



Economic Trends Shaping Semiconductor Demand

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Hilltop Economics LLC

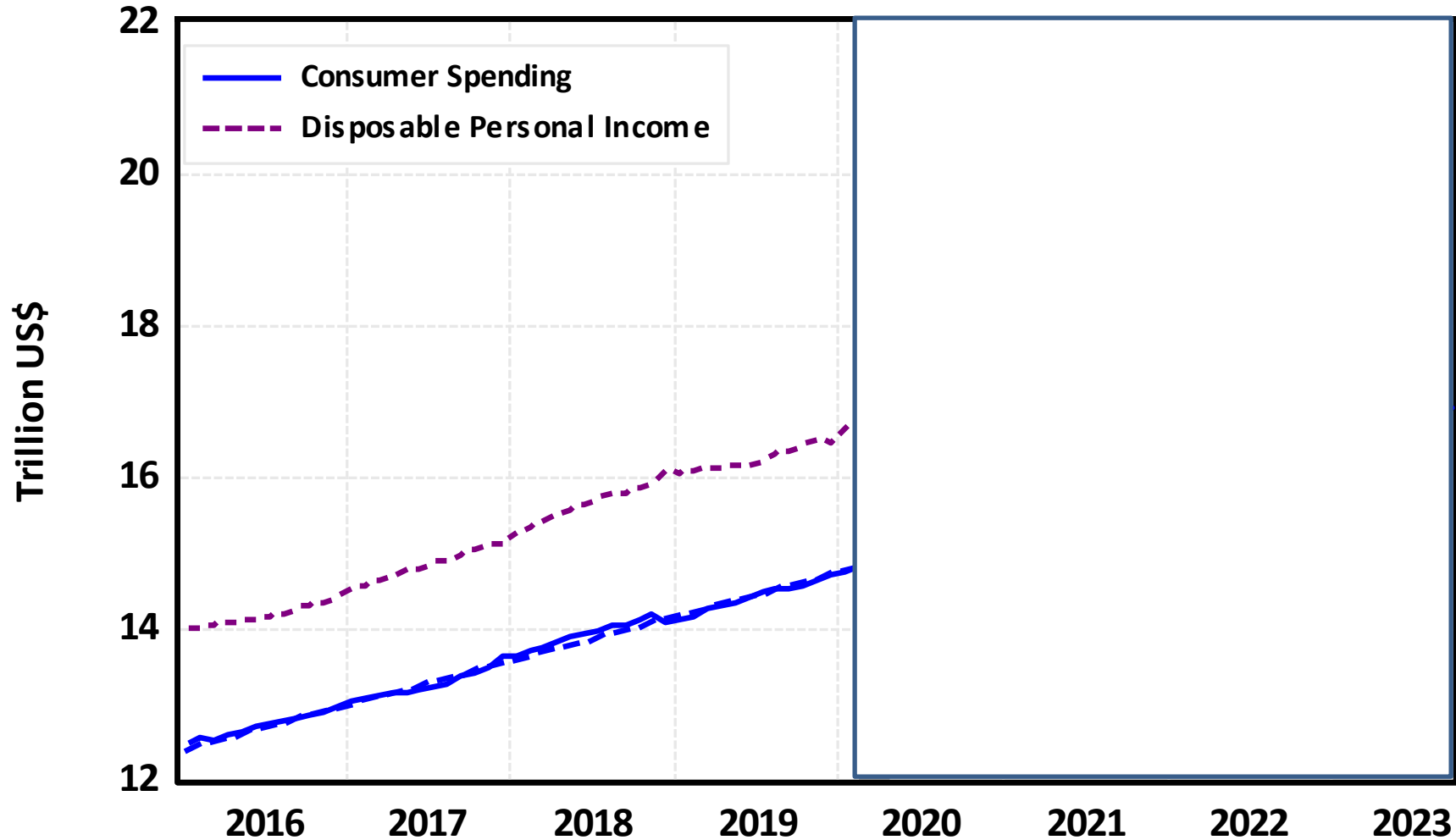
Duncan.Meldrum@hilltopeconomics.com

**Based on ESF 2022q4 November forecast & Consensus Economics, Inc. CONSENSUS FORECASTS®*

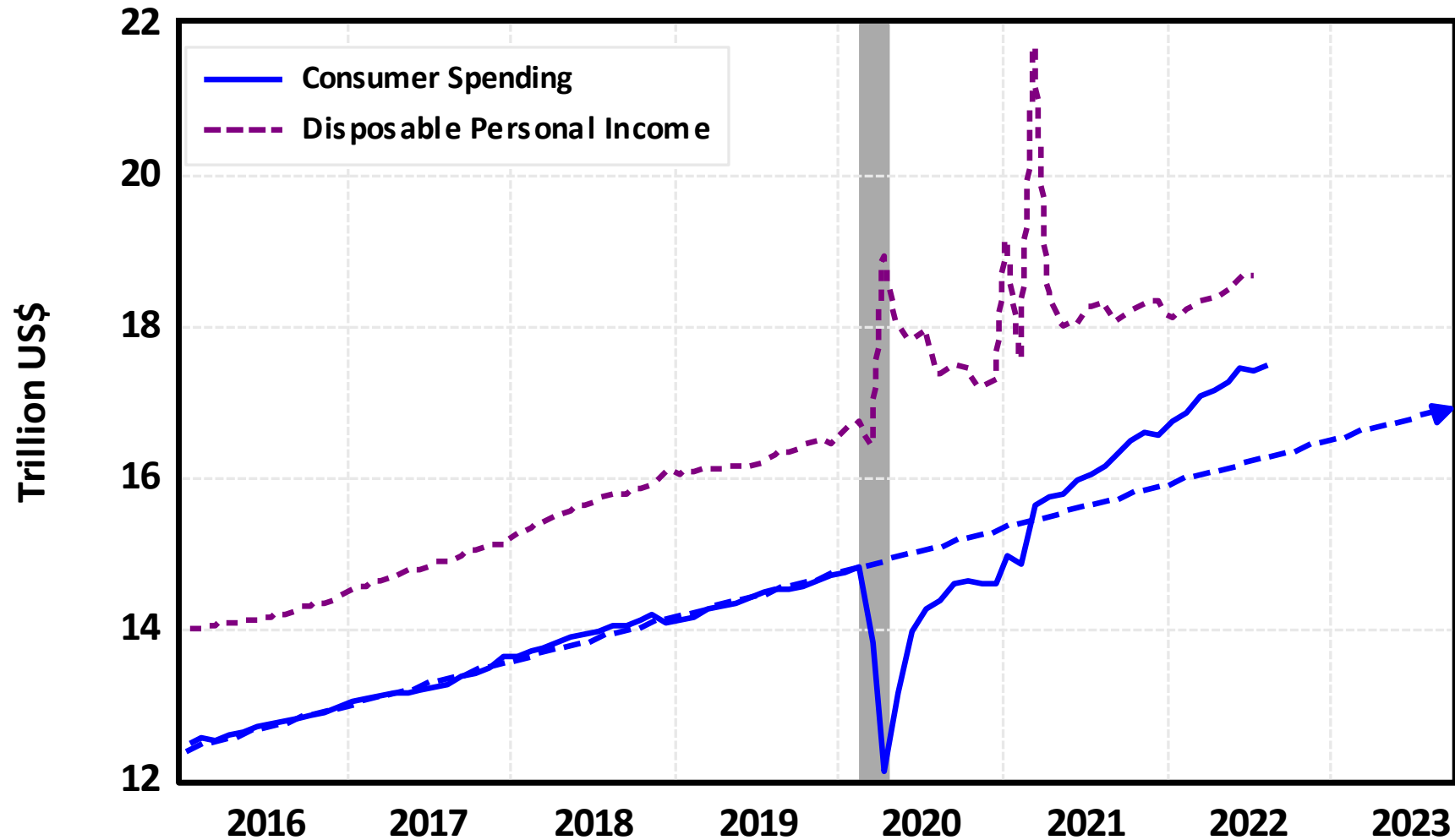
Overview

- **Macroeconomy backdrop**
 - Pandemic crash & stimulated economic recovery
 - Inflation & central banks' interest rate responses
 - Global economy on threshold of recession
- **Inflation-costs altering household spending patterns**
- **Pandemic-drive demand for tech goods reversing**
- **Semiconductor industry is heading for a downturn**

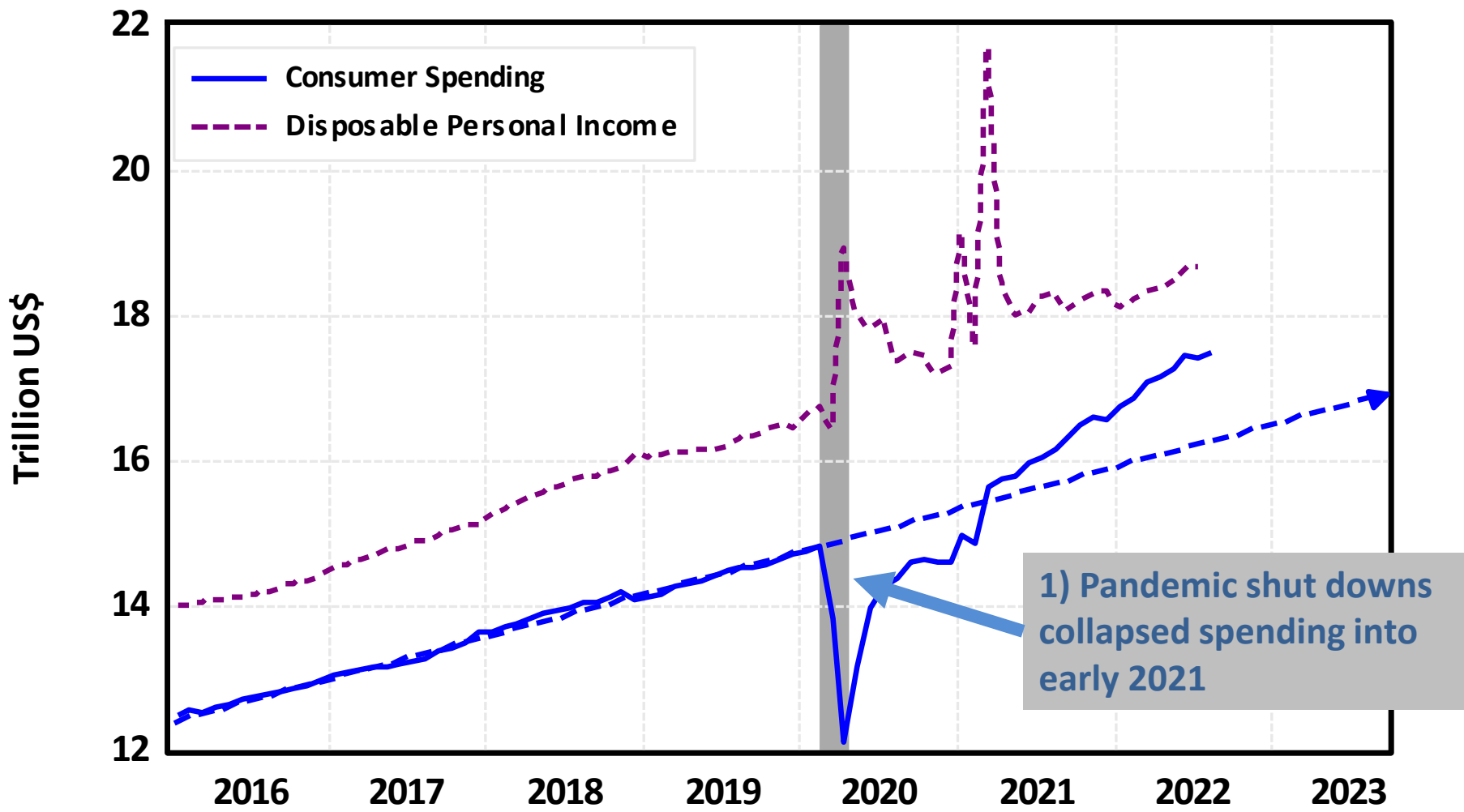
Pandemic Policies Shaped Today's Economy



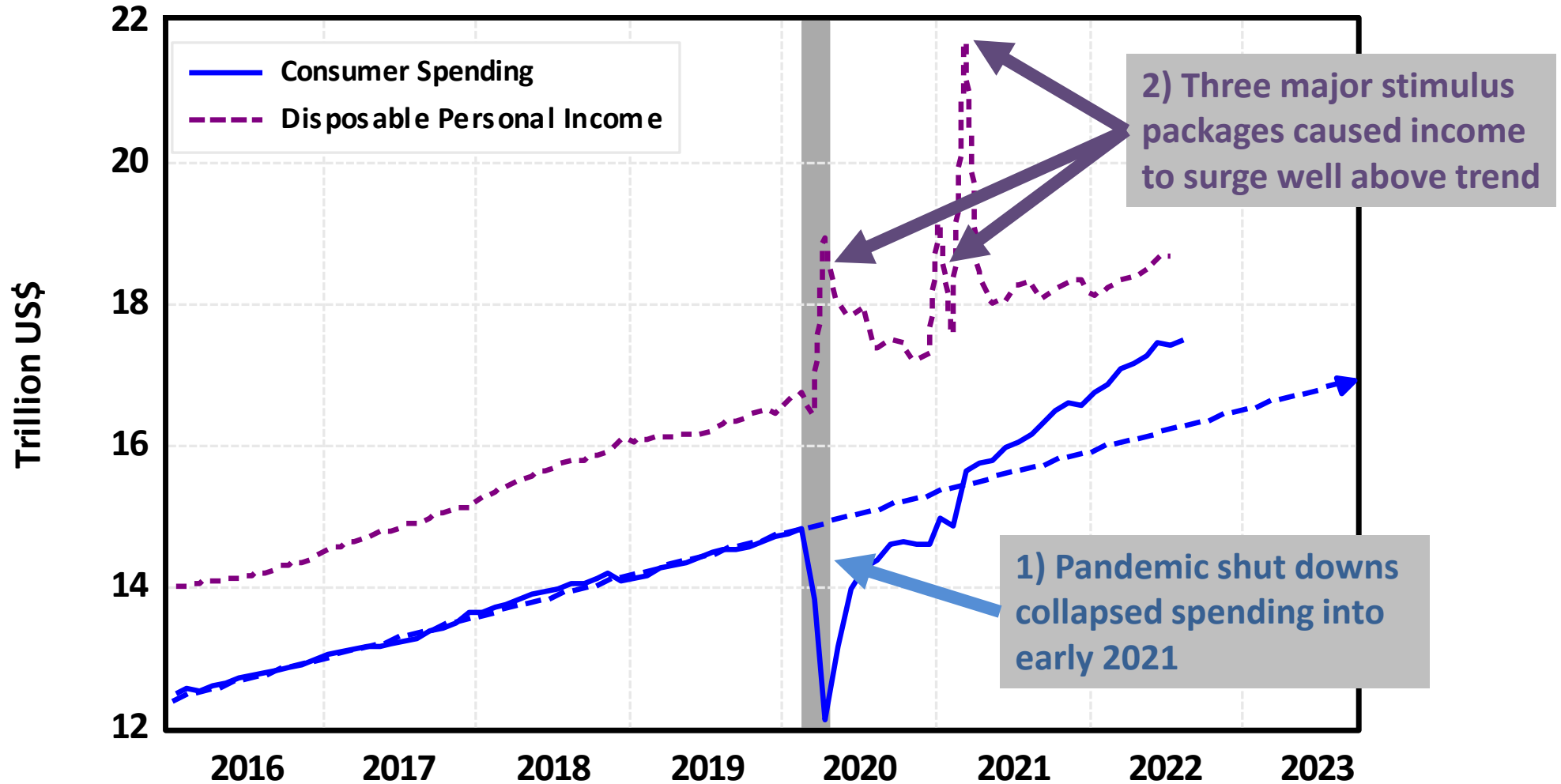
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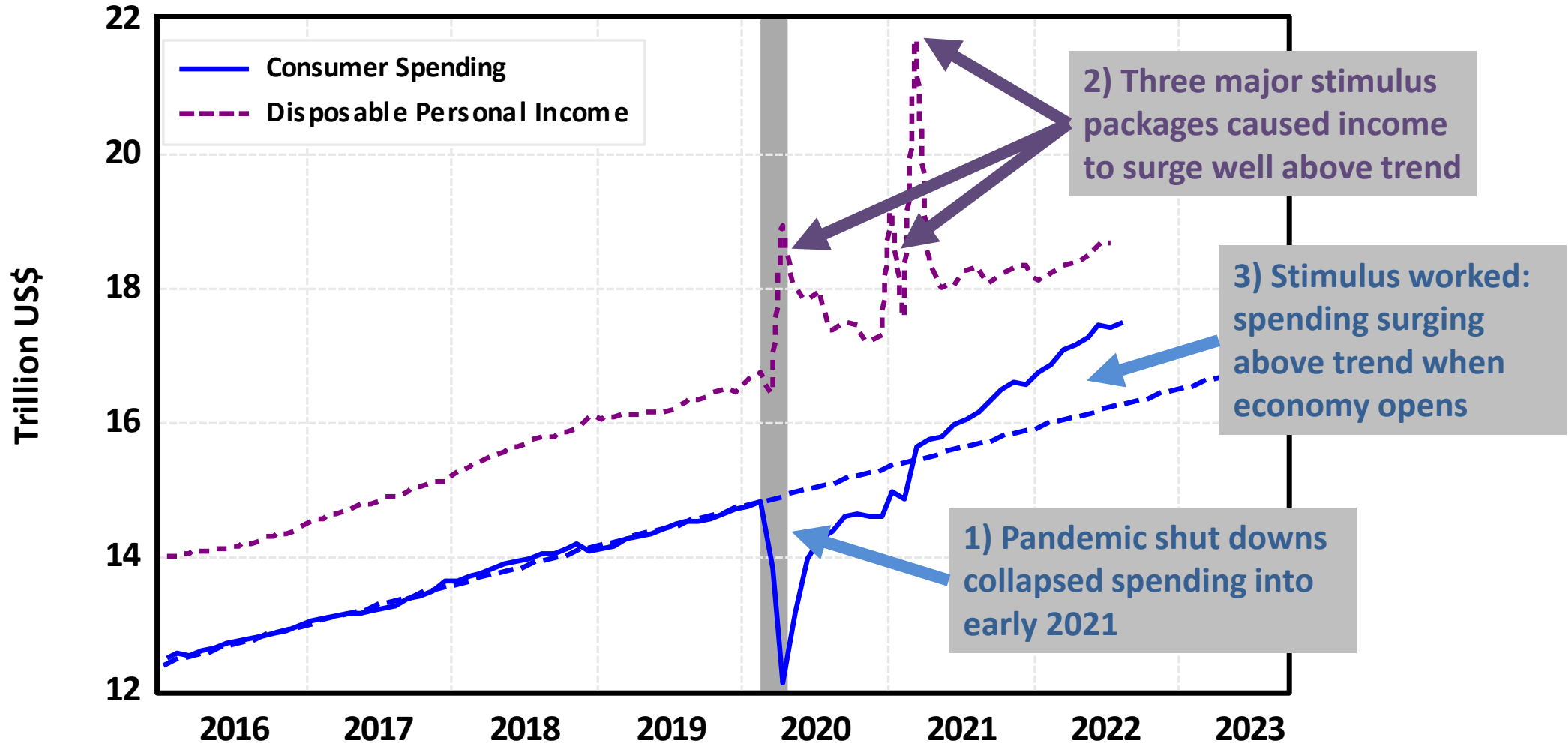
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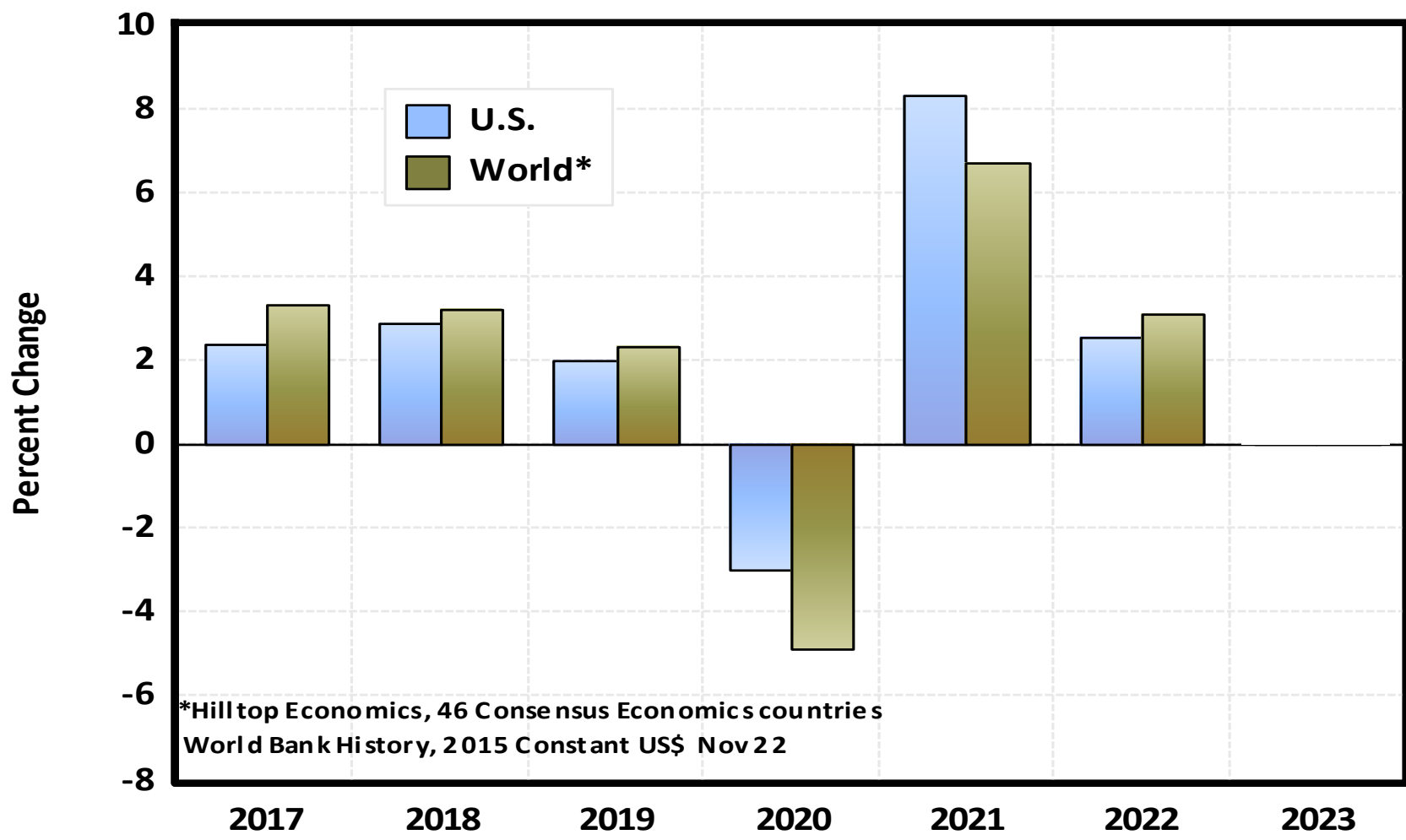


Pandemic Policies Shaped Today's Economy



Stimulus Worked: Final Demand Surged

Real Consumer Spending

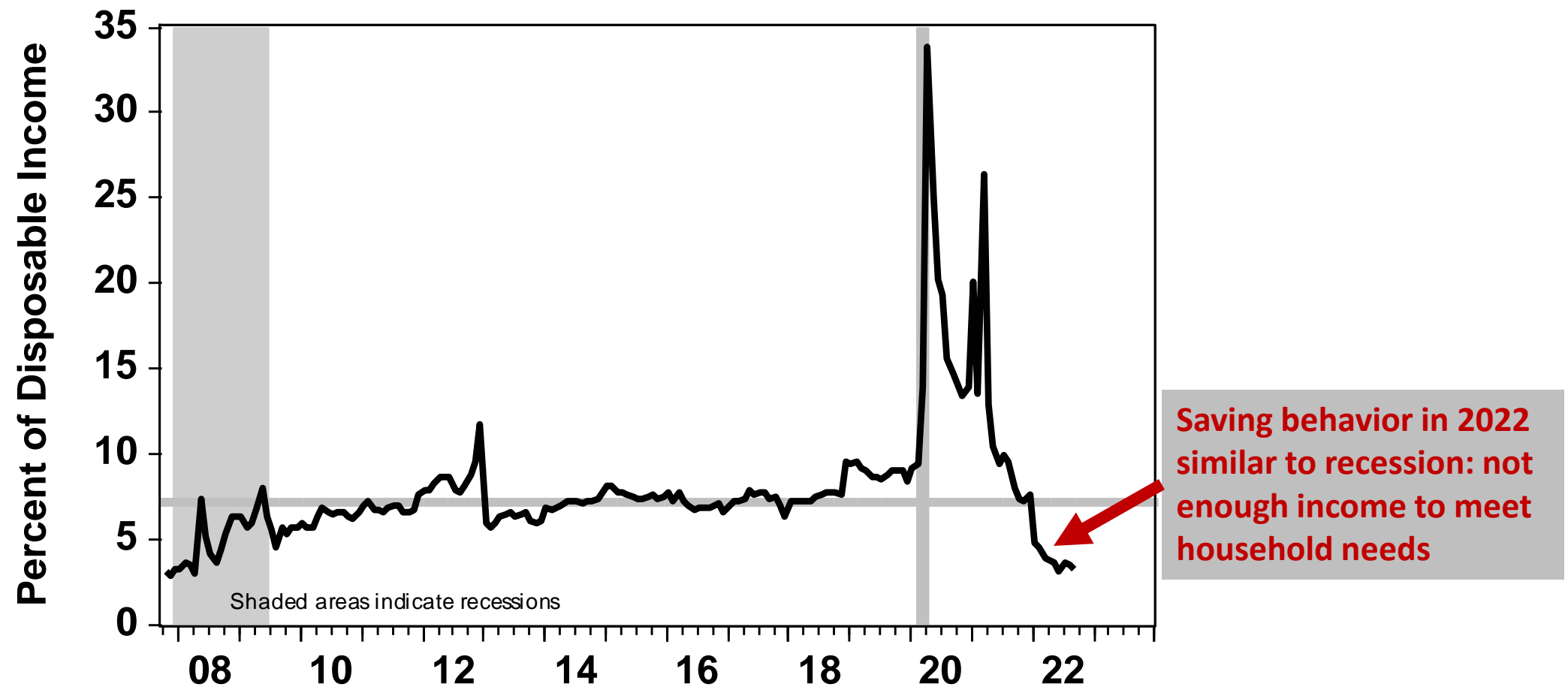


*Hilltop Economics, 46 Consensus Economics countries
World Bank History, 2015 Constant US\$ Nov 22

Household Saving Exploded 2020-2021H1

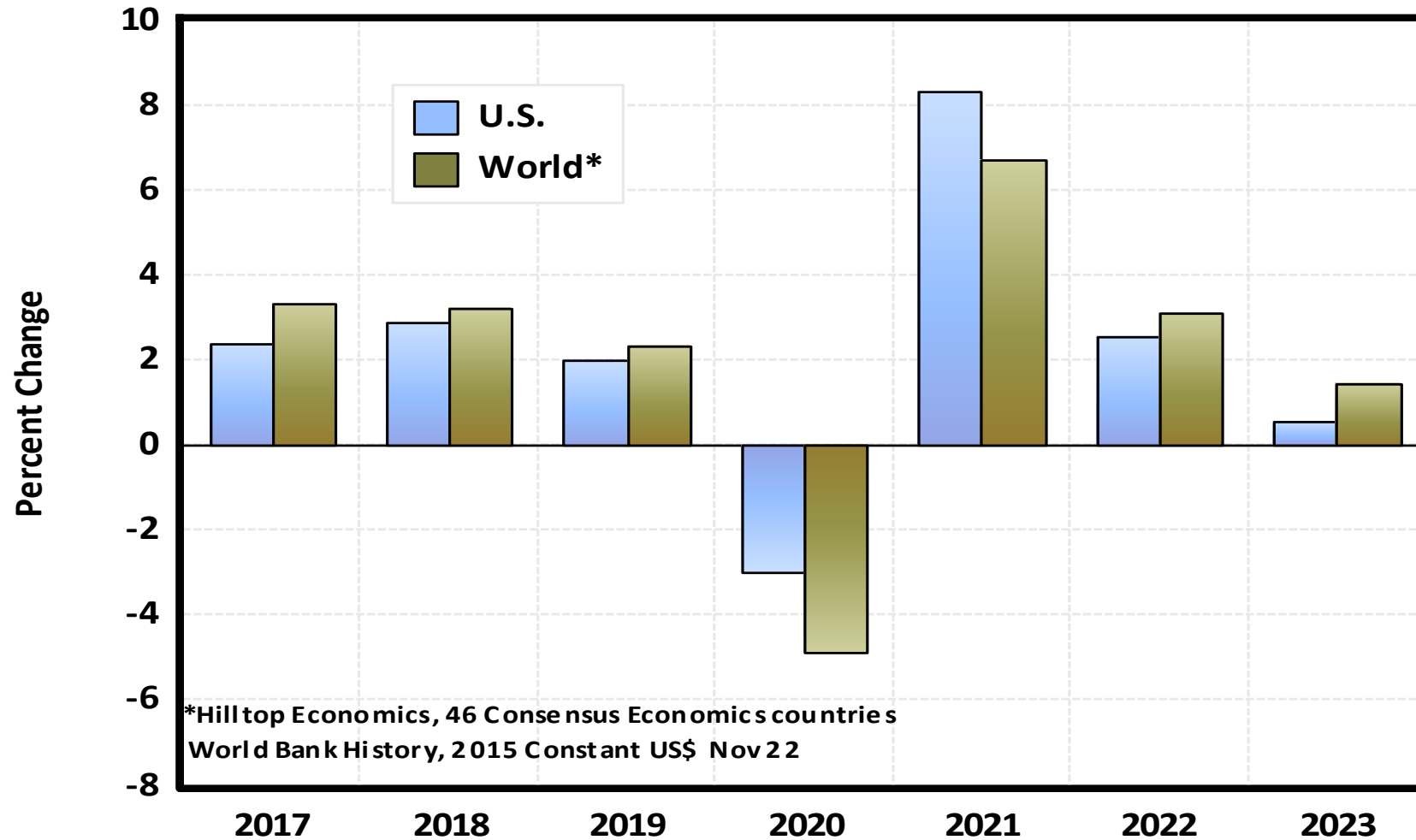
Supported recovery, but households now not saving to keep spending growing

U.S. Personal Saving Rate (%)



Consensus Forecasts a Sharp Slowdown in Spending in 2023

Real Consumer Spending

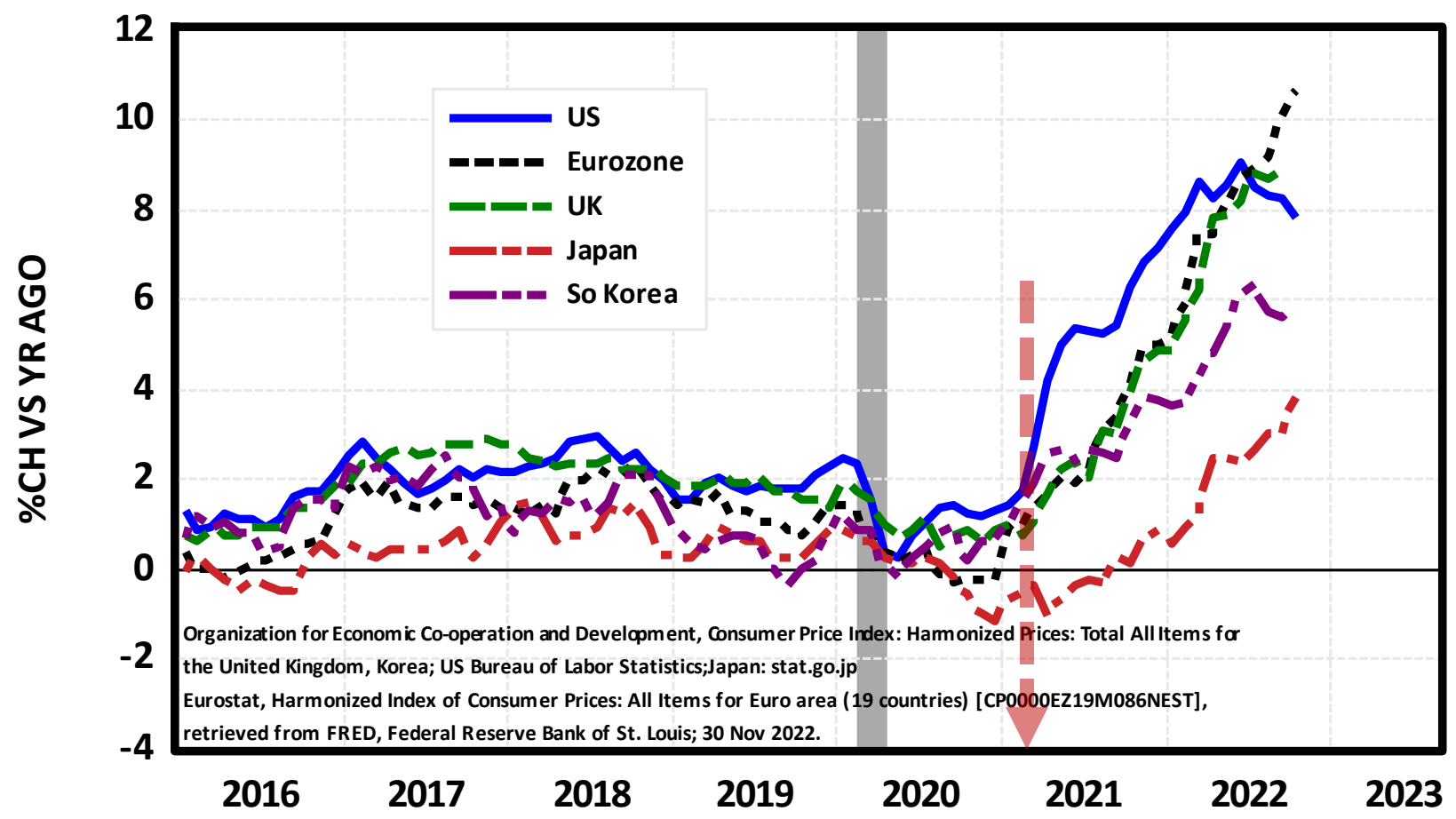


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Consumer Price Inflation – Highest in Decades, Began Taking Off Early 2021

Inflation: too much money chasing too few goods & services, or “Demand Exceeds Supply”

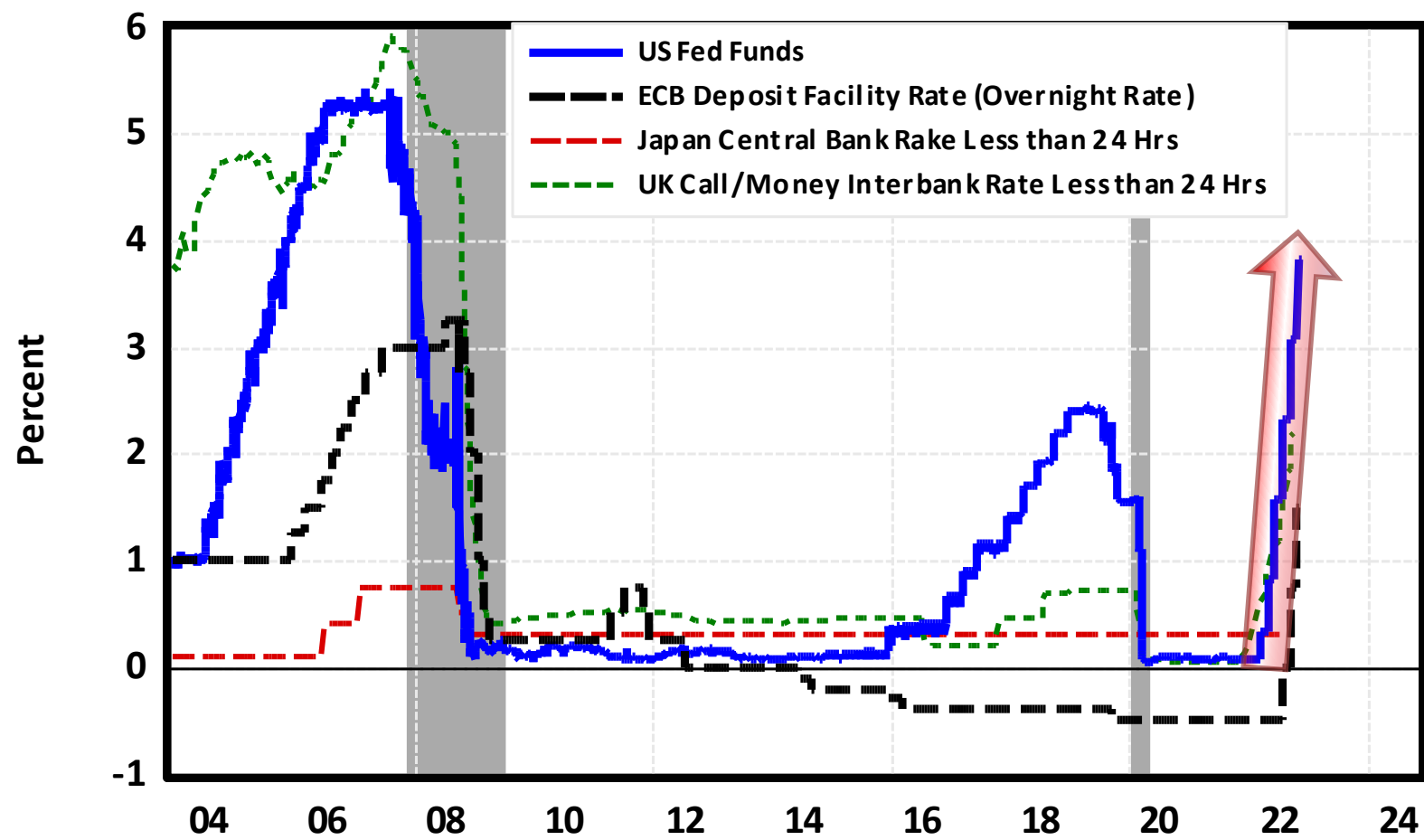
CPI Inflation



Central Banks Raising Rates To Weaken Demand: A Blunt Instrument

Fed began in mid-March 2022, ECB in mid-July – fastest increases since early 1980s, a year after inflation took off

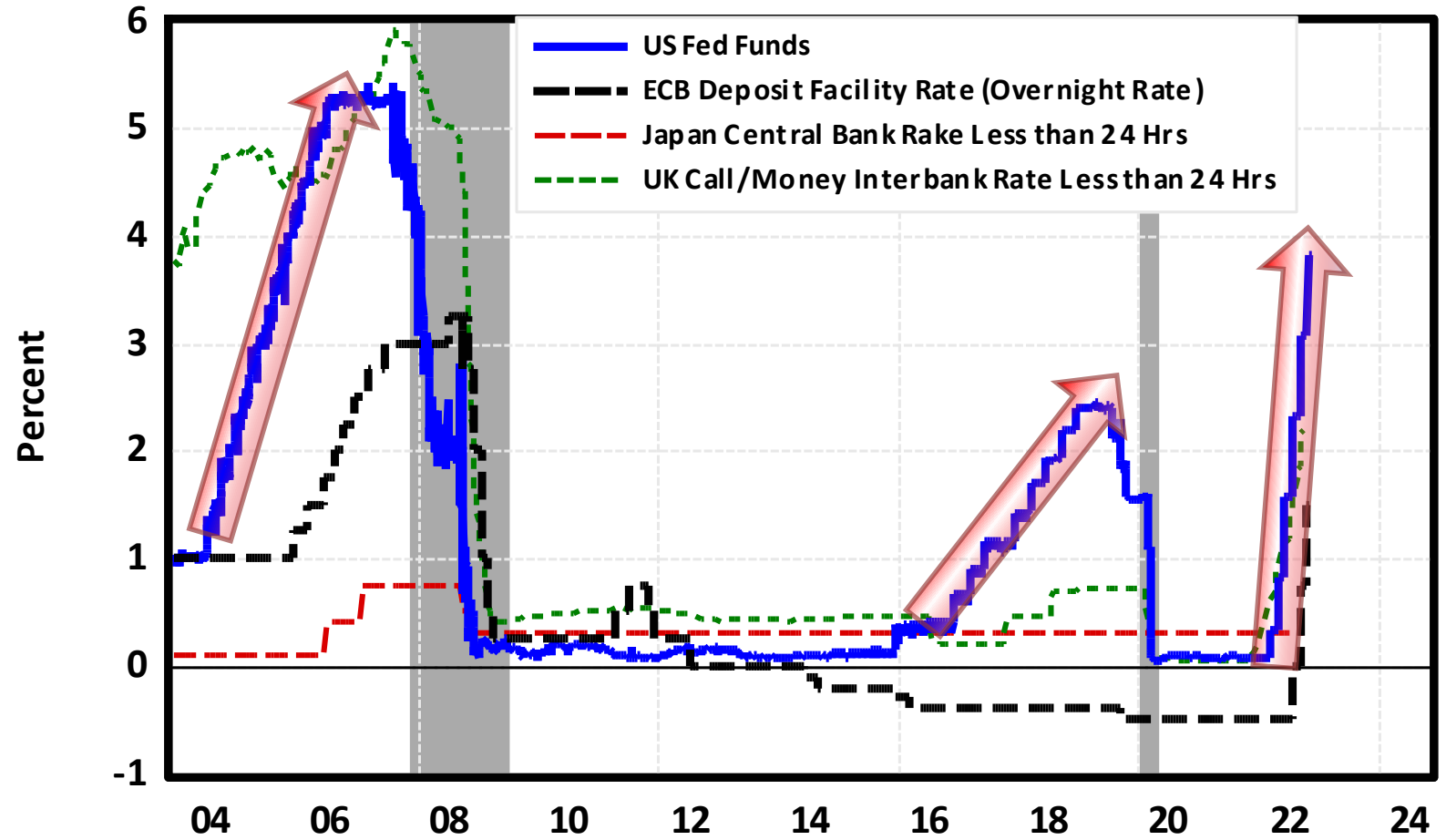
Overnight Interest (Policy) Rates



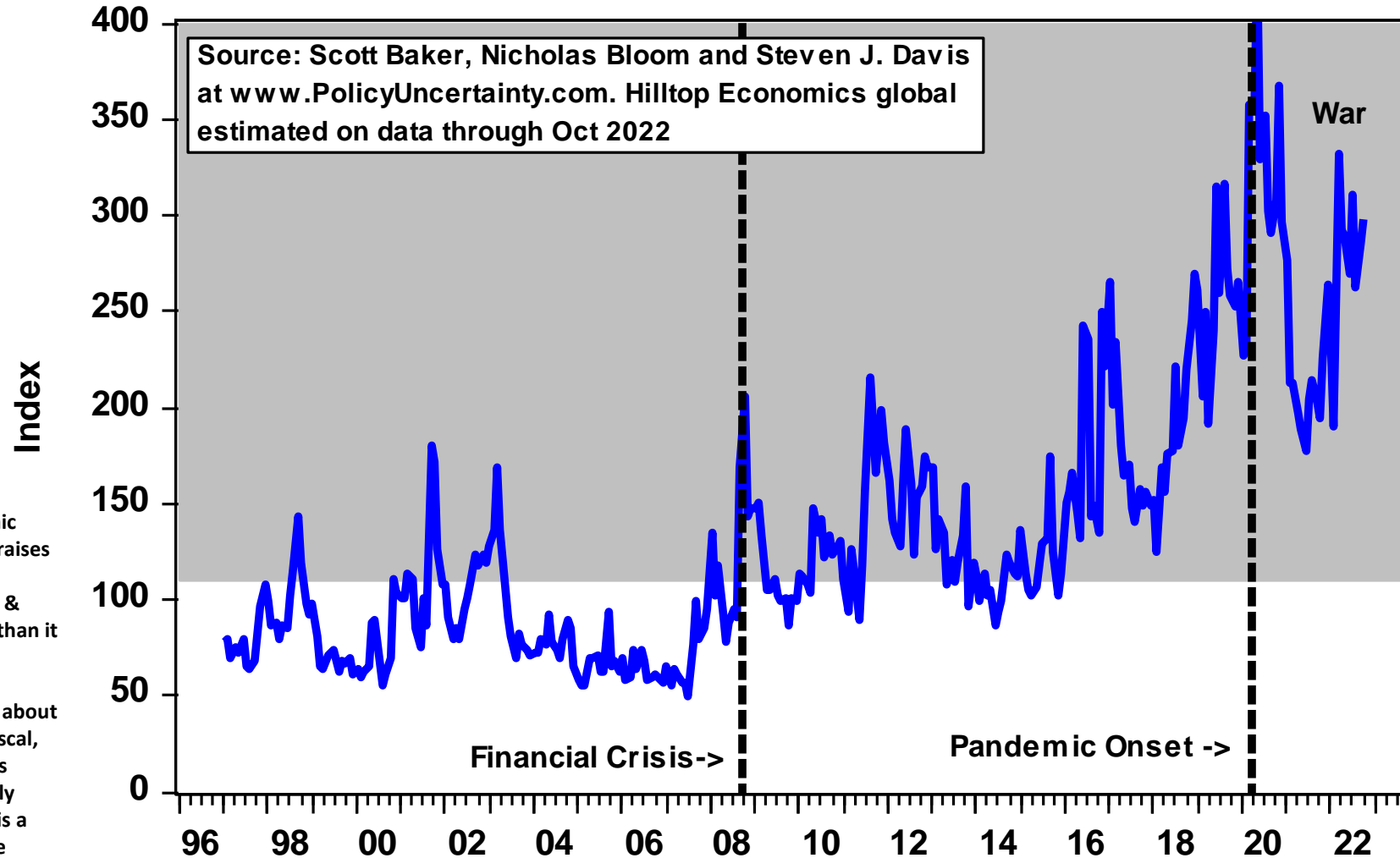
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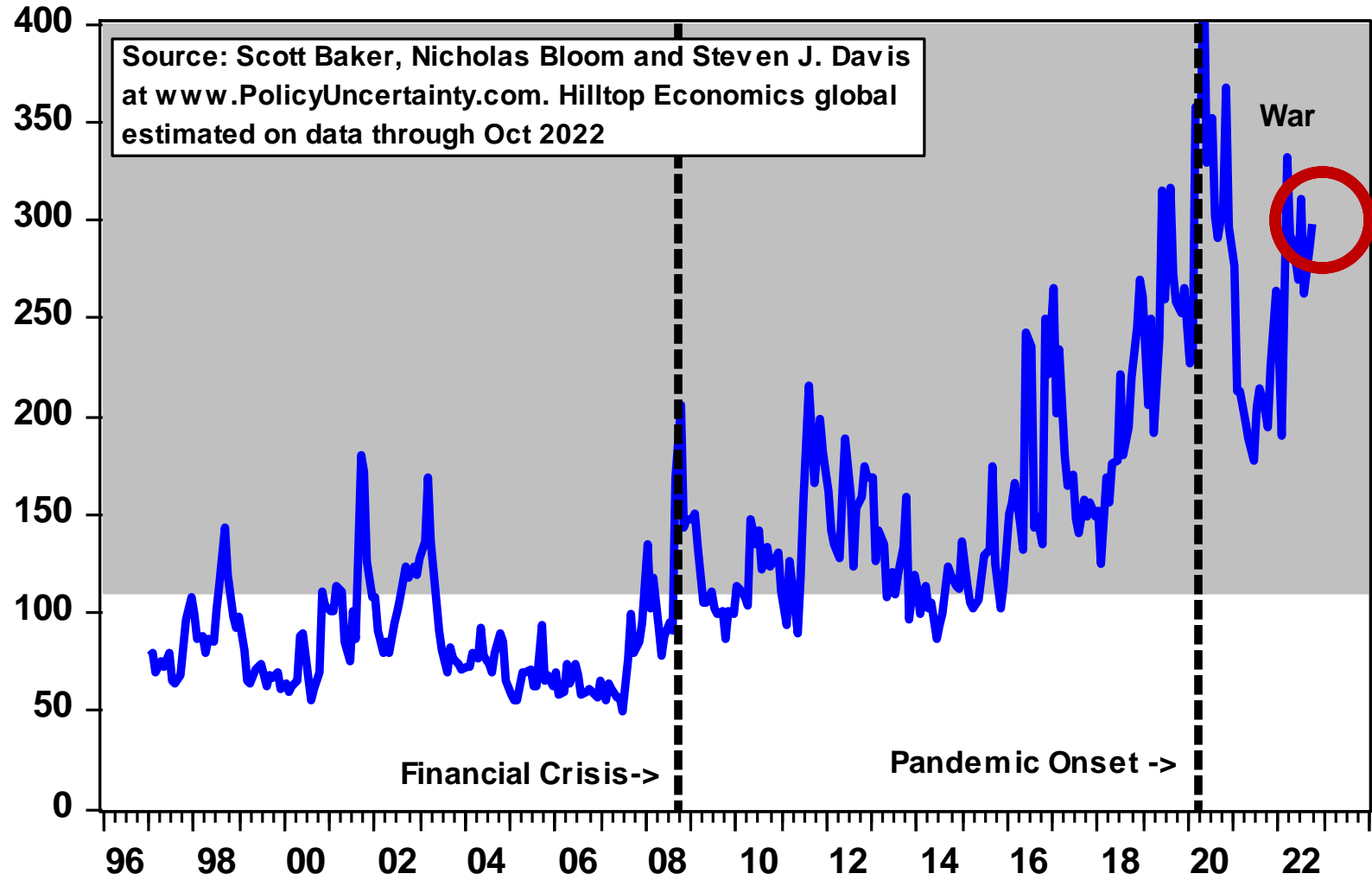
Global Economic Policy Uncertainty Index



High uncertainty about economic policy (“the rules of business”) raises risk aversion, reduces business confidence and makes planning & forecasting even more difficult than it normally is.

Shaded area: when uncertainty about economic policies (monetary, fiscal, international, regulatory, etc.) is above this level, it has negatively impacted economic activity. It is a significant negative factor in the semiconductor MSI model equations.

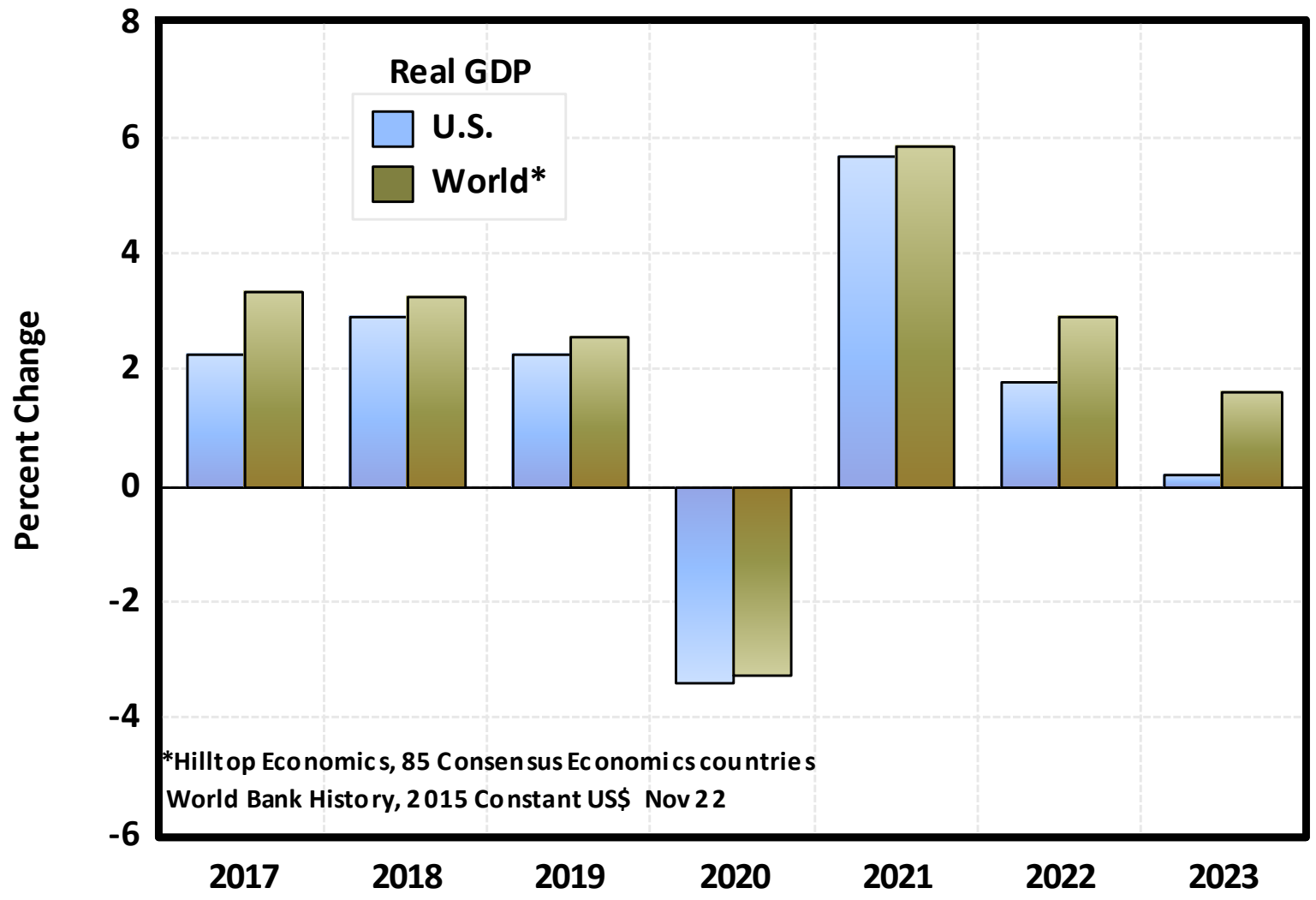
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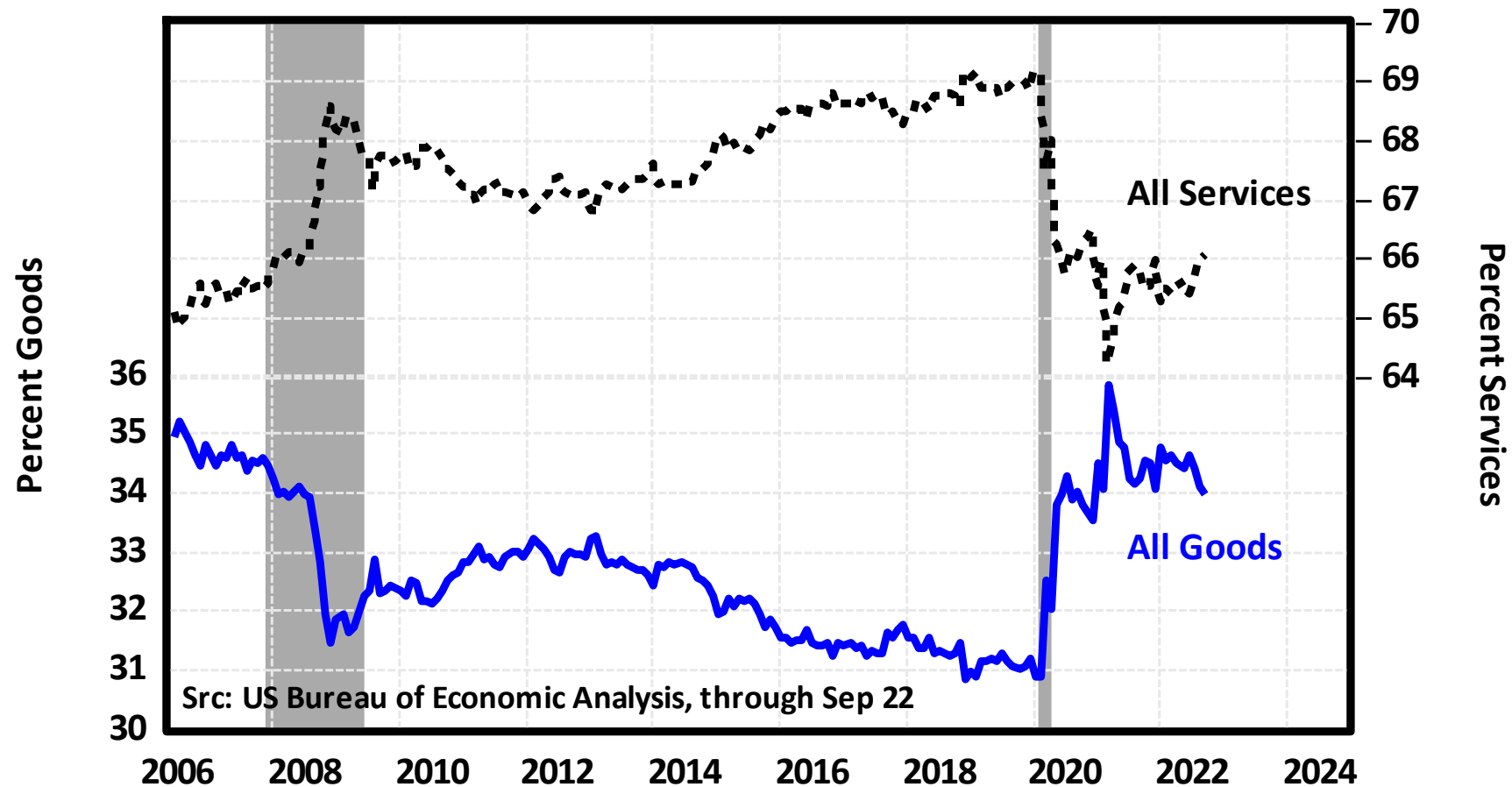
U.S. Heading toward Recession in 2023, World Still Grows Weakly(?)



Covid Distorted Composition of Final Demand

The change in demand structure compounded the problems in producing and moving goods as well as providing services. Global supply chains were not set up for this radical a shift in demand structure.

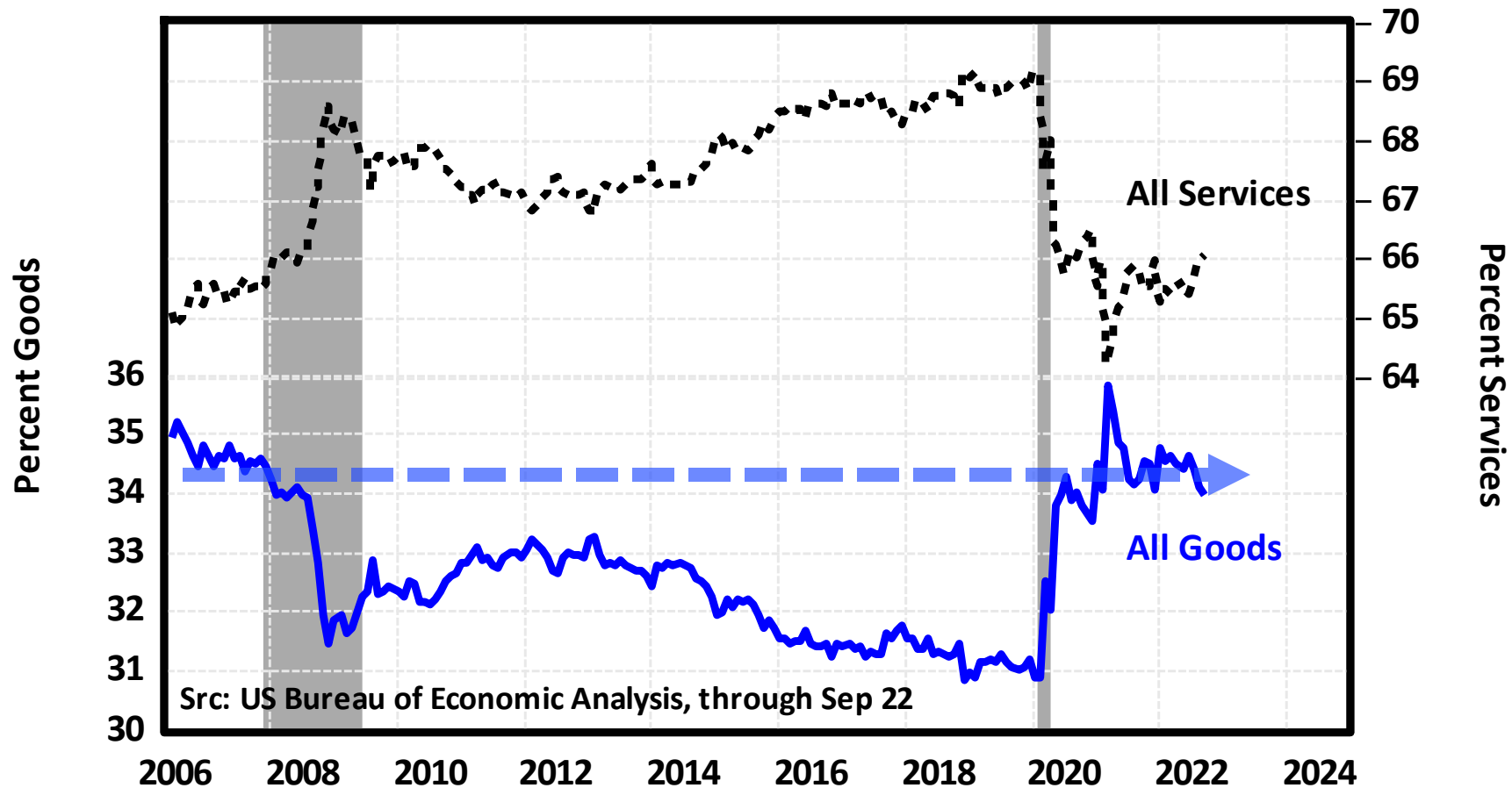
Services vs Goods (Nondurable & Durable)



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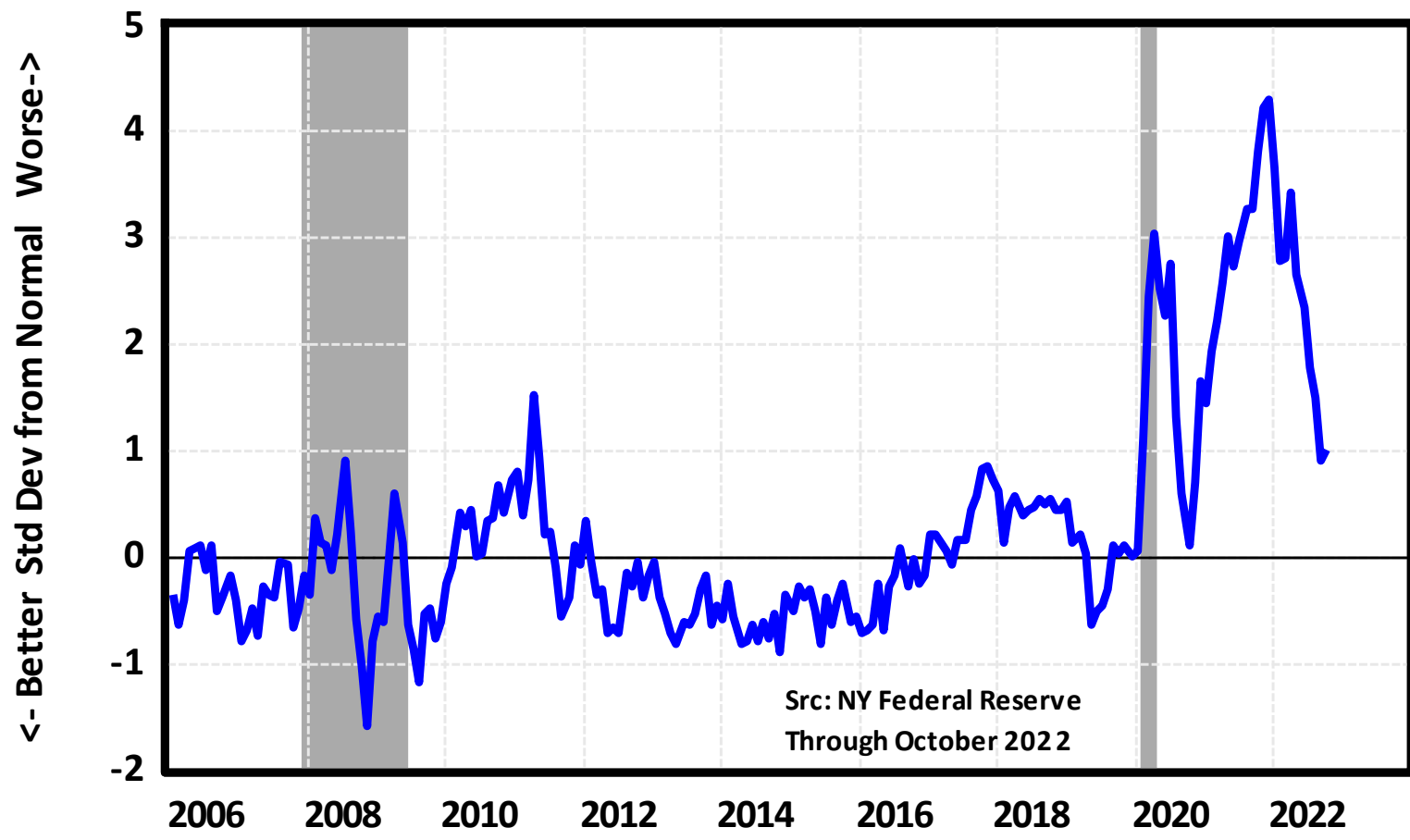
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Altered Demand Stressed the Supply Chain, Contributing to Inflation

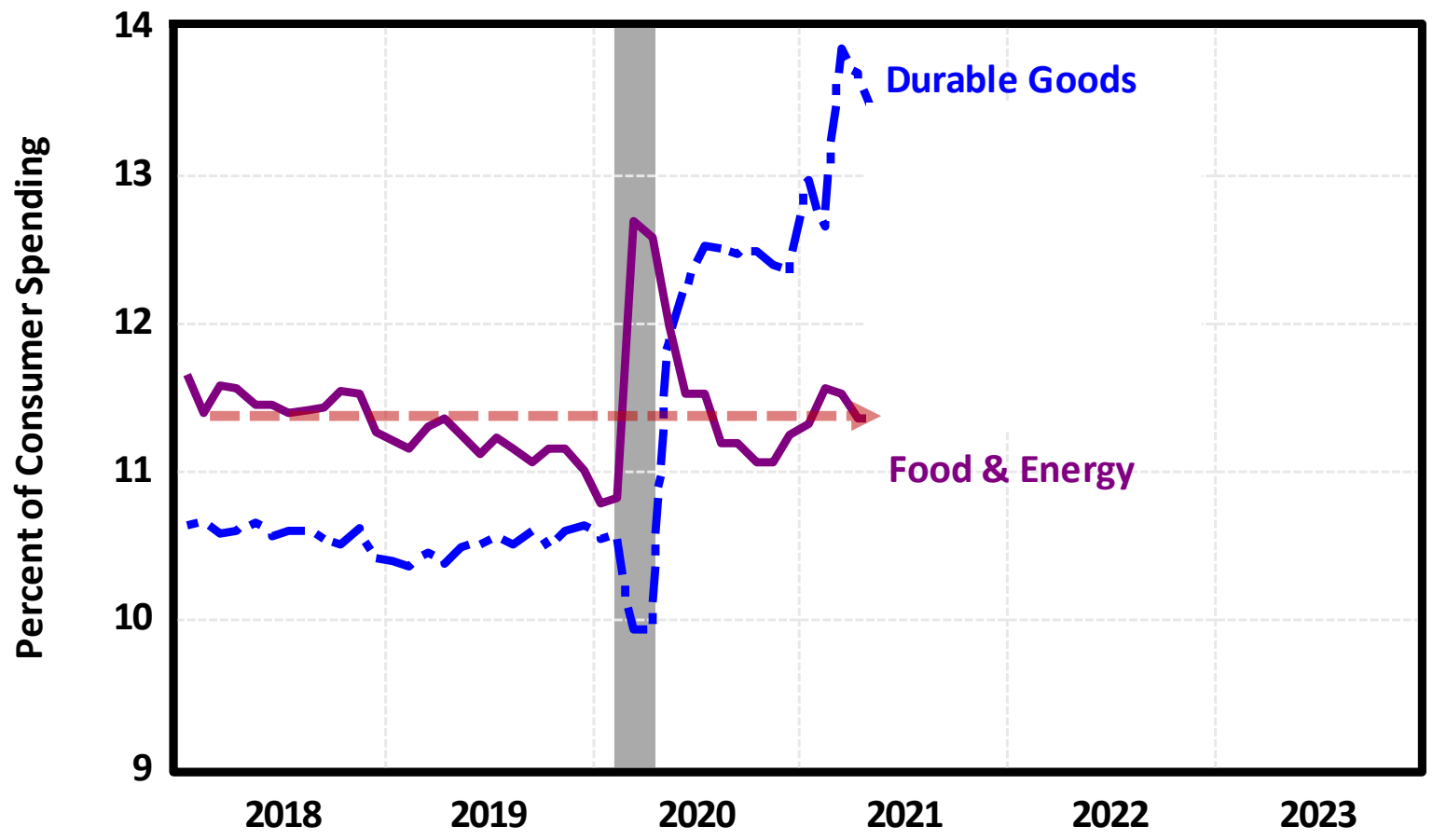
Central Banks cannot fix supply chains directly, but slowing demand eases pressure

Global Supply Chain Pressure Index



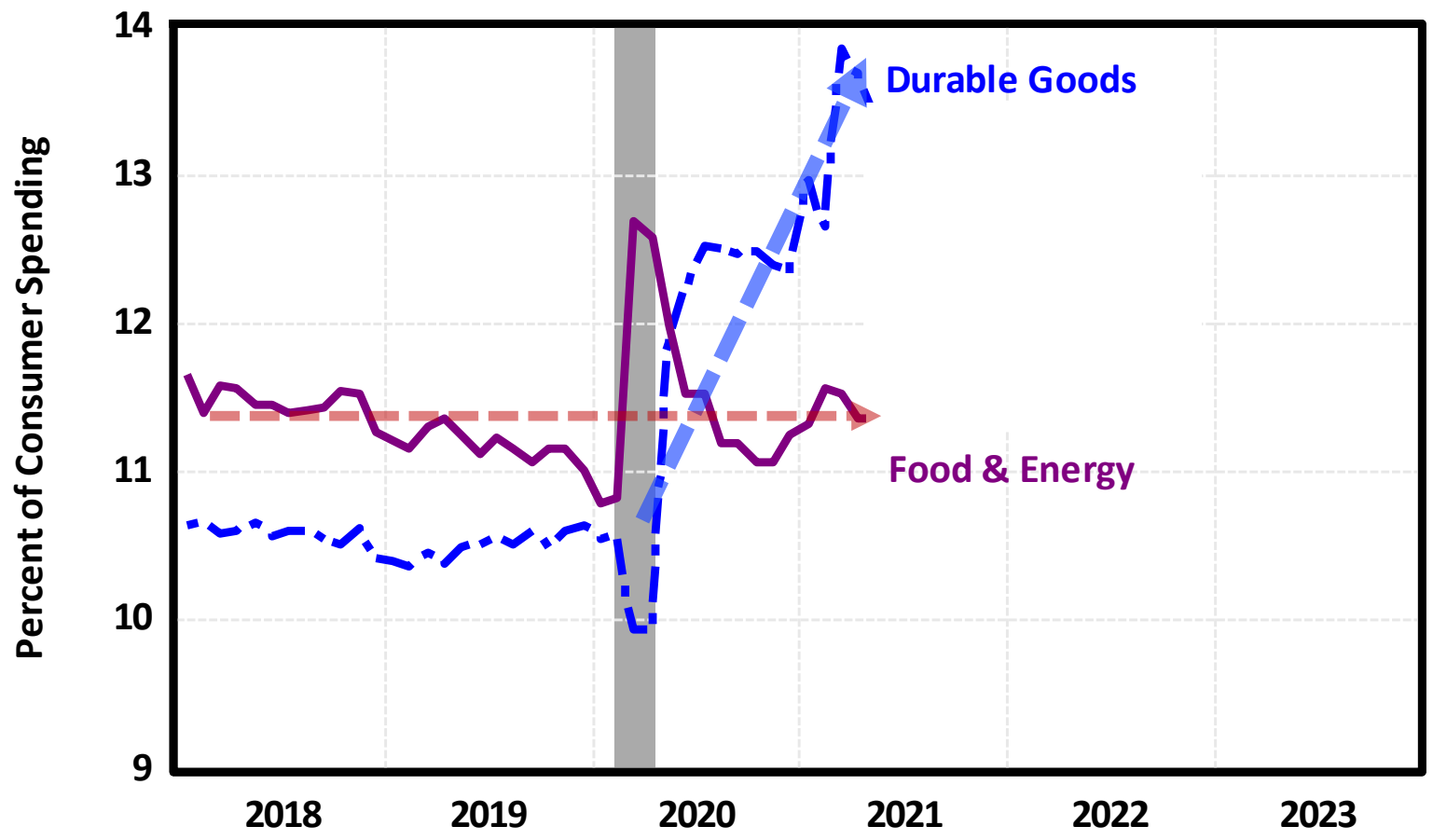
Pandemic Altered Consumer Spending Patterns
Inflation now causing a shift from durable-discretionary to nondurable-necessary, e.g. food and energy. Technology goods one of the negatively impacted categories.

Food & Energy VS Durable Goods



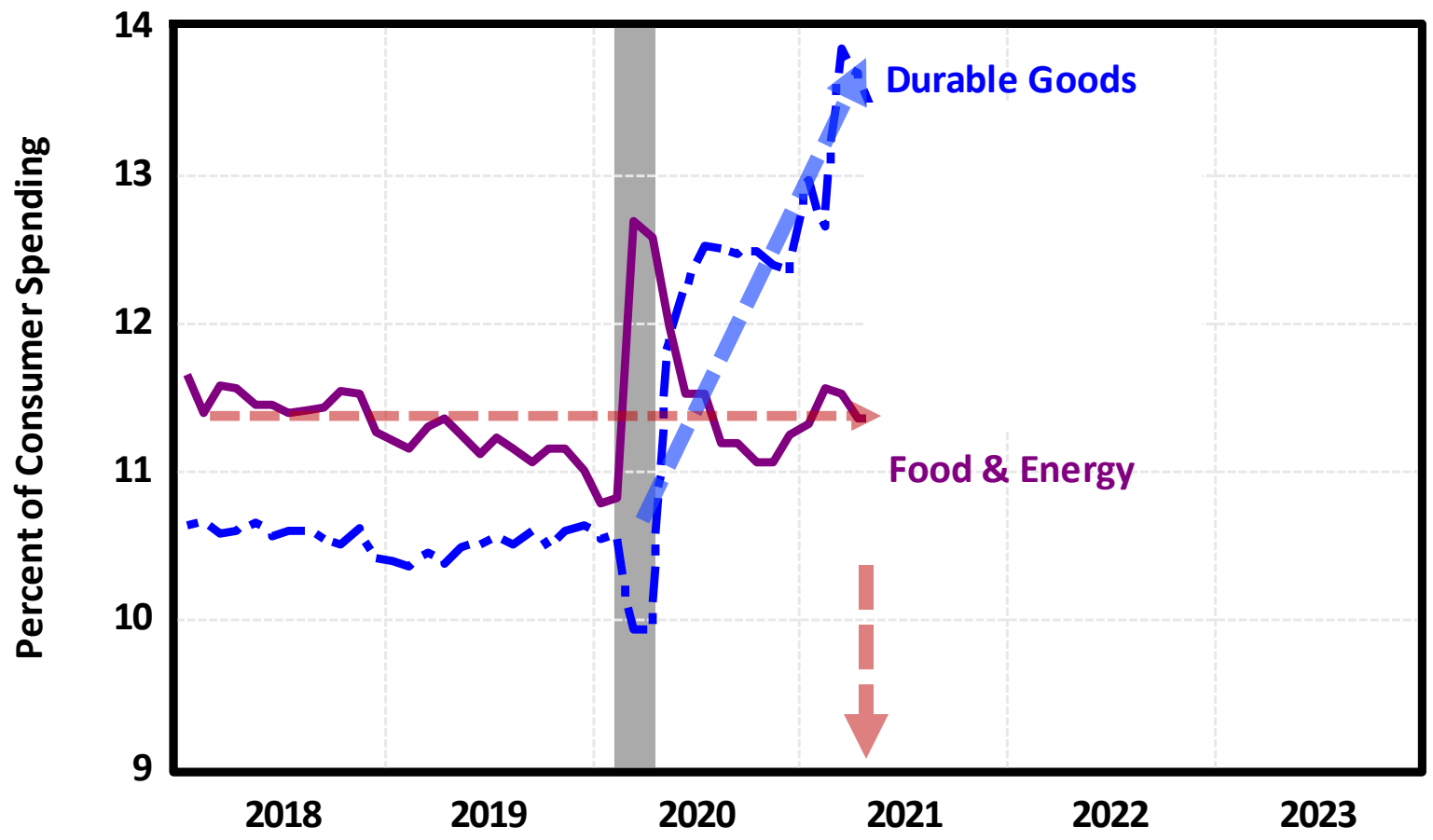
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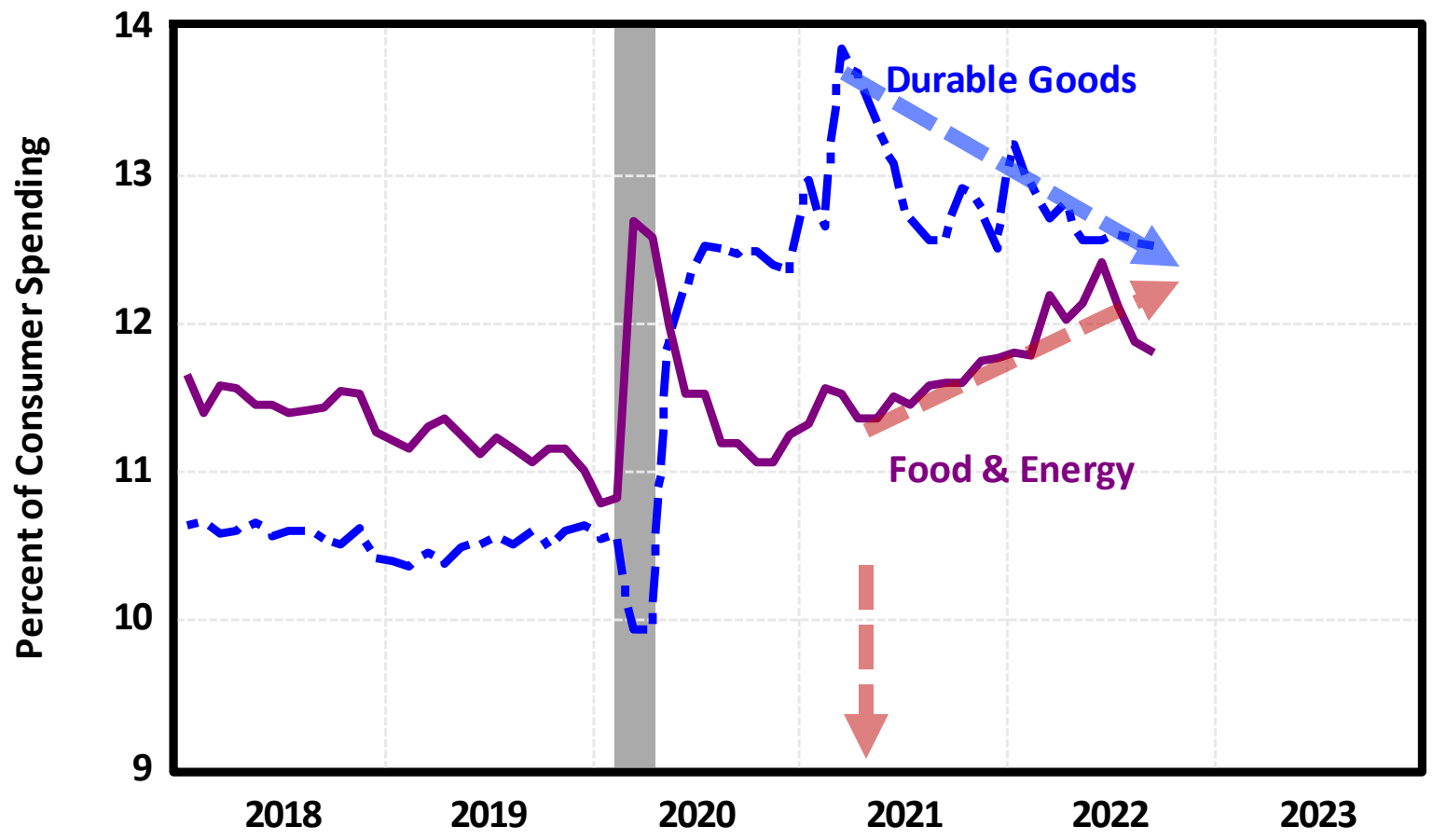
Inflation Further Changed Consumer Spending Patterns
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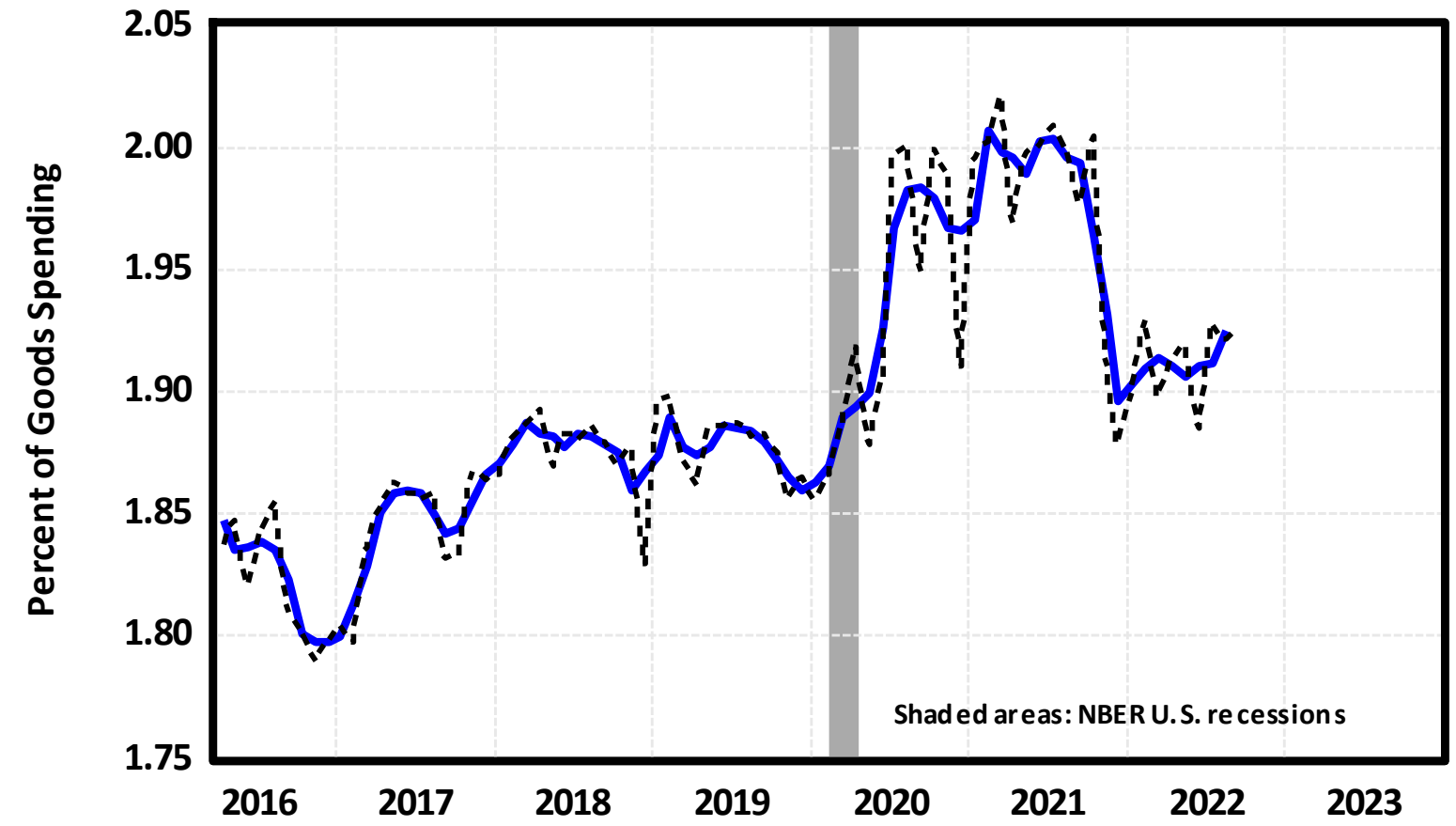
Food & Energy VS Durable Goods



Consumers Are Shifting Toward Pre-pandemic Preferences

As inflation took a toll on household budgets, it hastened the reversal in the desire for tech

Consumer Spending: Phones, PCs & Peripherals



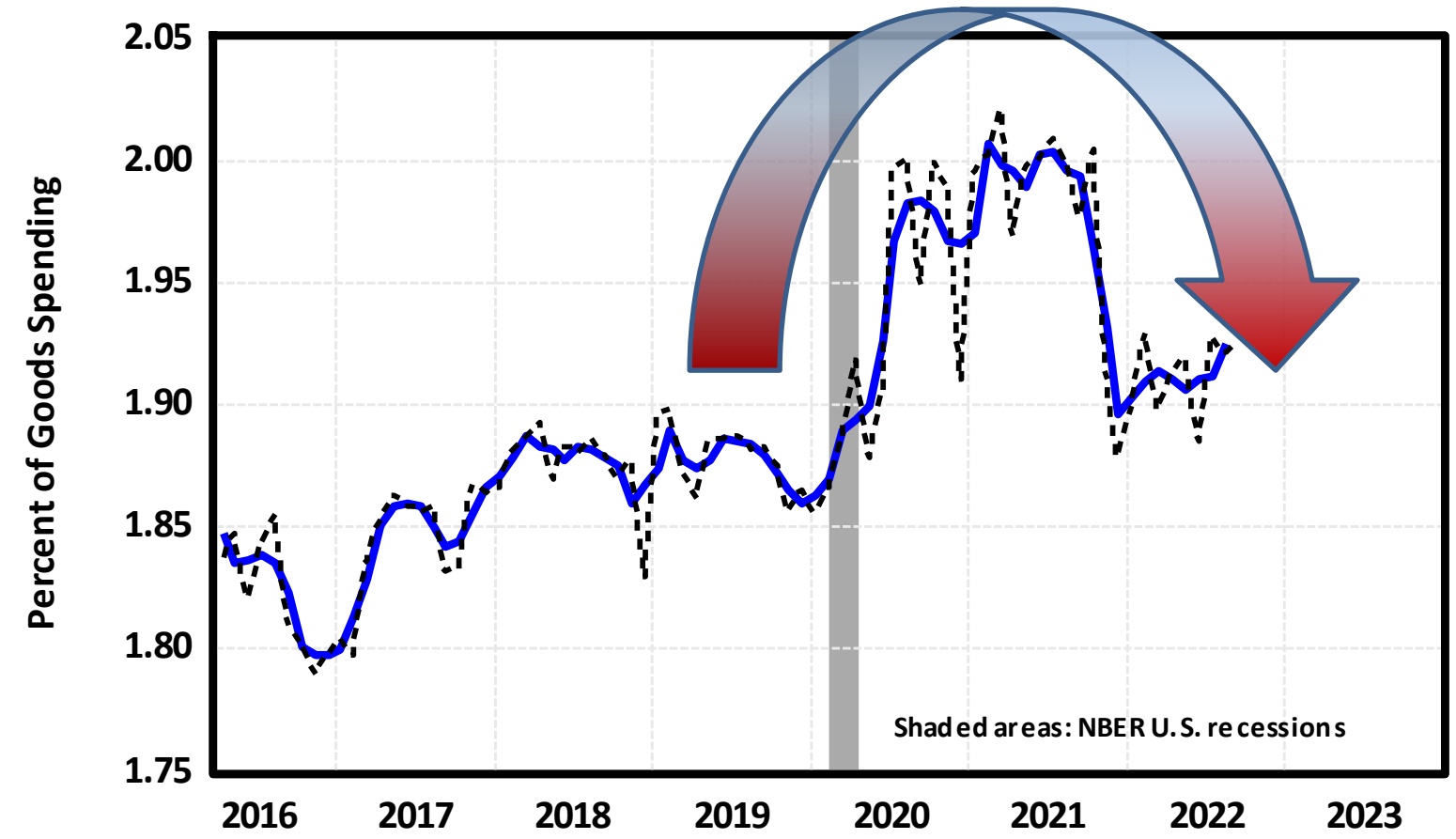
Shaded areas: NBER U.S. recessions

Source: U.S. BEA Underlying Detail, data through September 2022

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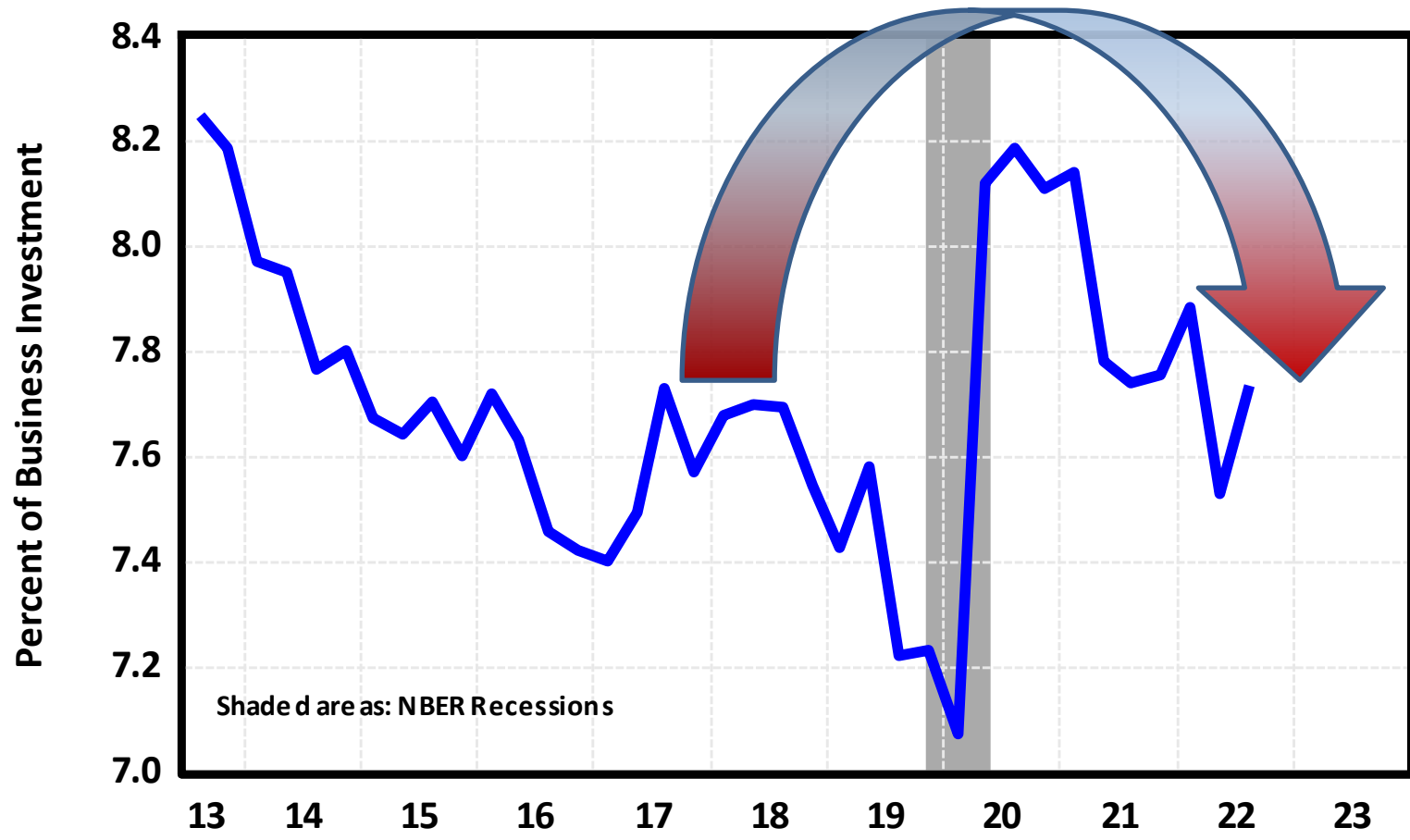
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Businesses Have Already Shifted To Pre-pandemic Preferences

Business Investment: Technology Goods

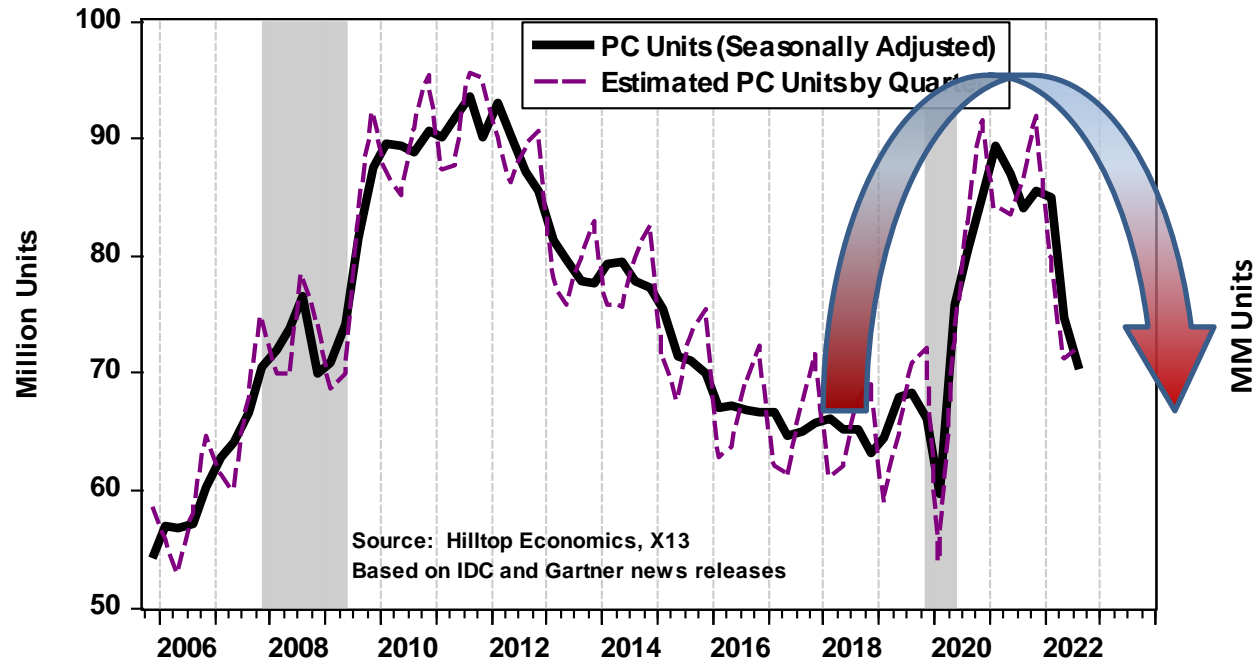


Source: U.S. BEA Underlying Detail, data through 2022 Q3

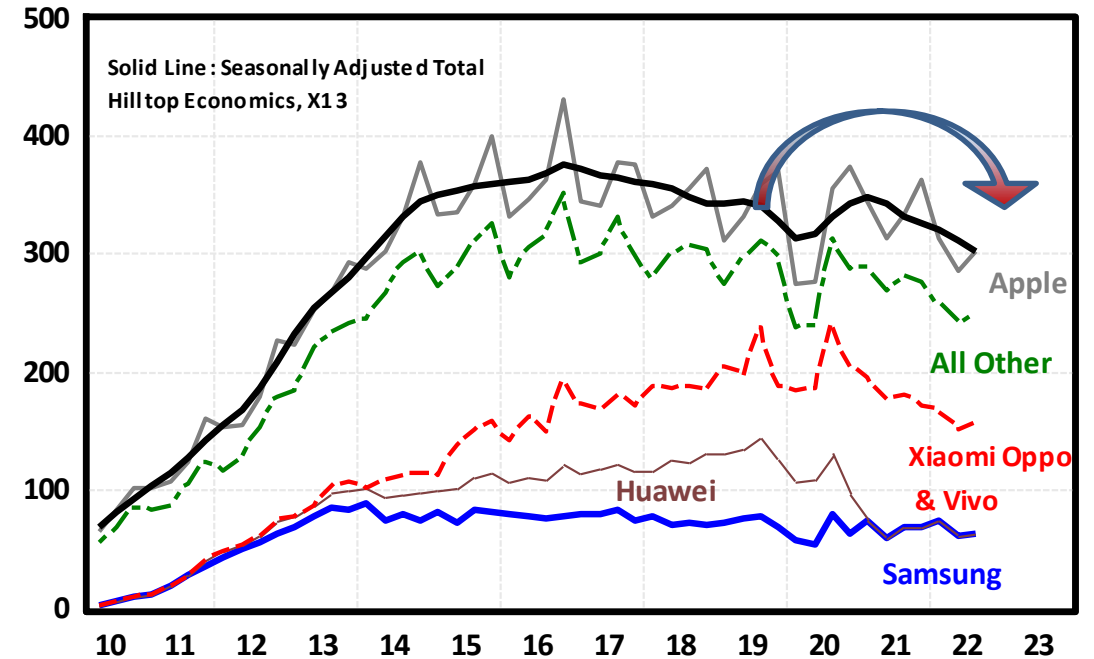
Key Global Markets for Semiconductors in Rapid Decline

More consistent with demand reversion/weakening narratives than supply chain narratives (exc China phones)

Global PC Sales



Global Smartphone Sales

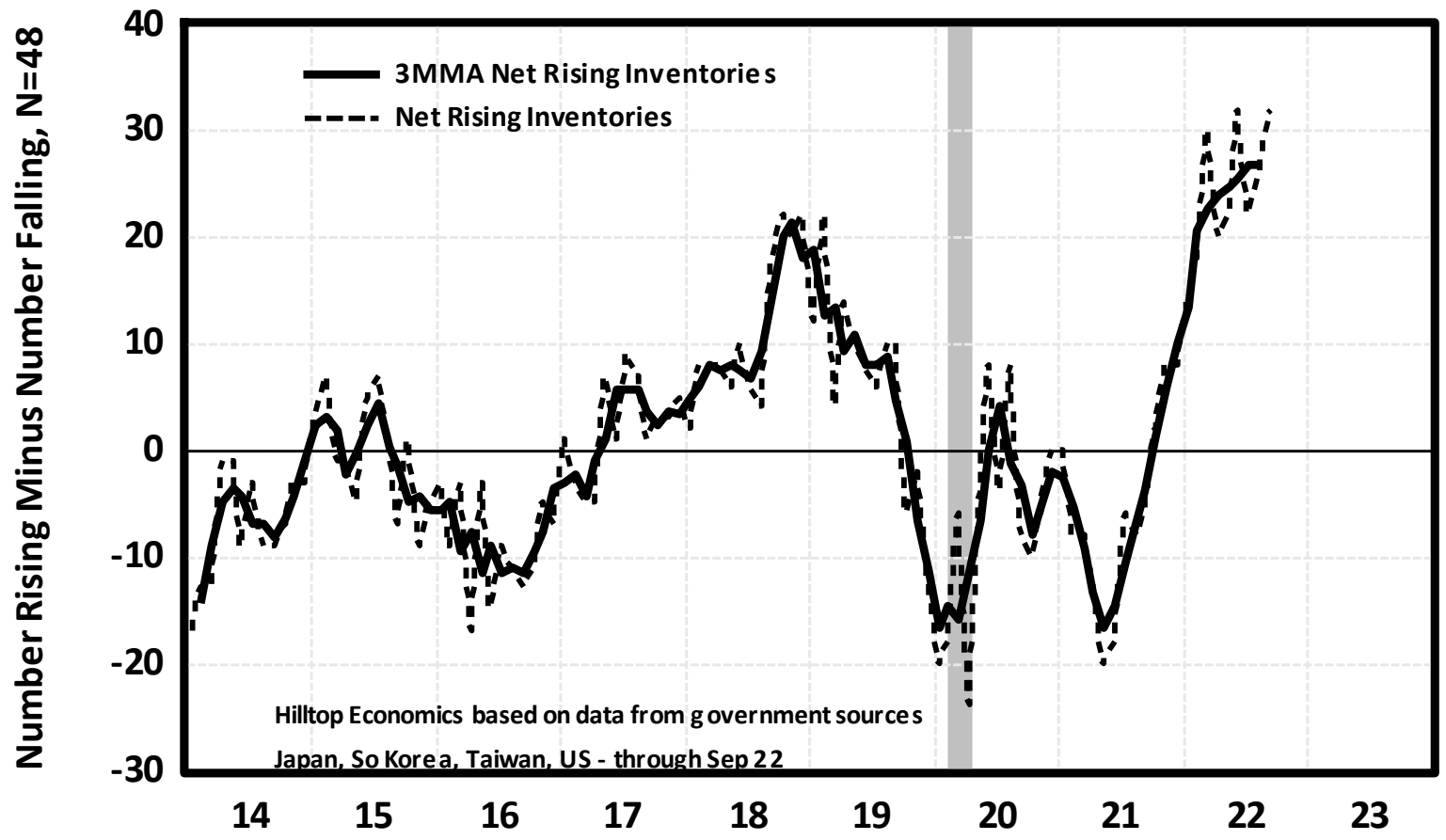


Unit	%CH VS YA	21Q1	21Q2	21Q3	21Q4	22Q1	22Q2	22Q3
PCs		55.6	15.0	4.2	0.4	-5.0	-14.7	-16.4
Smartphones		25.3	13.3	-5.9	-3.2	-8.9	-8.7	-9.6

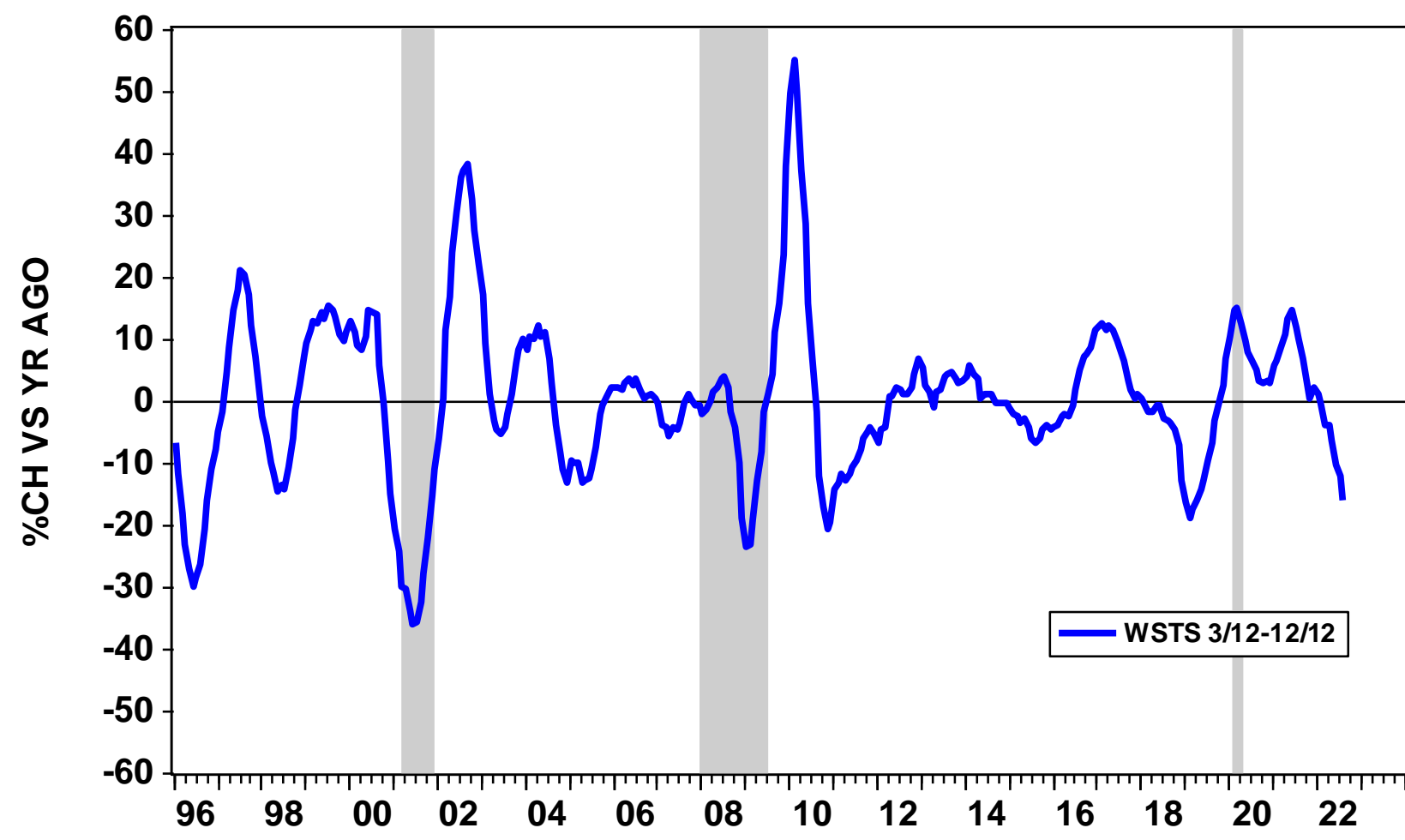
Downstream Industries and IC Inventories Rising to Extreme Levels

Now above "just in case" levels, highest index in ten years

NET RISING INVENTORIES: Electronics & Semiconductors

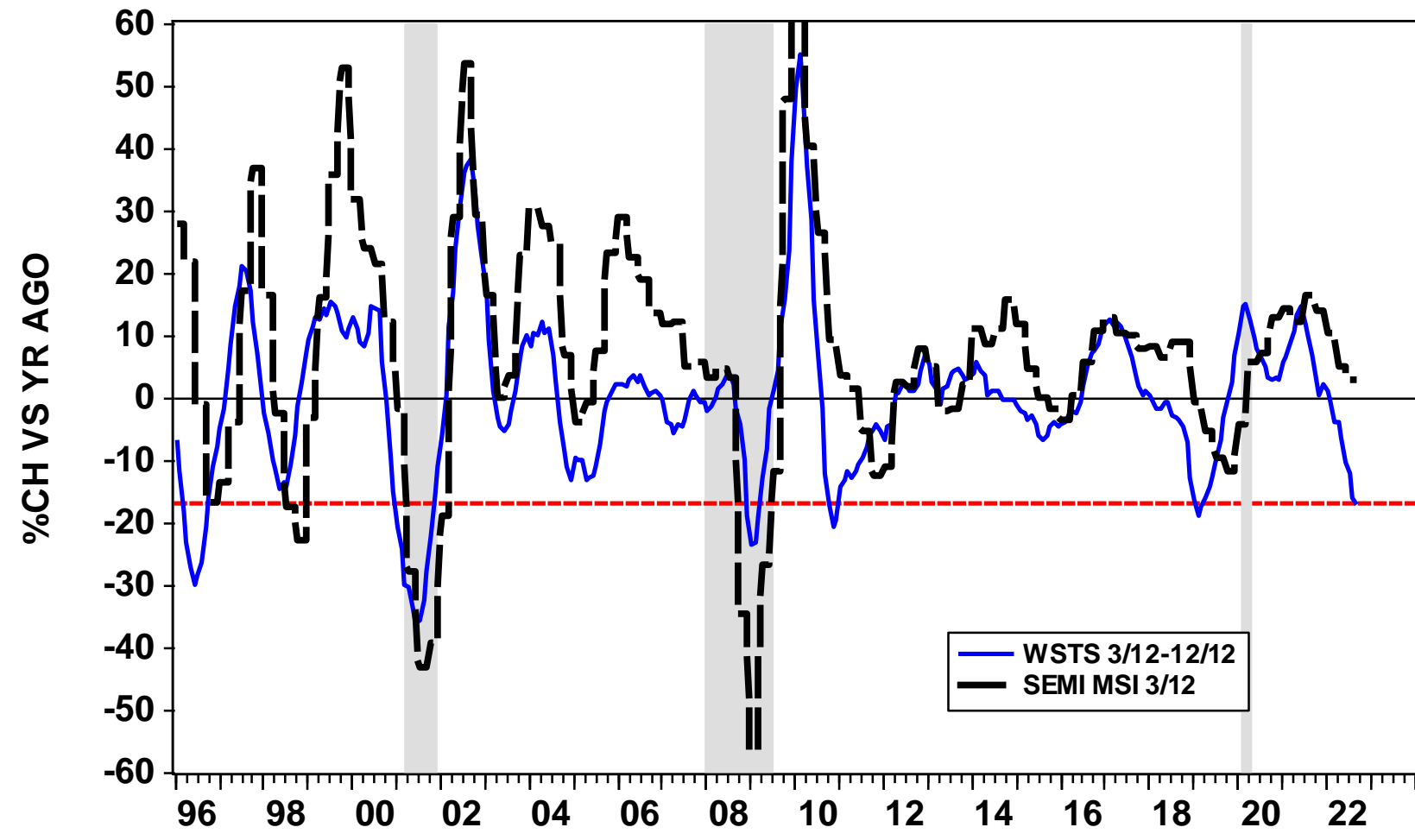


Revenue-based Leading Indicator of MSI Volume



Leading Indicator Momentum Hits MSI Decline Threshold

Leading indicator signaled a shift in MSI momentum in late 2021



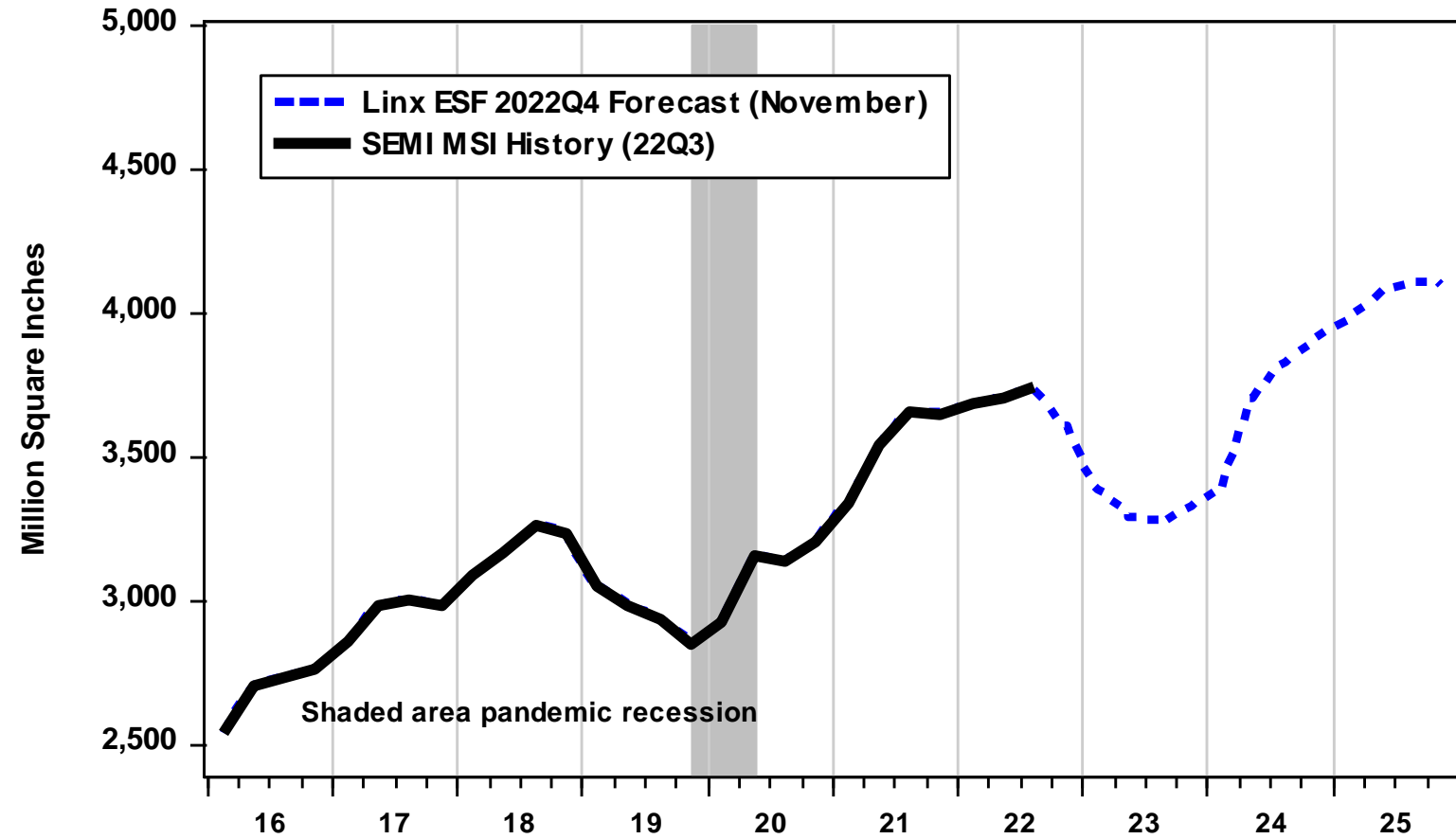
Heat Map Shows IC Output Declining Everywhere Except Taiwan

Monthly Performance Semiconductors	AVE %CHYA	Percent Change VS Year Ago									
		2022M01	2022M02	2022M03	2022M04	2022M05	2022M06	2022M07	2022M08	2022M09	2022M10
Industrial Production/Volume except WSTS (Revenue)	Prior 5 Yrs										
WSTS Revenue (3MMA)	10.1%	26.8%	26.2%	23.0%	21.1%	17.7%	11.9%	7.3%	(0.2%)	(3.0%)	
U.S. IP (SA) Semiconductor and other electronic component	7.4%	7.4%	9.3%	7.5%	2.8%	0.8%	3.0%	2.3%	0.4%	(1.4%)	(3.8%)
China Integrated Circuits Output (100 million units)	24.1%	7.6%	7.6%	(2.0%)	(9.5%)	(7.9%)	(6.6%)	(13.8%)	(22.9%)	(14.1%)	(25.2%)
Korea IP (SA) Mfg of Semiconductor	18.7%	28.3%	33.4%	26.4%	35.3%	24.7%	23.6%	17.1%	(0.1%)	(3.7%)	
Taiwan IP 2611: Integrated Circuits	15.4%	24.0%	19.9%	2.1%	25.0%	21.2%	7.7%	23.7%	29.1%	6.5%	
Japan IP All Integrated Circuits	4.8%	21.0%	28.7%	30.7%	10.2%	7.6%	34.7%	4.1%	(5.6%)	(3.1%)	
Singapore IP Semiconductors (3344)	21.3%	(5.5%)	26.7%	11.2%	6.3%	33.3%	(3.4%)	(3.2%)	(7.3%)	(8.7%)	
Number of Rising Indicators		22	22	19	21	19	18	16	10	8	0
Number of Falling Indicators		3	3	6	4	6	7	9	15	17	2
Net (Rising minus Falling)		19	19	13	17	13	11	7	(5)	(9)	(2)

Source: Hilltop Economics November 2022 Heat Map Report

Weak Final Demand Pulls SEMI MSI Down 10% in 2023

Semiconductor MSI Outlook





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Contact Hilltop Economics for information regarding Heat Map Report and
Economic Watch Dashboard

October 2022 Economic Watch Dashboard: Recession Risk High

Interest rates, confidence, prices point to recession; real measures (output, employment) still ok

- Yield Curve (inverted)
- Interest Differentials (US-EU gap wide)
- Business Earnings
- Global Consensus Forecast (weakening rapidly)
- Global Consumer confidence measures (recession levels)
- Economic Policy Uncertainty (war impact, interest rates)
- Equities (showing outlook concern)
- Global Inflation & Oil Prices
- Output momentum (growth holding up)
- Employment (strong, but hints the labor market is easing)

Hilltop Economics Economic Watch Dashboard: leading indicators that may help identify turning points that precede a downturn in the next 6 to 24 months. Available monthly.