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The background of the advertisement is a vibrant, futuristic digital landscape. It features glowing blue and green circuit-like patterns that resemble data paths or neural networks. In the center, a glowing globe is surrounded by these patterns. To the left, a laptop is open, displaying a similar digital scene. To the right, a white rocket with a blue nose cone is shown in profile. In the foreground, a red and white bridge structure is visible, with two small human figures standing on it, suggesting a connection between the present and the future. The overall color palette is dominated by blues, greens, and purples, creating a high-tech, futuristic atmosphere.

Your Bridge to the Future

Prospects of AI for Long-Term New Product Forecasting

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Technology Futures, Inc.
& TFI Projects

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**International Symposium
on Forecasting 2023**

June 25-28, 2023
Charlottesville, Virginia USA

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Short-Term vs Long-Term New Product Forecasting

Short-Term

Long-Term

	Short-Term	Long-Term
Time Horizon	Months to a year	Several years or more
Purpose	Operational planning, inventory management	Strategic decision-making, product development
Data	Lots of historical data	Little or no historical data
Methodologies	Statistical models, Machine Learning	Expert / Judgmental, S-shaped Curves, Analogies, etc
Outputs	Short-term sales forecasts	Long-term market demand estimates
Accuracy	Relatively higher accuracy	More uncertainty and variability
Evaluation	Accuracy	Good strategic business decisions

This chart created with the assistance of ChatGPT 3.5, 6/16/2023, Prompt: “Make a table comparing short-term and long-term new product forecasting

Product Forecasting Typology*

- Existing Products
- Routine New Products
 - New to the Firm
 - Additions to Existing Product Lines
 - Improvements and Revisions to Existing Products
 - Simple New-to-the-World Products
- Truly New-to-the-World Products

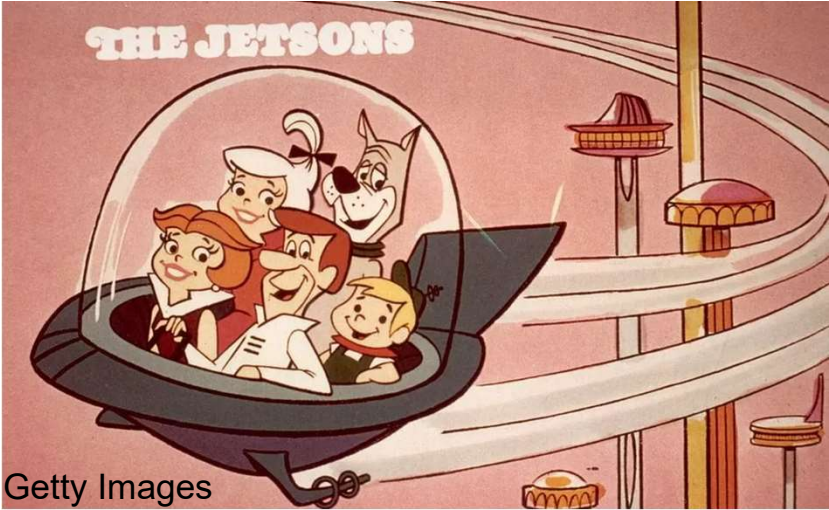
***Applies to Services and Technologies Too**

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Flying Taxis!



A Joby Aviation Air Taxi is seen outside of the New York Stock Exchange (NYSE) ahead of their listing in Manhattan, New York City, U.S., August 11, 2021. REUTERS/Andrew Kelly/File Photo



Getty Images



Bradley Wentze

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AI and Product Forecasting

	Existing Products	Routine New Products	Truly New Products
AI Literature	Broad	Minimal	Scant
Contests	M4 and M5	M4 & M5 informative	Unknown
AI Strengths	Leverages cross-learning across products and simple explanatory variables	Same as Existing Products	Hopefully, the same and more
Historical Data	Lots of historical data	Lots of historical data for similar products	Some historical data for analogous products
Time Horizon	Short-term	Short-term	Long-term
AI Methods	ANN & GBT	ANN & GBT	To be determined
AI Status	Proven superior to statistical methods in many cases	Appears to be useful in improving accuracy over customary methods	Pre-Exploratory

Using ChatGPT to Generate a Forecast for Flying Taxis

- Used free ChatGPT-3.5 at <https://chat.openai.com>
- First Try! No further tailoring of query.
- Date: June 16, 2023
- Prompt: Provide a quantitative long-term forecast for the adoption of flying taxis

LV

Provide a quantitative long-term forecast for the adoption of flying taxis

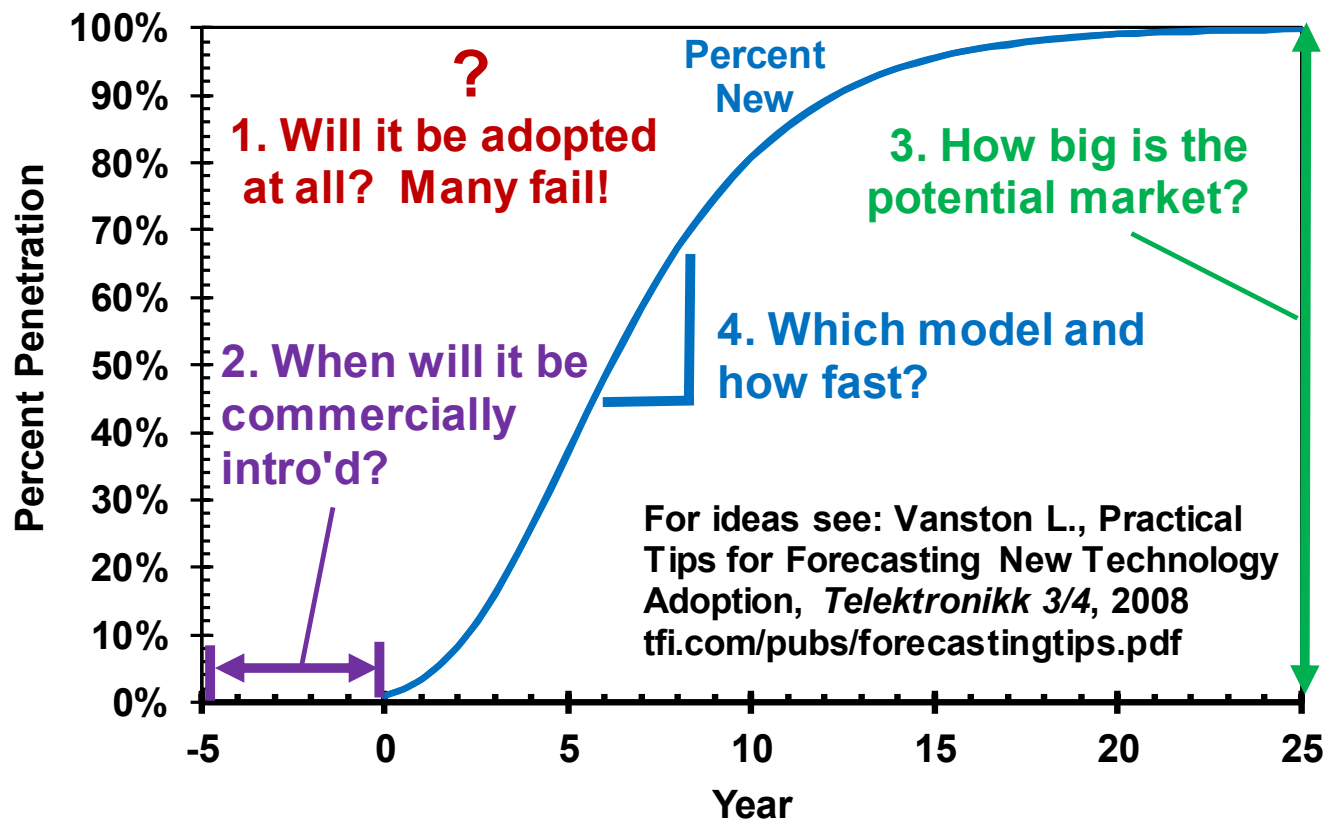


As an AI language model, I don't have access to real-time data or the ability to generate real-time forecasts. Additionally, predicting the long-term adoption of flying taxis would involve complex market analysis, technological advancements, regulatory considerations, and various other factors that are subject to change. It's also worth noting that the adoption of flying taxis is still an emerging field, and there is significant uncertainty surrounding its future trajectory.

To generate a quantitative long-term forecast for the adoption of flying taxis, you would need access to comprehensive industry data, market research, and expertise in forecasting methodologies. It would require analyzing factors such as consumer demand, regulatory developments, infrastructure requirements, cost considerations, and competitive dynamics. Professionals in the aviation industry or transportation market research organizations are better equipped to provide informed and data-driven long-term forecasts for the adoption of flying taxis.

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The Four Big Questions of Long-Term New Product Forecasting



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Long-Term Forecasting Approaches to New Product Forecasting

- Expert Opinion / Judgmental
- S-Shaped Curves & Analogies
- Multiple-Trend Analysis
- Drivers and Constraints

Expert Opinion / Judgmental

- Surveys, e.g., Delphi Method
- Structured Interviews
- Group Exercises
- Literature/Media review
- Scenarios

Using ChatGPT to Generate Scenarios for Flying Taxis

- Used free ChatGPT-3.5 at <https://chat.openai.com>
- First Try! No further tailoring of query.
- Date: June 16, 2023
- Prompt: Generate three alternative scenarios for the future of flying taxis



Generate three alternative scenarios for the future of flying taxis



Scenario 1: Ubiquitous Urban Air Mobility

In this scenario, flying taxis become a common mode of transportation in urban areas. The technology and infrastructure supporting flying taxis advance rapidly, enabling efficient and safe operations. The airspace is managed effectively, and regulations are established to ensure the integration of flying taxis with existing transportation systems. Flying taxis become an integral part of urban mobility, reducing traffic congestion, shortening commute times, and providing convenient transportation options for individuals and businesses alike. The market for flying taxis grows exponentially, attracting significant investments and competition among manufacturers and service providers.

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Scenario 2: Niche Premium Service

In this scenario, flying taxis remain a niche and premium service catering to high-end customers. The technology for flying taxis advances, but concerns over safety, noise pollution, and regulatory challenges limit their widespread adoption in urban areas. Instead, flying taxis find their niche in providing luxurious and exclusive transportation experiences, serving wealthy individuals, celebrities, and executives. These flying taxis offer personalized services, comfortable cabins, and unique routes for scenic tours or rapid travel between luxury destinations. While the market remains small, it sustains profitability through premium pricing and exclusivity.

Scenario 3: Rural Connectivity and Emergency Response

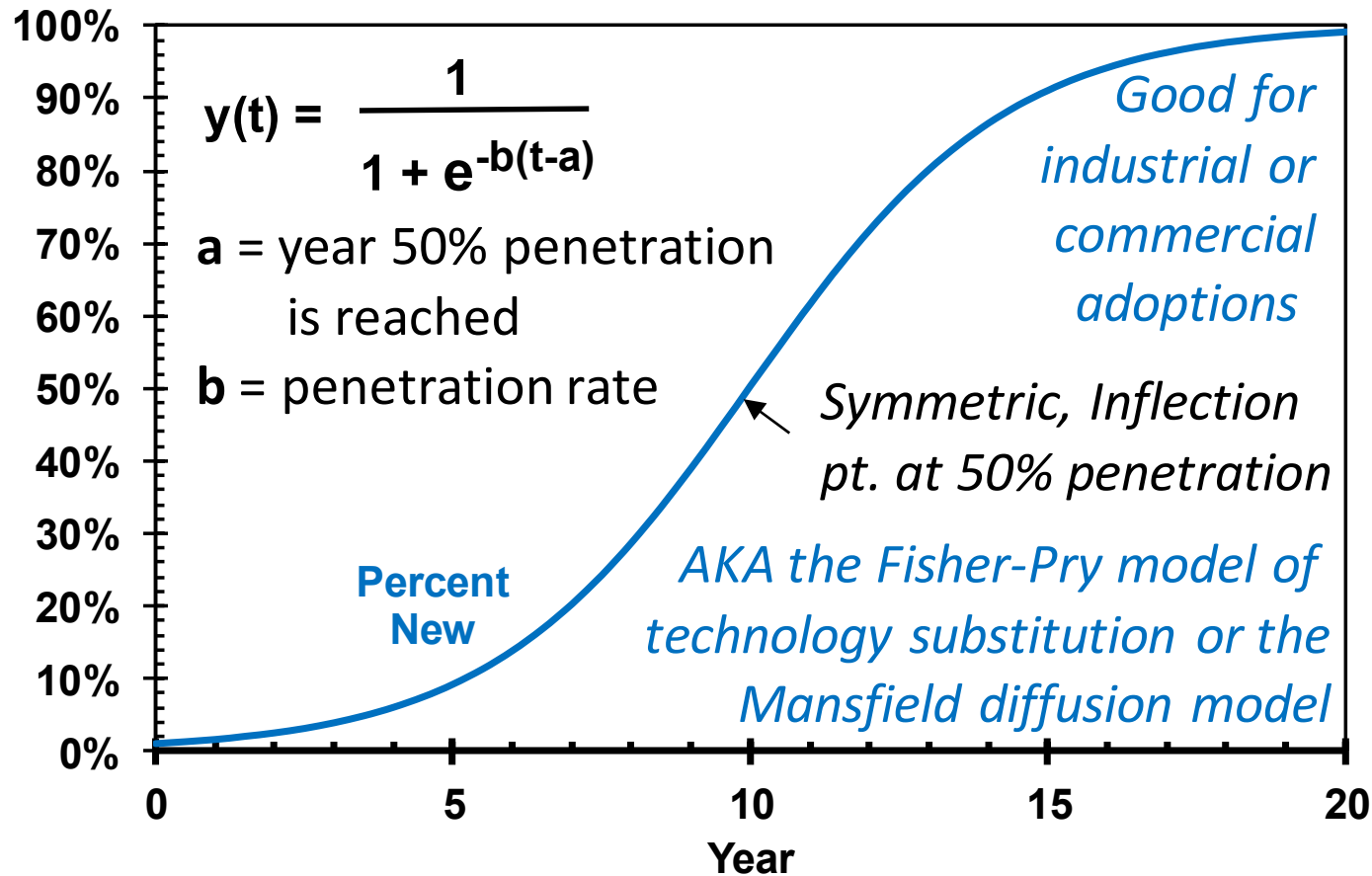
In this scenario, flying taxis primarily serve rural areas and play a crucial role in enhancing connectivity and emergency response. Recognizing the challenges of building extensive ground infrastructure, rural regions invest in flying taxi technology as a means to overcome geographical barriers and improve transportation accessibility. Flying taxis connect remote communities, transport medical personnel and supplies to remote locations, and assist in emergency situations such as natural disasters or medical emergencies. While the urban market for flying taxis may still be limited, this scenario showcases their potential to serve critical needs in rural areas and emergency situations.

It's important to note that these scenarios are speculative and based on current trends and assumptions. The actual future of flying taxis will depend on various factors, including technological advancements, regulatory frameworks, public acceptance, and market dynamics.

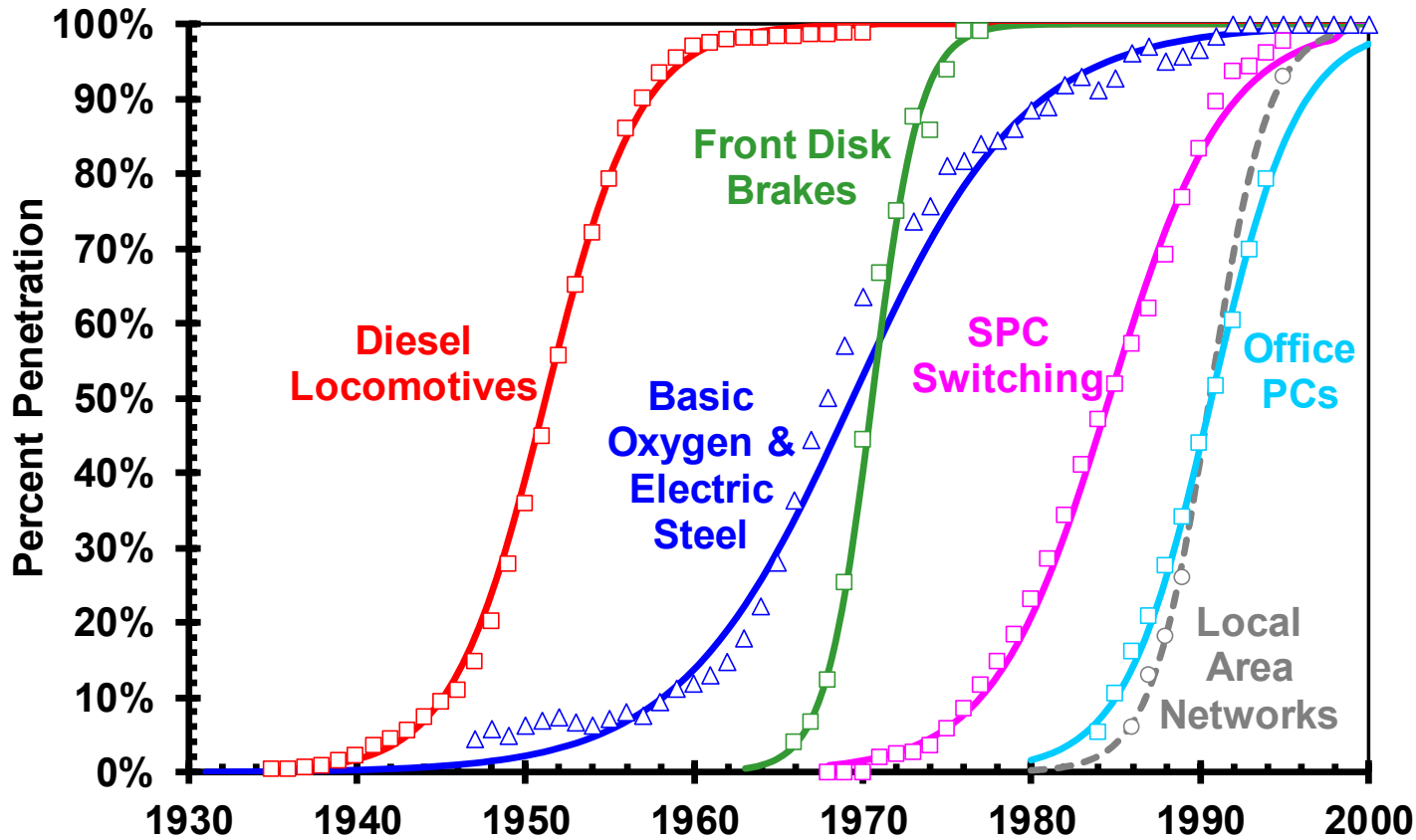
S-Shaped Curves and Analogies

- Simple 2-3 parameter models + extensions that reflect the fundamentals of technology change
- Measure percentage penetration of new product
- Generally, used to forecast the total market for a new product
- Most common models: Logistic, Gompertz, and Bass
- Various extensions for special cases in the literature and in practice
- Curve fitting and/or analogies can be used to estimate parameters

Logistic Model

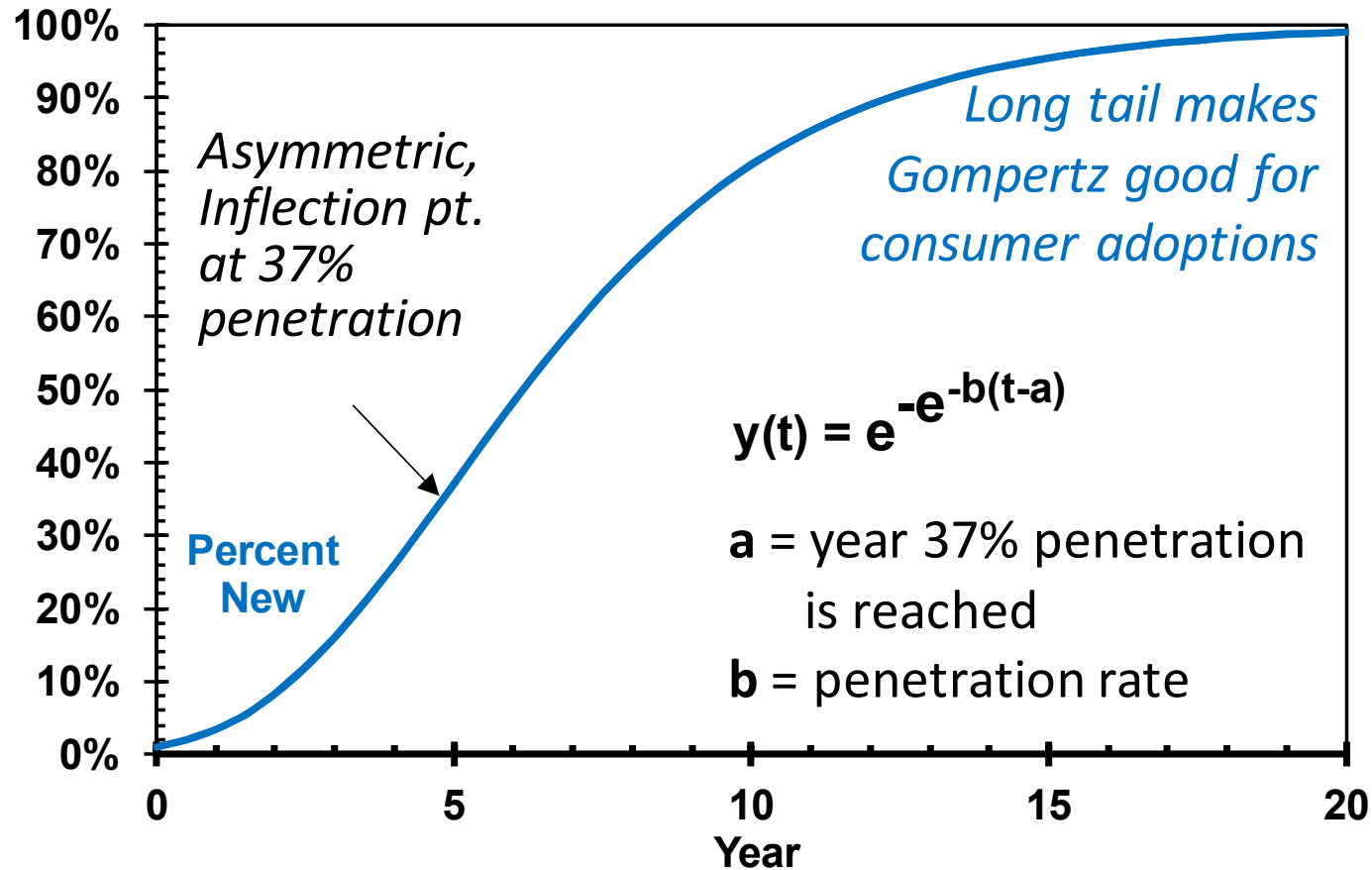


Classic Industry Examples (Logistic)



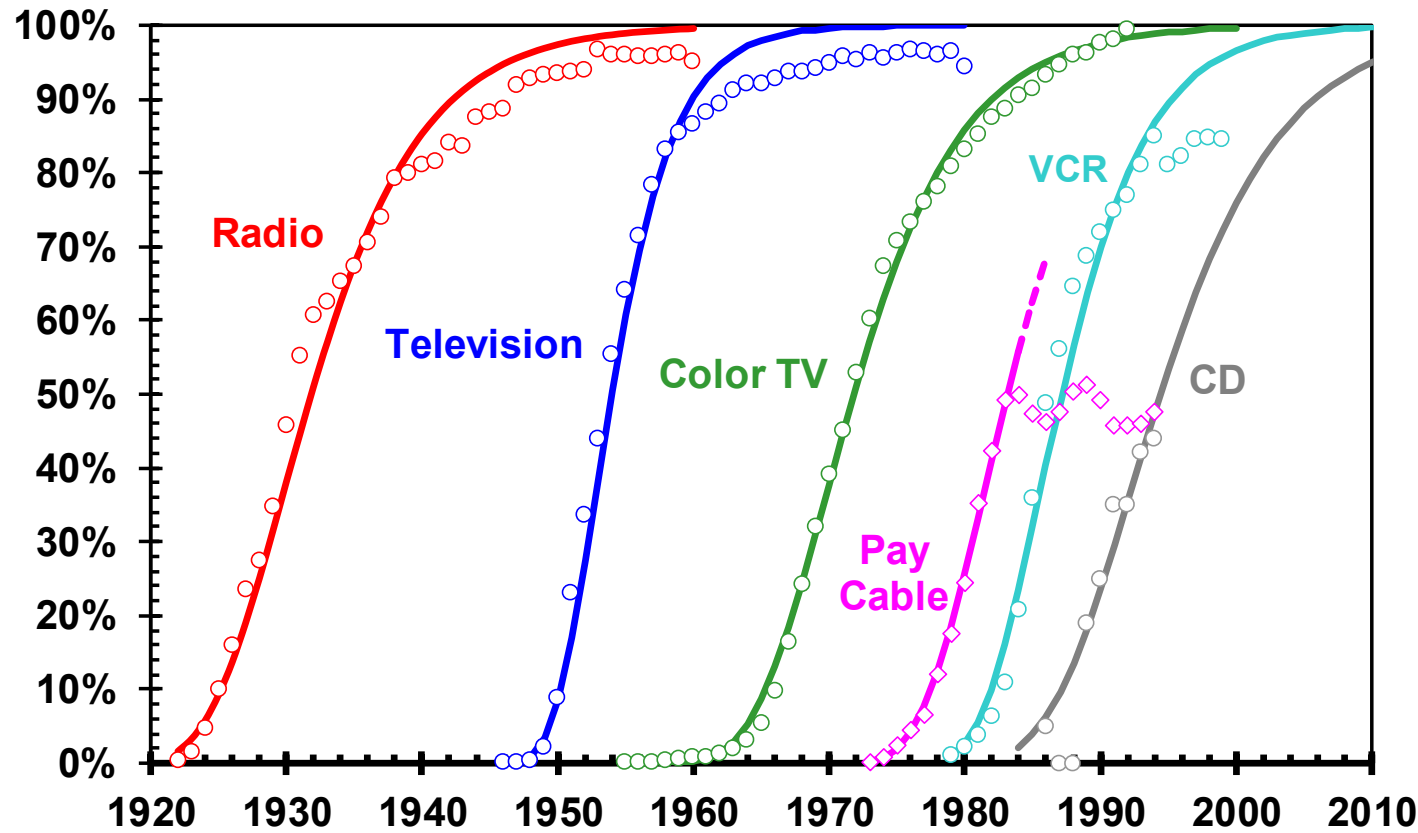
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The Gompertz Model



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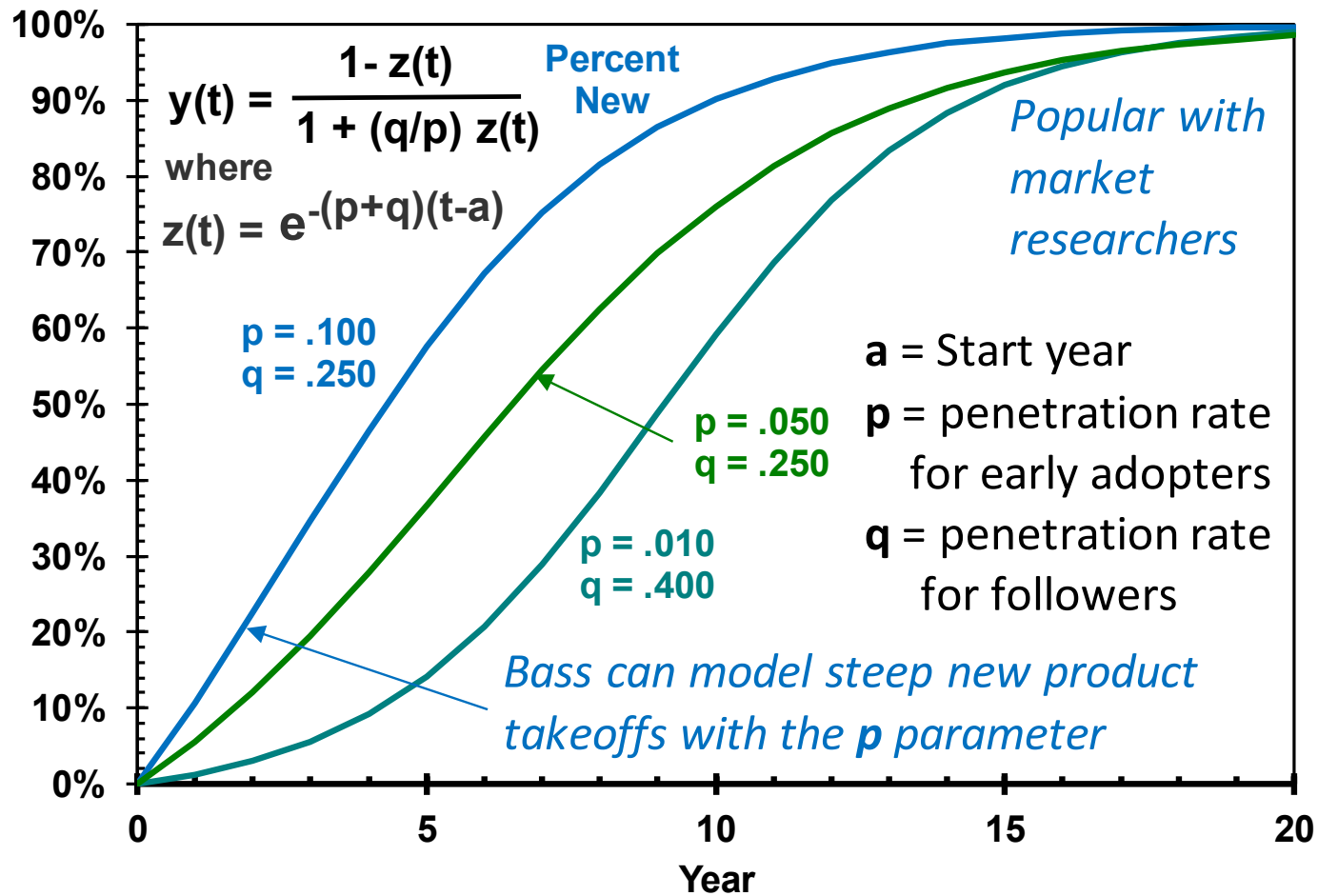
Classic Consumer Examples (Gompertz)



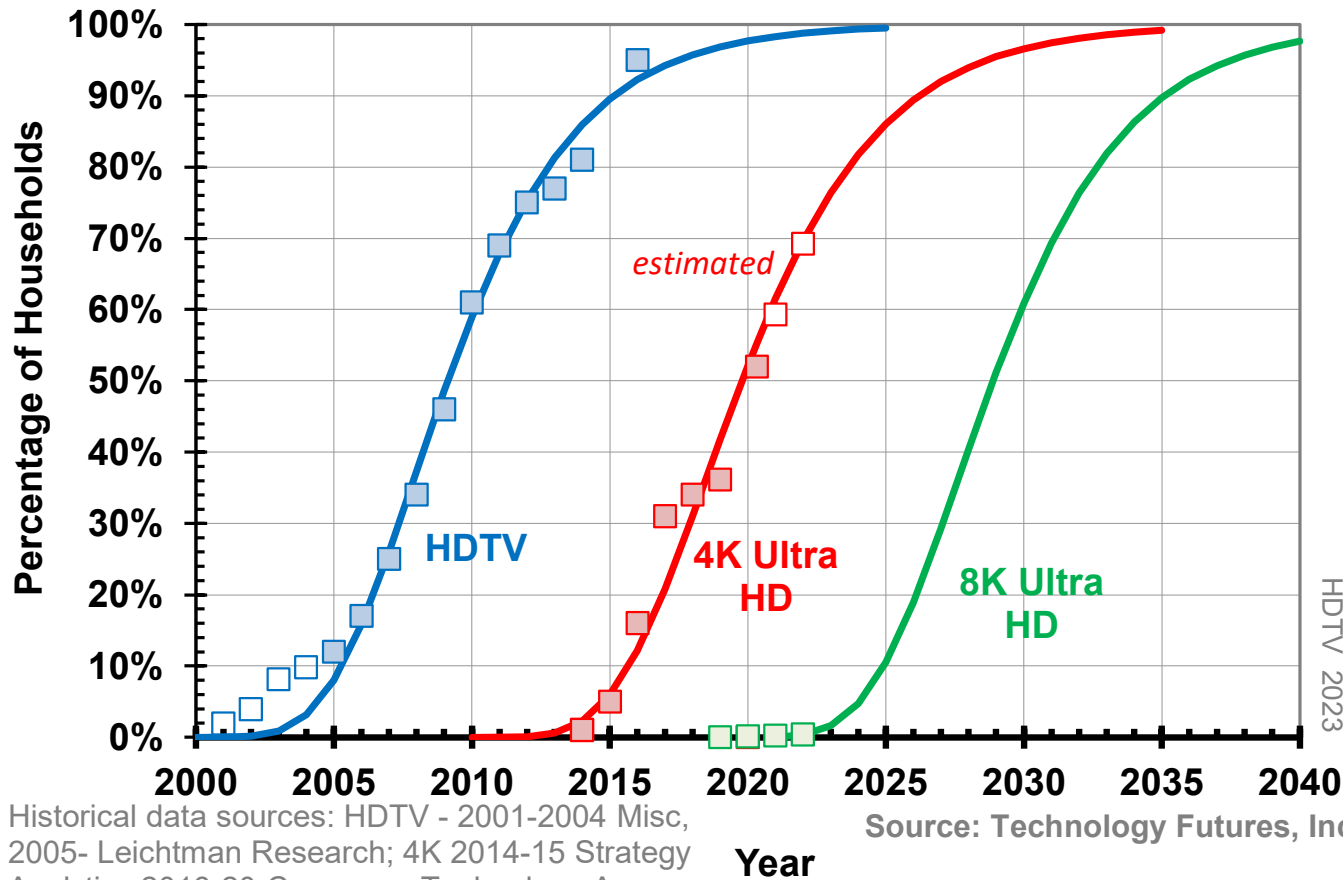
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Bass Model



Ultra HD Households (4K and 8K) - 2023 TFI Forecast



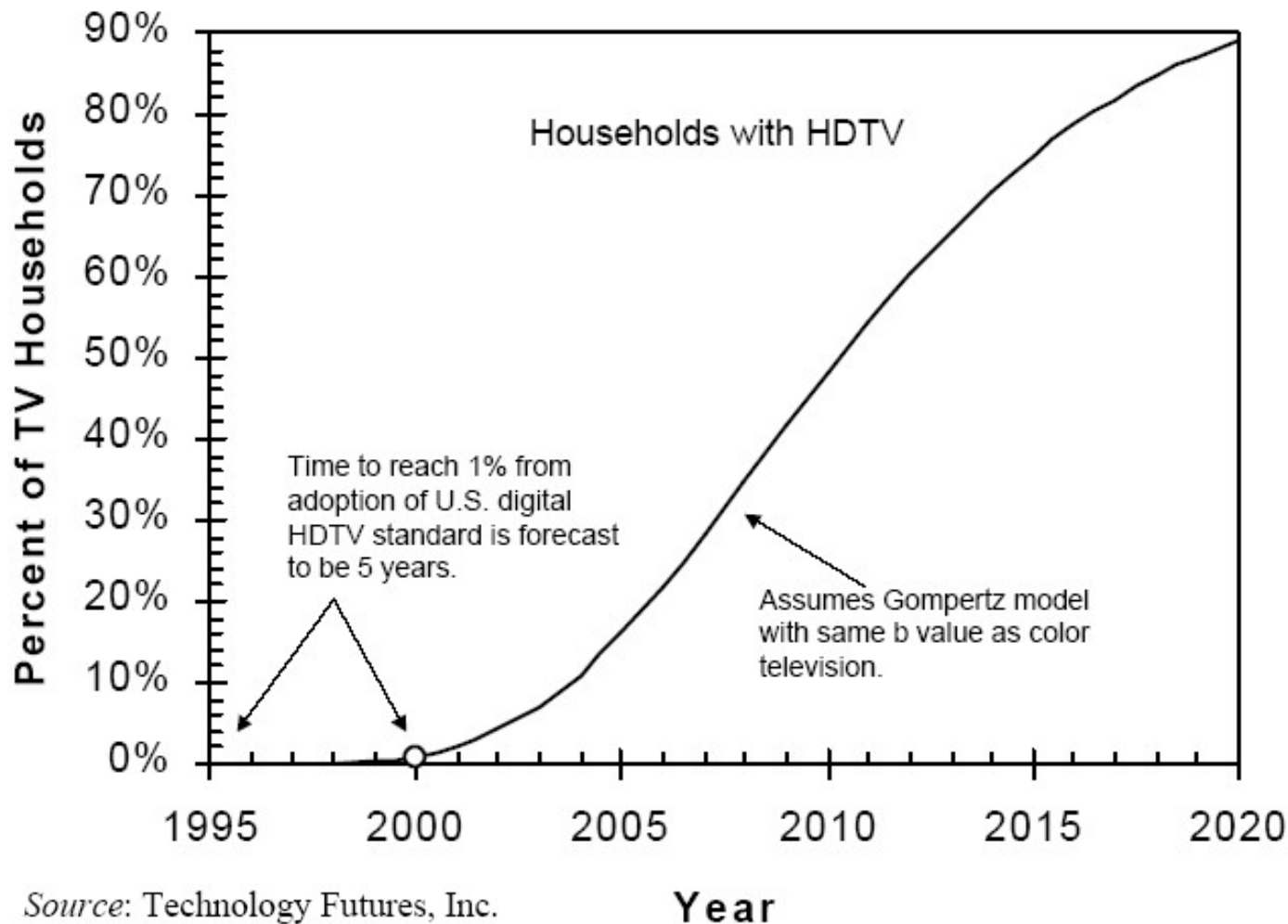
Historical data sources: HDTV - 2001-2004 Misc, 2005- Leichtman Research; 4K 2014-15 Strategy Analytics, 2016-20 Consumer Technology Assc 8K - 2019-20 Strategic Analytics, 2021-23 Trendforce

Source: Technology Futures, Inc.



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HDTV Households (USA) - 1995 TFI Forecast



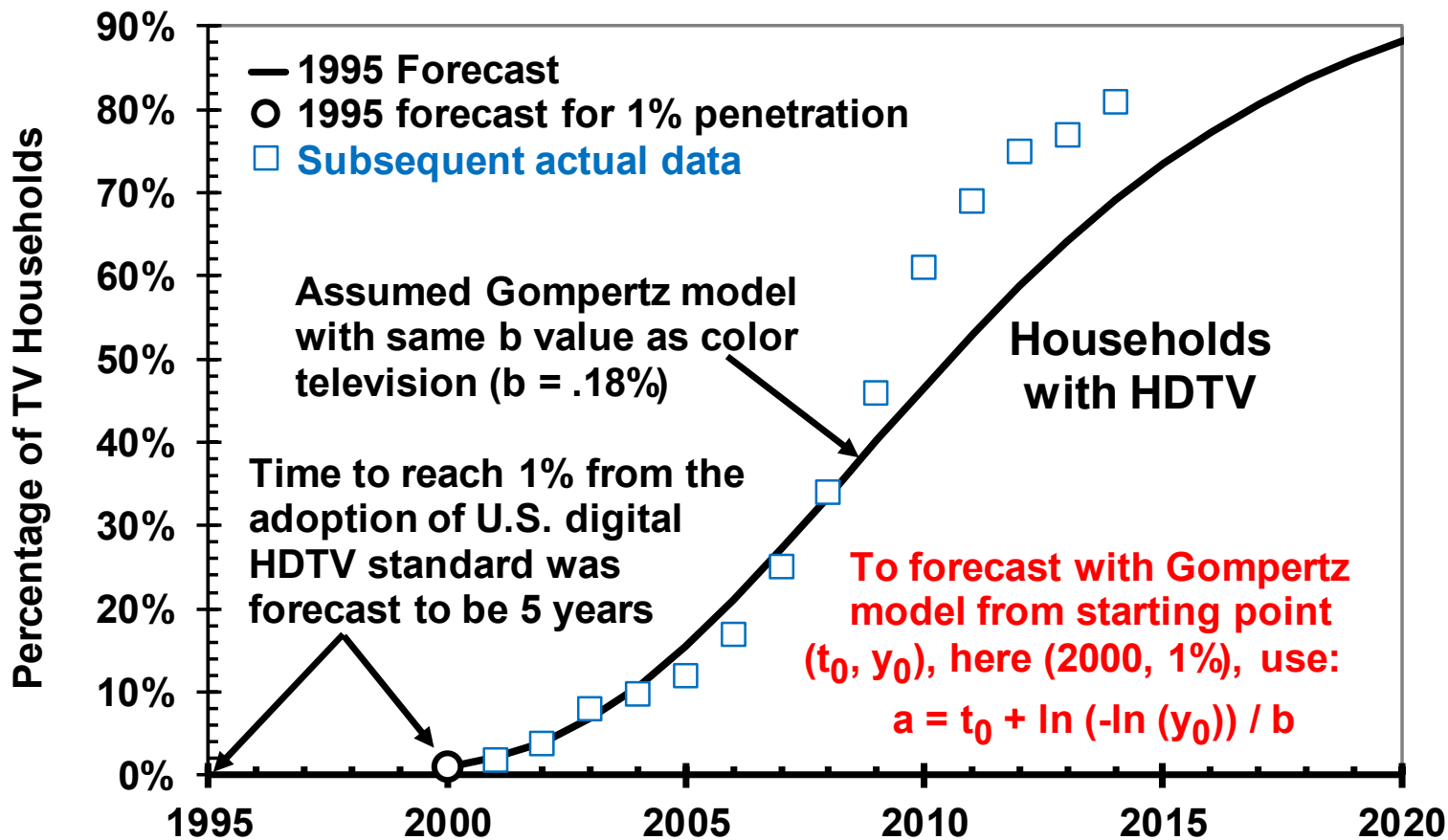
Source: Technology Futures, Inc.

Lawrence K. Vanston, Curt Rogers, and Ray L. Hodges, *Advanced Video Services—Analysis and Forecasts For Terrestrial Service Providers*, Technology Futures, Inc., 1995, p. 106. This graphic appears in *Introduction to Technology Market Forecasting*, 1996, p.25.

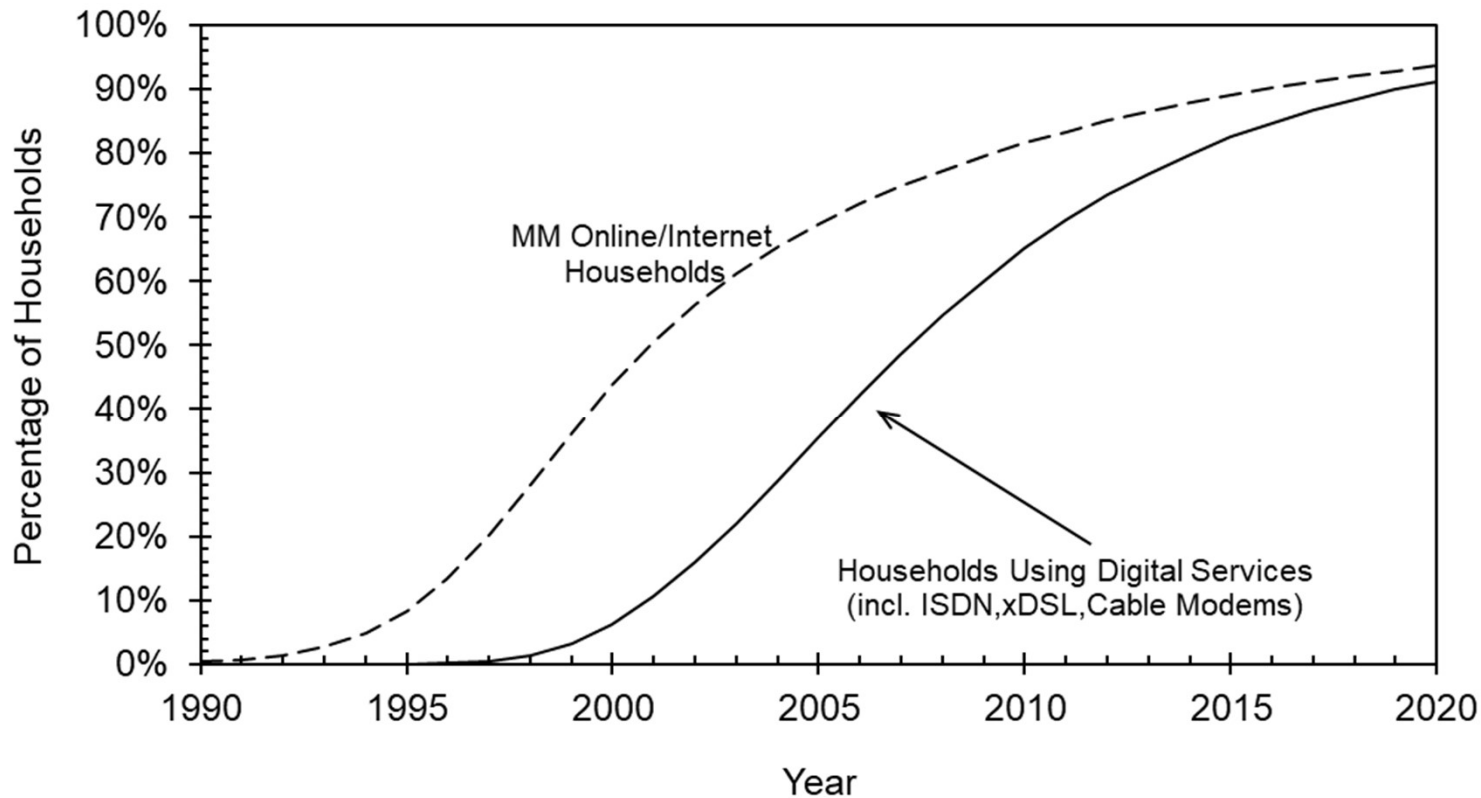
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HDTV Households (USA) - 1995 TFI Forecast



Forecasting Using Analogies – Digital Households (USA) - 1999 TFI Forecast



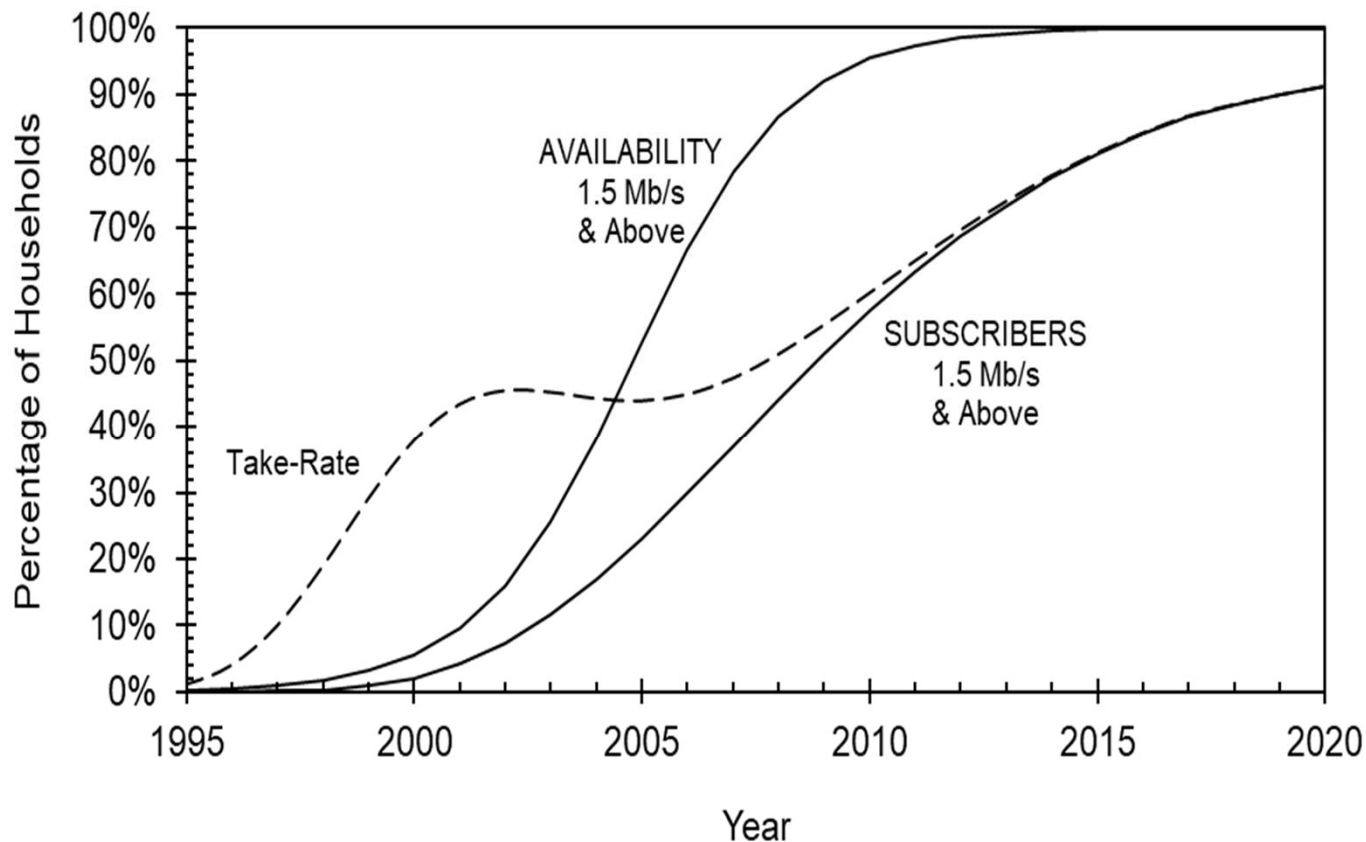
Analogy	b
Radio	.1803
Color TV	.1843
Television	.3175
CD Player	.1651
VCR	.2337
Pay cable	.2121
Average	.2155

Lawrence Vanston, *Forecasts for Internet/Online Access*, Presentation to 17th Annual ICFC Conference, Denver, Colorado, June 15-18, 1999.

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Multiple Trend Analysis

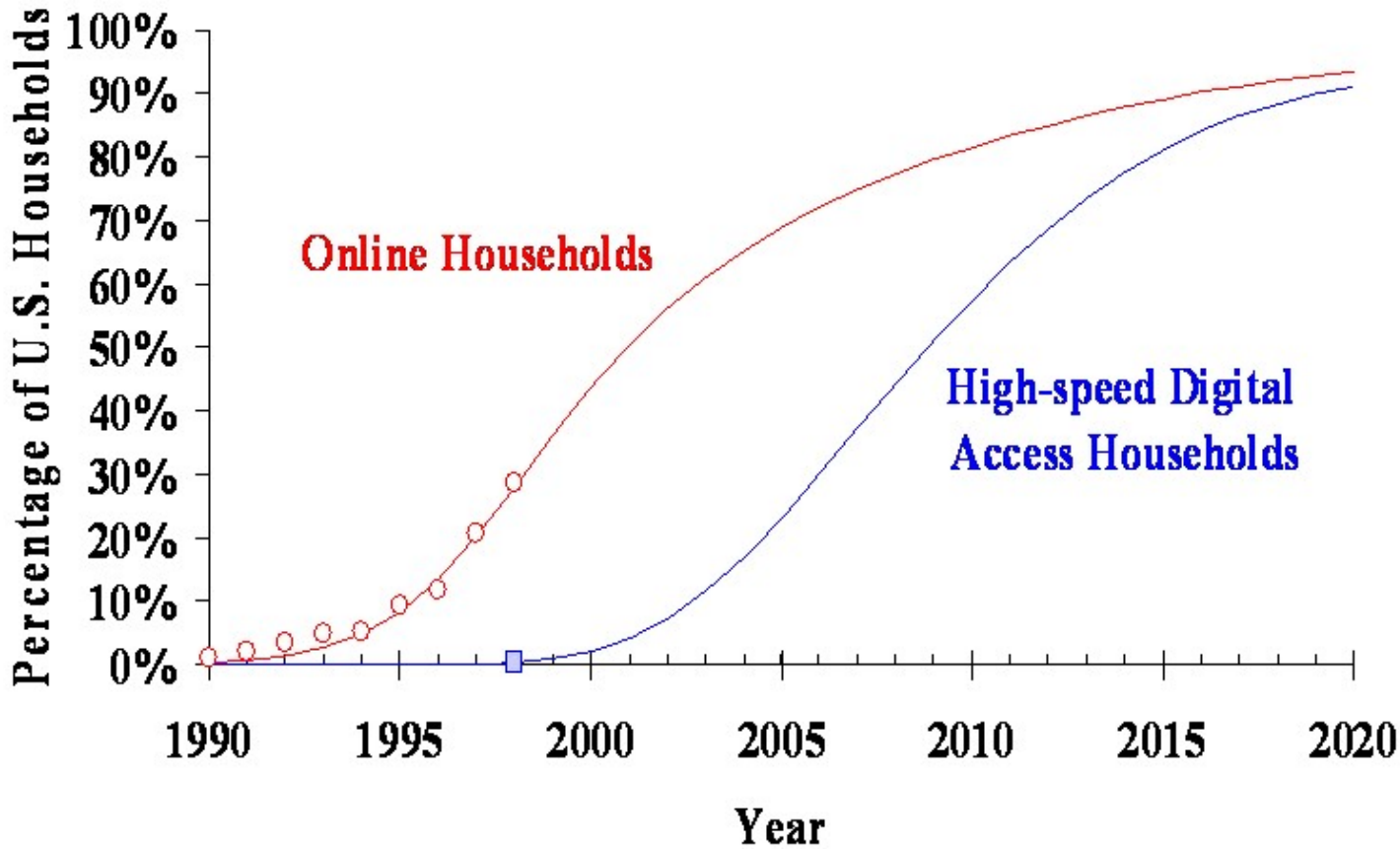
Broadband Availability vs Subscribers – 1999 TFI Forecast



The quantitative relationship is based on analogies to other adoptions, specifically, cable television, pay cable, and pay-per-view. See L. K. Vanston, J. A. Marsh, and S. M. Hinton, *Telecommunications for Television/Advanced Television* (1992) pp 123-144 (Austin, TX: Technology Futures, Inc.).

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Broadband Households (USA) - 1999 TFI Forecast

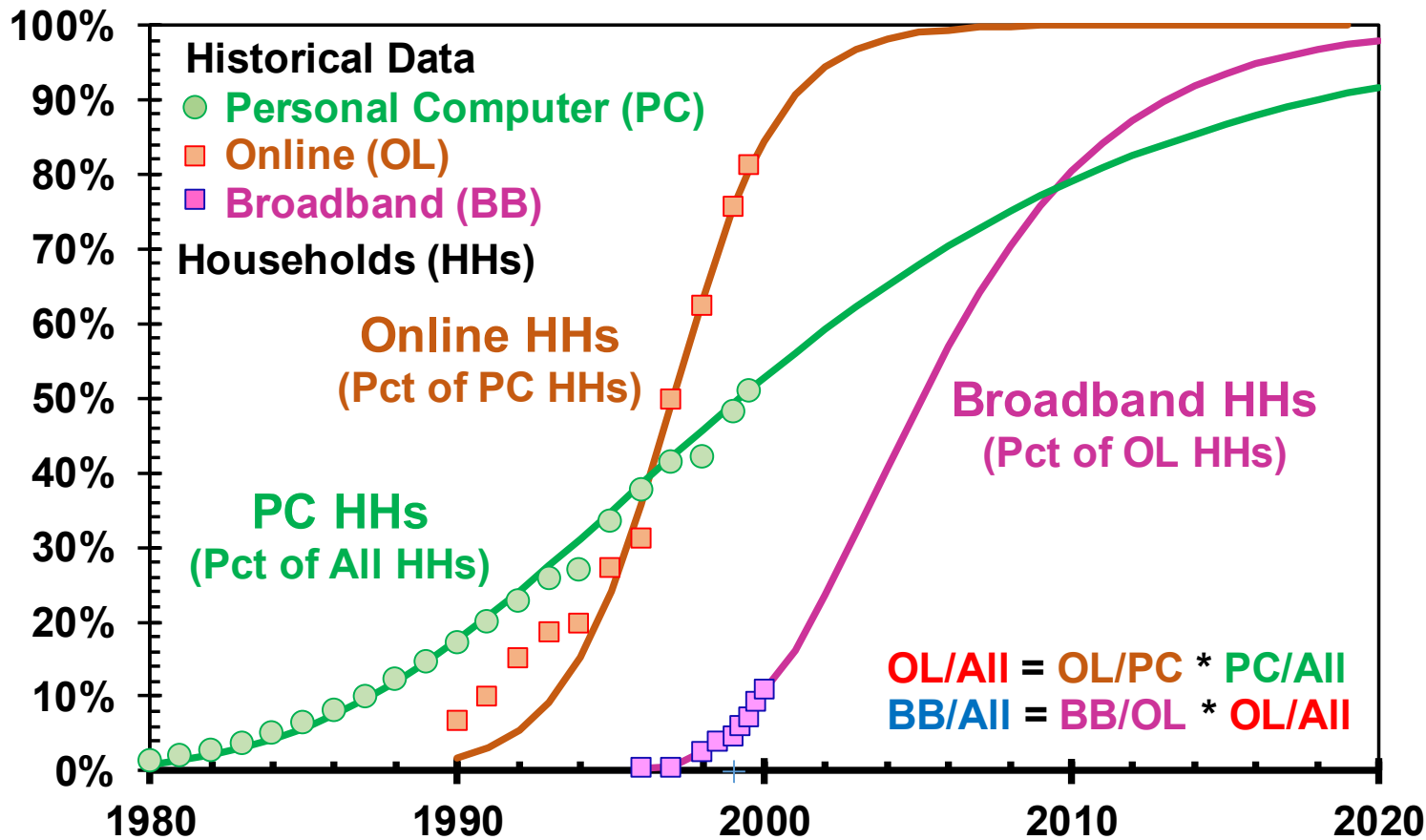


Lawrence Vanston,
*Forecasts for
Internet/Online Access,*
Presentation to 17th Annual
ICFC Conference, Denver,
Colorado, June 15-18, 1999.

Used a forecast of
broadband availability
to limit penetration.

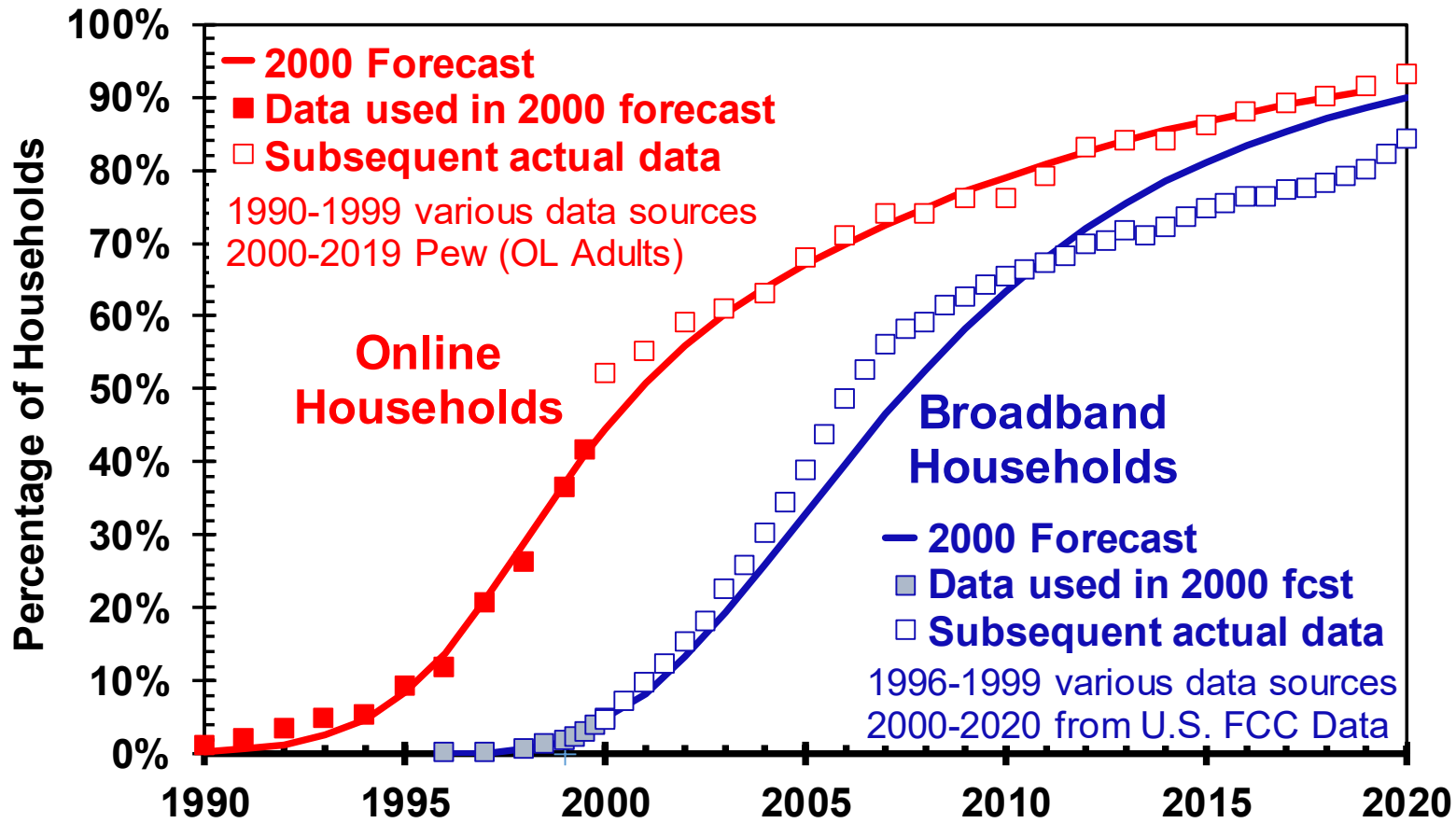
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Broadband Households (USA) - 2000 TFI Forecast



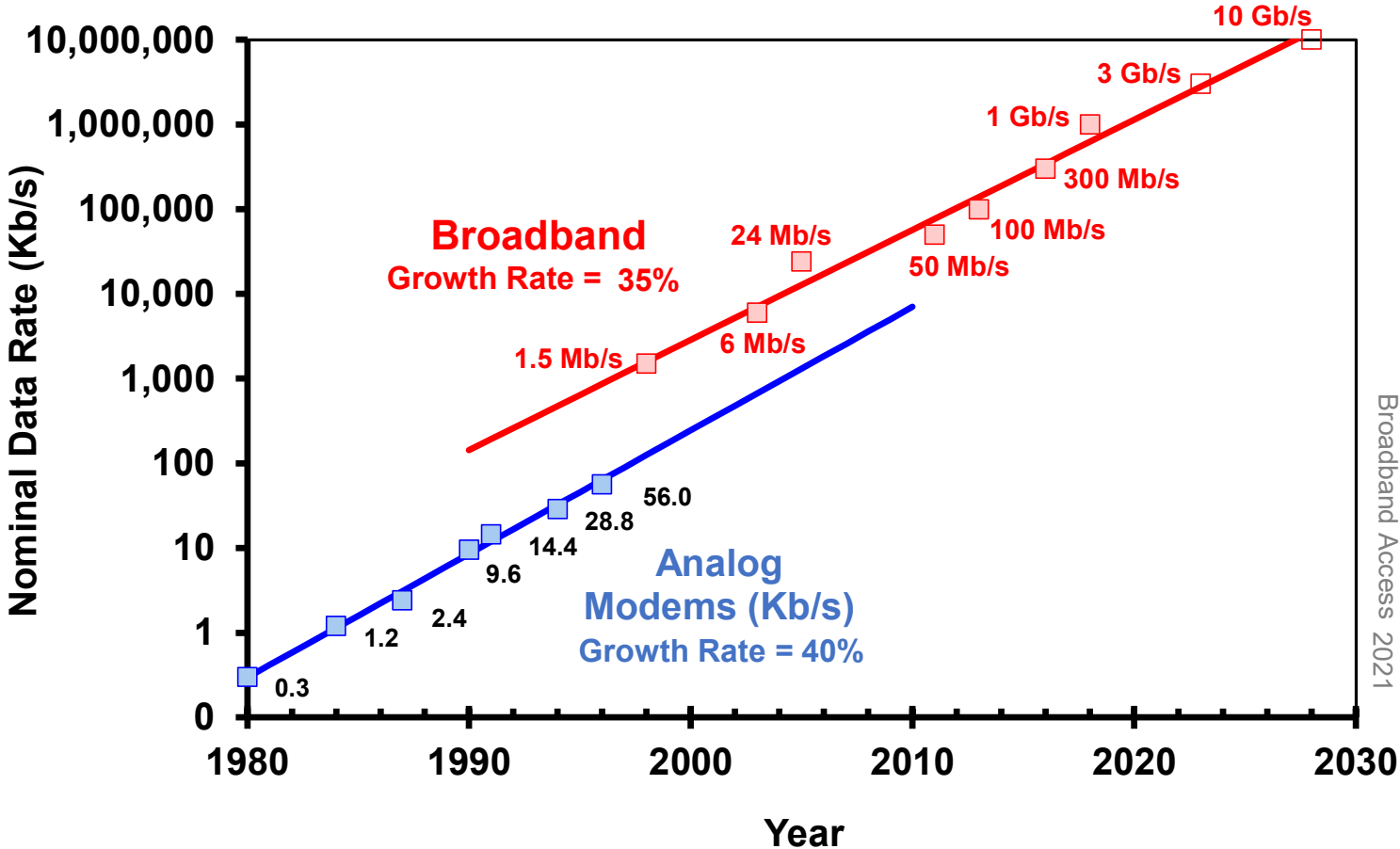
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Broadband Households (USA) - 2000 TFI Forecast



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Broadband Performance Milestones



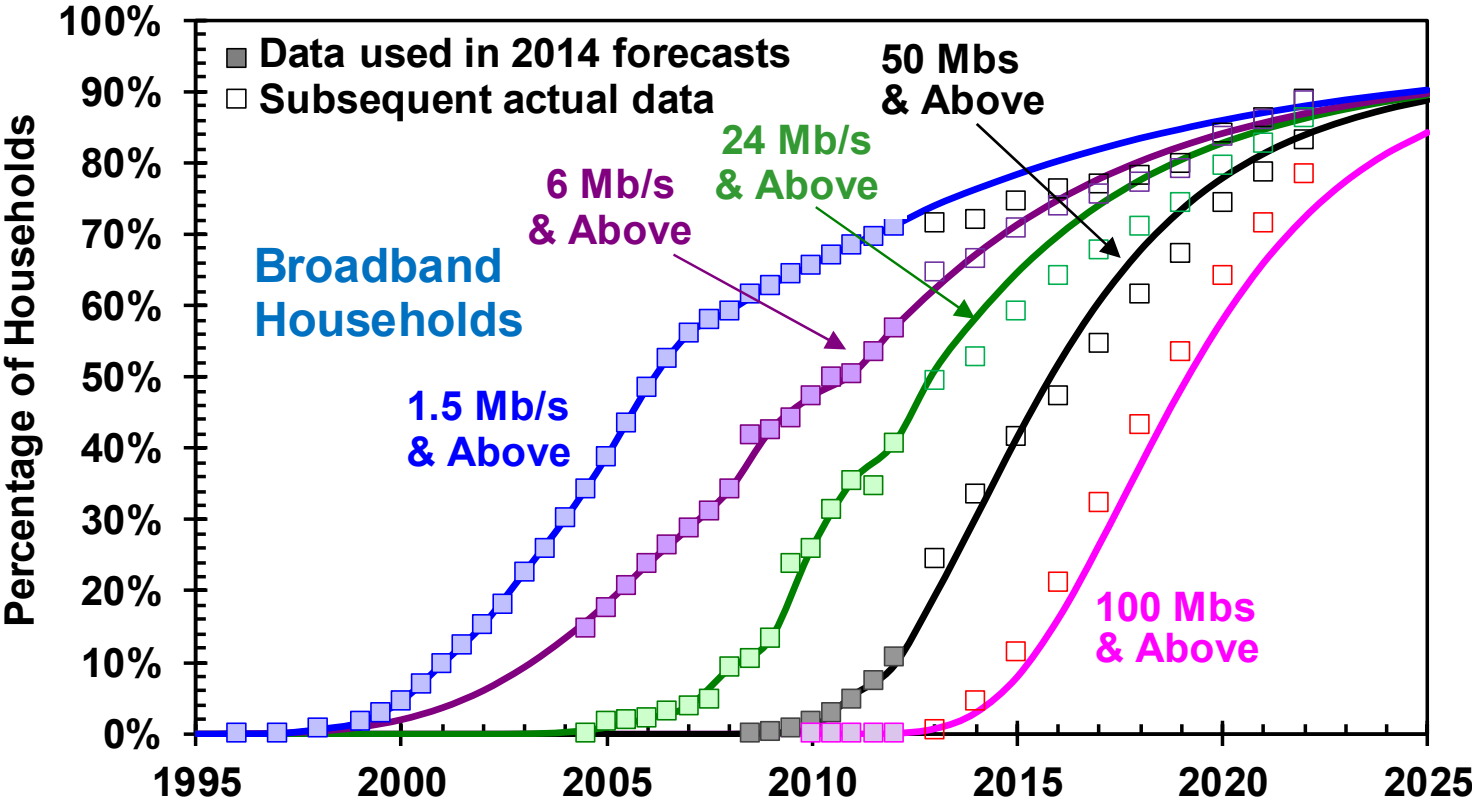
Broadband Access 2021



Source: Technology Futures, Inc.

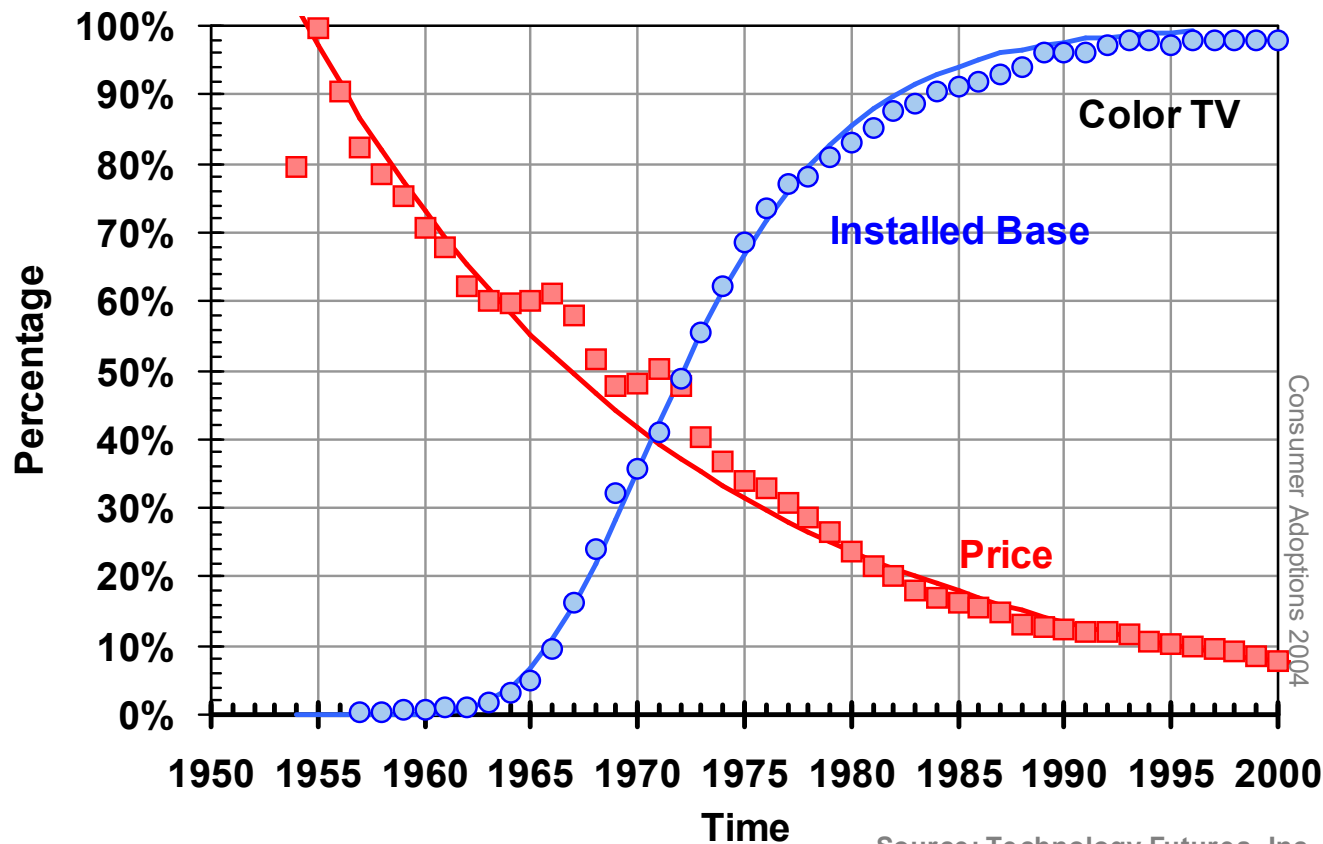
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Overlapping Generations – 2014 BB Forecast



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Price vs Adoption Relationship



Lawrence Vanston,
*Examining the Impact of
Price and Other Factors on
Forecasting for Technology
Adoption Rates*, IRR
Telecoms Market Forecasting
Conference, Lisbon,
Portugal, Sep 25-28, 2006

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Drivers and Constraints

- What are the drivers for adoption?
 - How strong are they?
- What are the constraints on adoption?
 - How strong are they? Can they be overcome?
- What is the balance of drivers and constraints?
 - Will this change?
- What are the important areas of uncertainty that need to be resolved?
 - How can these be addressed to everyone's satisfaction?

Drivers and Constraints Example

Forecasting AI for Forecasting, July 2018

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Forecasting AI and Thoughts on the Future of Forecasting

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24th IIF Workshop
Forecasting for Social Good

July 12-13, 2018
Cardiff, UK

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AI in Forecasting

- Over 20 years old
- Competitive in some applications with traditional methods
- Improvement over time
- Mixed AI/Statistical model won the 2018 M4 Competition ([Slawek Smyl](#), Uber Technologies)
- Presentations by major AI players at ISF 2018 in Boulder

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Constraints on AI in Forecasting

- Computation Intensive
- Large data requirements for training
- Over-fitting and instability
- Not always the most accurate
- Black Box
- AI's lack of insight
- Not as familiar to forecasters

Can these constraints be overcome?

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Can these constraints be overcome?

- Computation Intensive - ✓ ✓ ✓
- Large data requirements for training ✓ ✓
- Over-fitting and instability ✓ ✓
- Not always the most accurate ✓ ✓ ✓
- Black Box ✓ ✓
- AI's lack of insight ✓
- Not as familiar to forecasters ✓ ✓ ✓

Current Assessment: Yes, likely, to the extent that AI progress will continue and AI will likely substitute for traditional methods

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Using ChatGPT to Generate Drivers and Constraints for Flying Taxis

- Used free ChatGPT-3.5 at <https://chat.openai.com>
- First Try! No further tailoring of query.
- Date: June 12, 2023
- Prompt: What are the drivers and constraints on the adoption of flying taxis in the future?



What are the drivers and constraints on the adoption of flying taxis in the future



The adoption of flying taxis in the future is influenced by various drivers and constraints. Here are some key factors that impact their adoption:



Drivers:

1. Congestion and traffic reduction: Flying taxis can alleviate traffic congestion in urban areas by utilizing three-dimensional airspace, reducing travel times and improving overall transportation efficiency.
2. Environmental considerations: With the increasing concern over carbon emissions and environmental impact, flying taxis have the potential to be more sustainable than traditional ground transportation. Electric or hybrid-electric flying taxis can contribute to reducing greenhouse gas emissions and improving air quality.
3. Technological advancements: The development of advanced technologies such as electric propulsion, autonomous systems, and air traffic management systems are driving the feasibility and safety of flying taxis. These advancements provide a foundation for the future adoption of this

Regenerate response

4. Vertical takeoff and landing (VTOL) capabilities: VTOL capabilities enable flying taxis to operate without the need for traditional runways or helipads. This flexibility in takeoff and landing locations expands their usability and accessibility in urban areas.

Constraints:

1. Regulation and safety: The adoption of flying taxis requires the establishment of appropriate regulations and safety standards. Authorities need to develop guidelines for airspace management, pilot certifications, vehicle maintenance, and emergency procedures to ensure safe operations.
2. Infrastructure requirements: Flying taxis require dedicated infrastructure such as vertiports or landing pads for takeoff and landing, charging stations, and maintenance facilities. Establishing this infrastructure in urban areas can be challenging due to space limitations and potential noise concerns.
3. Public acceptance: Widespread public acceptance and trust are crucial for the adoption of flying taxis. Addressing concerns regarding safety, noise pollution, privacy, and potential visual impact will be essential to gain public support for this new mode of transportation.

4. **Cost and affordability:** Initially, flying taxis are likely to be expensive, limiting their accessibility to a broader population. Reducing manufacturing costs, technological advancements, and increased adoption could potentially make flying taxis more affordable in the future.
5. **Limited range and payload capacity:** Current flying taxi prototypes have limitations in terms of range and payload capacity. Overcoming these limitations to offer a comparable or superior experience to ground transportation is essential for their widespread adoption.

It is important to note that while there is significant interest and investment in flying taxis, their adoption will depend on the successful resolution of these drivers and constraints. The timeline for their integration into the transportation system will also depend on technological advancements, regulatory frameworks, and public acceptance.

ChatGPT Drivers and Constraints for Flying Taxis

Drivers:

1. Congestion and traffic reduction
2. Environmental considerations
3. Technological advancements
4. Vertical takeoff and landing capabilities
5. Time Efficiency (2nd Pass)

Constraints:

1. Regulation and safety
2. Infrastructure requirements
3. Public acceptance
4. Cost and affordability
5. Limited range and payload capacity

ChatGPT Drivers and Constraints for Flying Taxis

1st Pass Conclusion

It is important to note that while there is significant interest and investment in flying taxis, **their adoption will depend on the successful resolution of these drivers and constraints.** The timeline for their integration into the transportation system will also depend on technological advancements, regulatory frameworks, and public acceptance.

2nd Pass Conclusion

It's important to note that the adoption of flying taxis is a complex and multifaceted process that involves various stakeholders, including governments, regulators, manufacturers, infrastructure developers, and the general public. **The balance between drivers and constraints will determine the pace and extent of their adoption in the future.**

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Using ChatGPT to Generate Drivers and Constraints for Long-Term New Product Forecasting

- Used free ChatGPT-3.5 at <https://chat.openai.com>
- First Try! No further tailoring of query.
- Date: June 13, 2023
- Prompt: What are the drivers and constraints on the adoption of machine learning for long-term forecasting of new products?

 LV

What are the drivers and constraints on the adoption of machine learning for long-term forecasting of new products?



The adoption of machine learning for long-term forecasting of new products is influenced by various drivers and constraints. Here are some key drivers and constraints in this context:



Drivers:

1. **Data Availability:** The availability of large and diverse datasets is a significant driver for the adoption of machine learning in long-term forecasting. The more historical data and information on customer behavior, market trends, and product attributes, the better the forecasting models can perform.
2. **Improved Accuracy:** Machine learning algorithms have the potential to improve the accuracy of long-term forecasting compared to traditional methods. By leveraging complex algorithms and pattern recognition capabilities, machine learning models can uncover hidden patterns and relationships in data that may not be apparent to human analysts.

3. **Automation and Efficiency:** Machine learning enables automation of the forecasting process, reducing the need for manual intervention and human effort. This can result in increased efficiency, scalability, and faster turnaround times for forecasting new products.
4. **Competitive Advantage:** Adopting machine learning for long-term forecasting can provide organizations with a competitive edge. Accurate forecasting helps businesses identify emerging market trends, anticipate customer demands, and make informed decisions about new product development, pricing, and marketing strategies.

Constraints:

1. **Data Quality and Quantity:** Machine learning algorithms rely heavily on high-quality and sufficient data for training. Lack of historical data, incomplete or biased datasets, or poor data quality can hinder the effectiveness of forecasting models and limit their accuracy.
2. **Complex Model Development:** Creating accurate machine learning models for long-term forecasting is a complex task. It requires expertise in data science, machine learning techniques, feature engineering, and model validation. Organizations may face challenges in acquiring the necessary skills or resources to develop and maintain such models.

4. **Uncertainty and Volatility:** Long-term forecasting involves dealing with uncertainties and volatility, such as changing market conditions, customer preferences, and disruptive events. Machine learning models may struggle to adapt quickly to unforeseen events, requiring continuous monitoring, updating, and recalibration to maintain accuracy.
5. **Cost and Infrastructure:** Implementing machine learning for long-term forecasting may involve significant costs, including data collection, storage, computational resources, and skilled personnel. Organizations must consider the financial implications and infrastructure requirements before committing to such endeavors.
6. **Ethical and Privacy Considerations:** The use of machine learning in forecasting raises ethical considerations regarding privacy, bias, and the potential impact on individuals and society. Ensuring data privacy, fairness, and transparency in the use of machine learning models is critical to maintain trust and mitigate potential risks.

Overall, while there are notable drivers pushing the adoption of machine learning for long-term forecasting of new products, organizations must carefully navigate the constraints to leverage its full potential and make informed decisions.

ChatGPT Drivers and Constraints for Long-Term New Product Forecasting

Drivers

1. Data Availability
2. Improved Accuracy
3. Automation and Efficiency
4. Competitive Advantage

Constraints

1. Data Quality and Quantity
2. Complex Model Development
3. Interpretability and Explainability
4. Uncertainty and Volatility
5. Cost and Infrastructure
6. Ethical and Privacy Considerations

Prospects of AI for Long-Term New Product Forecasting

- Expert Opinion / Judgement
 - Research and Scenarios ✓ ✓ ✓
 - Survey, Interview, and Group Methods ?
- S-Shaped Curves and Analogies ✓ ✓ ✓
- Multiple-Trend Analysis ✓ ?
- Drivers and Constraints
 - Identification ✓ ✓
 - Strengths ?
 - Balance and overcoming constraints ✓ ?
 - Identifying Further Research Areas ?

Conclusion

- AI very promising for parts of the long-term forecasting process
- Somewhat promising for other parts of the process
- Comprehensive AI long-term forecast (beyond leveraging existing forecasts) is an open question.
- More research is needed on each

Overall, while there are notable drivers pushing the adoption of machine learning for long-term forecasting of new products, organizations must carefully navigate the constraints to leverage its full potential and make informed decisions. - ChatGPT



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