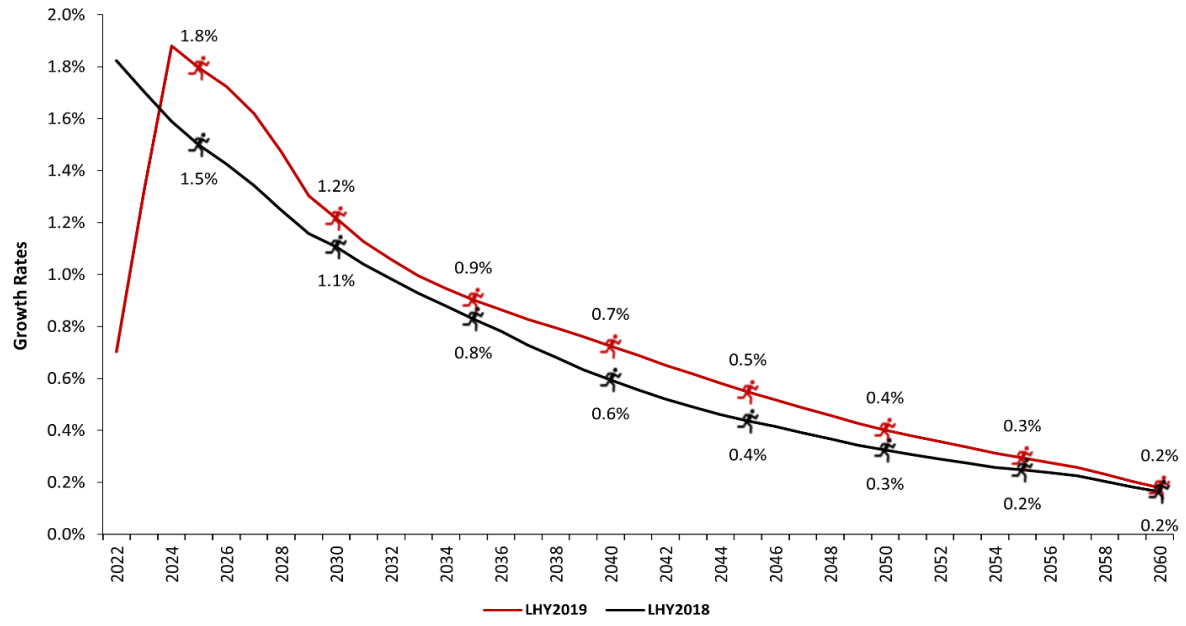
in higher economic migration forecasts for the period between 2024 and 2060. These updates lead to differences in the out-of-the-box population forecasts between the LHY2019 and LHY2018 models.

Figure 1. Clark County Population Forecasts: REMI Out-of-the-Box LHY2019 and LHY2018: 2022-2060



Note: Out-of-the-box refers to the model prior to recalibration. These numbers are not the final forecast.

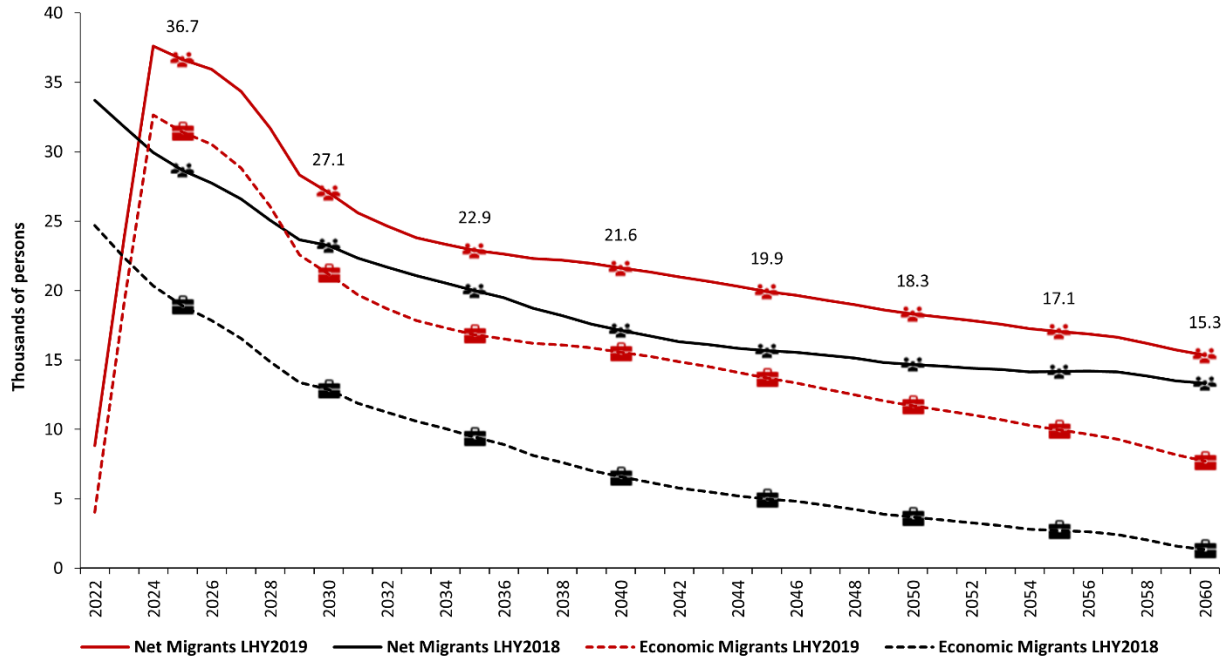
Figure 2. Clark County Population-Growth-Rate Forecasts: REMI Out-of-the-Box LHY2019 and LHY2018: 2022-2060



Note: Out-of-the-box refers to the model prior to recalibration. These numbers are not the final forecast.

Figures 1 and 2 compare the LHY2019 and LHY2018 population forecasts from the out-of-the-box models (i.e., before any updating for employment, infrastructure projects, the national GDP forecast, etc.).[5] The out-of-the-box population forecast arising from the LHY2018 model predicts higher population levels than the LHY2019 model through 2060. Regarding population levels, the out-of-the-box model forecasts population in the LHY2019 model for 2022 is approximately 93,000 lower than the LHY2018 model. This gap increases to 104,000 for 2023 due to the lower population growth rate forecast from the LHY2019 model compared to the LHY2018 model. The gap, however, diminishes over the forecast period to 9,000 in the year 2060 due to LHY2019's higher population growth rate forecasts from 2024 to 2060 compared to those of the LHY2018 model, but the out-of-the box forecasted population in LHY2019 is still lower than the forecast from LHY2018 in 2060 (Figure 2).

Figure 3. Clark County Net Migrant and Net Economic Migrant Forecasts: REMI Out-of-the-Box LHY2019 and LHY2018: 2022-2060



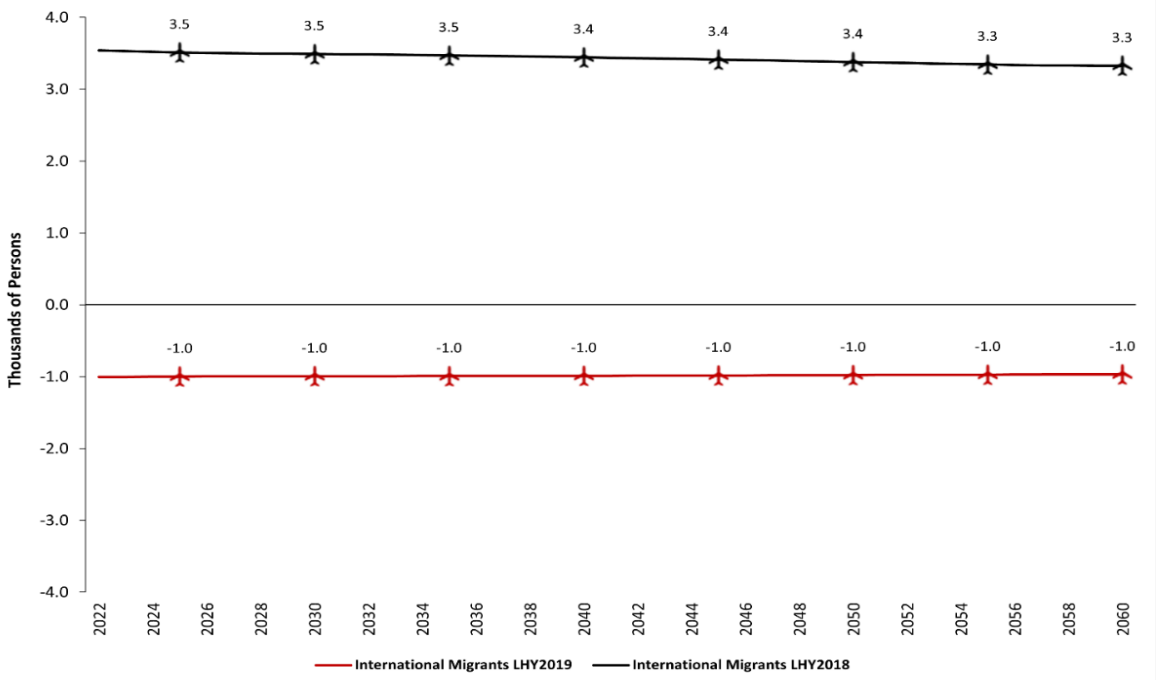
Note: Out-of-the-box refers to the model prior to recalibration. These numbers are not the final forecast.

The forecasted population growth rates for the LHY2019 and LHY2018 models generally decline over the entire forecast horizon through 2060, except 2022 and 2023 for the LHY2019 model as the model expects a recovery from the COVID-19 recession (Figure 2). The LHY2019 model forecasts a growth rate of population that exceeds the growth rate of the LHY2018 model for the entire forecast period except

[5] The detailed out-of-the-box results through 2060 appear in Table D1 of the Appendix D.

for 2022 and 2023. These higher growth rates from the LHY2019 model from 2024 mainly reflect higher net migrants[6] for the LHY2019 model compared to the LHY2018 model caused by higher net economic migrants despite lower birth-rate forecasts for the LHY 2019 model compared to the LHY2018 model for the entire forecast horizon (Figure 3).

Figure 4. Clark County Net International Migrant Forecasts: REMI Out-of-the-Box LHY2019 and LHY2018: 2022-2060



Note: Out-of-the-box refers to the model prior to recalibration. These numbers are not the final forecast.

The lower gap of net migrants compared to that of net economic migrants mainly reflects the reduced projections in net international migration for the LHY2019 relative to the LHY2018 models. Figure 4 shows that net international migration projections for LHY 2019 are much lower than those from LHY2018 by approximately 4,000 for each forecasted year. These decreases partly offset gains in economic migration projections for the LHY2019 model compared to the LHY2018 model. The negative projections for net international migration reflect the 2019 Census estimate released in 2020 as the REMI model

[6] The REMI model defines four components of net migration: economic, retired, special, and international migration. Economic migrants include individuals under 65 who emigrate from other regions to improve their living standards and to seek better job opportunities. Retired migrants include individuals 65 and older who move from one region to another and do not respond to economic conditions. The REMI model explains that economic migrants are the difference between the net domestic migrants and the net retired migrants. Special migrants include prisoners, college students, and military personnel and their dependents. Finally, net international migration includes migrants who move from outside the United States and into the 50 states and the District of Columbia, which includes migrants relocated from Puerto Rico and U.S. territories, Armed Forces, permanent and temporary migrants such as students, refugees, and illegal migrants.

expects net international migration will show the same trend as the Census's latest data. The most recent Census data, however, show an upward revision to 5,543 net international migration for Clark County. Clark County did not experience negative net international migration from 2010 to 2020 except for 2018. We, therefore, conclude that negative net international migration projections will not likely happen and rebase the net international migration projections for the forecast horizon to zero, which is shown in section III.F International Migration Rebase.

Table 2. Clark County REMI Out-of-the-Box Forecast Comparison: LHY2019 and LHY2018

	2022			2060		
	LHY2019	LHY2018	Change to forecast	LHY2019	LHY2018	Change to forecast
Population (Thousands)	2,313.05	2,406.19	-3.9%	3,102.77	3,111.83	-0.3%
Total Employment (Thousands)	1,299.85	1,435.80	-9.5%	1,713.58	1,660.60	3.2%
Total Employment as % of Nation	0.63	0.70	-6.6%	0.74	0.72	2.3%
Gross Domestic Product (Billions of Fixed 2012 Dollars)	112.13	121.43	-7.7%	239.98	233.42	2.8%
Gross Regional Product as % of Nation	0.56	0.61	-4.7%	0.63	0.61	1.7%
Migrants (Thousands)						
Economic Migrants	4.05	24.68	-83.6%	7.71	1.34	474.4%
Retired Migrants	5.81	5.84	-0.5%	8.60	8.67	-0.8%
International Migrants	-1.01	3.54	-128.4%	-0.97	3.33	-129.1%
Population by Age (Thousands)						
Ages 0-14	426.67	451.83	-5.6%	459.56	471.39	-2.5%
Ages 15-24	274.90	297.53	-7.6%	330.87	334.21	-1.0%
Ages 25-64	1,219.29	1,263.05	-3.5%	1,468.89	1,467.37	0.1%
Ages 64+	392.18	393.78	-0.4%	843.45	838.87	0.5%

Note: The numbers for both LHY 2019 and LHY 2018 models refer to the models prior to adjustments.

Table 2 compares the REMI out-of-the-box economic and demographic forecasts between the LHY2019 and LHY2018 models for the period between 2022 and 2060. The LHY2019 out-of-the-box model predicts a stronger Clark County economy in 2060, compared to the LHY2018 out-of-the-box model in terms of total employment and real GDP. Moreover, the LHY2019 out-of-the box model projects a larger Clark County economy as a percentage of the nation in 2060 compared to the out-of-the-box LHY2018 model. The total population for the LHY2019 model, however, is lower in the year 2060 as the total population level in 2022 for the LHY2019 model is 3.9 percent lower than the level from the LHY 2018 model. The gap, however, nearly converged by 2060, because of higher net economic migration forecasts (Figure 3). Net economic migration for the LHY2019 model is 83.6 percent lower in 2022 compared to the level from the LHY2018 model as the LHY2019 model expected ongoing recovery from the COVID-19 recession, while the LHY2018 model expected an economic expansion in 2022 after a full recovery from

the COVID-19 recession. Net economic migration for the LHY2019 surpassed the level from the LHY2018 model in 2024 and remained at higher levels until 2060. Net economic migration for the LHY2019 model in 2060 is higher than the level from the LHY2018 model due to higher economic migration despite reduced international migration. Higher levels of the net economic migration projections for the LHY2019 model contribute to a larger projected population between ages 25 and 64 compared to the LHY2018 model, which potentially produces a positive return for Clark County in that these migrants not only contribute to the local human capital resources but also boost the development of local businesses.

III. Recalibrating the Model

As noted previously, county-level personal income data only become available with a two-year lag. As a result, the REMI model also imposes a two-year lag on all its data history that ends with 2019 data for the current model, PI+ v2.5, released in 2021. To update the model, we incorporate available, pertinent model information, including the most recent national GDP forecast, most recent population estimates from SNRPC, most recent employment figures and forecasts, and spending on public and private capital projects to reflect Clark County information in the forecast. We describe each update in sequence.

A. Adjustment of the national economic forecast

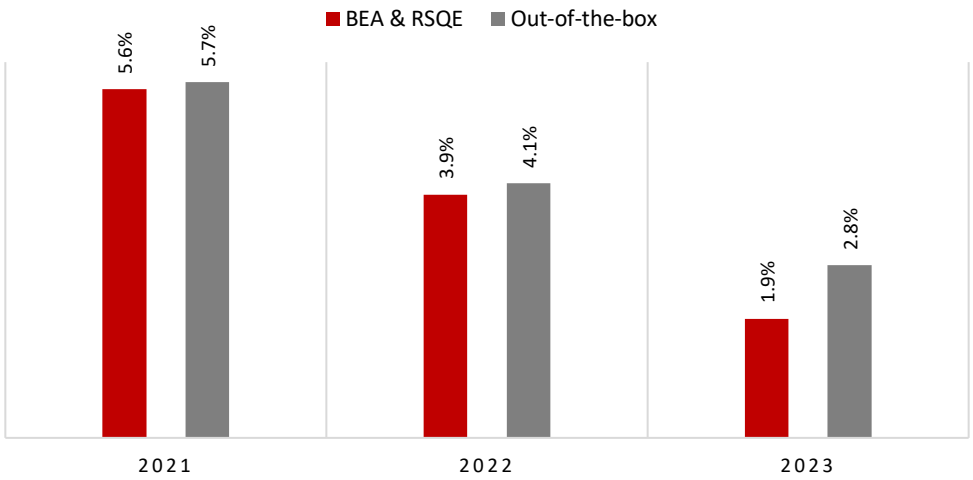
The REMI model relies on a baseline national GDP forecast from the University of Michigan's RSQE. Given the rapidly changing U.S. economy with an unprecedented fiscal and monetary stimulus and unlimited quantitative easing to recover from the unexpected COVID-19 recession, REMI sent out five updates to ensure that the REMI model remains current with the most recent available data. REMI sent their last update dated July 2021, so the data in the PI+ v2.5 model were updated with the RSQE's May 2021 forecasts, the March 2021 long-term economic projections from the Congressional Budget Office (CBO), and updated BEA national data for 2020. The original PI+v2.5 model includes the RSQE's February 2021 forecasts and CBO's February 2021 projections, and its latest historical year is 2019.

We, therefore, update our original REMI model, PI+v2.5 with REMI's *May Economic Forecast Update* released in July 2021. After that, we adjust the model's national GDP forecast using the BEA's most recent data and the February 2022 national GDP forecast from RSQE. Figure 5 displays the comparison between RSQE and REMI out-of-the box forecasts[7] for 2022 and 2023. For 2021, the actual real GDP expanded by 5.6 percent according to BEA, but the REMI model forecasted a 5.7 percent growth. The REMI model predicts 4.1 and 2.8 percent growth for the real GDP in 2022 and 2023, respectively,

[7] All out-of-the-box forecasts use the original REMI PI+v2.5 model before any REMI updates.

while the most recent RSQE's forecasts expect, respectively, 3.9 and 1.9 percent growth. This justifies the need of updates for the REMI model. The adjusted national forecast generates a new baseline forecast for Clark County. We, then, use the baseline forecast for the subsequent adjustments.

Figure 5. U.S. Real GDP Forecasts: RSQE vs. REMI Out-of-the-Box from 2021 to 2023



Note: REMI out-of-the-box growth rates from 2021 to 2023 reflect the RSQE's March 2020 prolonged fallout forecasts. For BEA & RSQE, the growth rate for 2021 is based on the BEA estimate, but the growth rates for 2022 and 2023 show the projections by RSQE.

B. Rebasing the population forecast

We rebase the population forecast using the population update feature in the REMI model. We update the population in 2021 based on the most recent SNRPC Clark County population estimates, that is 2.33 million, an unexpected decline of 1.8 percent from 2020, which largely reflects the 2020 Decennial Census of 2.27 million in 2020. The availability of the 2020 Census data produced a high variance in population growth rate estimates in 2021 among the three Clark County population estimates from the SNRPC, the Nevada State demographer, and the Census. In contrast to the large decline in population in 2021 reported by SNRPC, the Nevada State Demographer's estimate indicates no growth while the Census reports a 0.8 percent growth in 2021. As a result, we decided not to include CBER's short-term population growth rate forecasts.

C. Employment adjustment

The county-level employment data in REMI come from the BEA's local area personal income data, which only includes a 23-sector breakout. Even though the BEA reports the county-level employment data for 23 sectors, the BEA supplies the county-level wage data for 70 sectors. This means that REMI calculates employment for 70 sectors by incorporating the county-level wage data. Although the most recent

historical year in the model's employment data is 2019, BEA employment data are available for 2020. Table 3 shows the REMI out-of-the-box forecasts and BEA estimates for Clark County employment for 23 sectors. Although BEA estimates and REMI forecasts by sector appear different for some sectors, the total employment for 2020 is almost identical. That is, REMI indicates that the employment equals 1,239 thousand in 2020, which is only 1,000 lower than the actual employment of 1,240 thousand from BEA. To ensure that the model reflects the accurate employment by sector for 2020, we update the model's employment data with BEA estimates for the 23 sectors in 2020. We also update the model's employment data for 2021 as most wage and salary employment data are available from the Nevada DETR for 2021. We, therefore, update the model to account for the most recent information.

Table 3. Model Job Adjustments (in 000s) for 2020 with BEA Estimates

INDUSTRIAL CLASSIFICATION	*REMI FORECASTS*	BEA ESTIMATES
Forestry, fishing, and hunting	0.41	0.43
Mining	1.50	1.52
Utilities	2.59	2.87
Construction	75.78	81.33
Manufacturing	28.23	27.74
Wholesale trade	27.55	27.74
Retail trade	132.16	124.82
Transportation and warehousing	74.47	88.59
Information	15.73	13.78
Finance and insurance	70.34	69.23
Real estate and rental and leasing	76.21	70.22
Professional, scientific, and technical services	72.56	74.94
Management of companies and enterprises	26.27	25.05
Administrative, support, waste mgmt, and remediation services	97.70	94.30
Educational services; private	13.71	14.28
Health care and social assistance	106.58	110.95
Amusement, gambling, recreation	33.13	33.55
Accommodation and food services	208.38	198.62
Other services (except public administration)	55.86	60.89
State & local government	86.75	87.92
Federal civilian	16.12	14.64
Federal military	16.80	16.61
Farm	0.47	0.43
Total	1239.30	1240.45

Note: BEA estimates are also adjusted employment.

The latest growth rates for the REMI model forecasts as well as recent DETR estimates appear in Table 4. The actual growth rates from DETR differ from the REMI forecasts, suggesting a need for adjustment. That is, the growth rate estimates by DETR of total employment are substantially higher than

the REMI forecasts by 3.97 percent in 2021, which mainly reflects stronger recovery in the leisure and hospitality sector than the REMI model expected. The employment update proceeds as follows. First, we substitute BEA employment by 23 sectors into the REMI model and get the 70-sector estimates from the REMI model for 2020. Second, we compute the annual percentage change using DETR data and apply them to produce new estimates for 2021. This procedure implicitly assumes that the proportion of self-employed in each industry classification grows at the same rate as does the ratio between full- and part-time workers.

Table 4. Employment Growth Rates for Clark County before DETR Adjustment for 2021

Industrial Classification	*REMI Forecasts**	*DETR Estimates*
Construction	-3.60%	1.61%
Wholesale Trade	4.28%	3.93%
Retail Trade	5.56%	6.24%
Transit, Ground Passenger Transportation	2.30%	6.56%
Monetary Authorities, Et Al.	1.20%	5.36%
Ins Carriers, Related Activities	1.10%	4.87%
Real Estate	1.27%	4.31%
Professional, Technical Services	0.58%	4.04%
Management of Companies	2.05%	3.00%
Administrative, Support Services	2.66%	7.86%
Ambulatory Health Care Services	3.78%	8.41%
Hospitals	2.62%	3.49%
Amusement, Gambling, And Recreation	3.82%	20.77%
Accommodation	1.98%	10.46%
Food Services, Drinking Places	2.39%	20.45%
State & Local Government	-1.66%	-0.78%
Total	*1.76%*	*5.73%*

*The 2021 REMI forecasts are updated with the GDP and BEA updates.
Note: The total growth rates for DETR estimates are calculated after adjusting the employment forecasts with the DETR data for available sectors. Therefore, they do not represent actual DETR's growth rate estimates.

Table 5 reports the updated employment data by category for the model. The Clark County job growth numbers in 2021 show that local economic conditions recovered strongly from the COVID-19 recession after a 10.6 percent decline in 2020. Most sectors experienced gains except for forestry, fishing, hunting, and mining, and several manufacturing and government sectors. The robust growth mainly reflects double-digit increases in employment in key sectors such as accommodation, gaming, and food services as the COVID-19 pandemic effect wanes. As a result, Southern Nevada's economy added roughly 71,000 jobs in 2021.

Table 5. Model Job Adjustments (in 000s) for 2021 with DETR Estimates

Industrial Classification	BEA Estimates	DETR Growth Rate	Adjusted Job Levels
	2020	*2021*	*2021*
Forestry et al.	0.39	-56.52%	0.17
Support act for agriculture and forestry	0.04	-2.50%	0.04
Oil, gas extraction	0.03	-6.25%	0.03
Mining (except oil, gas)	1.47	-7.27%	1.37
Support activities for mining	0.01	-21.43%	0.01
Utilities	2.87	0.31%	2.88
Construction	81.33	1.61%	82.64
Wood product manufacturing	0.46	-0.22%	0.46
Nonmetallic mineral prod manufacturing	2.10	-2.91%	2.04
Primary metal manufacturing	0.43	11.16%	0.48
Fabricated metal prod manufacturing	3.19	-2.23%	3.12
Machinery manufacturing	0.71	-3.82%	0.68
Computer, electronic prod manufacturing	0.62	2.74%	0.64
Electrical equip, appliance manufacturing	0.47	0.43%	0.47
Motor vehicle manufacturing	0.32	4.44%	0.33
Trans equip mfg exc motor vehicle	0.28	-0.35%	0.28
Furniture, related prod manufacturing	1.36	4.41%	1.42
Miscellaneous manufacturing	6.21	2.21%	6.35
Food manufacturing	3.71	0.22%	3.71
Beverage, tobacco prod manufacturing	0.74	-1.21%	0.73
Textile mills; textile prod mills	0.47	2.55%	0.48
Apparel manufacturing	0.41	41.08%	0.58
Paper manufacturing	0.54	0.93%	0.54
Printing, related supp act	2.62	-0.08%	2.61
Petroleum, coal prod manufacturing	0.04	0.00%	0.04
Chemical manufacturing	1.48	-2.64%	1.44
Plastics, rubber prod manufacturing	1.61	1.12%	1.63
Wholesale trade	27.74	3.93%	28.83
Retail trade	124.82	6.24%	132.61
Air transportation	6.88	0.61%	6.93
Rail transportation	0.28	0.36%	0.28
Water transportation	0.06	0.00%	0.06
Truck transportation	8.36	2.49%	8.57
Couriers and messengers	9.09	3.27%	9.38
Transit, ground pass transportation	35.80	6.56%	38.14
Pipeline transportation	0.01	0.00%	0.01
Scenic, sightseeing transportation; supp	8.96	1.76%	9.12
Warehousing, storage	19.15	3.57%	19.83
Publishing, except internet	2.53	2.18%	2.58
Motion picture, sound rec	3.30	1.64%	3.35
Data processing, hosting, and rel services	3.04	2.69%	3.13

Table 5. Model Job Adjustments (in 000s) for 2021 with DETR Estimates (continued)

Industrial Classification	BEA Estimates	DETR Growth Rate	Adjusted Job Levels
	2020	*2021*	*2021*
Broadcasting, except int;	1.31	-0.08%	1.31
Telecommunications	3.60	3.33%	3.72
Monetary authorities, et al.	17.22	5.36%	18.14
Sec, comm contracts, inv	33.17	4.87%	34.78
Ins carriers, rel act	18.85	4.87%	19.76
Real estate	62.95	4.31%	65.66
Rental, leasing services	7.27	0.63%	7.31
Prof, tech services	74.94	4.04%	77.97
Mgmt of companies, enterprises	25.05	3.00%	25.80
Administrative, support services	91.44	7.86%	98.63
Waste mgmt, remediation services	2.86	1.82%	2.91
Educational services	14.28	3.11%	14.72
Ambulatory health care services	52.04	8.41%	56.41
Hospitals	22.75	3.49%	23.54
Nursing, residential care facilities	10.87	3.49%	11.25
Social assistance	25.29	3.78%	26.25
Performing arts, spectator sports	21.97	1.60%	22.32
Museums et al.	0.60	2.34%	0.61
Amusement, gambling, recreation	10.98	20.77%	13.26
Accommodation	112.21	10.46%	123.94
Food services, drinking places	86.41	20.45%	104.08
Repair, maintenance	13.59	2.28%	13.90
Personal, laundry services	27.15	4.72%	28.43
Membership assoc, organ	12.65	0.74%	12.74
Private households	7.50	4.36%	7.83
State & local government	87.92	-0.78%	87.24
Federal civilian	14.64	-1.82%	14.37
Federal military	16.61	-2.47%	16.20
Farm	0.43	-2.56%	0.42
Total	1,240.45	5.73%	1,311.51

D. Hotel room adjustment

We adjust future hotel employment based on the expected number of hotel rooms added in each of the next few years. The additional rooms and related employment represent either properties that are under construction with fixed opening dates, or properties that have development plans and a high probability of project completion during the specified year. In this way, we ensure that the model includes a good short-term forecast of new hotel investment and employment.

As of February 25, 2022, the LVCVA projects that hotel/motel construction will add an additional 321 rooms to the local room inventory by the end of 2022 (See Appendix B). This includes the opening of the ENGLiSH Hotel, TownePlace Suites, and Holiday Inn Express at Railroad Pass. In 2023, the LVCVA projects that hotel/motel construction will add an additional 4,254 hotel/motel rooms to the room inventory. This includes the opening of Fontainebleau Las Vegas; Durango, A Station Casino Resort (Phase 1); Springhill Suites by Marriott at S. Decatur Blvd and W. Sunset Rd; and Aloft Hotel. Finally, the LVCVA expects to see an additional 2,261 rooms added to the room stock in 2024 by Element Las Vegas Airport; SpringHill Suites Marriott at Tropicana Ave and Kelch Dr; Element Las Vegas; AC Hotel by Marriott; Delta Hotels by Marriott; Dream Las Vegas; and the Majestic Las Vegas. Overall, Las Vegas is expected to see an additional 6,836 hotel/motel rooms added to inventory by the end of 2024, which is a robust 4.5 percent increase compared to the current available room inventory.[8]

Table 6. Expected Additional Employment due to New Rooms: Projections for 2022-2024

Year	*LVCVA Projections*	*REMI New Jobs Needed*	*Cumulative Additional REMI New Jobs*
2022	321	417	417
2023	4,254	5,530	5,948
2024	2,261	2,939	8,887

Note: REMI New Jobs Needed are calculated by using a jobs-to-room multiplier of 1.3. We calibrated cumulative additional REMI new jobs in the REMI model.

The model adjustment for new hotel construction uses a jobs-to-room ratio of 1.3, which we calculated as follows.[9] First, we expect new hotel rooms to create new jobs in hotel services. Using historical information from 2010-2019, we take the historical average ratio of annual accommodation employment from the Bureau of Labor Statistics (BLS) divided by the total number of hotel rooms for both the Casino and non-Casino sectors. This produces job-to-room ratios of 1.25 and 0.49 for casino accommodation and non-casino accommodation, respectively. We, then adjust based on the shares of casino and non-casino rooms, 0.66 and 0.34 respectively, for new hotel construction.[10] From this calculation, we generate a weighted jobs-to-room multiplier of roughly 1.0 for hotel services. New hotel rooms will also generate secondary economic activity and, hence, additional jobs in other sectors. For example, increased tourism activity from new hotel rooms will also increase the demand for food services

[8] As of March 2022, Las Vegas had 150,693 available rooms in inventory according to the LVCVA.

[9] The detailed computation of the jobs-to-room ratio appears in Appendix A.

[10] See Appendix B for the casino and non-casino calculation.

and other tourism-related industries. We account for these new jobs as follows. We, first, use each industry's location quotient[11] to estimate the portion of the industry's employment attributable to tourism activity. We, then, take the historical average ratio of the annual employment in each of these sectors, which is attributable to tourism activity divided by the total hotel rooms. The sum of the ratios for the food services and other tourism-related industries is approximately 0.3. This, together with the jobs-to-room multiplier of 1.0 for hotel services, produces the overall jobs-to-room ratio of 1.3. We, then, use the jobs-to-room multiplier as the multiplicand times the number of additional rooms, producing a cumulative increase of about 9,000 jobs by 2024 (Table 6).

This method differs from our prior reports before 2020 in that the previous method only included the number of additional jobs *over and above* the rooms and jobs already accounted for in the model. Previously, we assumed that the existing number of rooms would be managed by the same number of hotel jobs for the projected period by the LVCVA. That is, an increase or decrease in REMI jobs must first be completely offset, and only then we do calibrate projected additional jobs into the REMI model. This method works if the tourism sector remains unchanged in terms of its productivity and environment. Due to the economic downturn caused by the COVID-19 pandemic, however, we lost a significant number of hospitality jobs, and the recovery in the tourism sector lags far behind compared to other sectors as it is directly affected by business restrictions related to COVID-19. Clark County, however, recently showed a strong pick-up in the local tourism sector caused by pent-up demand as the effect of COVID-19 waned. The REMI model still shows that the accommodation employment is projected to be below the pre-pandemic levels, meaning that an increase in REMI jobs is more likely due to the recovery of the tourism sector. Therefore, completely offsetting an increase in the REMI jobs with expected additional jobs due to the new hotel rooms will likely cause a distorted result. We, therefore, decided to, once again, this year use the same method we used in the *2020 and 2021 CBER Population Forecast*.

E. Transportation and infrastructure improvements

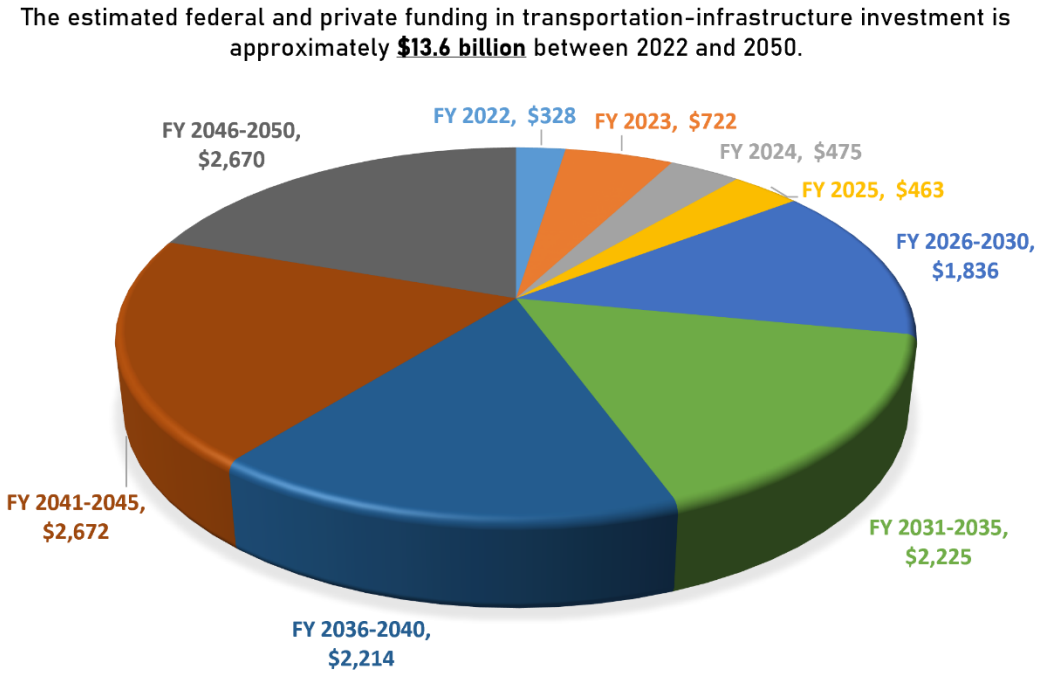
Clark County continues to invest in transportation infrastructure such as roads, highways, and mass transit. The REMI model assumes that public-infrastructure investment will follow a path consistent with the model history. Thus, some local spending on public infrastructure, such as road building and additional

[11] The Location Quotient (LQ) compares Clark County's employment in a given industry sector to that of the nation. An LQ greater than 1 indicates that the area has proportionately more workers than the nation employed in that specific industry sector. This implies that the area is producing more than is consumed by its residents. Hence, the portion of the LQ that is above 1 represents, CBER assumes, the proportion of the industry's employment attributable to tourism activity.

services, is built into the model. One-time monies, however, tend to come from outside the region (e.g., federal transportation funding). We adjust the model to incorporate these large transportation projects in the forecast.

The estimated federal and private funding in transportation-infrastructure investment is about $13.6 billion between 2022 and 2050 (Figure 6). We annualize expected transportation-infrastructure expenditures from RTC of Southern Nevada and include them in the REMI model as new construction projects. In addition, we assume that federal funding in transportation-infrastructure investment after 2050 will continue with a reasonable expectation that the federal funding will not fall to zero. Rather, we apply the flat amount of federal funding after 2050, where the REMI model adjusts this amount for inflation.

Figure 6. The Estimated Federal and Private Funding Allocation for the Regional Transportation Plan for Southern Nevada 2022-2050



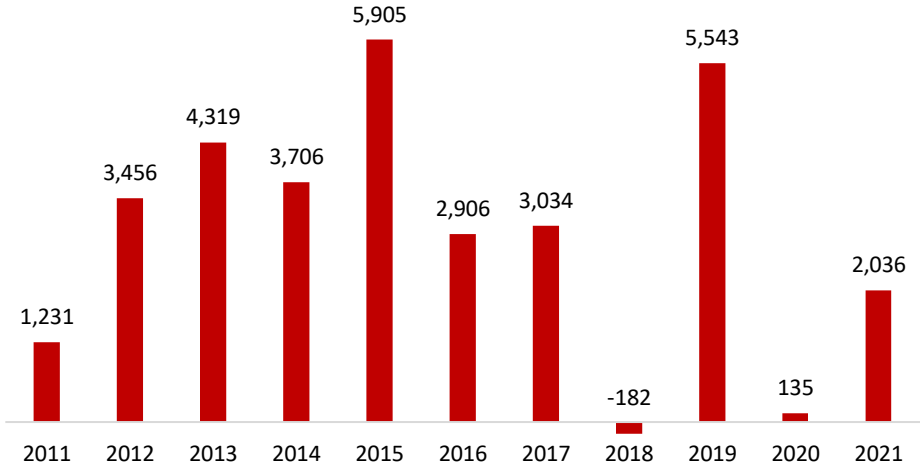
Note: The amount shown above only includes federal and private funding and is displayed in millions.
Source: The Regional Transportation Commission (RTC) of Southern Nevada

F. Net International Migration Rebase

The current REMI model predicts that net international migration will remain negative for the entire forecast horizon (Figure 4). That is, the REMI model expects that there will be more migrants moving to other countries from Clark County compared to in-migrants from other countries to Clark County. Clark

County net international migration, however, has never seen any negative level except for 2018, when the international immigration policies were stricter under the Trump administration (Figure 7). The REMI model predicts approximately -1,000 net international migration per year from 2022 to 2060. We conclude that negative net international migration forecasts are not likely based on prior history. Forecasting net international migration, however, is challenging as it is easily affected by political events. Therefore, we made a conservative assumption that no loss or gain in net international migration occurs over the forecast period, meaning that Clark County net international migration will be zero from 2022 to 2060.

Figure 7. Clark County Net International Migration Estimates from 2011 to 2021



Note: The REMI history of Clark County's net international migration for 2019 is -360 persons as the REMI used data from the Census released in 2020. Therefore, REMI's prediction is negative for the entire forecast period as REMI's net international migration predictions rely on the most recent historical year, which is 2019. The Census, however, revised the 2019 net international migration upward to 5,543 persons.
Source: The U.S. Census

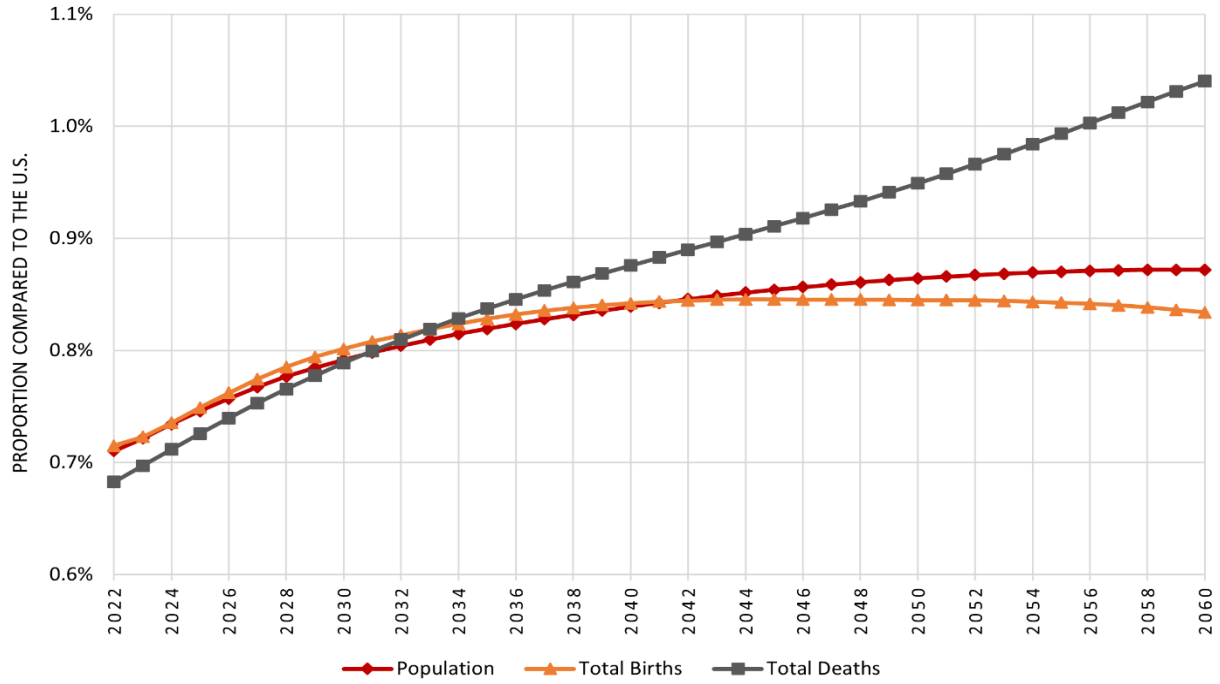
IV. Analysis of the Economic and Demographic Forecast

The forecast predicts significant rates of population growth for Southern Nevada in the near term and then moderating rates of growth over the forecast period extending out to 2060. The rate of growth, which decidedly exceeded the national average over the past 50 years, moderates and eventually moves below the national growth rate as the Southern Nevada economy matures and the Clark County population ages compared to the United States with a zero share of international migration over the forecasting horizon. The economic forecast calls for the continuation of the economic expansion over the forecast horizon. Tables 7, 8, and 9, respectively, report the final population, employment, and real GDP predictions for Clark County from the recalibrated model.

A. Population

In the short term, the current forecast predicts strong rates of population growth in Southern Nevada. CBER predicts that the population in Clark County will grow at rates of 1.8 percent in 2022 and 2.2 percent in 2023 as the Clark County economy recovers from the COVID-19 recession (Table 7). The population growth rate will hit 2.4 percent in 2024 with continued strong economic activities, boosted by infrastructure investment, including the high-speed rail project and new hotel room additions. CBER expects the population growth rates in the medium term to be robust but will decline over time with decreases in natural growth (births-deaths) and net migration. By 2054, the population growth rate falls to 0.39 percent, the same as the projected[12] national population growth rate. The population growth rate, however, continues to fall further, remaining slightly lower than the projected national population growth of 0.4 percent from 2055 to 2060. In 2060, we forecast the population growth rate for Clark County to be 0.3 percent.

Figure 8. Share of Clark County Population, Total Births, and Total Deaths



Note: Forecasts refer to the model after recalibration.

To understand why the projected national population growth rate surpasses the Clark County growth rate, we examine what the REMI model predicts regarding Clark County population components for the forecasting horizon compared to those of the United States. As shown in Figure 8, the model

[12] https://www.census.gov/data/tables/2017/demo/popproj/2017-summary-tables.html.

predicts the share of Clark County total deaths increases over the forecasting horizon and surpasses the share of Clark County population compared to the U.S. population after 2031. The share of Clark County total births, however, will be lower than the share of Clark County's population after 2042. This indicates that Clark County's population will age compared to the national average. Moreover, the share of Clark County's international migrants will be zero as Clark County's net international migration is assumed to be zero instead of negative for the entire forecast horizon. The REMI model predicts that the United States will have approximately 1.1 million of net international migrants per year from 2022 to 2060.

Table 7. Population History, REMI Forecasts, and Final Rebased Forecasts

Year	REMI Forecast*	Rebased Forecast	Change in Population Rebased Forecast	Growth in Population Rebased Forecast
2021	2,297,000	2,333,092**	-43,591	-1.8%
2022	2,313,000	2,375,000	41,908	1.8%
2023	2,344,000	2,427,000	52,000	2.2%
2024	2,388,000	2,485,000	58,000	2.4%
2025	2,431,000	2,540,000	55,000	2.2%
2026	2,472,000	2,593,000	53,000	2.1%
2027	2,512,000	2,644,000	51,000	2.0%
2028	2,549,000	2,691,000	47,000	1.8%
2029	2,583,000	2,733,000	42,000	1.6%
2030	2,614,000	2,773,000	40,000	1.5%
2031	2,644,000	2,810,000	37,000	1.3%
2032	2,671,000	2,845,000	35,000	1.2%
2033	2,698,000	2,879,000	34,000	1.2%
2034	2,724,000	2,910,000	31,000	1.1%
2035	2,748,000	2,940,000	30,000	1.0%
2040	2,859,000	3,073,000	25,000	0.8%
2045	2,948,000	3,181,000	20,000	0.6%
2050	3,017,000	3,266,000	16,000	0.5%
2055	3,067,000	3,334,000	12,000	0.4%
2060	3,103,000	3,387,000	9,000	0.3%

* This forecast refers to the model prior to recalibration.
** Southern Nevada consensus population estimate.
Note: A table detailing the rebased population forecast appears in the Appendix D–Table D2.

CBER forecasts that Clark County will add roughly 41,900 new residents in 2022. The forecast then predicts that population growth will be stronger in the near term as the local economy continue to recover from the COVID-19 pandemic. Population growth, however, will slow in the future as the population ages

and the local economy becomes less competitive in drawing more economic and international migrants when compared to the average for the United States as a whole. The population forecast predicts that Clark County's population will increase to roughly 3.39 million by 2060.

B. Employment

The forecast predicts a continued robust economic recovery for Southern Nevada in 2022. CBER forecasts that the Las Vegas economy will experience a gain of 58,000 jobs or 4.4 percent of total jobs in 2022. See Table 8.[13] CBER forecasts that the local economy will fully recover from the COVID-19 pandemic in 2023 by adding 64,000 jobs. The employment growth rate then will gradually decrease over time and stabilize at around 0.1 percent as the Southern Nevada economy matures.

Table 8. Employment Forecasts

Year	Employment Forecast	Change in Employment Forecast	Growth in Employment Forecast	Employment-population Forecast
2021	1,312,000	72,000	5.8%	0.56
2022	1,370,000	58,000	4.4%	0.58
2023	1,434,000	64,000	4.7%	0.59
2024	1,489,000	55,000	3.8%	0.60
2025	1,524,000	35,000	2.4%	0.60
2026	1,550,000	26,000	1.7%	0.60
2027	1,570,000	20,000	1.3%	0.59
2028	1,582,000	12,000	0.8%	0.59
2029	1,587,000	5,000	0.3%	0.58
2030	1,594,000	7,000	0.4%	0.57
2031	1,603,000	9,000	0.6%	0.57
2032	1,611,000	8,000	0.5%	0.57
2033	1,620,000	9,000	0.6%	0.56
2034	1,628,000	8,000	0.5%	0.56
2035	1,637,000	9,000	0.6%	0.56
2040	1,680,000	7,000	0.4%	0.55
2045	1,719,000	7,000	0.4%	0.54
2050	1,761,000	7,000	0.4%	0.54
2055	1,791,000	4,000	0.2%	0.54
2060	1,810,000	2,000	0.1%	0.53

[13] Unadjusted employment forecasts are shown in Appendix D.

C. Gross domestic product

Real gross domestic product (GDP) is defined as the (constant) dollar value of all final goods and services sold in a regional economy over a given time period. As such, it reflects the output of a local economy and avoids double-counting initial and intermediate goods. The forecast for growth in Clark County's real GDP, shown in Table 9, basically mirrors the growth pattern of local employment, although the real GDP growth rate forecasts show stronger projections due to increasing labor productivity as well as an aging population. The real GDP growth rate forecast expects robust gains of 5.5 and 5.8 percent, respectively, in 2022 and 2023 as the local economy recovers from the COVID-19 pandemic recession. The real GDP growth rate forecast expects to gradually decrease after 2023. The local economy expects to have a stabilized growth rate at around 1.4 percent from 2057 with a matured economy.

Table 9. Gross Domestic Product Forecasts (Billions of Fixed 2022 Dollar)

Year	GDP forecast	Change in GDP Forecast	Growth in GDP Forecast	GDP per Capita Forecast
2021	134.99	10.60	8.5%	57,859
2022	142.46	7.47	5.5%	59,977
2023	150.68	8.22	5.8%	62,072
2024	158.26	7.59	5.0%	63,690
2025	163.93	5.66	3.6%	64,542
2026	168.80	4.87	3.0%	65,096
2027	172.96	4.16	2.5%	65,419
2028	176.73	3.78	2.2%	65,681
2029	179.87	3.14	1.8%	65,813
2030	183.26	3.40	1.9%	66,095
2031	186.90	3.63	2.0%	66,508
2032	190.40	3.50	1.9%	66,915
2033	193.93	3.53	1.9%	67,368
2034	197.52	3.60	1.9%	67,874
2035	201.15	3.63	1.8%	68,416
2040	219.27	3.55	1.6%	71,361
2045	237.55	3.68	1.6%	74,685
2050	256.61	3.87	1.5%	78,570
2055	276.43	4.02	1.5%	82,910
2060	296.70	4.07	1.4%	87,591

Note: The forecasts refer to the model after recalibration

V. Comparing the Current Forecast with Forecasts of Previous Years

This section compares this year's final population growth-rate forecast with the final population growth-rate forecasts from previous years. This exercise assesses the consistency of the forecast methodology and examines the variability in the population growth-rate forecasts over the last six years.

Figure 9. Clark County Historical Population-Growth-Rate Forecasts: 2022-2035

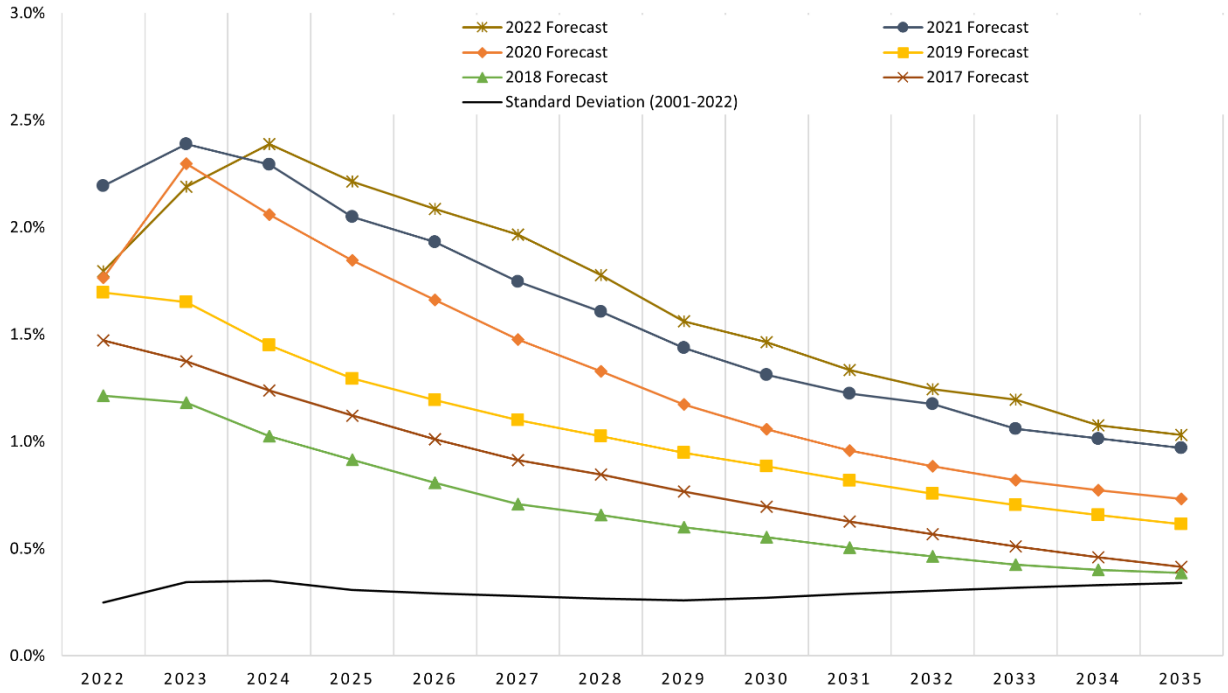


Figure 9 shows the population growth-rate forecasts generated from the 2017 to 2022 population forecast analyses as well as the standard deviation of the population-growth-rate forecasts in the last 22 years of forecasts (2001-2022).[14,15] Beginning in 2024, the growth rate forecasts rise monotonically from the 2017 forecast of 1.0 percent through the 2022 forecast of 2.4 percent Then, each forecast follows a downward trend, keeping the same order based on magnitude, ranging from 0.4 to 1.2 percent in 2035. The population growth-rate forecasts exhibit a similar level of variability from 2022 to 2035. The standard deviation of the population growth-rate forecast for the year 2022 is roughly 0.2 percent and increases in 2023 and 2024, but declines and remains around 0.3 percent after 2024. By 2030, the average of the forecasted growth rates converges to about 1.2 percent. Our forecasts tell a consistent story across

[14] That is, Figure 9 shows the forecasts of the population growth rate from 2022 through 2035 for six different forecast years, 2017 to 2022. The standard deviation calculation uses forecasts from 22 forecast years, 2001 to 2022. So, the standard deviation in 2022 measures the variability across the 22 different forecasts for the population growth rate in 2022.

[15] The standard deviation measures the variability among data points. For data that follow a normal distribution, around 95 percent of data points will fall within approximately two standard deviations of the mean.

different forecast years. This consistency improves as one moves to longer-term forecast values. Since the objective of this exercise is to provide primarily long-run planning guidance, the long-term growth predictions obtained during the last 20 years seem to meet that objective. Further analysis and findings appear in the *Evaluation of CBER Forecasts* in Appendix C.

VI. Risks to the Forecast

Our Southern Nevada population forecast rests on economic and demographic models embedded in the structural model for Clark County as produced by REMI. This structure provides long-term forecasts that exclude the noise that one finds in time-series data–that is, business-cycle, seasonal, and irregular events. In addition, the uncertainty of the forecasts rises the further into the future that the forecasts extend. For example, forecasts of population growth for the next two years see a much smaller range over which the forecast may actually vary than the range for our forecasts 40 years into the future.[16]

The main risks to the population forecasts arise from short-term fluctuations in both U.S. and Southern Nevada economic conditions. The U.S. economy has undergone unpredictable changes recently with high inflation, labor shortages, and supply disruptions amid strong demand and the Russian invasion of Ukraine. The Federal Reserve has begun to increase the Federal Funds rate, but it is uncertain if the Fed will succeed in controlling inflation without producing a recession. Deutsche Bank now predicts a major recession in late 2023 to early 2024. The local economy currently experiences a strong pick-up in its economic activity from pent-up demand for travel. The majority of Clark County visitors, however, come from the United States; therefore, the current ongoing uncertainty could be a headwind in the future with the recovery of the Southern Nevada economy. Moreover, the fear still exists that a COVID-19 variant may re-emerge and spread in the near future.

The future diversification of the local economy may provide a positive upside risk in terms of long-term population growth. In a Brookings Institution report,[17] Las Vegas ranked 96th out of 100 metropolitan areas based on improvement in prosperity (changes in productivity, average wealth and income, and

[16] The discussions in this and the immediate prior paragraphs may seem inconsistent. The discussion, however, focuses on two different issues. In the current paragraph, the uncertainty focuses on the range around an existing forecast within which we can expect the actual value to lie with some probability. For example, a typical range covers 95 percent of actual outcomes. In a statistical sense, the discussion involves confidence bands. The further into the future that the research tries to forecast, the larger the range of the confidence bands needs to be to capture 95 percent of potential outcomes. In the prior paragraph, the standard deviation came from a series of different vintage REMI forecasts. The economic and demographic structure of the REMI model leads to convergence over time. That is, the economic migrants respond to economic incentives. Then, the movement of economic migrants will tend to reduce and eliminate the economic incentive for more migrants to move in the longer run. That is, excessive growth relative to national growth disappears as the incentives for economic migration diminish.

[17] Source: The Brookings Institution (2017), *Metro Monitor*.

standard of living). The report emphasizes that high-tech-, research-, and capital-intensive-based economies grow faster than regions that rely on the hospitality and retail sectors for their economic growth. An updated report,[18] however, indicates that the effort to improve economic diversification has barely occurred, as Las Vegas ranked 53rd out of 53 very large metro areas in prosperity. Washoe County, which partly succeeded in diversifying its economy after the Great Recession,[19] posted fewer vulnerabilities to the COVID-19 recession compared to Clark County. That is, Washoe County employment declined less during the lockdown and has already recovered from the COVID-19 recession. Washoe County's unemployment rate fell to an all-time low of 2.6 percent in March 2022, while Clark County employment remained below the pre-pandemic level with severe labor shortages in the leisure and hospitality sector.

In summary, although we feel that the population forecast is sound, risks exist that could lead to either over- or under-forecasted population growth. CBER believes that the downside risk may exceed the upside risk for the Southern Nevada economy with the ongoing economic uncertainty, which means that the risk of overestimating population growth may exceed the risk of its underestimation in the near term. We reiterate that our long-term forecasts exclude business-cycle, seasonal, and irregular events, which respond more to these short-run risks. Our long-term forecasts are designed to aid in the process of long-term planning.

VII. Conclusion

The latest REMI model projects long-term population growth patterns that are consistent with previous population forecasts. Overall, the population forecast is lower than last year's forecast until 2058. It, however, surpasses last year's forecast and is slightly higher in 2060 due to the higher growth rate forecast from 2024. These patterns reflect not only the out-of-box forecast differences between this year and last year's REMI models but also the new data incorporated into the model and major adjustments with current employment and population data. As mentioned in Section II, the out-of-the box forecasted population for this year's model in 2022 is about 93,000 lower compared to last year's model; however, the gap decreases over the forecast period due to this year model's higher population growth rate forecasts from 2024 to 2060. We note that despite short-term economic uncertainties and model difficulties, the long-term population forecast, which is our primary focus in this forecasting exercise,

[18] Source: The Brookings Institution (2020), *Metro Monitor*.

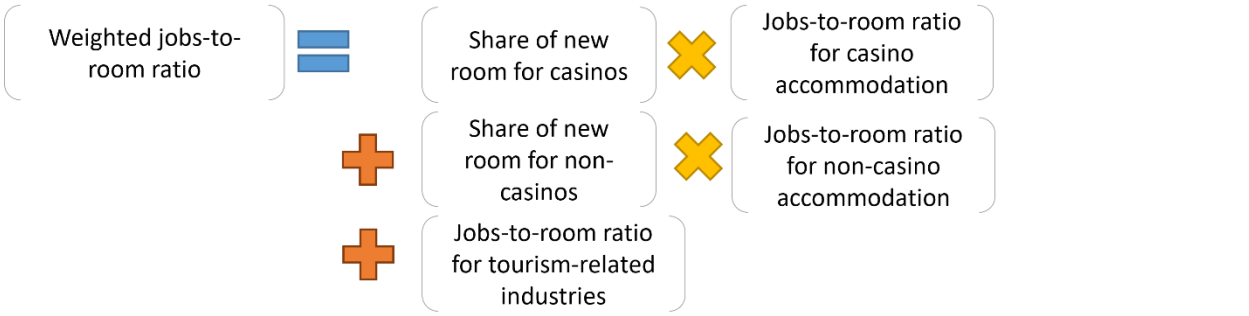
[19] According to Brookings Mountain West and the Lincy Institute, Las Vegas-Henderson-Paradise experienced -3.7, -0.5, and -9.3 percent growth in productivity, average annual wage, and standard of living from 2008 to 2018, while Reno gained by 4.0, 5.4 and 4.9 percent, respectively, during the same period.

remains consistent with past forecasts. By 2035, we predict that Clark County's population will reach about 2.94 million. In 2060, Clark County is expected to hit slightly below 3.39 million residents.

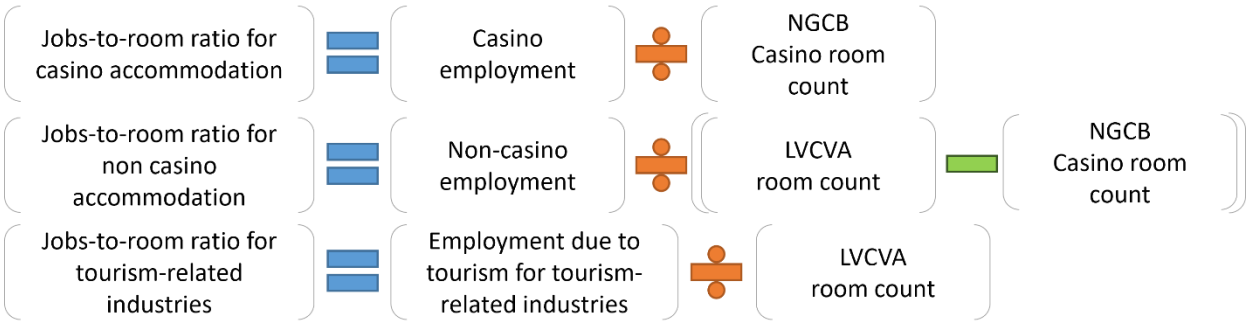
Appendices:

Appendix A: Computation of the Weighted Jobs-to-Room Ratio

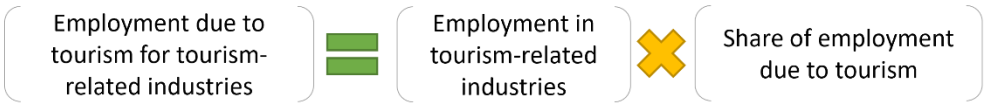
The adjustment for new hotel construction uses a ratio of jobs to rooms. Two issues arise in the computation of the jobs-to-room ratio. First, we expect new hotel rooms to create new jobs in hotel services. The hotel service jobs, however, will be calculated for casinos and non-casinos separately as they have different job-to-room ratios. Second, new hotel rooms themselves will also generate economic activity and, hence, additional jobs in other sectors. Increased tourism activity from new hotel rooms will increase the demand for food services and other tourism-related industries. Therefore, we need an approach that accounts for these two issues. To account for these issues, we suggest using a weighted ratio with the share of new hotel room for casinos and non-casinos. We propose the following formula:



where,



where,



Note: NGCB stands for the Nevada Gaming Control Board.

Table A1. Computation of Jobs-to-Room Ratios by Sequence (1) – (6)

(1) Employment (thousands)

Industrial Classification	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Casino accommodation	151.6	153.8	152.4	152.4	157.6	156.0	153.2	151.9	151.2	149.1
Non-casino accommodation	11.8	11.9	12.2	12.6	13.0	12.9	13.2	13.6	13.8	14.3
Clothing and clothing accessories	16.8	17.4	18.3	18.5	19.0	19.2	18.5	19.3	19.0	18.5
Transit, ground pass transportation	12.4	12.9	13.3	13.4	14.0	14.2	13.4	12.4	11.0	9.9
Arts, entertainment, and recreation	15.8	16.9	17.5	17.8	18.7	19.3	20.5	21.3	22.6	23.5
Food service and drinking places	74.2	77.0	79.4	84.5	89.3	94.1	98.8	101.9	103.5	106.6

Note: Non-casino accommodation is equal to accommodation minus casino accommodation
Source: Quarterly Census of Employment and Wages, U.S. Bureau of Labor Statistics

(2) Proportion of employment due to tourism (=(Location quotient**-1)/Location quotient)*

Industrial Classification	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Accommodation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Non-casino accommodation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Clothing and clothing accessories	0.46	0.49	0.50	0.50	0.51	0.52	0.49	0.49	0.49	0.49
Transit, ground pass transportation	0.78	0.78	0.79	0.78	0.78	0.77	0.75	0.73	0.69	0.64
Arts, entertainment, and recreation	0.20	0.25	0.26	0.25	0.24	0.23	0.24	0.24	0.25	0.25
Food service and drinking places	0.17	0.18	0.18	0.19	0.19	0.20	0.20	0.19	0.18	0.18

* Maximum value = 1. Minimum value = 0.
** The Location Quotient (LQ) compares Clark County's employment in a given industry sector to that of the nation. An LQ greater than 1 indicates that the area has proportionately more workers than the nation employed in that specific industry sector. This implies that the area is producing more than is consumed by its residents.
Note: We subtract 1/LQ from LQ, which represents the share of the employment, regardless of tourism, for the selected industries. For the accommodation sector, the proportion is 1 as we estimate the employment due to a hotel room.

(3) Employment due to tourism (thousands) = (1) x (2)

Industrial Classification	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Accommodation	151.6	153.8	152.4	152.4	157.6	156.0	153.2	151.9	151.2	149.1
Non-casino accommodation	11.8	11.9	12.2	12.6	13.0	12.9	13.2	13.6	13.8	14.3
Total for tourism-related industries*	32.8	37.0	38.6	40.6	42.6	43.8	43.7	43.5	41.0	40.4
Clothing and clothing accessories	7.7	8.5	9.2	9.3	9.7	9.9	9.1	9.5	9.2	9.0
Transit, ground pass transportation	9.7	10.0	10.5	10.5	10.9	11.0	10.1	9.0	7.6	6.4
Arts, entertainment, and recreation	3.2	4.3	4.6	4.4	4.5	4.5	5.0	5.1	5.6	5.8
Food service and drinking places	12.3	14.2	14.3	16.4	17.4	18.4	19.5	19.8	18.5	19.2

* The sum of employment due to tourism for clothing and clothing accessories, transit, ground pass transportation, arts, entertainment, and recreation, and food service and drinking places employment due to tourism. The numbers may not sum to the total because of rounding.

(4) Hotel room count (thousands)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
LVCVA room inventory	148.4	149.6	150.5	150.1	150.1	149.6	148.7	147.3	147.4	148.9
NGCB casino room inventory	122.6	124.3	123.5	123.4	123.3	123.5	122.4	121.8	121.4	119.7
Non-casino room inventory	25.8	25.3	27.0	26.7	26.8	26.2	26.3	25.5	26.0	29.1

Note: Room inventory is the average from January to December. Non-casino room inventory is equal to LVCVA room inventory minus NGCB casino room inventory.
Source: LVCVA; NGCB; CBER

(5) Employment due to a hotel room = (3)/(4)

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*Average**
Jobs-to-room ratio for Casino	1.24	1.24	1.23	1.23	1.28	1.26	1.25	1.25	1.25	1.25	**1.25**
Jobs-to-room ratio for non-casino	0.46	0.47	0.45	0.47	0.48	0.49	0.50	0.53	0.53	0.49	**0.49**
Jobs-to-room ratio for tourism-related industries	0.22	0.25	0.26	0.27	0.28	0.29	0.29	0.30	0.28	0.27	**0.27**

*Averaged jobs-to-room ratio from 2010 to 2019. We decided not to use 2020 data as the COVID-19 pandemic was an unprecedented disruption.

Note: Check the formulas for more detailed information.

(6) Weighted job-to-room ratio

	Casino	*Non-casino*
Share of new rooms (see appendix B)	0.661	0.339
Job-to-room ratio for accommodation	1.25	0.49
Jobs-to-room ratio for tourism-related industries	0.27	0.27

Therefore, the weighted job-to-room ratio = 0.661*1.25 +0.339*0.49 + 0.27 = 0.83+0.17+0.27 = 1.27 ~**1.3**.

Appendix B: Hotel/Motel Room Construction

Table B1. Expected Hotel/Motel Room Construction from 2022 to 2024

Complete Year	*Hotel Name*	*Zip Code*	*Hotel Rooms*	*Casino Y or N*
2022	The ENGLiSH Hotel	89101	74	N
2022	TownePlace Suites	89115	120	N
2022	Holiday Inn Express at Railroad Pass	89002	127	N
2023	SpringHill Suites by Marriott	89118	127	N
2023	Aloft Hotel	89044	136	N
2023	Durango, A Station Casinos Resort	89148	211	Y
2023	Fontainebleau Las Vegas	89109	3,780	Y
2024	Element Las Vegas Airport	89119	119	N
2024	SpringHill Suites by Marriott	89119	170	N
2024	Delta Hotels by Marriott	89103	284	N
2024	AC Hotel by Marriott	89106	322	N
2024	Element Las Vegas	89106	119	N
2024	Dream Las Vegas	89119	527	Y
2024	Majestic Las Vegas	89109	720	N

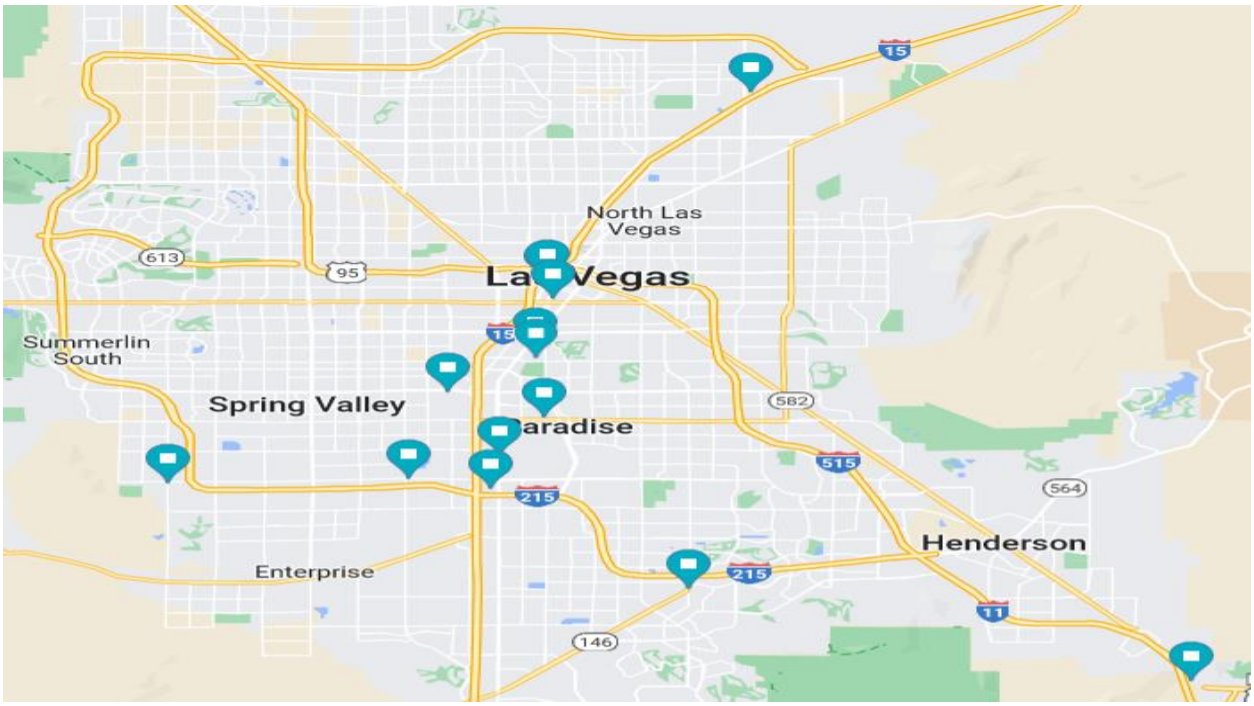
Note: The total number of additional rooms from 2022 to 2024 equals 6,836.
Source: Las Vegas Convention and Visitor Authority; CBER

Table B2. Expected Casino or Non-casino Room Construction from 2022 to 2024

Complete Year	*Casino*	*Non-casino*
2022	0	321
2023	3,991	263
2024	527	1,734
Total	**4,518**	**2,318**
Share of rooms	**0.661**	**0.339**

Source: Las Vegas Convention and Visitor Authority; CBER

Figure B1. Expected Hotel/Motel Room Construction Map



Source: Las Vegas Convention and Visitor Authority; CBER; Google Map

Appendix C: Evaluation of CBER Population Forecasts

I. Introduction

An important aspect of forecasting is the evaluation of the forecast against the actual value of the variable. Population growth is a demographic system with considerable inertia, making it possible to make reasonable forecasts over long time horizons. The Center for Business and Economic Research (CBER) prepares a population forecast each year. This evaluation provides us with an idea of accuracy of the forecasts as well as of the validity of the model (REMI). In our case, the actual value is the population of Southern Nevada (Clark County). The time-period over which the forecast is evaluated is 2002-2020. All demographic counts are estimates. They are obtained by surveys, which are subject to a margin of error.

We use three series that represent the actual annual CC population:

1) The SNRPC (Southern Nevada Regional Planning Commission) series, which is adopted by SNWA (Southern Nevada Water Authority);

2) The Nevada State Demographer (Nevada Department of Taxation) series;

3) The US Census series as reported by FRED (Federal Reserve Economic Data, St Louis Fed) in the series NVCLAR3POP). These estimates, updated on March 24, 2022, are computed during the intercensal period. The U.S. Census Bureau releases regular intercensal estimates of the total population of the country, states, and metropolitan areas (MSA) annually.

Given the estimated nature of these series, we combined them into a fourth series by averaging year by year the previous three series. We call this series AVERAGE.

This report is composed of two parts. The first part presents descriptive statistics, correlation analysis as well as tests of equality of means and variances across the three benchmark series. The descriptive statistics show that the series closely match each other in their statistical characteristics and that they are highly correlated with each other. Moreover, we cannot reject the null hypotheses of the same mean and variance across the three series.

The second part reports the forecast evaluation findings, both in terms of population levels and in terms of population growth. The main results are a bit of a puzzle. First, when forecasting the level of population, the short-term forecast dominates the long-term forecast. In particular, the one-year-ahead forecast has a higher predictive ability than the medium- and long-term forecasts, that is, the 5- and 10-year-ahead forecasts.

One explanation lies in the strong autoregressive nature of the population series. The current level of the CC population strongly correlates to the past year's level. The first-order autoregression analysis

suggests that the U.S. Census data have a positive and highly significant autoregression coefficient equal to 0.94. Similarly, the State Demographer data present an autocorrelation coefficient of 0.93, while the SNRPC autoregression coefficient is 0.93. In all cases, the coefficient of determination (i.e., the R-square) exceeds 0.98, suggesting a good fit between CBER's forecast and the three estimates of population.

Second, when forecasting the population growth, the long-term forecasts dominate short-term forecasts. In particular, we find that the 3-year ahead growth forecast has a lower predictive ability than the 10-year ahead growth forecast, which is somewhat of a puzzle.

Why this puzzle? We can think of two possible explanations: 1) the population growth rates are more volatile and random in the short and medium run than in the long run; 2) the population levels display a stronger autoregressive behavior than growth rates.

A word of caution is warranted. The annual CC population estimates that we worked with have not been the subject of independent assessments, and consequently they carry inherent uncertainty. Assessing the accuracy and the quality of population estimates is an issue that has occupied statisticians and demographers since the 1940s, when analysts reported that the "decennial" census missed 453,000 men registered for the draft that year. The 1940 census missed 3 percent of men aged 21 to 35, but 13 percent of Black men in the same age group. This disparity was the first statistical evidence of what demographers call the "differential undercount," i.e. a disproportionate undercounting of some population subgroups, most notably minorities, children, and renters compared to non-Hispanic Whites, older Americans, and homeowners.

Analyses of census accuracy are obtained for the "decennial" census using two independent approaches. First, the "Demographic Analysis" (DA) compares the census figures with independent estimates of the population such as birth and death certificates, immigration records, and Medicare data. This assessment is not independent but is conducted by the U.S. Census Office. Second, and in contrast, the "Post-enumeration Survey" (PES) is an independent evaluation of the Census results and attempts to capture the difference between the census count and the true population size. To estimate the true population size, the 2020 PES used a technique called "dual-system estimation," with the two systems being the independent survey and the census.

DA and PES analyses of the 2000 and 2010 Census indicate that Non-Hispanic Whites were overcounted while Non-Hispanic Blacks were undercounted. The DA and PES reports for the 2020 Census are not much dissimilar. The 2020 Census undercounted the Black population, the American Indian or Alaska Native population living on a reservation, the Hispanic population, and people that reported being of "Some Other Race." On the other hand, the 2020 Census overcounted the Non-Hispanic White and the

Asian population. The Native Hawaiian and Other Pacific Islander population was neither overcounted nor undercounted. The COVID-19 pandemic was a major challenge to the 2020 Census, as face-to face-contacts were kept to a minimum, including the door- to-door efforts to reach millions of households that had not responded, and millions of Americans that had relocated, such as college students whose campuses closed down. Potentially, these events may also have affected the count of the CC population.

The three estimates of CC population, SNRPC (Southern Nevada Regional Planning Commission); the NV State Demographer (Nevada Department of Taxation), and the US Census series are independently computed and represent implicitly three independent assessments. Thus, each measure can be viewed as forms of post-enumeration survey (PES) of the accuracy of the remaining two demographic systems.

The rest of this note includes four sections. Section II illustrates the univariate and bivariate properties of the series. Section III outlines the statistical methodology of forecast evaluation. Section IV displays the empirical results. Section V concludes.

II. Descriptive statistical analysis.

Table C1 reports the main descriptive statistics of the three series of CC population measures.

Table C1. Univariate Descriptive Statistics (First and Second Moments)

U.S. Census	Units
Mean	1,947,826
Standard Error	52728
Median	1962162
Mode	#N/A
Standard Deviation	229834
Sample Variance	52823713482
Kurtosis	-0.7492
Skewness	-0.3299
Range	760346
Minimum	1515538
Maximum	2275884
Sum	37008689
Count	19
State Demographer	**Units**
Mean	1,989,472
Standard Error	49172
Median	1968831
Mode	#N/A
Standard Deviation	214337
Sample Variance	4540639089
Kurtosis	-0.2149
Skewness	-0.4144
Range	770450
Minimum	1549657
Maximum	2320107

Sum	37799980
Count	19

SNRPC	Units
Mean	2,023,618
Standard Error	50524
Median	2008654
Mode	#N/A
Standard Deviation	220230
Sample Variance	48501544059
Kurtosis	-0.2428
Skewness	-0.3875
Range	798351
Minimum	1578332
Maximum	2376683
Sum	38448742
Count	19

Table C2 reports the Pearson correlation coefficient. This measure indicates the linear relationship as a number between minus one (perfectly negative correlated) to zero (not correlated) to plus one (perfectly positive correlated). Two things to be cautious when using Pearson correlation include: 1) outliers skew the results and 2) it assumes that the data are homoscedastic such that the variance of the data is homogeneous (constant) across the data.

Table C2. Bivariate Descriptive Statistics (Correlation Coefficients Matrix)

	U.S. Census	State Demographer	SNRPC
US Census	1		
State Demographer	0.9898	1	
SNRPC	0.9859	0.9996	1

Tables C3, C4, and C5 test the equality of the population means between each pair of the three benchmark population estimates—(i) the U.S. Census's and the State Demographer's population estimates, (ii) the U.S. Census's and the Southern Nevada Regional Planning Coalition's population estimates, and (iii) the State Demographer's and the Southern Nevada Regional Planning Coalition's population estimates.

Table C3. Tests of Equality of Population Means (t-tests)

	U.S. Census	State Demo.
Mean	1,947,825.74	1,989,472
Variance	52,823,713,482	45,940,639,089
Observations	19	19

Pooled Variance	49,382,176,286
Hypothesized Mean Difference	0
DF	36
t Stat	-0.578
P(T<=t) one-tail	0.284
t Critical one-tail	1.688
P(T<=t) two-tail	0.567
t Critical two-tail	2.028

Conclusion: Accept the null hypothesis of equality of population means.

Table C4. Tests of Equality of Population Means (t-tests)

	U.S. Census	SNRPC
Mean	1,947,826	2,023,618
Variance	52,823,713,482	48,501,544,059
Observations	19	19
Pooled Variance	50,662,628,770	
Hypothesized Mean Difference	0	
DF	36	
t Stat	-1.038	
P(T<=t) one-tail	0.153	
t Critical one-tail	1.688	
P(T<=t) two-tail	0.306	
t Critical two-tail	2.028	

Conclusion: Accept the null hypothesis of equality of population means.

Table C5. Tests of Equality of Population Means (t-tests)

	State Demo.	SNRPC
Mean	1,989,473	2,023,618
Variance	45,940,639,089	48,501,544,059
Observations	19	19
Pooled Variance	47,221,091,574	
Hypothesized Mean Difference	0	
DF	36	
t Stat	-0.484	
P(T<=t) one-tail	0.316	
t Critical one-tail	1.688	
P(T<=t) two-tail	0.631	
t Critical two-tail	2.028	

Conclusion: Accept the null hypothesis of equality of population means.

The test is conducted using the pooled variance approach, given the fact that Tables C6, C7 and C8 support the hypothesis of equality of population variances between each pair of series.

Table C6. Tests of Equality of Population Variances (F tests)

	U.S. Census	State Demo.
Mean	1,947,826	1,989,473
Variance	52,823,713,482	45,940,639,089
Observations	19	19
DF (NDF, DDF)	18	18
F	1.150	
P(F<=f) one-tail	0.385	
P two-tail	0.770	
F Critical one-tail	2.217	

Conclusion: Accept the null hypothesis of equality of population variances.

Table C7. Tests of Equality of Population Variances (F tests)

	U.S. Census	SNRPC
Mean	1,947,826	2,023,618
Variance	52,823,713,482	48,501,544,059
Observations	19	19
DF (NDF, DDF)	18	18
F	1.089	
P(F<=f) one-tail	0.429	
P two-tail	0.858	
F Critical one-tail	2.217	

Conclusion: Accept the null hypothesis of equality of population variances.

Table C8. Tests of Equality of Population Variances (F tests)

	SNRPC	State Demo.
Mean	2,023,618	1,989,473
Variance	48,501,544,059	45,940,639,089
Observations	19	19
DF (NDF, DDF)	18	18
F	1.056	
P(F<=f) one-tail	0.455	
P two-tail	0.910	
F Critical one-tail	2.217	

Conclusion: Accept the null hypothesis of equality of population variances.

In summary, the main result of this statistical exercise evidences a common outcome: The three series have in common the first (mean) and second (variance) moments, which is indicative of homogeneity of the data and provide information of pairwise global synchrony between the series.

III. Methodology

We evaluated the CBER forecasts at 10 different horizons, from the one-year ahead forecast (one-step ahead forecast) to the ten-year ahead forecast (ten-step ahead forecast) using the root mean squared error and the mean absolute error metrics.

Let A(t) be the actual value of the population of Clark County at year t and let F(t) be the corresponding population forecast made at year t-1 for year t. Then the preliminary step for the forecast evaluation of the one-year ahead forecast is based on aligning two data series: the one year ahead forecast with the actual population one year later until the data are exhausted, as follows:

Table C9: One-Year-Ahead Forecast Evaluation

Year of the Forecast	One-Year-Ahead Forecast F(t+1)	Actual Value A(t+1)
2001	F(2002)	A(2002)
2002	F(2003)	A(2003)
…	…	…
…	…	…
2019	F(2020)	A(2020)
2020	F(2021)	A(2021)

While there is only one F(t+1), there are four A(t+1), resulting in four sets of data. From each data set, we then compute the forecasting error as A(t+1) – F(t+1). Then, for each data set, the RMSE and the MAE metrics are computed as follows:

$$RMSE = \sqrt{\frac{\sum_{j=1}^{N}\left(A_j\left(t+1\right)-F_j\left(t+1\right)\right)^2}{N}}$$ and

$$MAE = \frac{\sum_{j}^{N}\left|A_j\left(t+1\right)-F_j\left(t+1\right)\right|}{N},$$

where *N* is the size of the bivariate data set. The RMSE is the quadratic score that measures the average magnitude of the error. It is the square root of the average of squared differences between forecast and actual observation. The MAE, on the other hand, measures the average magnitude of the error without considering the direction (plus or minus). It is the average of the absolute differences between forecast and actual observation, where all differences have equal weight. Both metrics can range from zero to infinity and are indifferent to the direction of errors. They are negative-oriented scores, which means lower values are better. Note that in the RMSE, the errors are squared before they are averaged. The metric, thus, gives a relatively high weight to large errors. This means that the RMSE should be used when large errors are particularly undesirable.

Similarly, the five-year-ahead forecast evaluation is obtained by aligning two data series: the five-year-ahead forecast with the actual forecast five years later until the data are exhausted, as follows:

Table C10: Five-Year-Ahead Forecast Evaluation

Year of the Forecast	Five-Year-Ahead Forecast F(t+5)	Actual Value A(t+5)
2001	F(2006)	A(2006)
2002	F(2007)	A(2007)
…	…	…
…	…	…
2015	F(2020)	A(2020)
2016	F(2021)	A(2021)

Again, while there is only one F(t+5), there are four A(t+5), resulting in 4 sets of data. The RMSE and MAE are then computed as follows:

$$RMSE = \sqrt{\frac{\sum_{j=1}^{N}\left(A_j\left(t+5\right)-F_j\left(t+5\right)\right)^2}{N}}$$ and

$$MAE = \frac{\sum_{j}^{N}\left|A_j\left(t+5\right)-F_j\left(t+5\right)\right|}{N},$$

where *N* is the size of the new dataset.

Finally, the 10-year-ahead forecast evaluation is obtained by aligning two data series: the ten-year-ahead forecast with the actual forecast ten years later until the data are exhausted, as follows:

Table C11: Ten-Year-Ahead Forecast Evaluation

Year of the Forecast	One-Year-Ahead Forecast F(t+10)	Actual Value A(t+10)
2001	F(2011)	A(2011)
2002	F(2012)	A(2012)
…	…	…
…	…	…
2010	F(2020)	A(2020)
2011	F(2021)	A(2021)

The RMSE and MAE are then computed as follows:

$$RMSE = \sqrt{\frac{\sum_{j=1}^{N}\left(A_j\left(t+10\right)-F_j\left(t+10\right)\right)^2}{N}} \text{ and}$$

$$MAE = \frac{\sum_{j}^{N}\left|A_j\left(t+10\right)-F_j\left(t+10\right)\right|}{N}.$$

We note that the forecasting sample reduces as the value of k (k-year ahead forecast) increases.

IV. Empirical results

We evaluate both the population level forecast and the resulting population growth forecast. The lowest and highest values of the statistics are highlighted in yellow and green color, respectively.

Table C12. Summary of Forecast Evaluation of Clark County Population (LEVEL)

		SNRPC	U.S. Census	State Demo.	Average
1 Year Ahead	RMSE	59,012	112,614	77,263	78,093
	MAE	41,457	91,100	57,042	57,273
2 Year Ahead	RMSE	96,059	136,645	112,130	110,349
	MAE	69,644	103,806	80,911	78,233
3 Year Ahead	RMSE	142,021	165,925	152,695	149,433
	MAE	105,919	119,794	111,543	105,053
4 Year Ahead	RMSE	182,993	199,177	193,476	188,542
	MAE	137,976	143,081	138,654	133,905
5 Year Ahead	RMSE	220,502	233,693	231,861	225,998
	MAE	170,567	168,547	175,868	167,864
6 Year	RMSE	256,210	269,403	266,786	262,082

Ahead	MAE	200,269	196,924	206,080	198,985
7 Year Ahead	RMSE	283,256	303,508	296,757	293,189
	MAE	226,439	225,651	231,437	227,596
8 Year Ahead	RMSE	303,379	337,510	325,318	321,249
	MAE	233,685	258,565	249,100	246,027
9 Year Ahead	RMSE	328,650	370,086	355,695	351,012
	MAE	254,074	288,103	274,232	272,136
10 Year Ahead	RMSE	357,109	401,172	385,409	380,941
	MAE	281,170	318,977	303,772	301,306

Examining Table C12, we note that Irrespective of the measure of actual population, both the RMSE and the MAE show a monotonic increase from the 1-year-ahead forecast to the 10-year-ahead forecast. In the 1-year-ahead forecasts, the CBER forecast has the lowest RMSE and MAE in the case of SNRPC, and the highest RMSE and MAE occur with the US Census, followed by State Demographer and Average. The RMSE and MAE are the highest in the 10-year-ahead forecast. Among the 10-year-ahead forecasts, the CBER forecast has the lowest RMSE and MAE in case of SNRPC, and the highest RMSE and MAE in the case of US Census data. This pattern, where the CBER forecast is best when evaluated against SNPS and worst when evaluated against the U.S. Census, is uniformly present in all steps ahead forecasts.

The short-term forecasts, in particular the 1-year-ahead forecast, are superior to the medium term and long-term forecasts, in particular the 10-year ahead forecasts. One explanation lies in the autoregressive nature of the population series. That is the current level of the CC population is strongly related to the previous year's level of the CC population. The first-order autoregression analysis suggests that the U.S. Census data have a positive and highly significant autoregression coefficient (estimate: 0.94; t-statistic = 53.89). Similarly, the State Demographer data present an autocorrelation coefficient of 0.93 (t-stat = 33.90), while the SNRPC autoregression coefficient is 0.93 (t-stat= 25.30) and the autoregression coefficient for the AVERAGE is 0.93 (t-stat=33.31). In all cases, the coefficient of determination (R-square) of the autoregressions exceeds 0.98.

In contrast, the GROWTH results (Table C13) exhibit different patterns, alternating, with a maximum of the RMSE and MAE at the 3 year ahead forecast and a minimum at 8 year ahead forecast (SNRCP) and 10-year-ahead forecast (U.S. Census, State Demographer, and AVERAGE), which suggests that the long-term forecast is more on target that the short-term results. The sinusoidal pattern of RMSE and MAE is worth noting. In the case of SNRCP, the metrics increase from 1-year horizon to 3-year horizon, then decrease from the 3-year horizon to the 8-year horizon, and finally increase again from the 8-year horizon to the 10-year horizon.

Table C13. Summary of Forecast Evaluation of Clark County Population (GROWTH)

		SNRPC	U.S. Census	State Demo.	Average
1 Year Ahead	RMSE	0.0201	0.0117	0.0180	0.0156
	MAE	0.0126	0.0083	0.0128	0.0106
2 Years Ahead	RMSE	0.0237	0.0136	0.0202	0.0184
	MAE	0.0155	0.0106	0.0145	0.0128
3 Years Ahead	RMSE	0.0306	0.0152	0.0223	0.0206
	MAE	0.0267	0.0119	0.0172	0.0154
4 Years Ahead	RMSE	0.0244	0.0152	0.0215	0.0196
	MAE	0.0161	0.0125	0.0162	0.0148
5 Years Ahead	RMSE	0.0239	0.0146	0.0200	0.0186
	MAE	0.0166	0.0122	0.0164	0.0148
6 Years Ahead	RMSE	0.0226	0.0130	0.0171	0.0165
	MAE	0.0147	0.0096	0.0132	0.0118
7 Years Ahead	RMSE	0.0198	0.0119	0.0144	0.0139
	MAE	0.0117	0.0090	0.0111	0.0092
8 Years Ahead	RMSE	0.0157	0.0112	0.0127	0.0113
	MAE	0.0081	0.0096	0.0104	0.0086
9 Years Ahead	RMSE	0.0160	0.0089	0.0087	0.0095
	MAE	0.0089	0.0073	0.0070	0.0062
10 Years Ahead	RMSE	0.0176	0.0082	0.0078	0.0100
	MAE	0.0094	0.0058	0.0060	0.0059

Similarly, the US Census, the State demographer and the Average forecasts exhibit metrics that increase from the 1-year horizon to the 3-year horizon, and then monotonically decrease from the 3-year horizon to the 10-year horizon. One possible explanation is that population GROWTH is more volatile and random in the short and medium run than in the long run. We also notice that estimated autoregressive coefficients are significantly lower. The first-order autoregression analysis suggests that the U.S. Census growth data have an autoregression coefficient estimate of 0.67 (t-statistic = 53.89). Similarly, the State Demographer data present an autocorrelation coefficient of 0.71 (t-stat = 4.25), while the SNRPC autoregression coefficient is 0.36 (t-stat= 1.57), which falls in the region of non-significance. The coefficient of determination (R-square) is also significantly lower, varying from 0.38 (US Census), 0.54 (State Demo) to 0.14 (SNRPC). Using growth averages, the autoregression coefficient is 0.61 (t-stat = 3.11) and the R-square is 0.39.

V. Conclusions

The analysis of the population forecast analysis conducted at CBER lead to several conclusions. The CBER population forecasts are evaluated against three series (SNRPC, U.S. Census, State Demographer) that represent alternative estimates of the actual annual Clark County population and their linear combination (Average). The time-period over which the forecasts are evaluated is 2002-2020. The evaluation process employs the RMSE and MAE metrics. The main results are as follows: 1) short-term forecasts dominate long-run forecasts in the LEVEL case; 2) long-term forecasts dominate short-term forecasts in the GROWTH case. This remains a puzzle that we should further investigate in the future.

Appendix D: Detailed Report Tables

Table D1. Out-of-the-Box Clark County Population and Population Growth Forecasts from REMI Models LHY2019 and LHY2018

Year	LHY2019 Population (Thousands)	LHY2018 Population (Thousands)	LHY2019 Population Growth	LHY2018 Population Growth
2022	2,313	2,406	0.7%	1.8%
2023	2,344	2,447	1.3%	1.7%
2024	2,388	2,486	1.9%	1.6%
2025	2,431	2,523	1.8%	1.5%
2026	2,472	2,559	1.7%	1.4%
2027	2,512	2,594	1.6%	1.4%
2028	2,549	2,626	1.5%	1.2%
2029	2,583	2,656	1.3%	1.1%
2030	2,614	2,686	1.2%	1.1%
2031	2,644	2,714	1.1%	1.0%
2032	2,671	2,740	1.0%	1.0%
2033	2,698	2,766	1.0%	0.9%
2034	2,724	2,790	1.0%	0.9%
2035	2,748	2,813	0.9%	0.8%
2040	2,859	2,911	0.6%	0.6%
2045	2,948	2,983	0.4%	0.4%
2050	3,017	3,038	0.3%	0.3%
2055	3,020	3,020	0.2%	0.2%
2060	3,103	3,112	0.2%	0.2%

Note: Out-of-the-box refers to the model prior to recalibration. These numbers are not the final forecast.

Table D2. Detailed Final Clark County Population Forecast: 2010 – 2060

Year	Population Forecast	Change in Population Forecast	Growth in Population (Percent)
2010	1,951,269*	-55,078	-2.7%
2011	1,966,630**	15,361	0.8%
2012	2,008,654**	42,024	2.1%
2013	2,062,253**	53,599	2.7%
2014	2,102,238**	39,985	2.0%
2015	2,147,641**	45,403	2.2%
2016	2,205,207**	57,566	2.7%
2017	2,248,390**	43,183	2.0%
2018	2,284,616**	36,226	1.6%
2019	2,325,798**	41,182	1.8%
2020	2,376,683**	50,885	2.2%
2021	2,333,092**	-43,591	-1.8%
2022	2,375,000	41,908	1.8%
2023	2,427,000	52,000	2.2%
2024	2,485,000	58,000	2.4%
2025	2,540,000	55,000	2.2%
2026	2,593,000	53,000	2.1%
2027	2,644,000	51,000	2.0%
2028	2,691,000	47,000	1.8%
2029	2,733,000	42,000	1.6%
2030	2,773,000	40,000	1.5%
2031	2,810,000	37,000	1.3%
2032	2,845,000	35,000	1.2%
2033	2,879,000	34,000	1.2%
2034	2,910,000	31,000	1.1%
2035	2,940,000	30,000	1.0%
2036	2,969,000	29,000	1.0%
2037	2,996,000	27,000	0.9%
2038	3,023,000	27,000	0.9%
2039	3,048,000	25,000	0.8%
2040	3,073,000	25,000	0.8%
2041	3,096,000	23,000	0.7%
2042	3,119,000	23,000	0.7%
2043	3,140,000	21,000	0.7%
2044	3,161,000	21,000	0.7%
2045	3,181,000	20,000	0.6%
2046	3,199,000	18,000	0.6%
2047	3,217,000	18,000	0.6%
2048	3,234,000	17,000	0.5%
2049	3,250,000	16,000	0.5%
2050	3,266,000	16,000	0.5%
2051	3,281,000	15,000	0.5%
2052	3,295,000	14,000	0.4%
2053	3,309,000	14,000	0.4%
2054	3,322,000	13,000	0.4%
2055	3,334,000	12,000	0.4%
2056	3,346,000	12,000	0.4%
2057	3,357,000	11,000	0.3%
2058	3,368,000	11,000	0.3%
2059	3,378,000	10,000	0.3%
2060	3,387,000	9,000	0.3%

* 2010 U.S. Census.

** SNRPC consensus population estimate.

Note: The average annual forecasted growth rate is 0.9 percent.

Table D3. Economic Forecast

Variable	Unit	2022	2023	2024	2025	2026	2027	2028	2029
Total Employment	Thousands (Jobs)	1369.93	1433.71	1488.52	1523.64	1550.41	1569.56	1581.71	1587.20
Private Non-Farm Employment	Thousands (Jobs)	1251.52	1313.33	1365.89	1399.21	1423.85	1441.13	1451.98	1456.38
Residence-Adjusted Employment	Thousands	1341.14	1404.20	1458.15	1492.88	1519.55	1538.72	1551.00	1556.74
Population	Thousands	2470.26	2427.47	2484.93	2539.84	2593.06	2643.80	2690.77	2733.04
Labor Force	Thousands	1145.86	1177.49	1212.63	1243.72	1272.96	1298.93	1321.17	1339.06
Gross Domestic Product	Billions of Fixed (2022) $	142.46	150.68	158.26	163.93	168.80	172.96	176.73	179.87
Output	Billions of Fixed (2022) $	235.33	248.90	261.32	270.51	278.27	284.73	290.42	294.92
Value Added	Billions of Fixed (2022) $	142.46	150.68	158.26	163.93	168.80	172.96	176.73	179.87
Personal Income	Billions of Fixed (2022) $	127.90	133.90	139.09	144.66	150.01	155.15	161.11	164.73
Disposable Personal Income	Billions of Fixed (2022) $	115.29	120.28	125.06	130.17	134.01	137.92	143.57	146.84
PCE-Price Index	2012=100 (Nation)	116.78	119.77	122.59	125.47	128.31	131.19	134.05	136.88

Variable	Unit	2030	3035	2040	2045	2050	2055	2060
Total Employment	Thousands (Jobs)	1594.21	1636.66	1680.46	1719.45	1760.69	1791.49	1809.96
Private Non-Farm Employment	Thousands (Jobs)	1462.33	1500.06	1540.37	1576.83	1615.90	1646.12	1665.54
Residence-Adjusted Employment	Thousands	1564.00	1607.05	1650.81	1689.57	1730.43	1761.06	1779.55
Population	Thousands	2772.75	2940.12	3072.71	3180.66	3265.99	3334.08	3387.27
Labor Force	Thousands	1352.39	1406.68	1450.30	1487.72	1519.30	1541.34	1554.86
Gross Domestic Product	Billions of Fixed (2022) $	183.26	201.15	219.27	237.55	256.61	276.43	296.70
Output	Billions of Fixed (2022) $	299.55	325.24	355.03	387.29	422.04	459.46	499.43
Value Added	Billions of Fixed (2022) $	183.26	201.15	219.27	237.55	256.61	276.43	296.70
Personal Income	Billions of Fixed (2022) $	170.75	194.92	219.24	244.85	272.25	301.21	331.19
Disposable Personal Income	Billions of Fixed (2022) $	152.47	174.36	196.20	219.23	243.89	269.98	297.04
PCE-Price Index	2012=100 (Nation)	139.66	154.27	170.44	188.37	208.17	230.03	254.14

Table D4. Employment (in thousands)

Variable	2022	2023	2024	2025	2026	2027	2028	2029
Private Non-Farm	1251.52	1313.33	1365.89	1399.21	1423.85	1441.13	1451.98	1456.38
Forestry, Fishing, Other	0.22	0.27	0.32	0.31	0.31	0.32	0.32	0.31
Mining	1.50	1.63	1.71	1.76	1.81	1.85	1.87	1.88
Utilities	2.97	3.02	3.06	3.08	3.09	3.08	3.07	3.06
Construction	89.86	100.61	107.34	113.55	117.97	121.69	123.27	123.37
Manufacturing	27.82	28.42	28.59	28.65	28.60	28.57	28.51	28.54
Wholesale Trade	28.95	29.44	29.88	30.22	30.47	30.62	30.70	30.73
Retail Trade	129.02	129.49	131.02	132.32	133.08	133.42	133.56	133.40
Transportation and Warehousing	96.26	101.13	106.09	109.78	112.60	114.56	115.90	116.66
Information	14.33	14.67	14.86	14.96	14.99	14.98	14.95	14.90
Finance and Insurance	74.91	76.51	78.15	79.51	80.57	81.30	81.88	82.30
Real Estate and Rental and Leasing	75.97	78.37	80.62	82.48	83.92	84.93	85.63	85.98
Professional and Technical Services	80.75	84.28	86.72	88.75	90.19	91.39	92.23	92.86
Management of Companies and Enterprises	26.42	26.94	27.28	27.54	27.66	27.73	27.77	27.82
Admin and Waste Services	105.86	110.26	114.15	117.01	119.29	121.04	122.41	123.44
Educational Services	15.34	16.03	16.64	17.09	17.44	17.70	17.92	18.08
Health Care and Social Assistance	122.37	125.81	130.12	134.19	137.65	140.29	142.64	144.49
Arts, Entertainment, and Recreation	39.29	43.77	46.20	47.20	47.76	48.06	48.22	48.22
Accommodation and Food Services	248.86	266.75	283.88	289.29	293.45	295.48	296.29	295.74
Other Services (except public administration)	70.83	75.95	79.26	81.52	83.01	84.13	84.83	84.63
Government	118.02	119.99	122.23	124.03	126.17	128.03	129.34	130.43
State and local	88.52	90.67	93.78	96.52	98.80	100.69	102.16	103.28
Federal civilian	13.73	13.83	13.04	12.11	11.97	11.92	11.77	11.73
Federal military	15.77	15.49	15.41	15.40	15.40	15.42	15.41	15.41
Farm	0.39	0.39	0.39	0.40	0.39	0.39	0.39	0.40

Table D4. Employment (in thousands) (continued)

Variable	2030	3035	2040	2045	2050	2055	2060
Private Non-Farm	1462.33	1500.06	1540.37	1576.83	1615.90	1646.12	1665.54
Forestry, Fishing, Other	0.31	0.31	0.31	0.30	0.29	0.28	0.27
Mining	1.89	1.92	1.94	1.96	1.98	2.00	2.00
Utilities	3.05	3.00	2.94	2.86	2.78	2.69	2.57
Construction	123.24	121.91	121.39	121.35	121.33	120.86	119.55
Manufacturing	28.58	29.28	30.67	32.28	34.14	36.03	37.90
Wholesale Trade	30.73	31.01	31.58	32.15	32.75	33.10	33.15
Retail Trade	133.56	136.08	141.68	147.37	152.89	157.04	159.36
Transportation and Warehousing	117.51	122.79	128.49	134.06	140.02	145.30	149.74
Information	14.88	15.09	15.68	16.41	17.30	18.20	19.07
Finance and Insurance	82.97	86.52	89.55	91.77	93.88	95.19	95.49
Real Estate and Rental and Leasing	86.40	88.55	90.29	91.51	92.62	93.03	92.57
Professional and Technical Services	93.54	97.29	101.31	105.30	109.71	113.79	117.46
Management of Companies and Enterprises	27.85	28.36	29.05	29.76	30.61	31.40	32.09
Admin and Waste Services	124.58	131.13	138.09	145.04	152.53	159.45	165.60
Educational Services	18.23	19.02	19.58	19.93	20.30	20.53	20.50
Health Care and Social Assistance	146.68	158.08	168.81	178.66	189.24	198.77	207.47
Arts, Entertainment, and Recreation	48.25	48.69	49.01	49.11	49.23	49.07	48.58
Accommodation and Food Services	295.36	295.76	294.65	292.20	290.15	286.59	281.47
Other Services (except public administration)	84.70	85.27	85.37	84.82	84.15	82.80	80.70
Government	131.49	136.20	139.68	142.21	144.38	144.95	144.00
State and local	104.36	108.94	112.05	114.12	115.70	115.78	114.41
Federal civilian	11.71	11.73	12.01	12.38	12.81	13.21	13.57
Federal military	15.42	15.53	15.62	15.71	15.87	15.97	16.02
Farm	0.40	0.41	0.41	0.42	0.42	0.43	0.43

Table D5. Gross Domestic Product (billions of fixed 2022$)*

Variable	2022	2023	2024	2025	2026	2027	2028	2029
Personal Consumption Expenditures	111.08	115.41	120.45	124.97	129.29	132.93	136.48	139.51
Motor vehicles and parts	3.58	3.61	3.75	3.87	3.99	4.11	4.24	4.37
Furnishings and durable household equipment	3.33	3.44	3.58	3.72	3.87	4.02	4.19	4.36
Recreational goods and other durable goods	6.69	6.89	7.19	7.49	7.82	8.16	8.55	8.96
Food and beverages	8.20	8.36	8.61	8.88	9.13	9.36	9.61	9.85
Clothing and footwear	3.13	3.22	3.34	3.45	3.54	3.62	3.70	3.76
Motor vehicle fuels, lubricants, and fluids	1.97	2.02	2.08	2.10	2.15	2.15	2.16	2.16
Fuel oil and other fuels	0.11	0.11	0.12	0.13	0.13	0.14	0.14	0.14
Other nondurable goods	9.54	9.78	10.20	10.62	11.02	11.41	11.82	12.23
Housing	16.85	17.39	17.93	18.47	18.93	19.30	19.68	19.99
Household utilities	2.77	2.80	2.84	2.88	2.92	2.95	2.99	3.02
Transportation services	2.47	2.75	3.06	3.30	3.49	3.63	3.73	3.78
Health care	15.24	16.01	16.93	17.82	18.62	19.33	20.02	20.61
Recreation and other services	37.20	39.02	40.83	42.25	43.69	44.75	45.66	46.28
Gross Private Domestic Fixed Investment	28.66	31.60	34.18	36.46	38.18	39.77	40.97	41.87
Residential	5.69	6.36	7.03	7.55	7.99	8.29	8.33	8.19
Nonresidential structures	3.18	3.92	4.61	5.14	5.51	5.82	6.07	6.24
Nonresidential equipment	10.99	11.85	12.65	13.42	14.00	14.59	15.14	15.66
Nonresidential intellectual property products	8.81	9.47	9.89	10.35	10.69	11.07	11.43	11.78
Change in Private Inventories	0.26	0.20	0.14	0.07	0.06	0.04	0.04	0.03
Government Consumption Expenditures	24.60	24.97	25.56	26.12	26.63	27.10	27.51	27.86
Federal military	7.97	7.86	7.85	7.88	7.91	7.95	7.99	8.03
Federal civilian	3.00	3.11	3.12	3.13	3.14	3.16	3.17	3.19
State and local government	13.63	14.00	14.59	15.11	15.58	15.99	16.35	16.64
Total Exports	71.40	76.04	80.09	82.28	84.04	85.39	86.65	87.73
Total Imports	93.81	98.10	102.52	106.32	109.69	112.55	115.18	117.38

*Note: The sum of the components may not add up to the total GDP due to rounding.

Table D5. Gross Domestic Product (billions of fixed 2022$) (continued)*

Variable	2030	2035	2040	2045	2050	2055	2060
Personal Consumption Expenditures	142.86	160.85	179.63	198.84	219.17	240.32	261.86
Motor vehicles and parts	4.52	5.33	6.21	7.17	8.21	9.34	10.52
Furnishings and durable household equipment	4.55	5.64	6.93	8.43	10.18	12.23	14.57
Recreational goods and other durable goods	9.42	12.10	15.24	18.92	23.24	28.00	33.31
Food and beverages	10.10	11.41	12.71	13.98	15.25	16.52	17.72
Clothing and footwear	3.82	4.11	4.36	4.58	4.76	4.94	5.06
Motor vehicle fuels, lubricants, and fluids	2.13	2.08	2.03	1.94	1.83	1.76	1.65
Fuel oil and other fuels	0.14	0.15	0.16	0.16	0.16	0.16	0.16
Other nondurable goods	12.68	15.17	18.01	21.16	24.70	28.61	32.88
Housing	20.32	21.93	23.38	24.68	25.83	26.88	27.73
Household utilities	3.07	3.29	3.49	3.66	3.80	3.92	4.00
Transportation services	3.84	4.16	4.44	4.68	4.92	5.13	5.31
Health care	21.27	24.71	28.37	32.10	35.99	39.89	43.86
Recreation and other services	47.03	50.77	54.30	57.40	60.30	62.94	65.10
Gross Private Domestic Fixed Investment	42.63	46.44	50.60	54.96	59.47	63.79	68.16
Residential	8.02	7.21	6.87	6.68	6.59	6.59	6.65
Nonresidential structures	6.36	6.92	7.52	8.13	8.75	9.39	9.98
Nonresidential equipment	16.14	18.52	20.77	23.03	25.31	27.29	29.28
Nonresidential intellectual property products	12.12	13.79	15.45	17.12	18.82	20.52	22.25
Change in Private Inventories	0.04	0.04	0.05	0.05	0.05	0.05	0.04
Government Consumption Expenditures	28.17	29.52	30.66	31.73	32.72	33.54	34.25
Federal military	8.06	8.24	8.39	8.57	8.77	8.95	9.16
Federal civilian	3.20	3.26	3.32	3.39	3.46	3.54	3.63
State and local government	16.91	18.02	18.95	19.78	20.49	21.05	21.46
Total Exports	88.80	95.46	103.27	111.89	121.37	131.88	143.58
Total Imports	119.49	131.43	145.18	160.19	176.43	193.40	211.46

*Note: The sum of the components may not add up to the total GDP due to rounding.

Table D6. Income (billions of fixed 2022$)

Variable	2022	2023	2024	2025	2026	2027	2028	2029
Total earnings by place of work	85.24	90.51	95.39	98.98	102.24	104.95	107.31	109.18
Total wage and salary disbursements	63.08	67.18	70.96	73.74	76.24	78.24	79.95	81.27
Supplements to wages and salaries	14.14	14.96	15.74	16.38	17.00	17.60	18.14	18.64
Employer contributions for employee pension and insurance funds	9.37	9.90	10.41	10.84	11.25	11.64	12.00	12.33
Employer contributions for government social insurance	4.77	5.07	5.33	5.55	5.76	5.96	6.14	6.31
Proprietors' income with inventory valuation and capital consumption adjustments	8.02	8.36	8.69	8.86	9.00	9.11	9.22	9.27
Less: Contributions for government social insurance	9.94	10.58	11.11	11.46	11.84	12.14	12.40	12.62
Employee and self-employed contributions for government social insurance	5.17	5.51	5.78	5.91	6.09	6.18	6.26	6.30
Employer contributions for government social insurance	4.77	5.07	5.33	5.55	5.76	5.96	6.14	6.31
Plus: Adjustment for residence	-0.57	-0.66	-0.76	-0.81	-0.83	-0.85	-0.86	-0.85
Gross in	1.49	1.54	1.57	1.61	1.64	1.67	1.70	1.73
Gross out	2.07	2.20	2.32	2.41	2.47	2.52	2.56	2.58
Equals: Net earnings by place of residence	74.72	79.26	83.53	86.72	89.57	91.96	94.06	95.72
Plus: Rental, personal interest, and personal dividend income	28.83	30.15	30.76	31.69	33.12	34.76	36.67	38.62
Plus: Personal current transfer receipts	24.34	24.49	24.80	26.25	27.32	28.43	30.39	30.39
Equals: Personal income	127.90	133.90	139.09	144.66	150.01	155.15	161.11	164.73
Less: Personal current taxes	12.60	13.62	14.02	14.50	16.00	17.23	17.55	17.89
Equals: Disposable personal income	115.29	120.28	125.06	130.17	134.01	137.92	143.57	146.84

Table D6. Income (billions of fixed 2022$) (continued)

Variable	2030	2035	2040	2045	2050	2055	2060
Total earnings by place of work	111.22	120.54	129.86	139.65	150.25	161.67	173.84
Total wage and salary disbursements	82.68	89.03	95.38	102.18	109.72	118.07	127.25
Supplements to wages and salaries	19.19	21.60	23.89	26.14	28.37	30.56	32.64
Employer contributions for employee pension and insurance funds	12.69	14.28	15.77	17.21	18.60	19.94	21.16
Employer contributions for government social insurance	6.50	7.32	8.12	8.93	9.77	10.62	11.48
Proprietors' income with inventory valuation and capital consumption adjustments	9.36	9.91	10.59	11.34	12.16	13.04	13.95
Less: Contributions for government social insurance	12.85	13.94	15.01	16.15	17.40	18.77	20.27
Employee and self-employed contributions for government social insurance	6.36	6.62	6.89	7.22	7.63	8.15	8.79
Employer contributions for government social insurance	6.50	7.32	8.12	8.93	9.77	10.62	11.48
Plus: Adjustment for residence	-0.84	-0.82	-0.85	-0.91	-0.97	-1.02	-1.07
Gross in	1.77	1.92	2.06	2.21	2.38	2.56	2.78
Gross out	2.61	2.74	2.91	3.11	3.34	3.59	3.85
Equals: Net earnings by place of residence	97.53	105.78	114.00	122.60	131.88	141.88	152.50
Plus: Rental, personal interest, and personal dividend income	40.83	49.55	57.68	65.45	72.68	78.85	83.38
Plus: Personal current transfer receipts	32.39	39.59	47.55	56.80	67.69	80.48	95.31
Equals: Personal income	170.75	194.92	219.24	244.85	272.25	301.21	331.19
Less: Personal current taxes	18.28	20.56	23.03	25.62	28.36	31.23	34.16
Equals: Disposable personal income	152.47	174.36	196.20	219.23	243.89	269.98	297.04

Table D7. Population and Labor Force (in thousands)

Variable	2022	2023	2024	2025	2026	2027	2028	2029
Total population	2375.25	2427.47	2484.93	2539.84	2593.06	2643.80	2690.77	2733.04
By race and ethnicity								
White	971.41	986.63	1003.75	1019.50	1034.23	1047.64	1059.22	1068.65
Black	283.23	289.62	296.64	303.36	309.90	316.15	321.97	327.26
Other	353.21	361.27	370.03	378.37	386.39	394.01	401.02	407.30
Hispanic	767.40	789.94	814.51	838.62	862.54	886.01	908.56	929.83
By age								
Ages 0-14	439.73	444.86	452.62	459.97	466.39	473.39	479.11	484.18
Ages 15-24	285.31	298.34	311.13	322.86	331.73	336.41	340.08	342.10
Ages 25-64	1252.41	1270.23	1291.22	1310.01	1331.43	1354.24	1376.02	1395.18
Ages 65 & older	397.80	414.04	429.95	447.01	463.51	479.76	495.57	511.58
Labor force	1145.86	1177.49	1212.63	1243.72	1272.96	1298.93	1321.17	1339.06
Labor force participation rate	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
Participation rates by gender								
Male (16 & older)	0.68	0.68	0.68	0.68	0.68	0.67	0.67	0.67
Female (16 & older)	0.54	0.55	0.55	0.55	0.55	0.55	0.55	0.55

Variable	2030	2035	2040	2045	2050	2055	2060
Total population	2772.75	2940.12	3072.71	3180.66	3265.99	3334.08	3387.27
By race and ethnicity							
White	1076.81	1102.22	1111.16	1110.25	1102.94	1092.53	1080.39
Black	332.27	354.02	372.17	387.48	399.83	409.62	417.40
Other	413.16	437.70	457.47	474.25	487.82	498.69	506.80
Hispanic	950.50	1046.18	1131.91	1208.69	1275.39	1333.24	1382.68
By age							
Ages 0-14	488.06	506.09	515.92	519.77	518.13	512.81	506.63
Ages 15-24	344.30	346.48	353.05	361.95	365.99	367.10	364.41
Ages 25-64	1412.93	1491.39	1549.17	1594.25	1619.95	1629.16	1626.92
Ages 65 & older	527.45	596.15	654.57	704.69	761.93	825.01	889.31
Labor force	1352.39	1406.68	1450.30	1487.72	1519.30	1541.34	1554.86
Labor force participation rate	0.61	0.59	0.58	0.57	0.56	0.56	0.55
Participation rates by gender							
Male (16 & older)	0.67	0.65	0.65	0.64	0.63	0.62	0.62
Female (16 & older)	0.55	0.53	0.52	0.51	0.50	0.50	0.49

Table D8. Demographics (in thousands)

Variable	2022	2023	2024	2025	2026	2027	2028	2029
Starting population	2333.09	2375.25	2427.47	2484.93	2539.84	2593.06	2643.80	2690.77
Births	27.57	27.99	28.58	29.20	29.78	30.32	30.80	31.18
Deaths	19.85	20.39	20.98	21.60	22.25	22.92	23.61	24.32
Natural growth	7.72	7.60	7.60	7.60	7.54	7.41	7.19	6.86
Population before migrants	2340.81	2382.85	2435.07	2492.52	2547.38	2600.46	2650.99	2697.63
Total migrants	34.44	44.62	49.86	47.32	45.68	43.34	39.78	35.41
Economic migrants	29.16	39.01	43.84	41.06	39.26	36.78	33.14	28.64
International migrants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Retired migrants	5.81	5.96	6.11	6.27	6.42	6.54	6.66	6.76
Special pops migrants	-0.53	-0.35	-0.09	-0.01	0.00	0.02	-0.01	0.01
Total population	2375.25	2427.47	2484.93	2539.84	2593.06	2643.80	2690.77	2733.04

Variable	2030	2035	2040	2045	2050	2055	2060
Starting population	2733.04	2910.14	3048.33	3161.05	3250.48	3321.65	3378.07
Births	31.50	32.63	33.07	32.94	32.71	32.60	32.37
Deaths	25.04	28.72	32.17	35.01	37.23	38.98	40.59
Natural growth	6.46	3.91	0.90	-2.07	-4.52	-6.38	-8.22
Population before migrants	2739.50	2914.05	3049.22	3158.98	3245.96	3315.26	3369.85
Total migrants	33.25	26.07	23.49	21.68	20.03	18.82	17.42
Economic migrants	26.40	19.02	16.40	14.45	12.43	10.75	8.82
International migrants	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Retired migrants	6.84	7.02	7.08	7.21	7.56	8.05	8.60
Special pops migrants	0.01	0.03	0.02	0.03	0.03	0.01	0.01
Total population	2772.75	2940.12	3072.71	3180.66	3265.99	3334.08	3387.27