California Agriculture to 2050: Where are we headed and what issues are driving?

SEED CENTRAL

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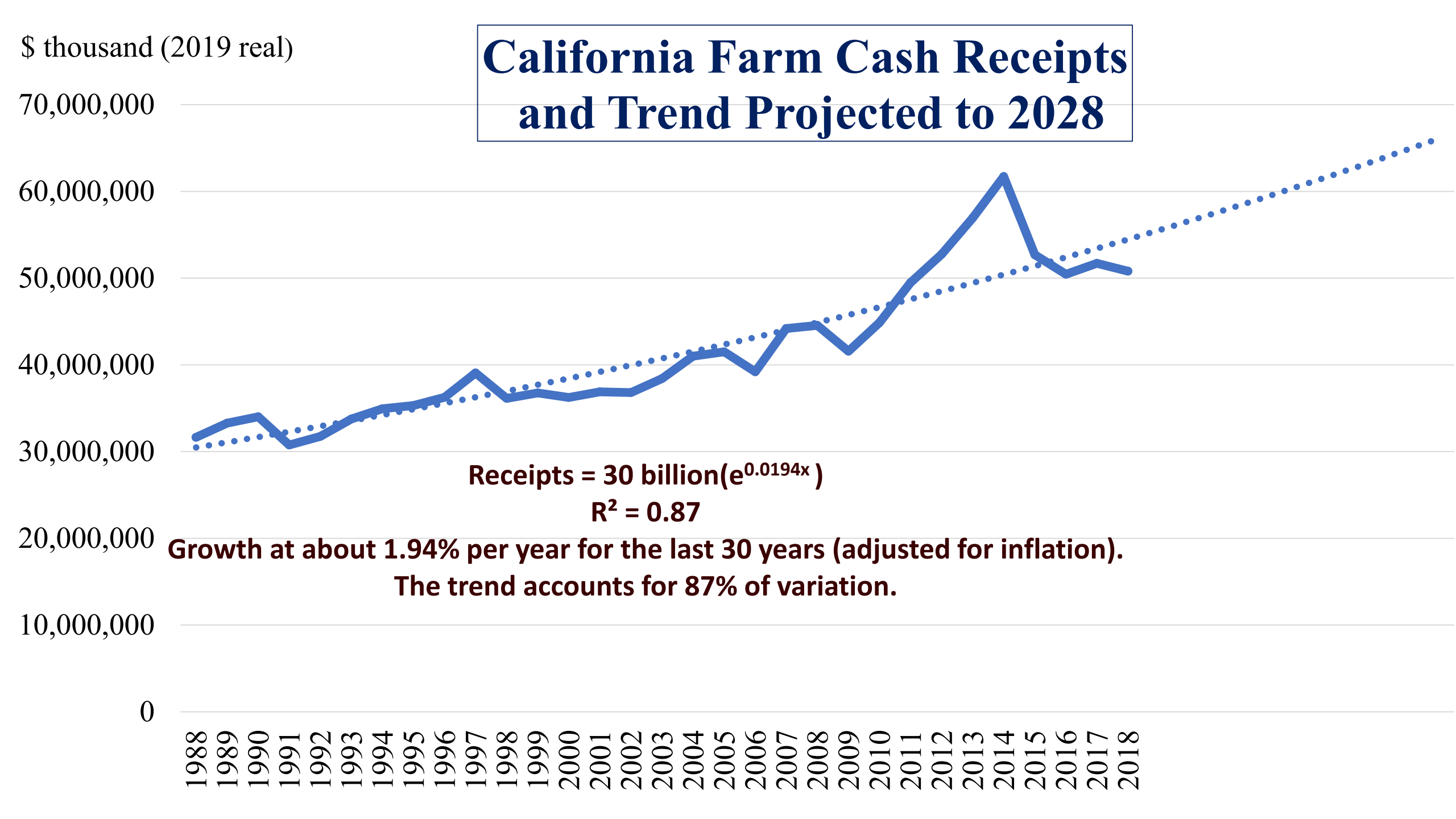
Outline and Overview

- California agriculture is diverse and dynamic. It defies quick summary. Diversity and dynamism will continue!
  - Data and underlying supply and demand basics help us understand and project out three decades to 2050
  - Cost and supply conditions, with buyer and market fundamentals on the demand side, help guide implications of recent trends
- Farm revenue and net incomes continue to grow (with some ups and downs) as markets change and divergent trends prevail
  - Investment (driven by low interest rates) continues to reduce field crop area, the future seems to include still more tree and vines
  - Little change in livestock numbers (both confined and pasture-based)
  - Continuity amid change is the theme.
  - Coastal valley agriculture will grow by innovating to reduce labor intensity
- The pandemic has not changed the long term farm outlook!


$ thousand (2019 real)
California Farm Cash Receipts and Trend Projected to 2028
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Receipts = 30 billion(e^0.0194x)
R² = 0.87
Growth at about 1.94% per year for the last 30 years (adjusted for inflation).
The trend accounts for 87% of variation.

Drivers on the supply side

1. **Farm labor costs and availability will limit growth for some crops, maybe some relief is coming from guest workers and innovation**
2. **Water scarcity, regulations high prices and some hopeful signs... Secure ownership, flexibility and markets can unleash incentives that make much more powerful use surface and ground water**
3. **Climate changes mean less snow, fewer chill hours, changes in pests and more... The concerns are global and response must be innovation and adaptation, a strength of California agriculture.**
4. **California regulations respond to political demands and raise costs**
5. **Resilience requires innovation. Firms and farms are responding but need public R&D as a base... Will California return to leadership?**

A broad price-cost squeeze implies lower farmland returns, but maybe not lower production. As the squeeze differs across crops, shifts follow. But the squeeze on *net* returns may not reduce *gross* revenue.

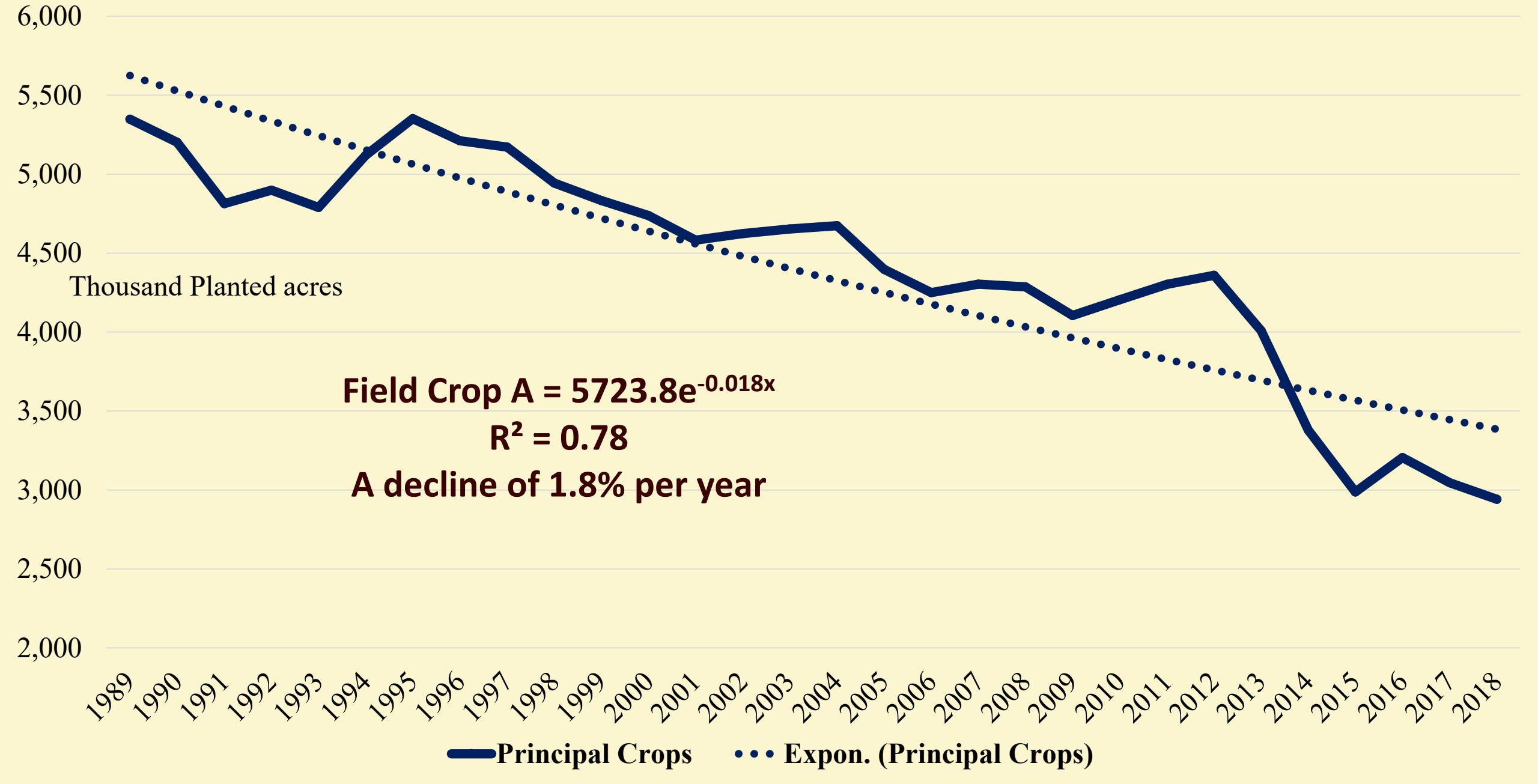
Rising labor costs are trouble for many crops

- **Farm labor cost disadvantages can be managed with innovation, but does not work for all crops**
- **Mechanically harvested and pruned crops (tree nuts) have advantages, but others (berries and olives) are also reducing labor intensity**
- **California policy drives some of the California concerns, but labor costs are also rising among competitors**
- **The shift away from field crops increases the demand for labor.**
- **Niche markets for labor-intensive practices may meet demands of wealthy consumers who want services imbedded in their products.**

Labor Cost Shares for California Crops

crop name	Year	Location	% of operating cost	% of total cost
almonds	2016	San Joaquin Valley North	20.47%	13.91%
broccoli	2017	Central Coast	48.22%	38.15%
grapes-table	2018	San Joaquin Valley South	59.56%	49.11%
grapes-wine	2016	North Coast	79.89%	31.50%
olives	2016	Sacramento Valley	63.22%	48.56%
olive oil	2016	Sacramento Valley	28.70%	16.44%
oranges	2015	San Joaquin Valley South	55.24%	38.70%
peaches	2017	San Joaquin & Sac. Valley	72.76%	45.76%
pistachios	2015	San Joaquin Valley South	19.19%	10.17%
prunes	2018	Sacramento Valley	21.51%	13.52%
strawberries	2016	Central Coast	42.27%	38.89%
tomatoes	2018	San Joaquin Valley South	16.40%	12.30%
walnuts	2018	Sacramento Valley	20.71%	9.50%

Principal Field Crops Acreage

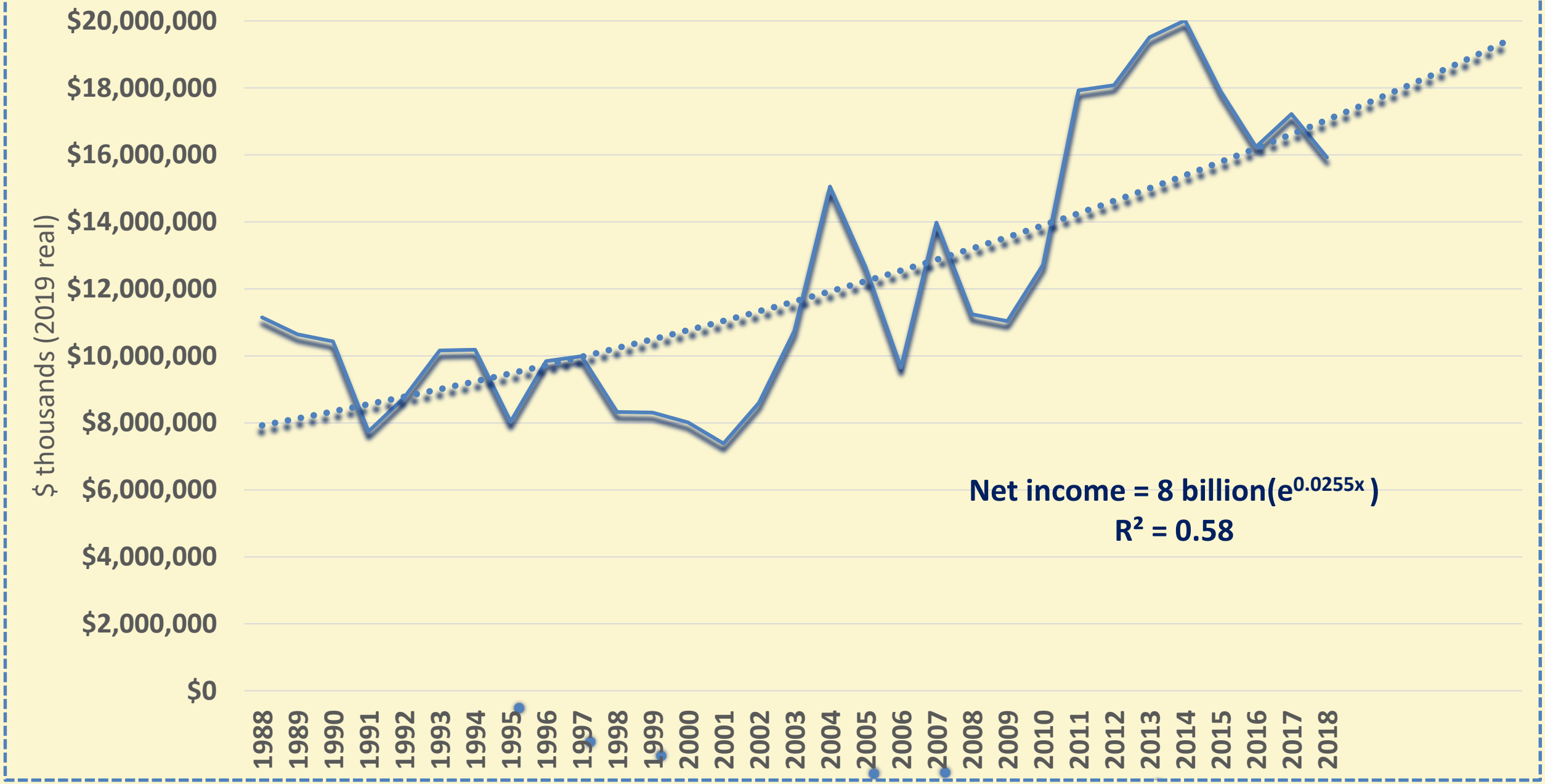


Water costs and availability

- **Water availability and costs depend on Federal, State and local district public policy. Policy innovations that allow a thorough role for markets can help mitigate losses from climate change and environmental demands.**
- **The most important innovation is inter-temporal and regional water markets in groundwater resources. This requires property rights.**
- **Over the next decade or two a new generation of leaders may accept water markets as the only way to allow water to flow and the Valley to flourish. That means trading water across farms, regions, and years.**

- **I am optimistic about the 30 year water horizon. Maybe too optimistic?**

Net farm income



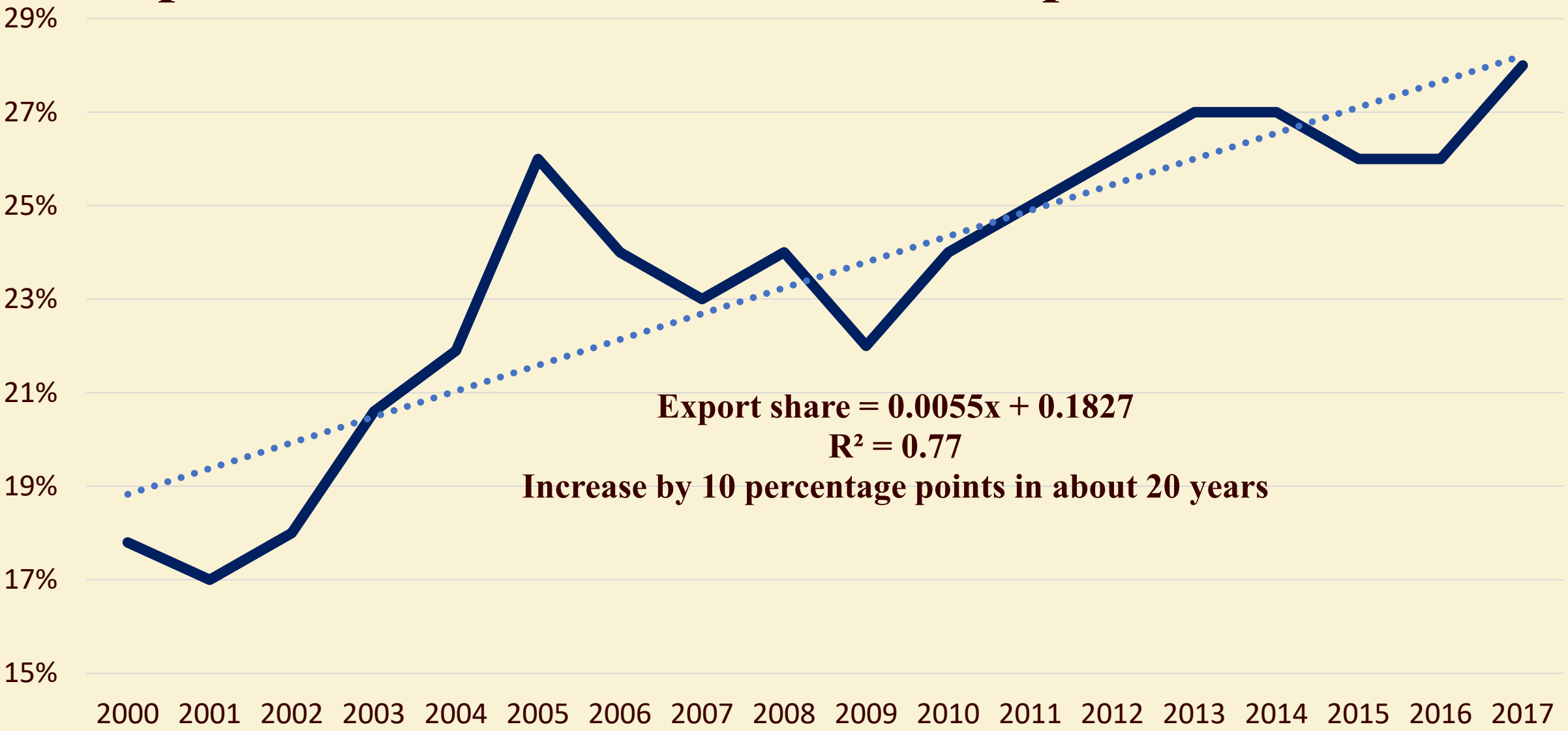
Drivers on the demand side

Local, national and global markets are all important

1. **Population growth is slowing, but global population numbers are not key for California.**
2. **Income growth is important as more potential consumers enter middle incomes and demand more of what California sells**
3. **Buyers continue to pay for product attributes based on farm practices. California is well suited to that demand.**

Overall demand growth prospects are strong so long as income growth continues and buyers continue to seek diet quantity and responsive farm practices.

Export share of California farm output



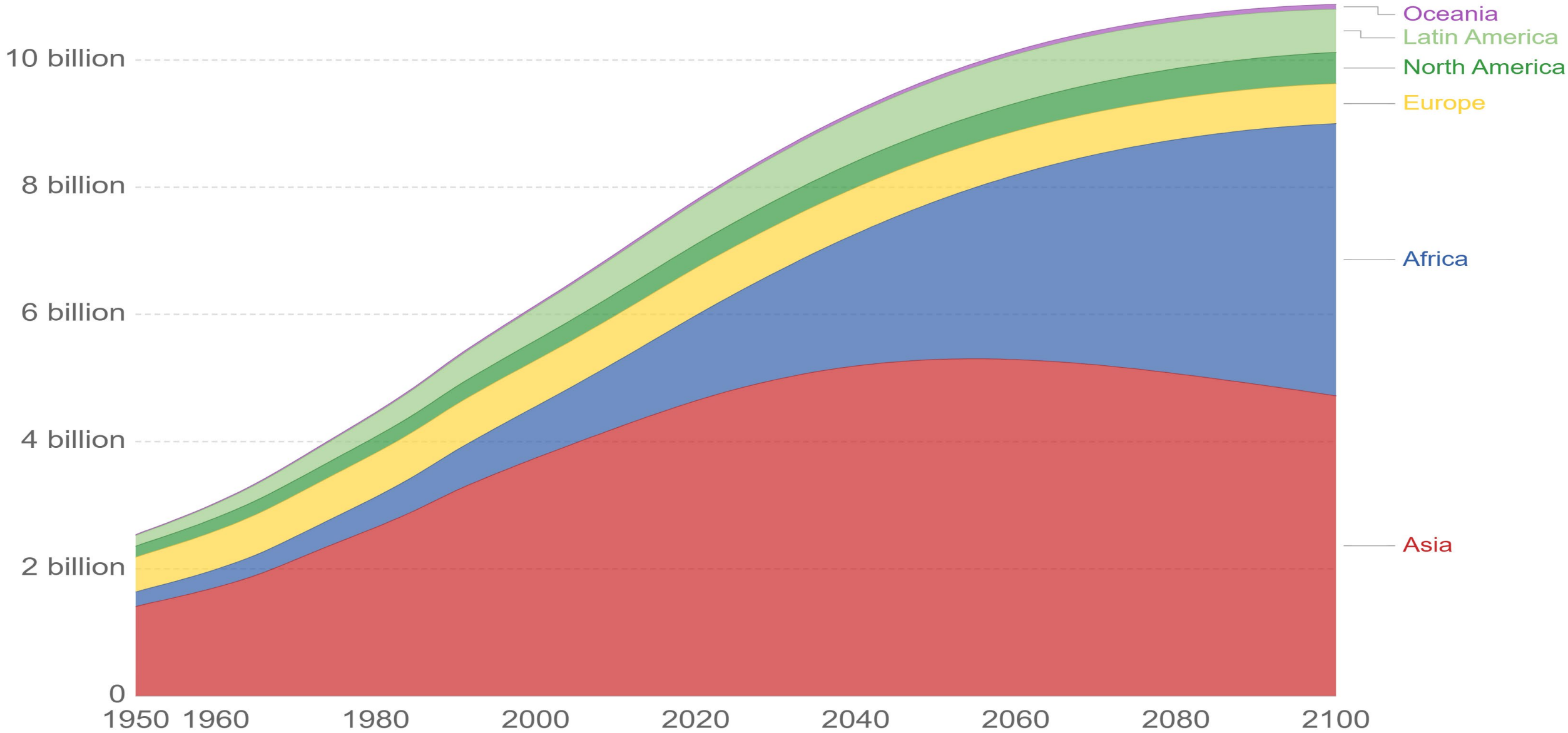
Source: University of California, Agricultural Issues Center

Long term global demand drivers: Population and income patterns and the product innovation that follow

World population by region projected to 2100

Projected population to 2100 is based on the UN's medium population scenario.

Our World in Data

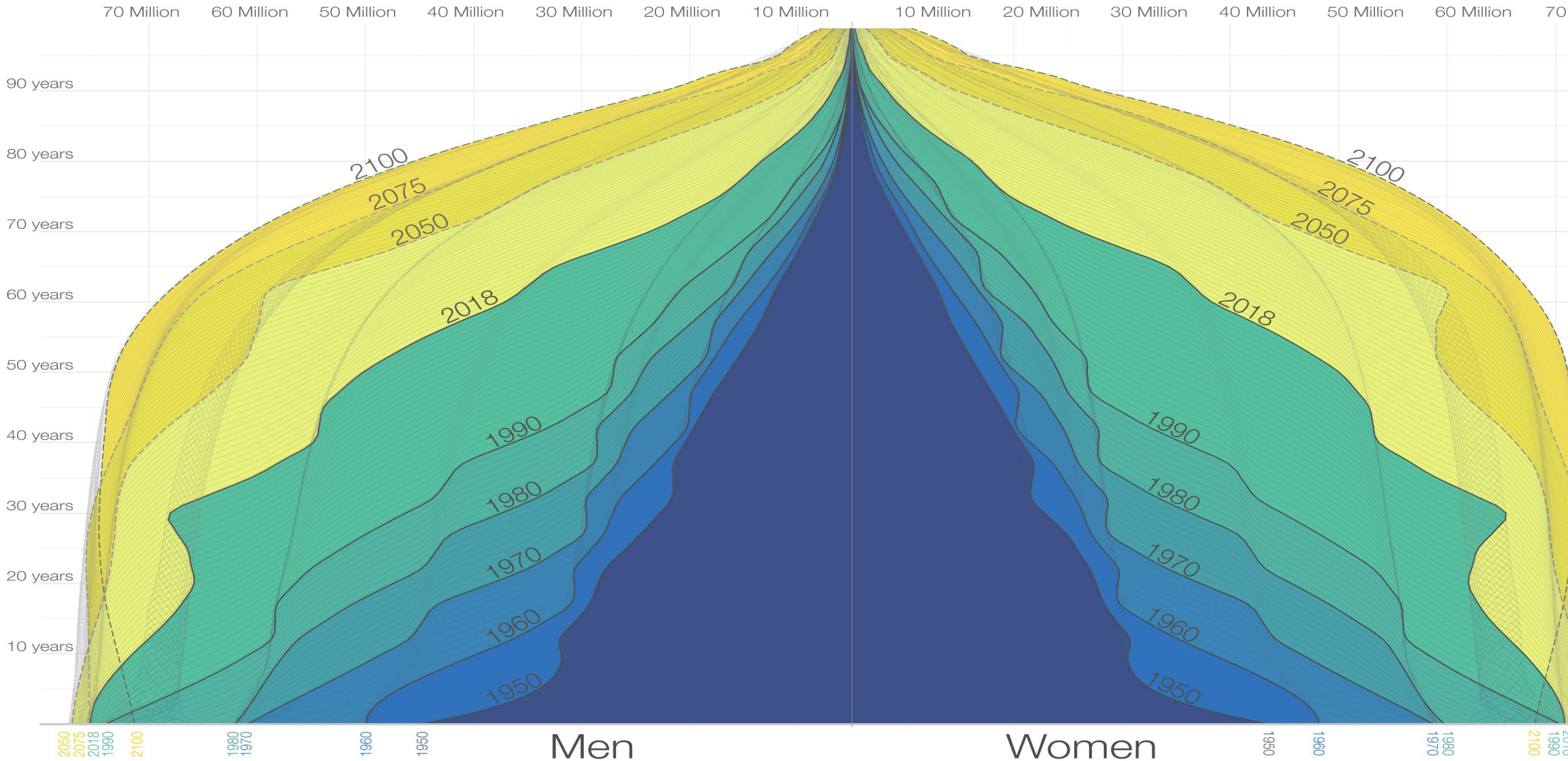


Source: HYDE (2016) & UN, WPP (2019)

OurWorldInData.org/world-population-growth • CC BY

The Demography of the World Population from 1950 to 2100

Shown is the age distribution of the world population – by sex – from 1950 to 2018 and the *UN Population Division*'s projection until 2100.



Data source: United Nations Population Division – World Population Prospects 2017; Medium Variant.

The data visualization is available at OurWorldinData.org, where you find more research on how the world is changing and why.

“Peak baby” is already here.
Now the world gets older cohort by cohort

- Distribution by age varies by region and country with big implications for product demand
- And, big implications for income growth
- Follow the data on the old dependents and the young
- China will have fewer kids but many old folks (like Japan now).
- Nigeria has many kids for a while and then many working age.
- But, economies need skills and jobs. India has struggle with both.
- The broad shoulders of an aging world.
- Each decade the population ages and the world looks more like Japan.

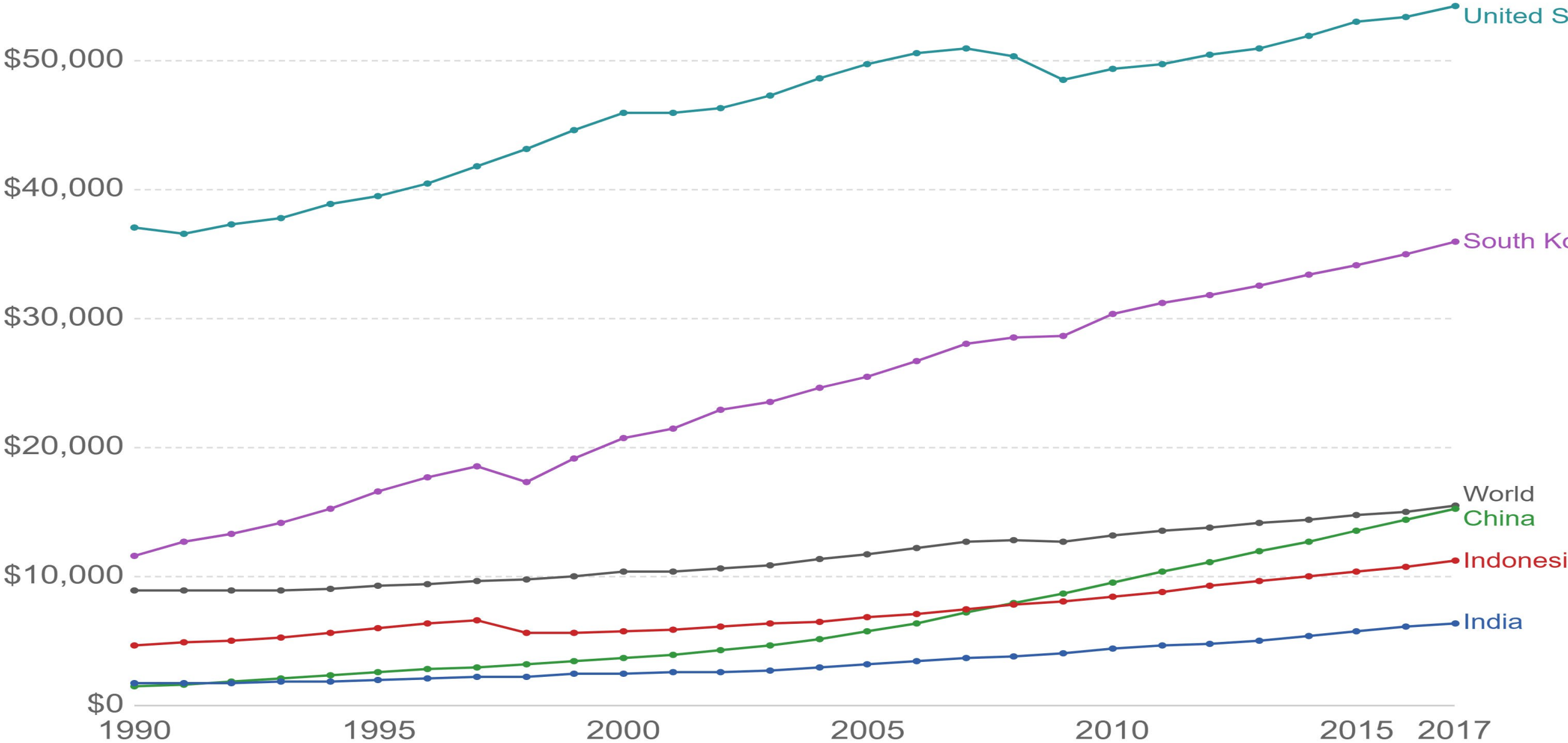
Income growth is more important for California agriculture than population growth

- **Distribution of incomes is vital.**
- **To buy our California agricultural products requires that consumers enter the global middle class.**

- **Each decade millions and then billions enter the zone that demands the products and qualities that California produces.**

GDP per capita

GDP per capita adjusted for price changes over time (inflation) and price differences between countries – it is measured in international-$ in 2011 prices.



Income growth will continue for most of the world's people unless destroyed by failure to invest, caused by bad government

- Convergence is the story for most of the world, including in Asia and that is great news for people and for markets for California agriculture.
- Rich South Korea was very poor. Poor North Korea is still poor.
- Indonesia, China and India: … growing after a long delay.
- Huge diversity within countries and across countries, so potential markets are almost everywhere
- The shift from Asia to Africa will become crucial.

Income growth and changing markets has benefited demand for some commodities more than others: But, picking winners is not a matter of simple economic evidence.

- Recall, a vibrant US economy (over the long term) underlies most demand for California agriculture.
- But, in the rich world *product innovation* is not income driven
- Demand side competition among commodities and regions for the latest product to catch on is not about economic fundamentals.

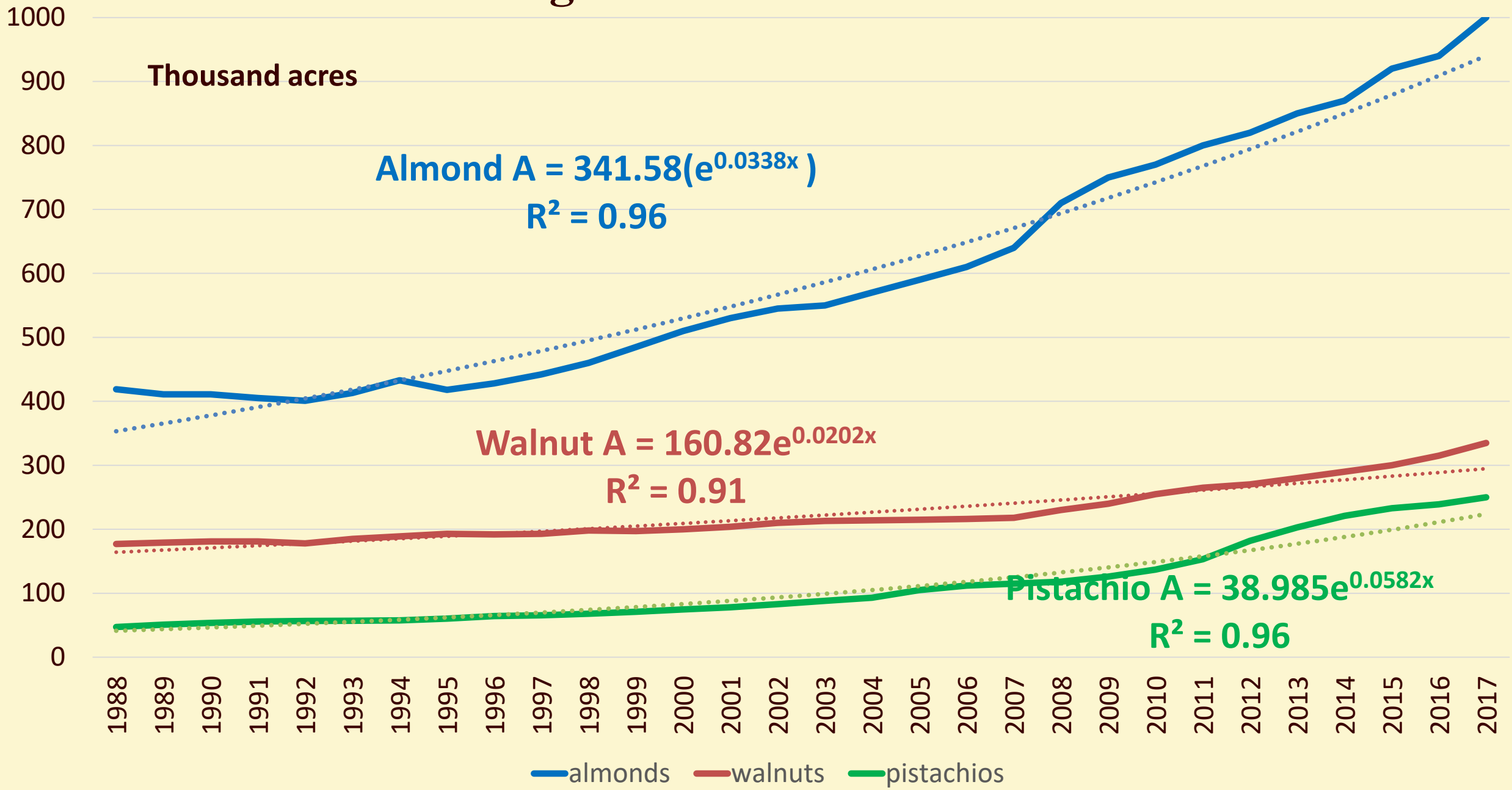
The pandemic food and farm story

1. **Remarkable industry and market resilience**
2. **It could have been so much worse with actual shortages!**
3. **Food has been a huge success story. USDA did the job to keep SNAP, and meal program money flowing**
4. **Others helped those falling through the cracks.**
5. **Disease is tragic, but the food and farm workers have been there as needed, with some disruption (livestock processing)**
6. **For farm economics $37 BILLION plus crop insurance in what turned out to be a (sort of) normal market year.**

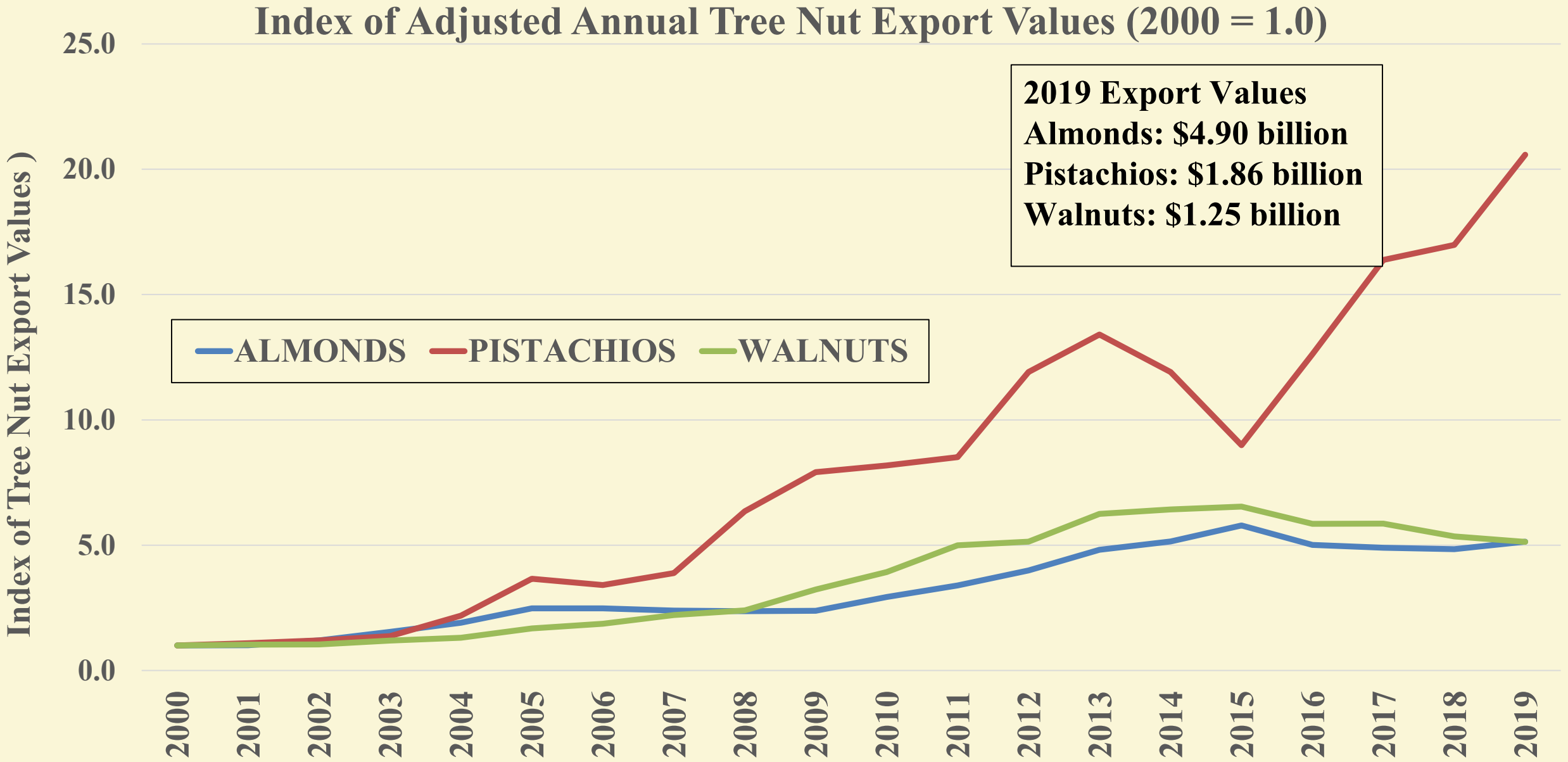
Income growth and changing markets has benefited demand for some commodities more than others: But, picking winners is not a matter of simple economic evidence.

- Avocados took off, kale was great and cauliflower is everywhere: Who knew? All great products, all with a great story. But what is next?
- Can chick peas become a billion dollar crop?
- High investment crops thrive with low interest rates, if they use little labor, they can pay for needed water.
- But, markets must continue to grow.
- The pandemic has paused income growth.
- Long term public investment in innovation has not kept up.

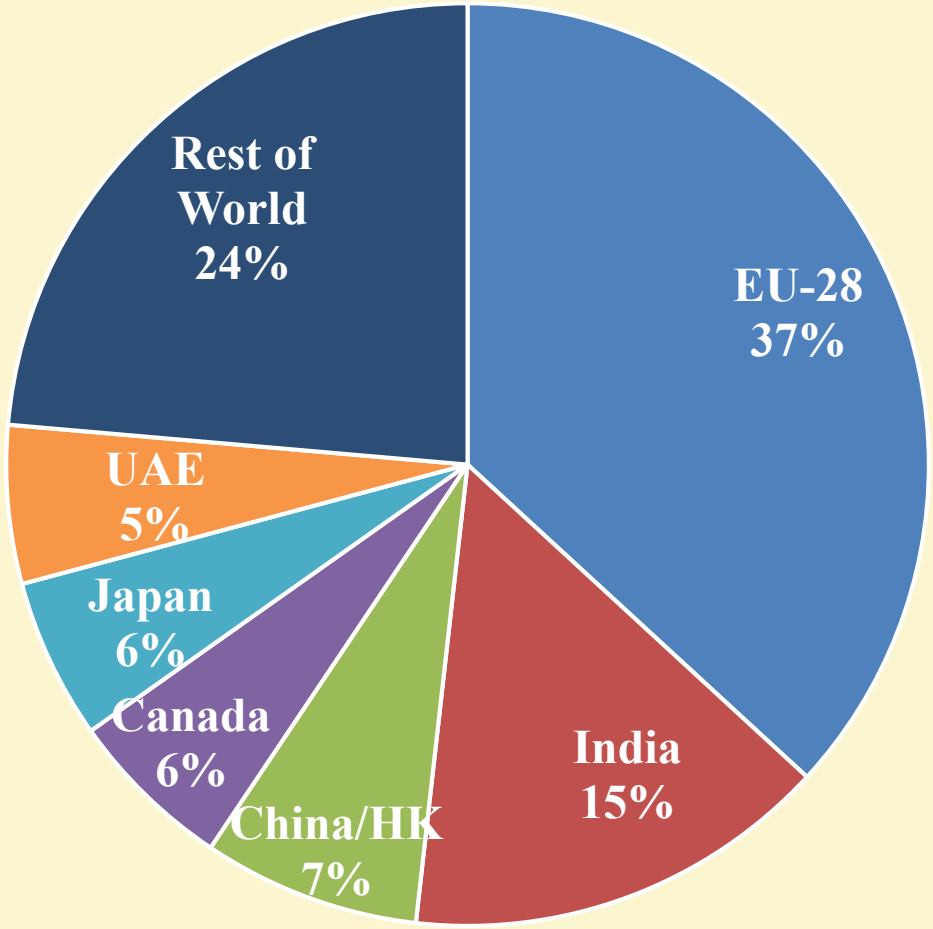
Bearing acres of tree nuts in California



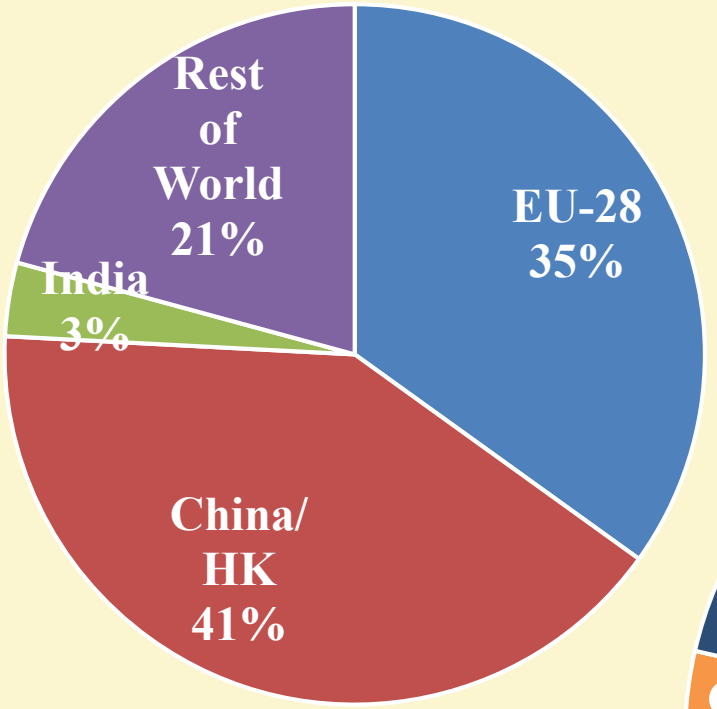
Treenut Exports Trends



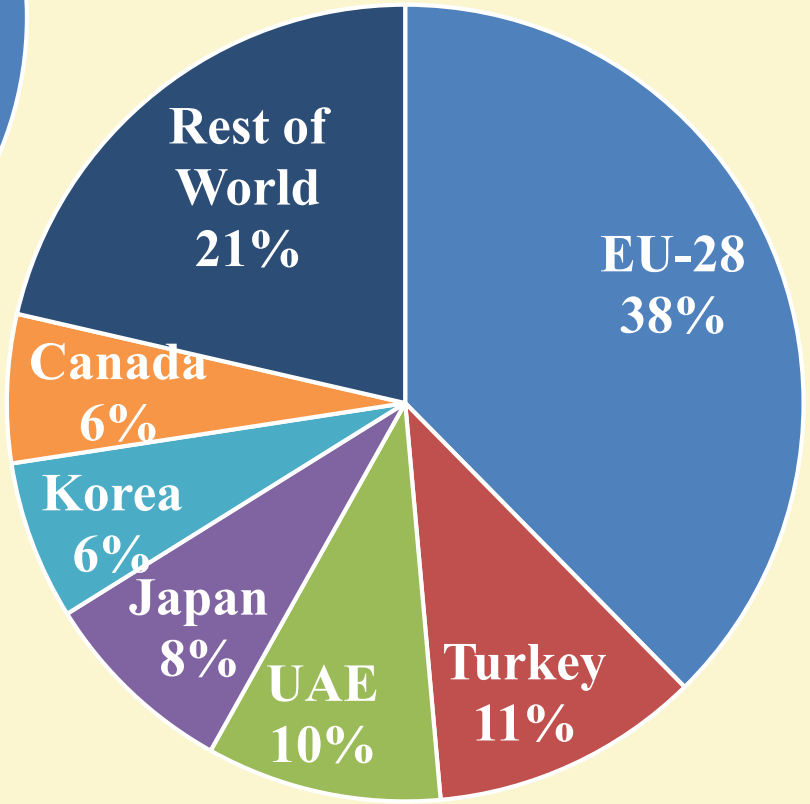
2019 Almond Exports
$4.9B and 805M MT's



2019 Pistachio Exports
$1.86B and 230M MT's



2019 Walmut Exports
$1.25B and 279M MT's

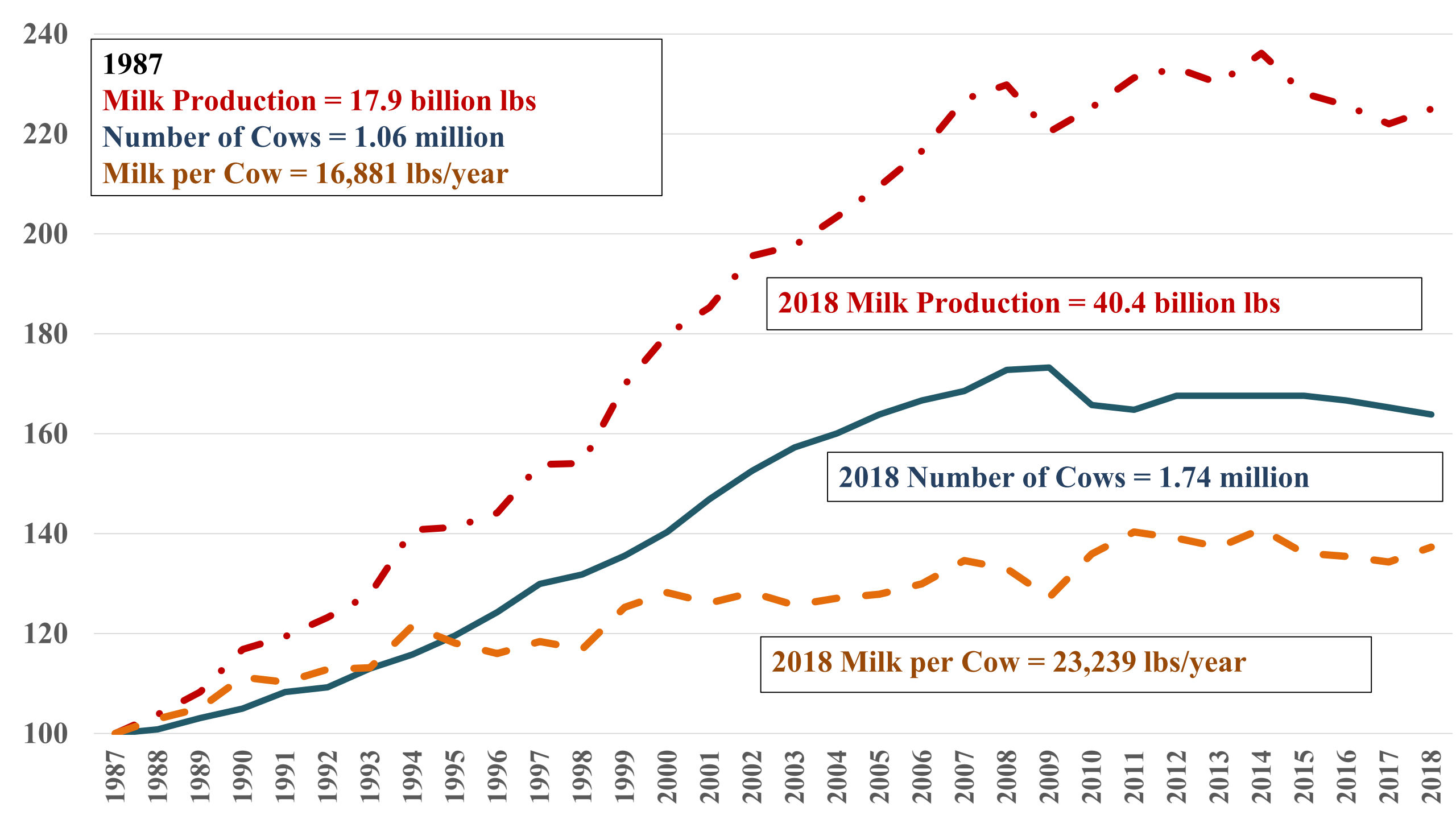


Tree nut growth can continue, but resource limits will bind before demand runs out

- Tree nuts face favorable demand prospects, limited competition and favorable nutrition profiles
- Resource limits on supply means growth rates cannot continue and must reach limits: but where and when?
- Nuts can succeed in competitive water and land markets, but locations that combine suitable micro-climate, soil, topography and secure, reliable water are ever more scarce.
- A million more acres on top of the current more than 2 million? Seems hard to picture more than that.

Dairy is Central to California Agriculture

- Milk is a major value of output
- Milk processing is a vital industry for agricultural counties and the whole economy
- Cow forage (hay and silage) uses more land than any other crop


1987
Milk Production = 17.9 billion lbs
Number of Cows = 1.06 million
Milk per Cow = 16,881 lbs/year
2018 Milk Production = 40.4 billion lbs
2018 Number of Cows = 1.74 million
2018 Milk per Cow = 23,239 lbs/year
240
220
200
180
160
140
120
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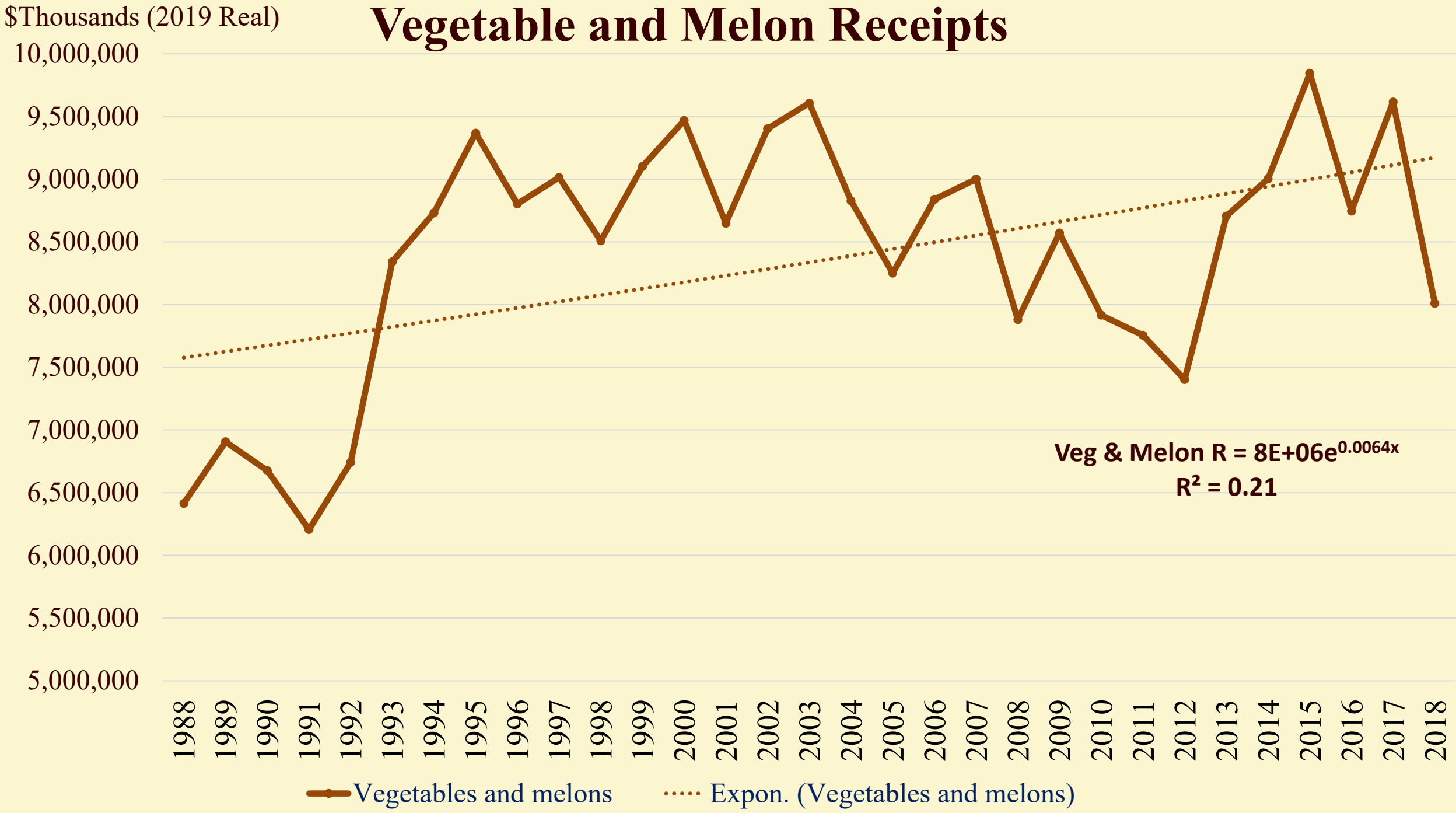
Dairy prospects affect much of the rest of California agriculture

- Dairy growth...stellar for 50 years. The past decade showed new realities
- Global demand growth looks strong! But why dairy in California?
- Farm costs have risen relative to competitive U.S. regions
- Producers elsewhere have adapted “California-style” innovations, while keeping their feed, labor and other cost advantages
- Dairy feed crops cannot compete for land and water near California cows and processing plants
- Relative processing costs have risen, which means lower local farm prices.
- Markets for California milk are most global and highly competitive, so low cost producers dominate. The market for niche dairy is still small compared to our huge dairy production base.
- Growth prospects are limited.

Vegetable and Melon Receipts



Costal fresh produce and wine industries can continue to grow; cattle can maintain its place

- Ranching has long traditions and little competition for more than 10 million acres of pasture. Global demand for quality beef continues. California cow-calf operations are as competitive as any
- California's unique coastal valleys produce for North America competing with imports, but have their own successful profiles.
- Labor costs incentivise innovation in biology and technology
- Fresh vegetables and berries adapted to consumer demands and have grown in importance. That growth can continue.
- Wine from costal valleys and hillsides--high pries and continuing demand
- Water and climate concerns require innovative responses.

What new crop will match the 10-fold growth of pistachios?

- We have no shortage of candidates, but all seem to have limits.
- Cannabis (THC) and hemp (CBD) may be important economic contributors that use little land, and rely on labor, capital and expertise.
- But, what unique California advantage can last for three decades?
- Perhaps chickpeas (garbanzo beans) will be the crop of the future? California is ideally suited to produce this Mediterranean legume. Revenue is about $1,500 per acre, with low water or labor intensity.
- Rapid demand growth in the U.S. fits plant-based diet trends and per capita consumption is now tiny.
- With about 10,000 acres, 10 fold increase could turn a $15 million crop into a $150 million crop.. and up from there. Or, maybe not.

Fundamentals suggest optimism about ability to overcome obstacles and generate growth for California agriculture

1. Rapid change will continue!
2. Labor concerns and water pressures will increase, but unleashing incentives will allow innovation
3. California is suited to food and farm trends, where the key is anticipating complex customer demands
4. Future gains will be derived from adapting to California's unique resources and advantages, including openness to change
5. Governments help by support for investment that firms and farm cannot supply, and setting rules that allow firms to adapt

THANK YOU

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