

# Light-duty vehicle energy demand, demographics, and travel behavior



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*For*

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*By*

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## Examining changes in light-duty vehicle travel trends

- Recent data indicate possible structural shift in travel behavior, measured as vehicle miles traveled (VMT)
  - VMT per licensed driver, vehicles per capita, vehicles per licensed driver, and vehicles per household peaked in 2006-2007
  - Macroeconomic indicators such as household income and employment now appear more correlated with VMT than disposable income and unemployment
  - Shifting demographic factors are also influencing VMT, along with technological, social, and environmental factors
- Changes in *AEO2014* to explore these shifts
  - Uses employment instead of unemployment as a determinant of travel
  - Includes more detailed information on driver demographics
  - Created a Low VMT case that continues post-recession trend
  - Created a High VMT case that takes into account limits based on demographic factors

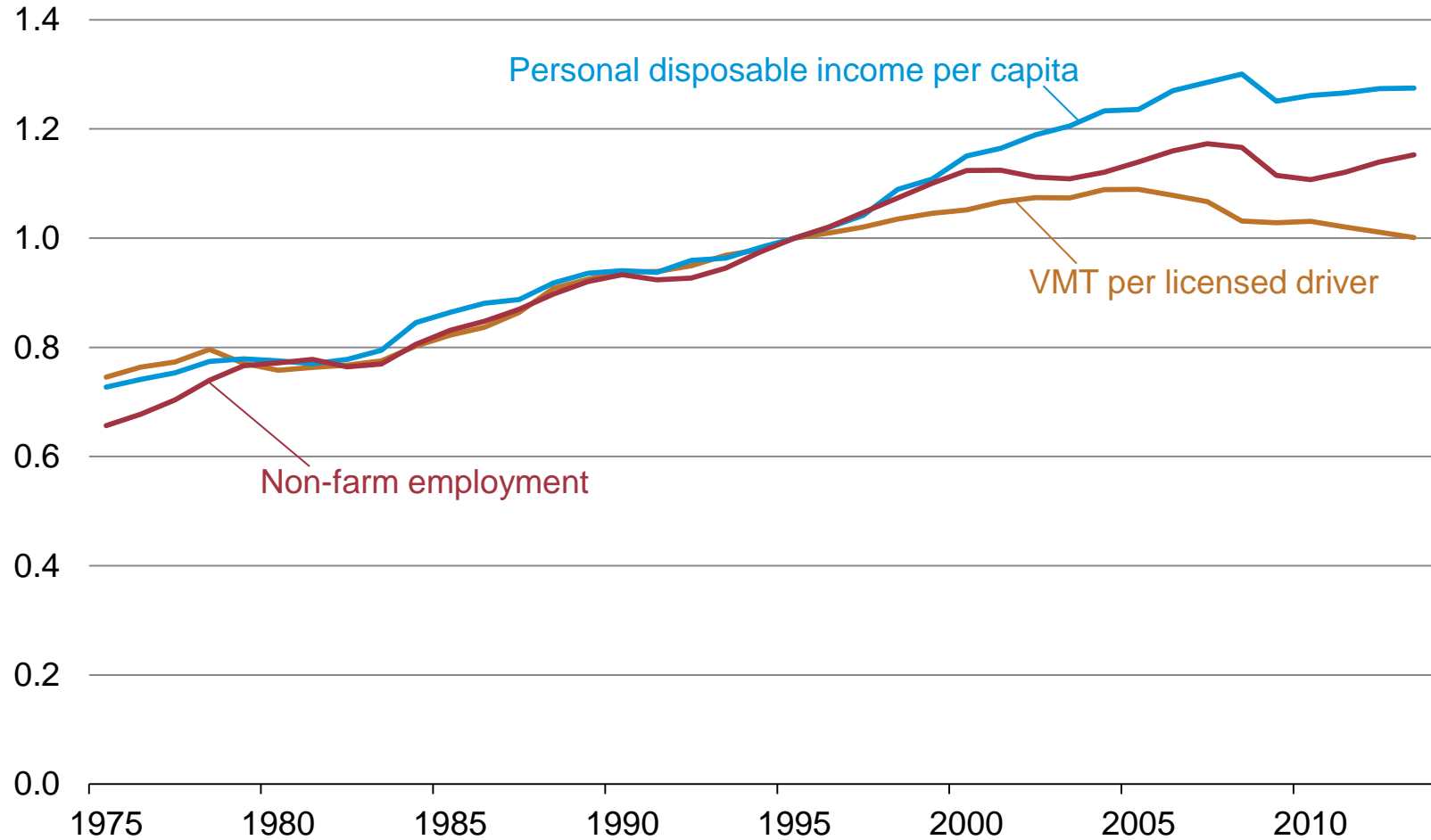
## Examining changes in light-duty vehicle travel trends (cont'd)

- EIA results from *AEO2014*
  - In the Reference case, total VMT continues to grow with population and income
  - Increasing light-duty vehicle fuel efficiency offsets growth in VMT to result in falling light-duty vehicle energy demand in all cases
  - Total light-duty vehicle transportation energy demand falls from 6.7 million barrels of oil equivalent per day in the High VMT case to 5.3 in the Low VMT case
  - Total transportation carbon dioxide emissions fall from 1,742 million metric tons in the High VMT case to 1,552 in the Low VMT case

# Personal travel may be shifting away from economic indicators

index

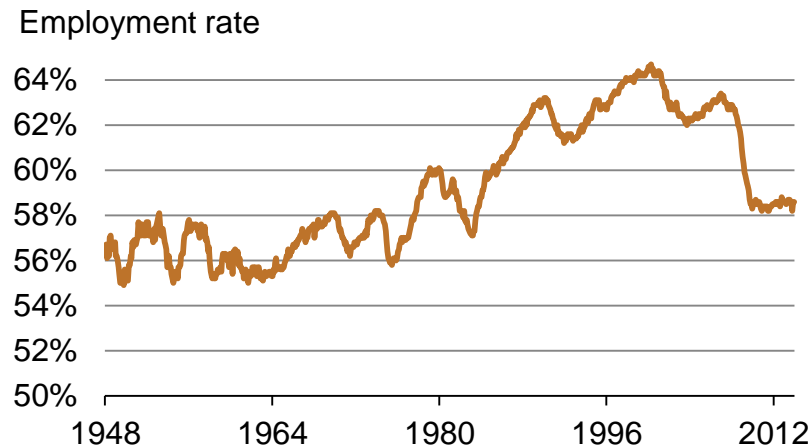
1995 = 1.0



# Macroeconomic factors are still the dominant influence on passenger travel

- Unemployment vs. employment

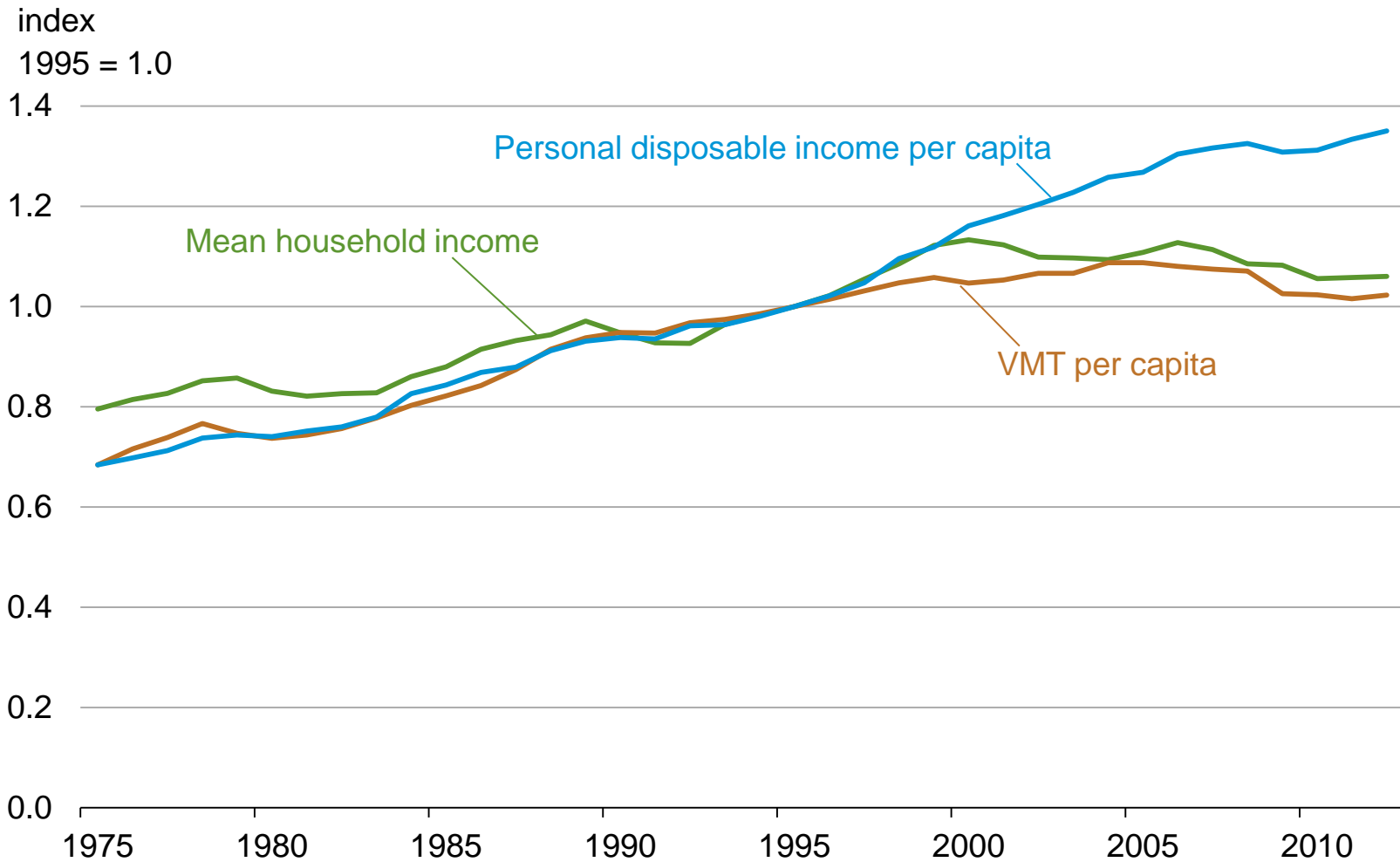
- Previously, EIA used unemployment as an indicator
- As individuals stop looking for work, they are removed from the labor pool
- Federal reserve employment rate data series removes labor force participation and reveals historically volatile trend; current trend is unusual/unprecedented



- Other macroeconomic factors also influence travel

- Income, fuel price, costs of purchasing a vehicle, vehicle operating costs

# Household income also deviates from personal disposable income



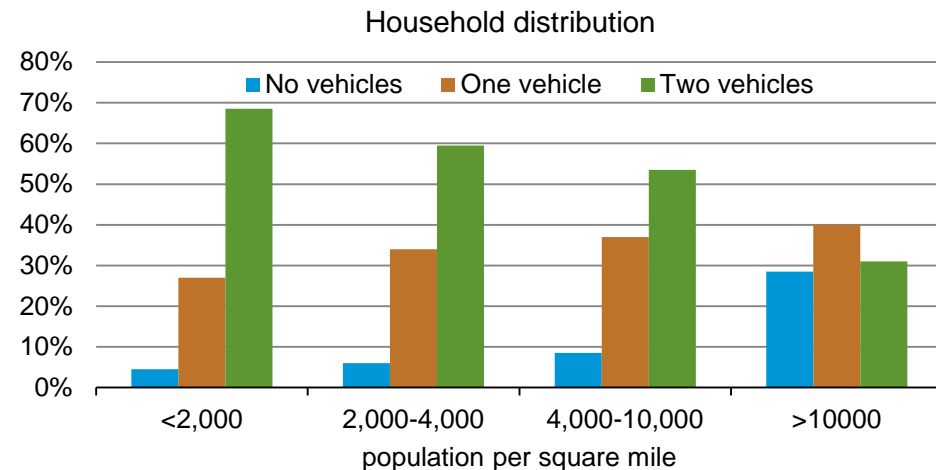
Source: U.S. Department of Transportation, U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis

## Demographic, technological, social, and environmental factors also play an important role in influencing personal travel

- Demographic changes may counteract or reinforce economic influence on travel
  - Aging of the driving population
  - Age and gender distributions within driving population
  - Driver licensing rates
- Technological, social, and environmental factors
  - Telecommuting, e-commerce, etc.
  - Access to alternative transportation options (public transport, car-sharing, car-pooling, car-rental, etc.)
  - LDV fuel efficiency changes (rebound effect)
  - Social media as substitute for travel
  - Urbanization, geographic population shifts

## Other factors may influence personal travel

- *Teleworking* at least one day per week increased from 7% to 9.5% since 1997; exclusive teleworking increased from 4.8% to 6.6%
- *Work-related travel* in 2009 was 25% of total personal travel
- *Regional* differences and *population density* influence driving behavior
  - Highest density locations have the highest percentage of households without personal vehicles
  - Urban drivers average 9,930 mi/yr
  - Rural drivers average 14,856 mi/yr





## Population, demographics, and travel behavior are important determinants of light-duty vehicle energy demand

$$(1) \text{ Population}_{G,AC} * \text{ Licensing Rate}_{G,AC} * \left( \frac{\text{VMT}}{\text{LD}} \right)_{G,AC} = \text{Total VMT}$$

$$(2) \frac{\text{Total VMT}}{\text{MPG}} = \text{Energy Demand}$$

where:

- $G$  = gender (male, female)
- $AC$  = age cohort (5)
- $\left( \frac{\text{VMT}}{\text{LD}} \right)$  = vehicle miles traveled per licensed driver
- MPG = stock average light-duty vehicle fuel efficiency

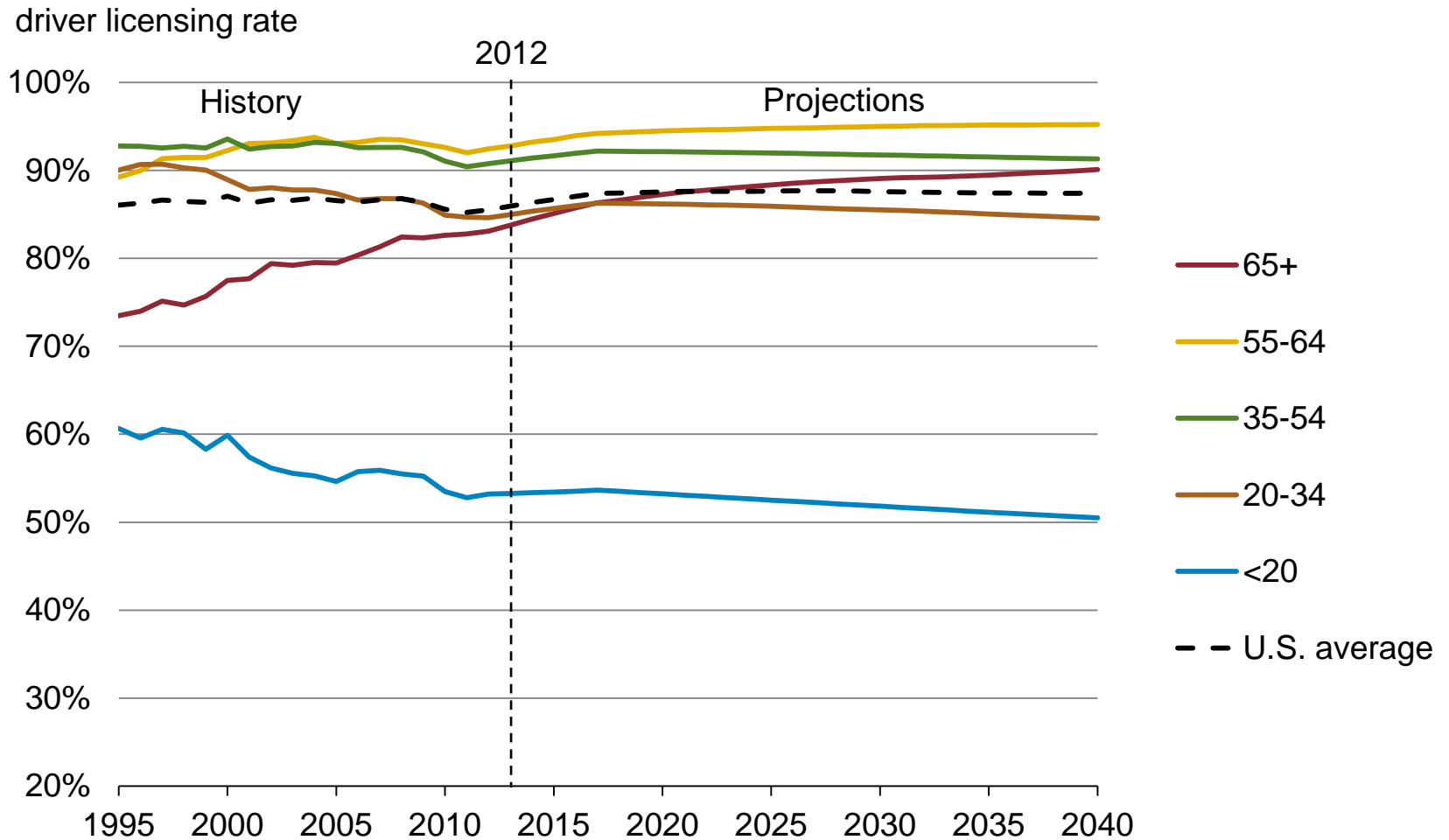
## Historic and projected age cohort distribution for this analysis

- VMT estimated by Census Division and aggregated to national level
- Based on travel behavior and regional licensing rates for males/females
- 13 licensing rate age groups and 5 VMT age groups

Age (years)	Percent of population aged 16 and above		
	2012	2025	2040
<20	6.9	6.1	6.0
20-34	26.1	24.4	22.8
35-54	34.1	30.9	30.9
55-64	15.5	15.0	13.5
65+	17.4	23.7	26.8

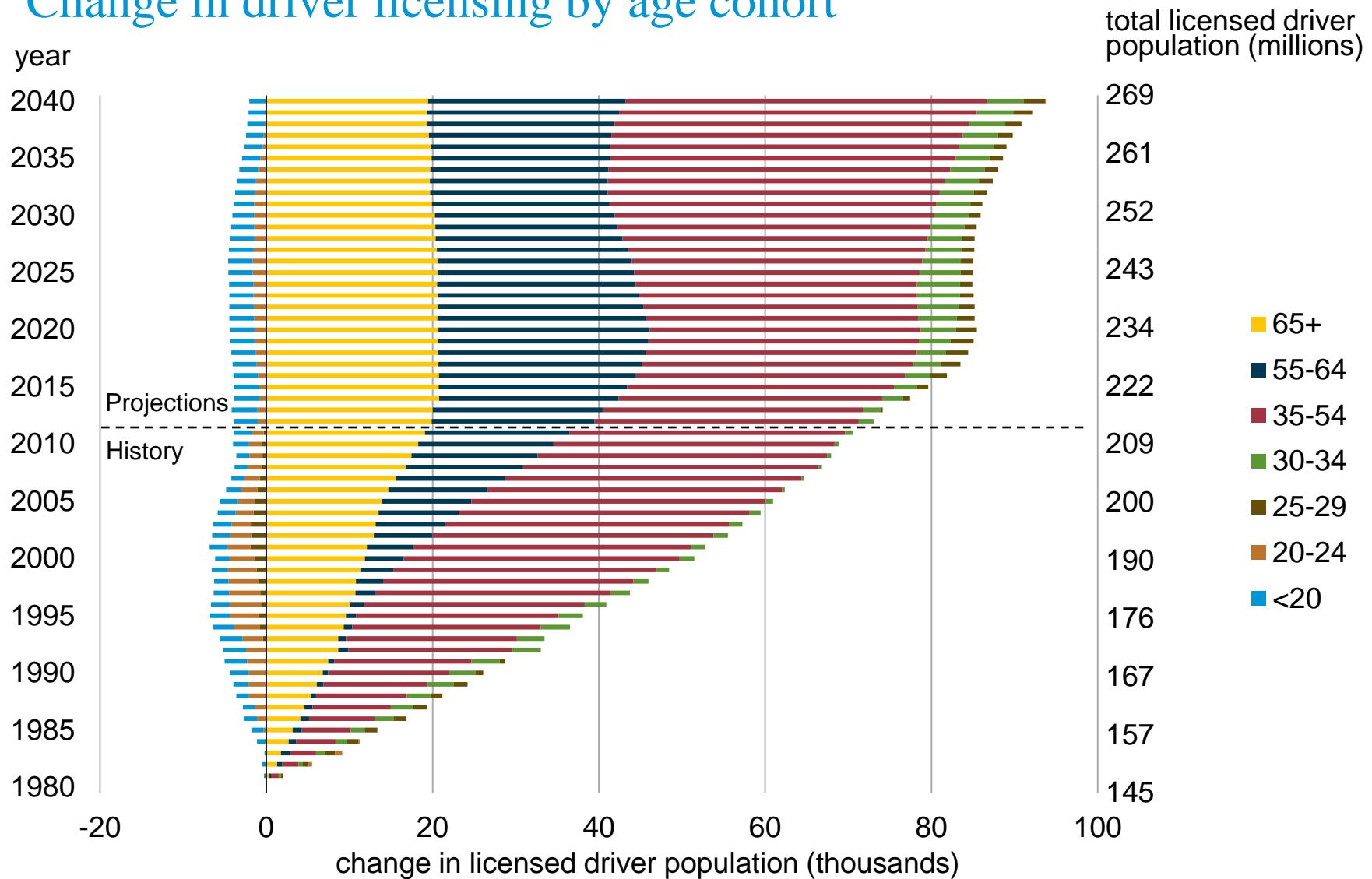
Source: U.S. Census Bureau, U.S. Energy Information Administration AEO2014

# Declining and flattening licensing rates for age cohorts under 54 years old, while increasing rates for age cohorts above 54



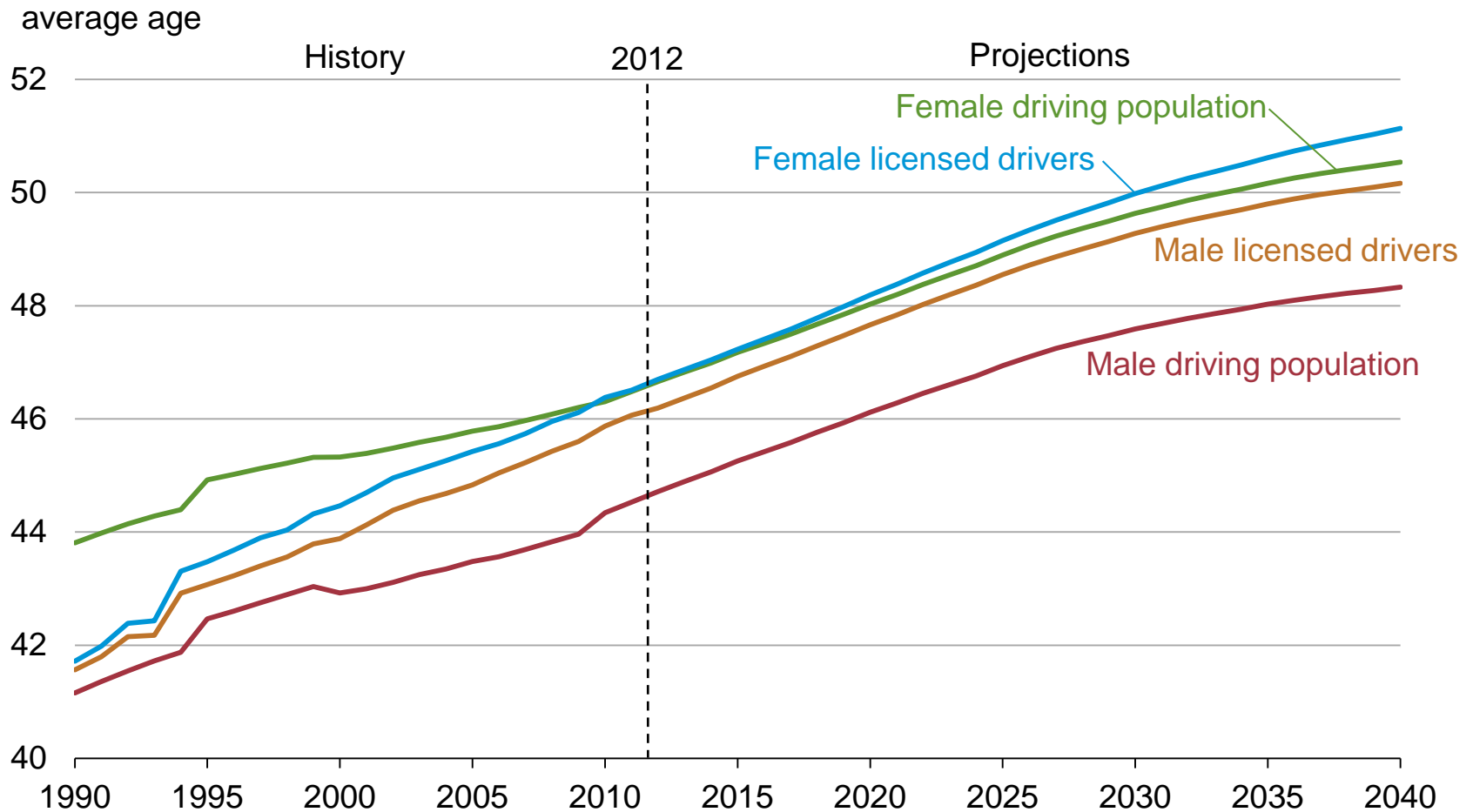
Source: U.S. Department of Transportation, U.S. Energy Information Administration AEO2014

# Change in driver licensing by age cohort



Source: U.S. Department of Transportation, U.S. Energy Information Administration AEO2014

# Age cohort distribution and changes in licensing rates impact average licensed driver age relative to the driver population; females 65+ licensing rate is fastest growing



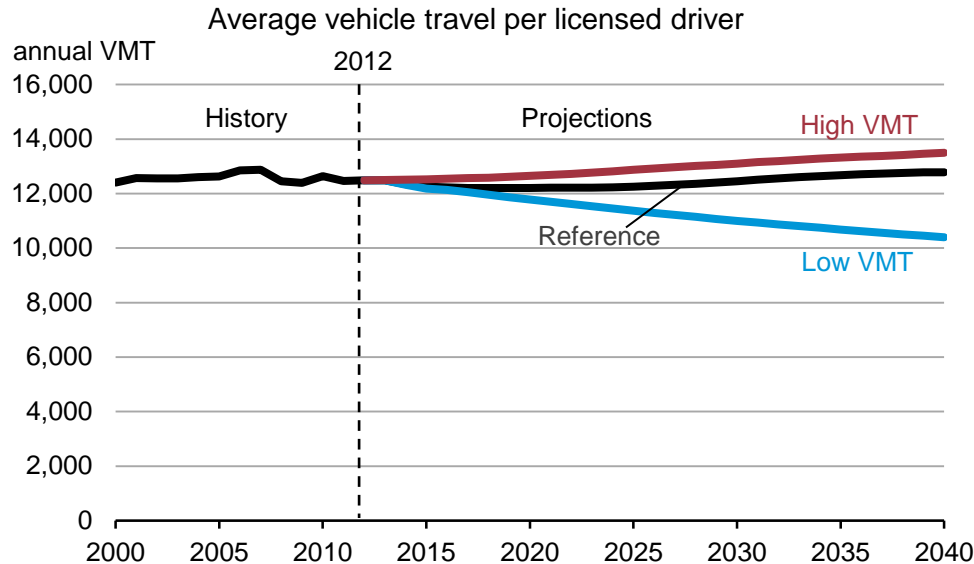
Source: U.S. Department of Transportation, U.S. Energy Information Administration AEO2014

## AEO2014 VMT cases consider alternate trends in travel behavior

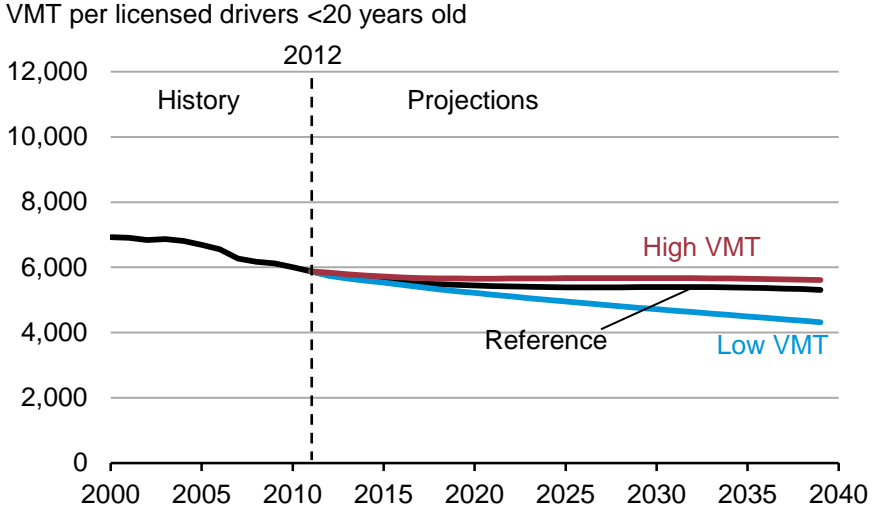
- Low VMT case: continues recent trend in travel behavior (0.5% annual decrease in VMT per licensed driver since 2007)
- High VMT case: gradual increase in VMT per licensed driver

### High VMT case annual increase in VMT per licensed driver

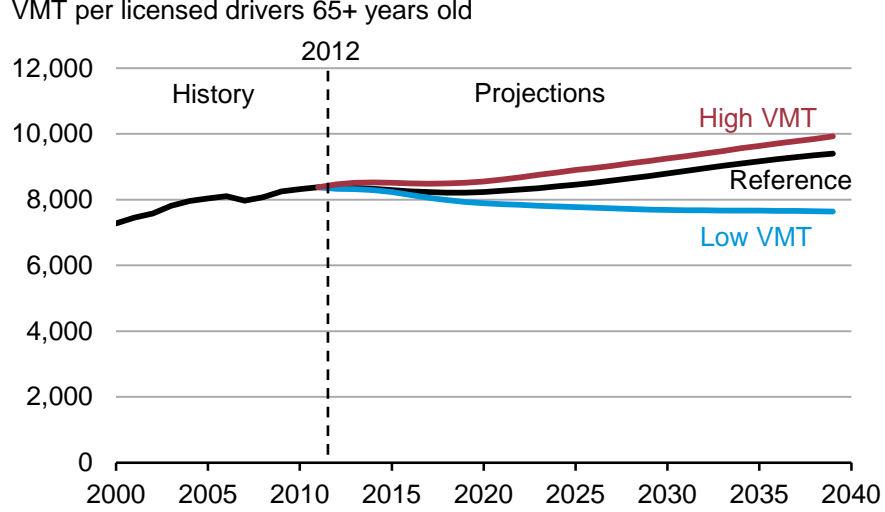
2013-2015	2016-2018	2019-2022	2023-2026	2027-2031	2032-2035	2036-2040
0.3%	0.4%	0.5%	0.6%	0.5%	0.4%	0.3%



# Personal travel for younger age cohorts levels off or declines, while personal travel for older age cohorts continues or grows through projection

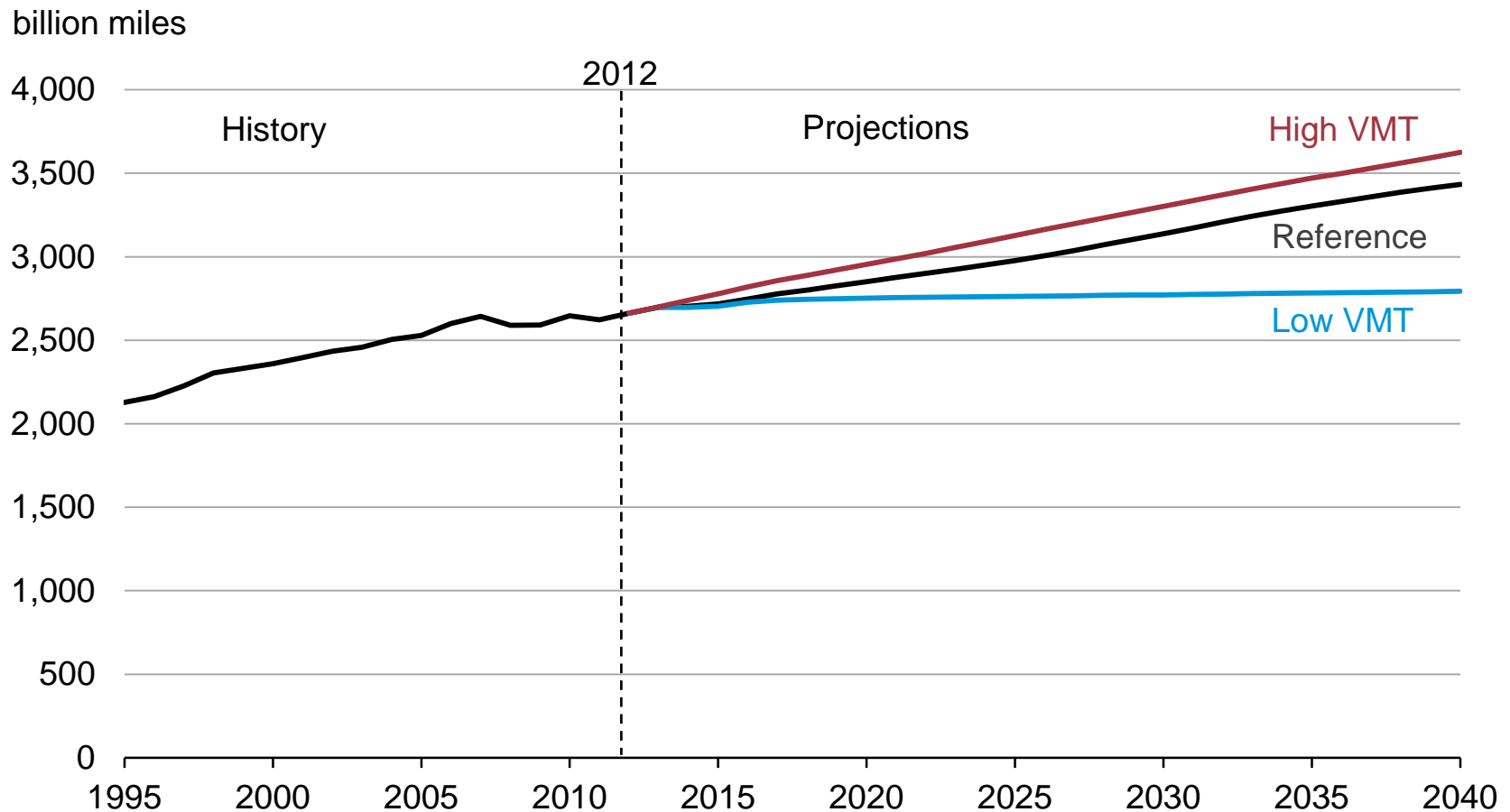


Source: U.S. Energy Information Administration, AEO2014



Source: U.S. Energy Information Administration, AEO2014

# Total light-duty vehicle miles traveled ranges from 3.6 trillion miles in the High VMT case to 2.8 trillion miles in the Low VMT case

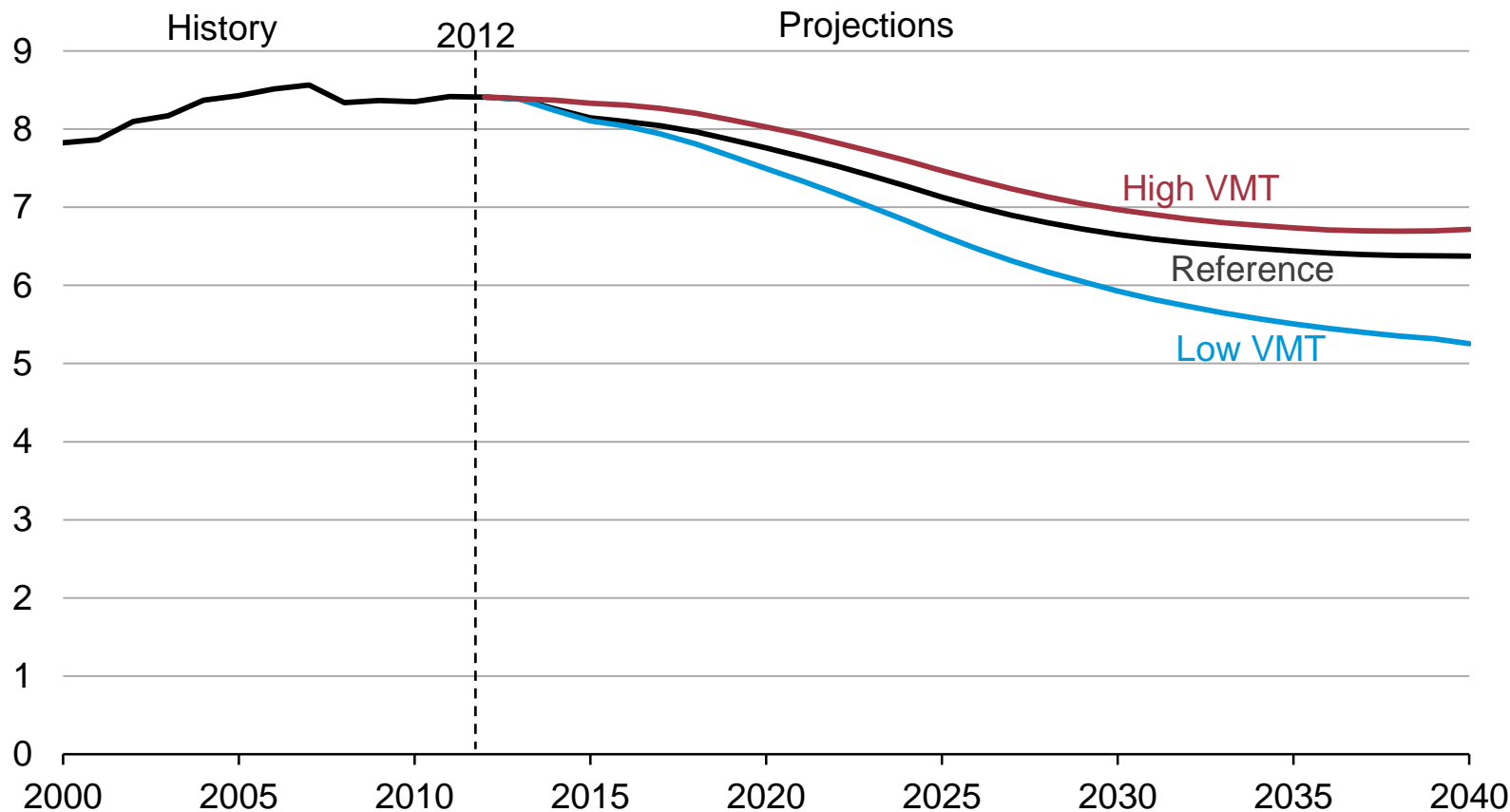


Source: U.S. Energy Information Administration AEO2014



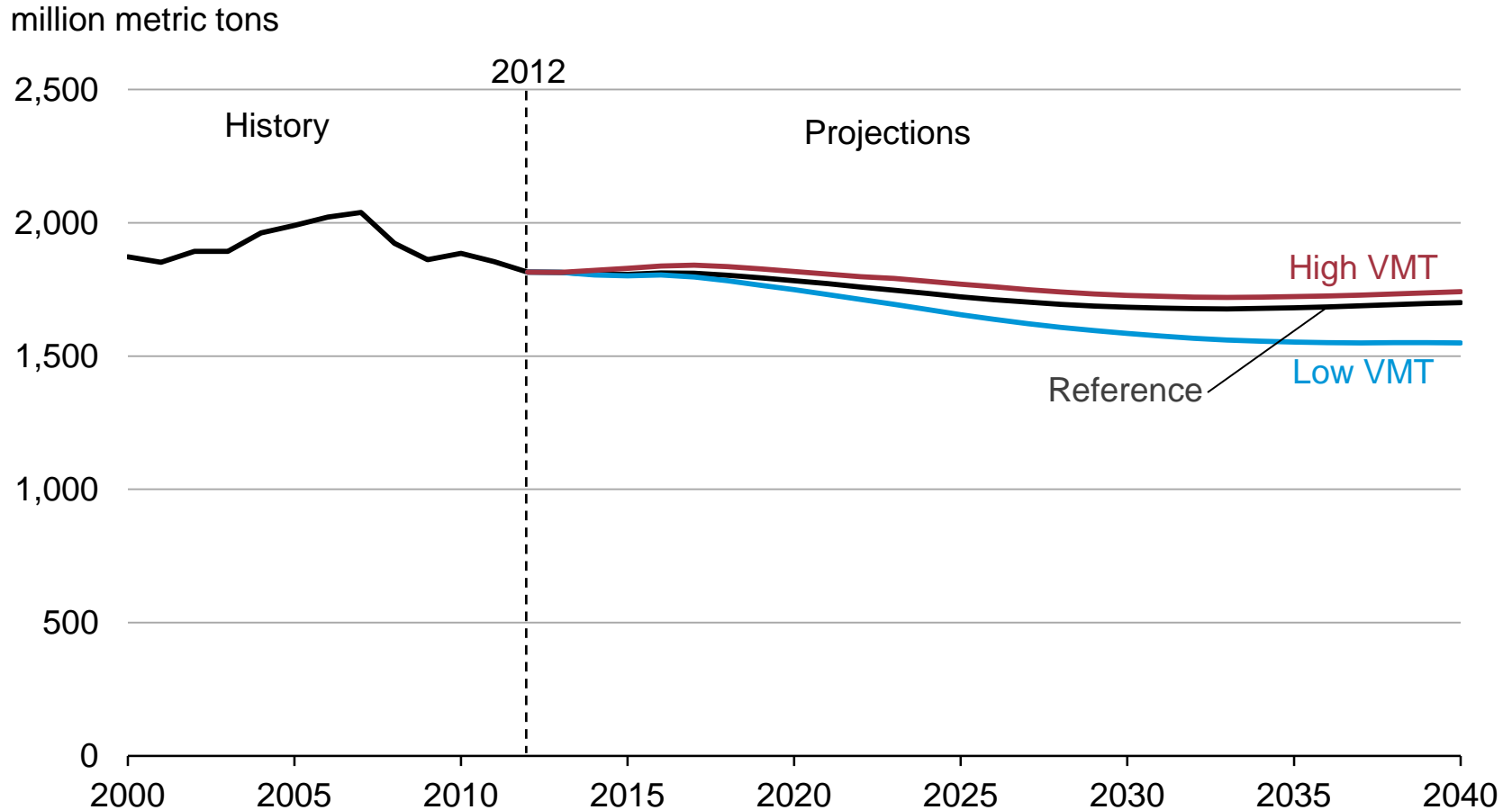
# Total light-duty vehicle transportation energy demand decreases by an average annual rate of 0.8% in the High VMT case, and 1.7% in the Low VMT case

million barrels of oil equivalent per day



Source: U.S. Energy Information Administration AEO2014

# Total U.S. transportation carbon dioxide emissions increase by 3% in the High VMT case, decrease by 9% in the Low VMT case when compared to the Reference case



Source: U.S. Energy Information Administration AEO2014

# Discussion/questions

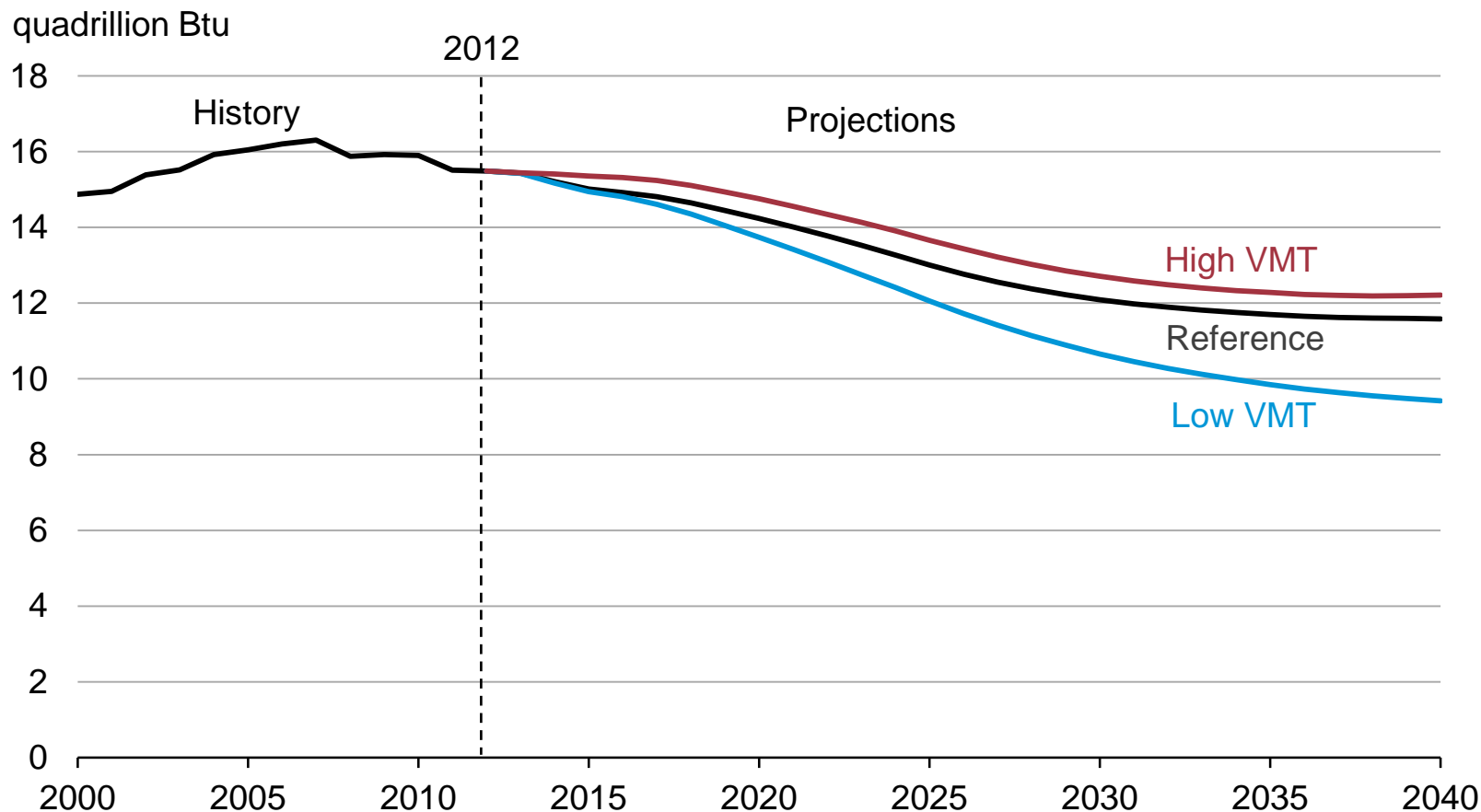
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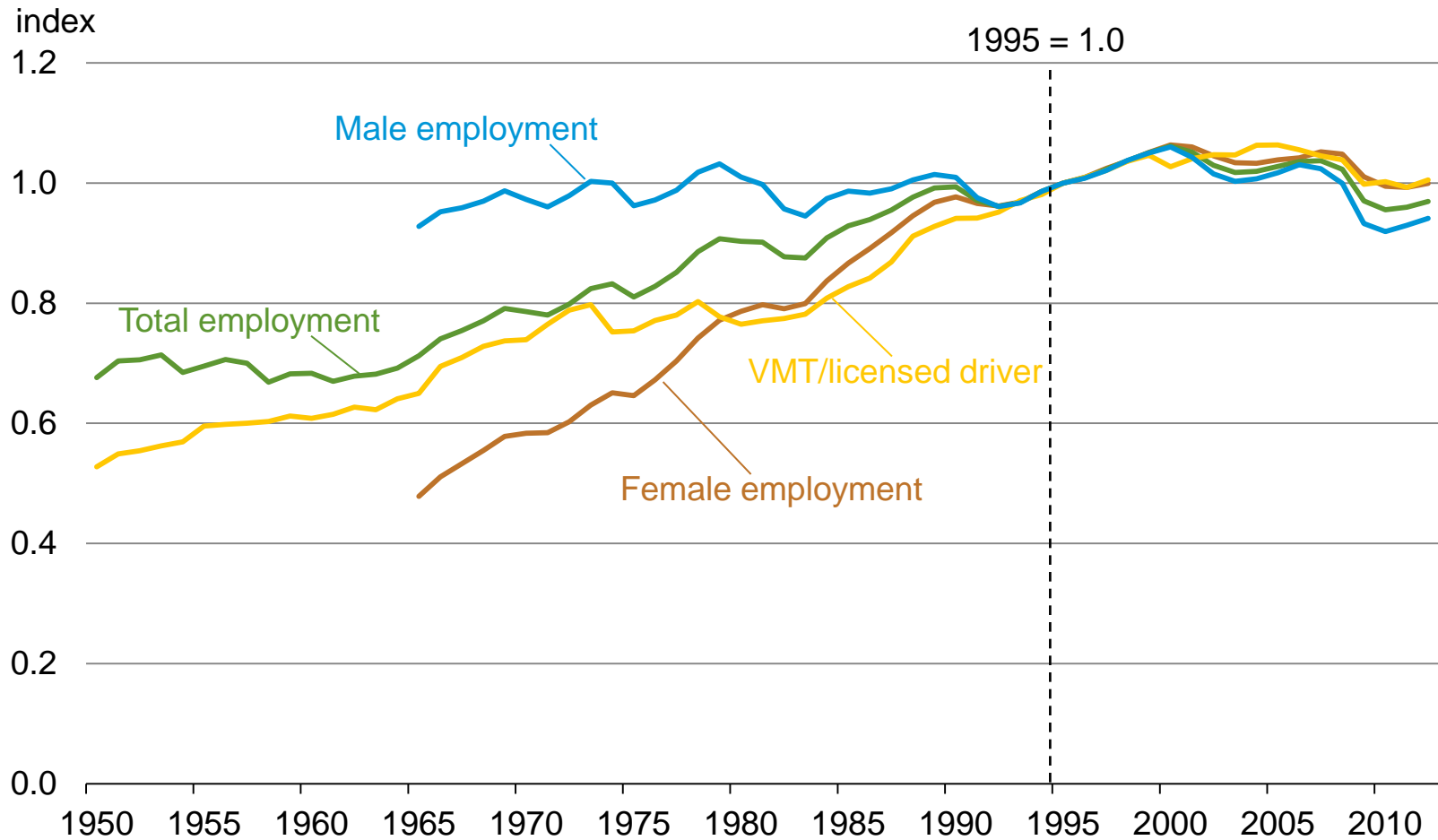
# Supplemental slides

# Total light-duty vehicle transportation energy demand decreases by an average annual rate of 0.9% in the High VMT case, and 1.8% in the Low VMT case



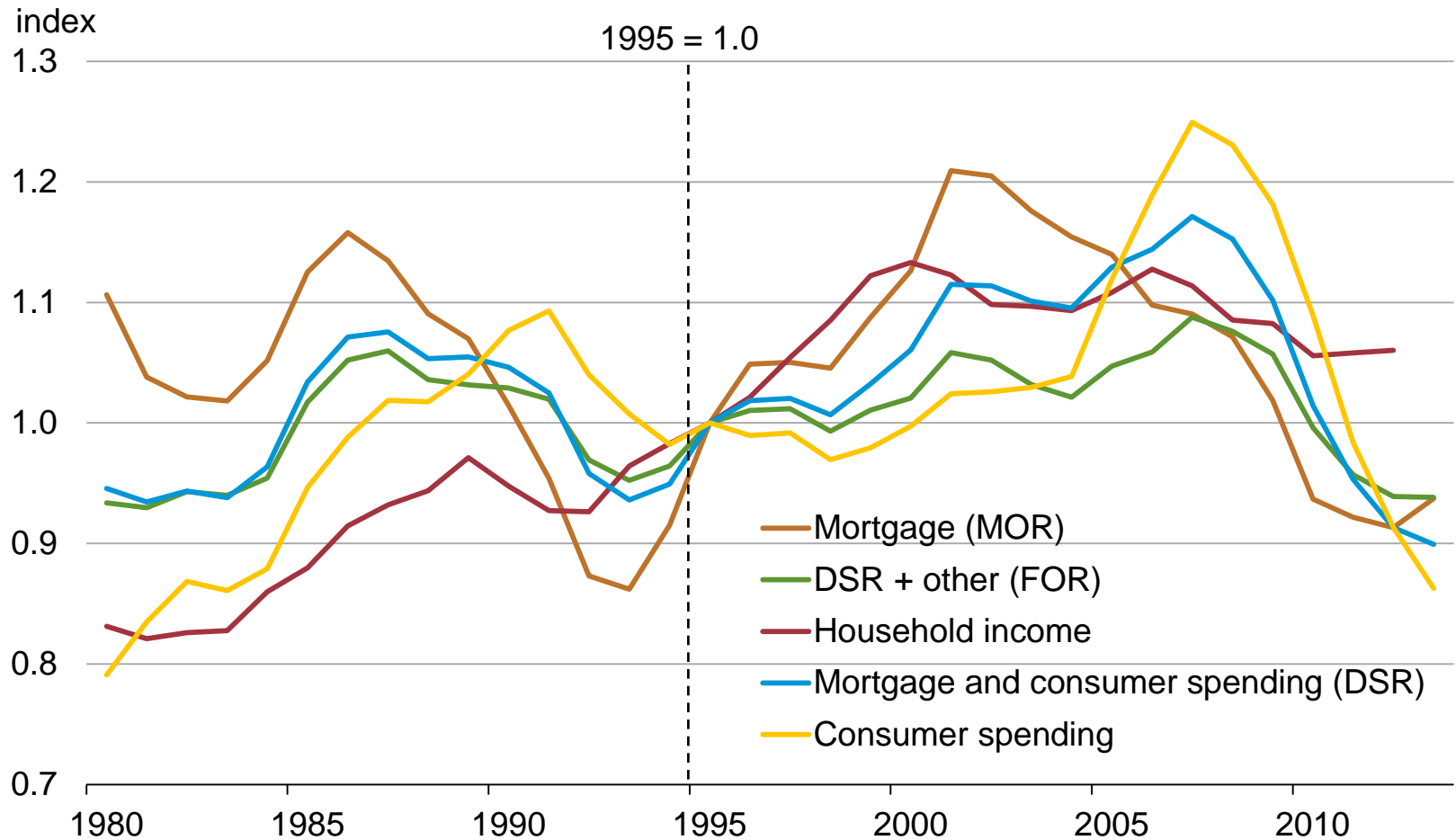
Source: U.S. Energy Information Administration AEO2014

# Employment indexed to 1995



Source: U.S. Department of Transportation, U.S. Bureau of Labor Statistics

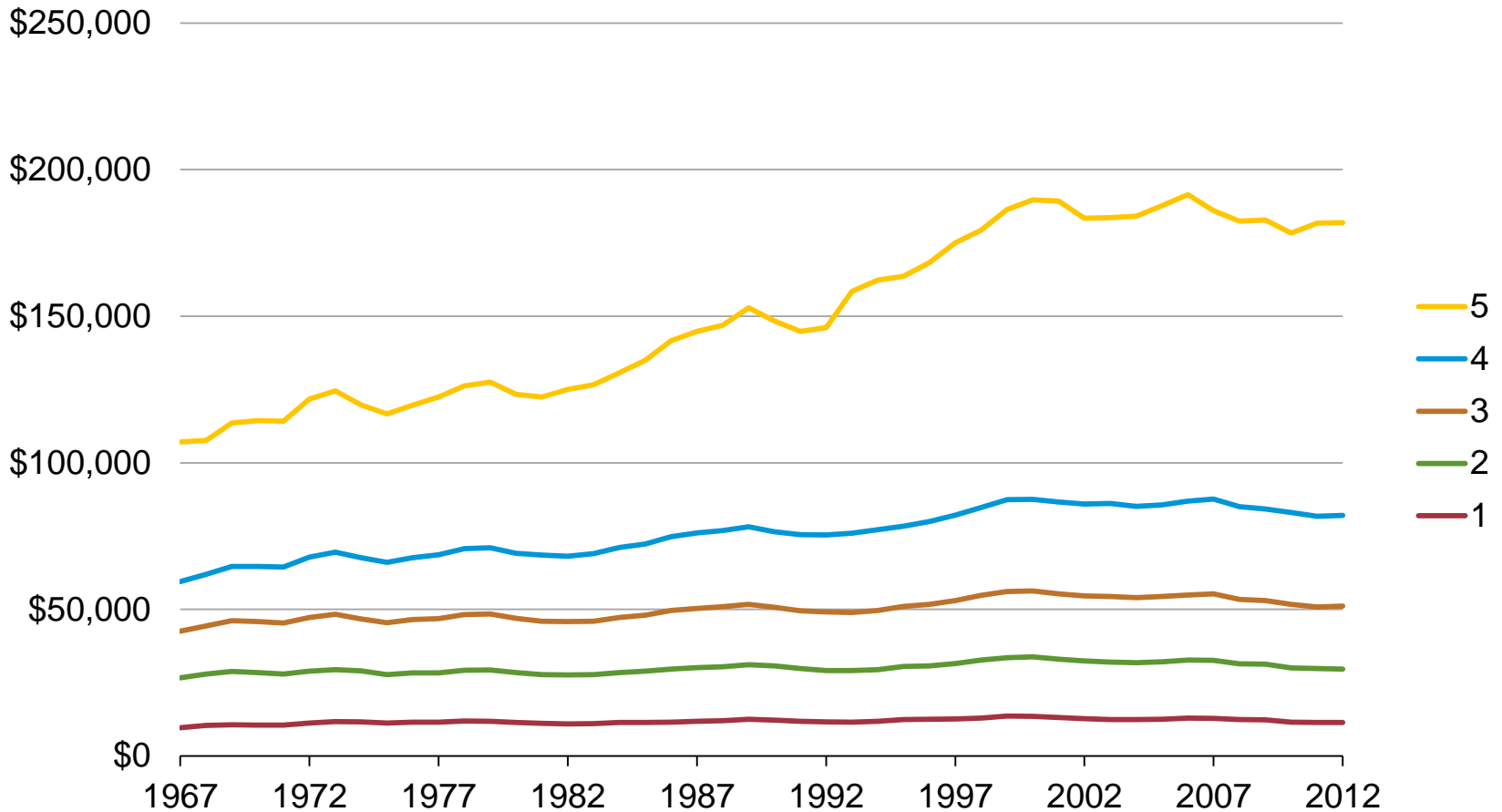
# Consumer spending and household income indexed to 1995



Source: Federal Reserve

# Income by quintile

mean personal disposable income

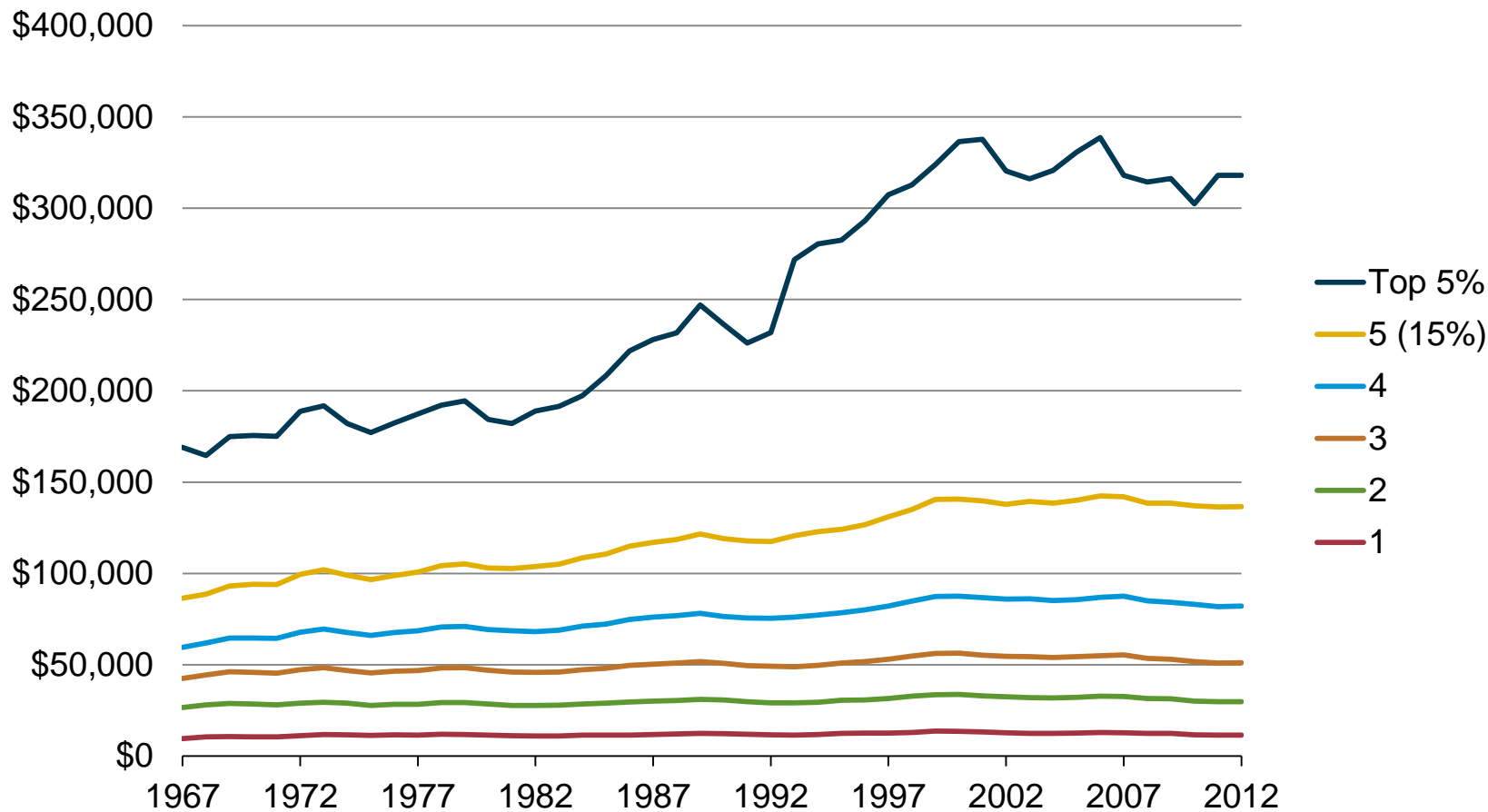


Source: U.S. Census Bureau



# Top 5 percent of population shows greatest increase in income through recent history

mean personal disposable income



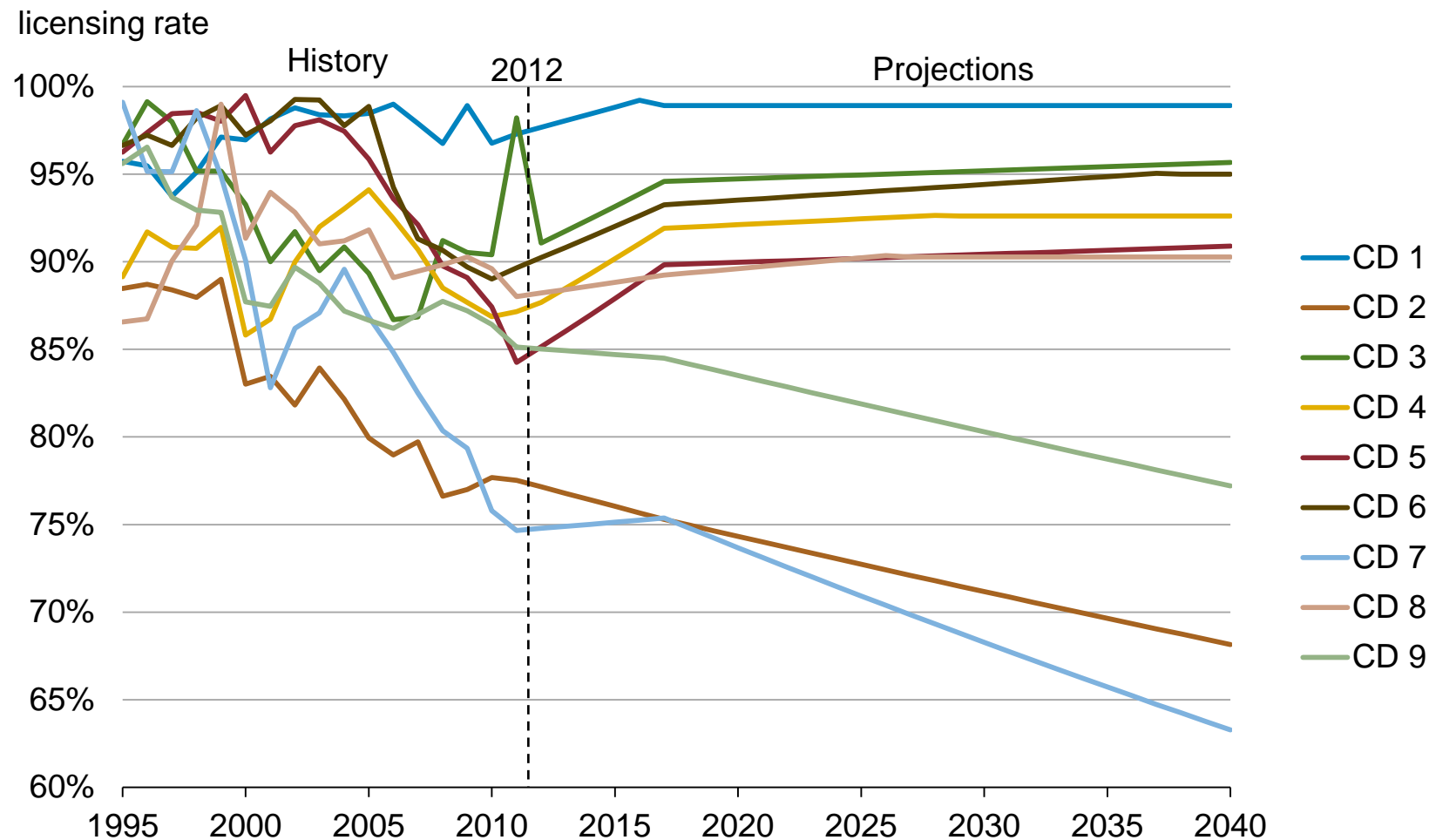
Source: U.S. Census Bureau

# Annual vehicle miles traveled by licensed drivers



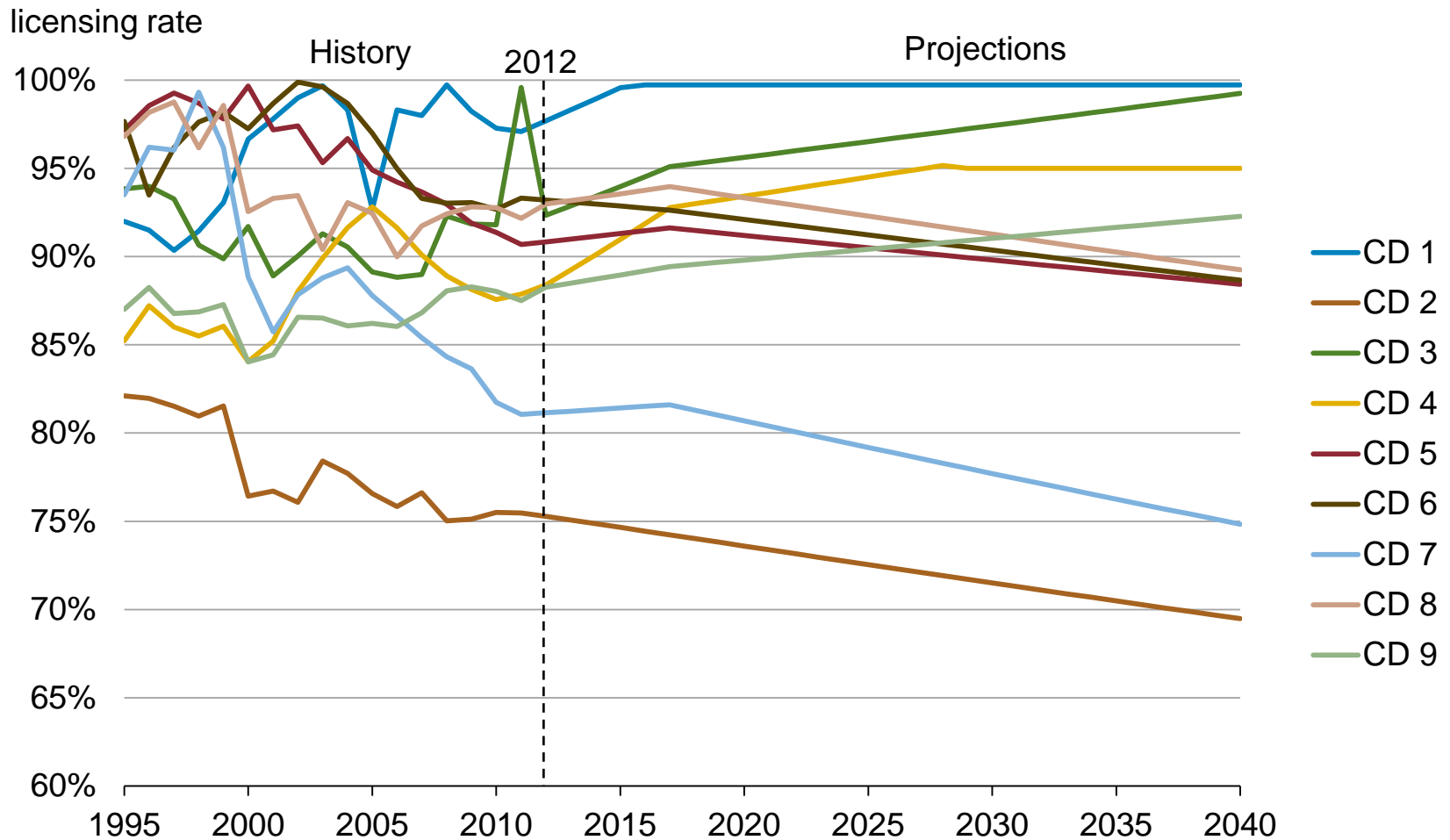
Source: U.S. Department of Transportation, National Personal Travel Survey

# Male licensing rates by Census Division (CD), age 25-29 years



Source: U.S. Energy Information Administration AEO2014

# Female licensing rates by Census Division (CD), age 25-29 years



Source: U.S. Energy Information Administration AEO2014