Health Affairs
Scholar
EMERGING & GLOBAL HEALTH POLICY

OXFORD

Understanding macroeconomic indicators affected by COVID-19 containment policies in the United States: a scoping review

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Abstract

Containment policies were essential in controlling the spread of the COVID-19 pandemic in the United States, but they also introduced significant economic challenges. This scoping review aimed to examine the macroeconomic indicators used to assess COVID-19 closure and containment policies in the United States. We reviewed 42 eligible studies from 4516 records identified across PubMed, Web of Science, and EconLit. These studies explored various economic impacts, focusing on employment, labor market indicators, consumer spendings, etc., primarily using publicly available sources. During the pandemic, high-frequency data (eg, mobility and card transactions) became newly accessible and played a key role in evaluating the real-time effects of mitigation policies. Our review summarizes macroeconomic indicators investigated and provides researchers and policymakers with a list of data sources for assessment of economic impacts in the future. This review emphasizes the need for comprehensive evaluations to balance public health measures with economic considerations in future pandemic responses.

Key words: scoping review; evidence synthesis; policymaking; public health policy; nonpharmaceutical Intervention.

Introduction

As the COVID-19 pandemic spread across the United States, policymakers and government officials were tasked with creating policies and interventions to mitigate its impact. They relied on expert opinions and disease modeling studies to guide decisions and predict potential outcomes of different policy implementations.[1] During the pandemic, nonpharmaceutical interventions (NPIs) such as social distancing and mask mandates were widely adopted in the United States.[2] NPIs became popular due to their ability to mitigate the spread of COVID-19 while requiring fewer resources for distribution and management. Hsiang et al.[3] found that implementing NPIs led to a nearly 60% reduction in weekly COVID-19 cases during the early months of the pandemic. However, while NPIs were crucial in controlling the pandemic, their impact extended beyond the health sector, contributing to significant economic challenges, such as mass unemployment.

The economic disruptions caused by NPIs and associated measures, such as lockdowns, became evident, manifesting in rising unemployment rates, inflation, and shifts in gross domestic product (GDP).[4] Particularly, the mass unemployment resulting from COVID-19 containment policies could be linked to substantial declines in health outcomes as reported by numerous reviews, which reported 20% to 35% increased cardiovascular risks for unemployed individual compared to the employed.[5-8] These macroeconomic changes have significant implications for population health, affecting access to healthcare, food security, mental well-being, and adherence to medication regimens, ultimately impacting health outcomes. Therefore, these macroeconomic impacts, driven both by the pandemic itself and the interventions employed to contain it, highlight the importance of considering broader economic outcomes when implementing public health policies. Several studies have examined the economic activity associated with NPIs, confirming that these disruptions arose not only from the health crisis but also from the containment measures.[9-11] Given the significant macroeconomic consequences, it is essential to systematically evaluate the broader economic impacts of NPIs and other containment strategies to better inform future policies aimed at balancing public health and economic stability.[12]

While existing reviews have explored specific subsets of COVID-19 mitigation strategies, such as Bazak et al.'s[13] scoping review on the economic impact of international travel restrictions, no comprehensive review has yet assessed the macroeconomic impacts of containment and closure strategies in the United States. This scoping review aims to address this gap by (1) summarizing the economic indicators used to describe the effects of COVID-19 closure and containment policies in the United States and (2) proposing a set of key indicators and their sources that future researchers and policymakers can utilize. By consolidating relevant economic data into a comprehensive narrative, this review aims to offer actionable insights for policymakers seeking to balance public health and economic stability in future pandemics or crises.

Methods

Overall descriptions

We conducted this scoping review to investigate economic indicators utilized in empirical studies on containment interventions aimed at mitigating the COVID-19 pandemic in the United States, in accordance with the preferred reporting items for systematic reviews and meta-analyses extension for Scoping Reviews (PRISMA-ScR).[14] The study protocol was registered in advance on the Open Science Framework (OSF) (https://osf.io/qyg6f/).

Search strategy

Our search strategy was designed to capture relevant studies that fit within the scope of this review, using search strings related to containment policies, economic indicators, COVID-19, and the United States. We developed search strings for containment policies based on the "Containment and Closure" categories provided by the Oxford COVID-19 Government Response Tracker (OxCGRT), which offers a comprehensive classification of mitigation policies implemented during the pandemic.[15] To capture all relevant studies that evaluated macroeconomic indicators, we modified search terms from a previously conducted review on the economic impacts of international travel restrictions.[13] Systematic searches were conducted in 3 databases: PubMed, Web of Science, and EconLit. The search included studies from the inception of these databases until April 16, 2024. A pilot study was conducted to ensure the robustness and quality of the review methodology. Grey literature was not included. A searching strategy is provided in Supplementary Appendix S1.

Eligibility criteria screening

Studies were included in this scoping review if they met the following criteria: (1) examined public health policies in the context of COVID-19, (2) were either observational or interventional studies, and (3) included at least one of the policies classified under the "Containment and Closure" category of OxCGRT. The review was limited to studies conducted in the United States. In addition, studies had to assess macroeconomic outcomes, including proxy indicators, even if the outcomes were not explicitly described as macroeconomic but were established as such in prior literature. Studies were excluded if they (1) were based solely on forecasts or simulations without any empirical analysis (that is, we may include simulation studies analyzing empirical data as part of simulation), (2) did not directly assess the link between policies and economic outcomes, or (3) analyzed the impact of adherence or compliance to policies, which could introduce additional behavioral factors, which is not directly related to the economic impact of policy itself. Each study underwent a screening process by 2 independent reviewers (T.P. and W.L.), beginning with titles and abstracts, followed by full texts. Any discrepancies between the 2 reviewers were discussed with a third reviewer (J.-Y.C.). Duplicate studies were detected and removed prior to screening using EndNote 21.

Data extraction

We extracted the following data from each included study: (1) study characteristics (study setting, study objective, mitigation strategy, data period observed, and methods used); and (2) macroeconomic indicators (evaluated macroeconomic indicators, descriptions of indicators, measuring frequency, data sources, and whether policymakers were referenced or engaged by the study). Mitigation strategies were categorized based on "Containment and Closure" policies of OxCGRT according to the descriptions provided by each study. Regarding the outcomes, which is key information for this review, we scrutinized the macroeconomic indicators in greater depth, particularly their data sources, measurement levels (eg, national, state, city, or county levels), availability, and whether the data collection was routine or COVID-specific. Additionally, we assessed the studies' policy implications and engagement with policymakers and/or stakeholders. This was done by evaluating whether the study explicitly discussed its implications for policy, engaged policymakers and/or stakeholders, and provided descriptions of such engagements, where applicable. We also reviewed the authors' affiliations and funding sources to assess potential engagement or policy relevance. Two independent reviewers (T.P. and J.C.) performed the data extraction. Any discrepancies were resolved through consensus or by consulting a third reviewer (N.C.) when necessary. Data extraction was conducted using Microsoft Excel.

Analysis

We performed both qualitative and quantitative synthesis to provide a narrative summary of the relevant literatures, focusing on the macroeconomic impacts of COVID-19 containment policies in the US Data sources for macroeconomic indicators identified in the studies were assessed for their availability and unit of analysis. Our qualitative synthesis involved a narrative synthesis and thematic analysis of the included studies to summarize key themes and findings. The quantitative synthesis consisted of descriptive statistics to summarize the characteristics of the included studies and the frequency of reported indicators and data sources. Moreover, we assessed whether the studies are relevant to policy decision making based on their discussion and study context, particularly how the empirical evidence (primarily observational and identifying associations) were utilized by policymakers during the pandemic. We acknowledge that the studies included in this review are largely observational and identify associations between containment policies and macroeconomic indicators, rather than establishing causal relationships.
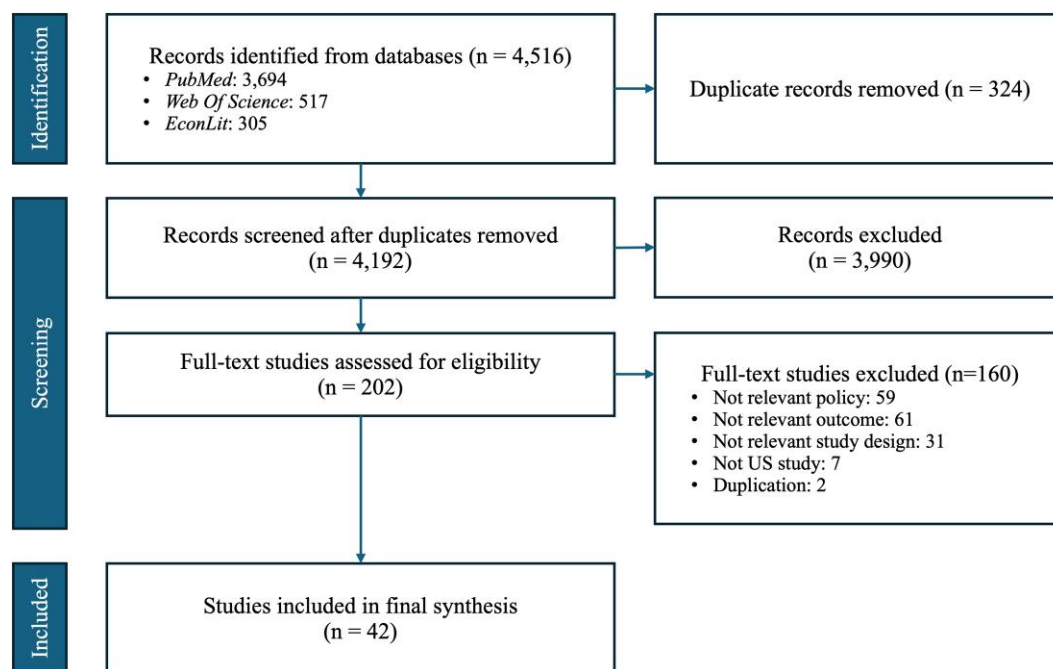
Figure 1. PRISMA flow chart.

Results

Study selection

A total of 4516 citations were identified from 3 databases: PubMed, Web of Science, and EconLit. After the removal of 324 duplicate records through automated detection, 3970 studies were excluded further during the title and abstract screening. Most of the excluded studies were either non-US or nonempirical studies. Thus, 202 articles were subjected to a full-text review. At this stage, 160 studies were excluded for various reasons, including the use of nonempirical methods (eg, model simulation) or the absence of explicit economic indicators assessed with containment measures (Supplementary Appendix S2). Consequently, 42 studies met eligible criteria and were carried forward to the data extraction and qualitative synthesis (Figure 1).[9-11,16-54]

Study characteristics

A comprehensive data synthesis was completed to extract key information to summarize the identified economic indicators and their data sources (see Table 1; Supplementary Appendix S3 and S4). While the dates from the included publications ranged from 2021 and 2023, reflecting the research activity in response to the COVID-19 pandemic, the data collection periods primarily focused on the initial phases of the COVID-19 pandemic and the implementation of containment policies. The majority of studies (35/42, 83.3%) analyzed data until 2020, capturing the period of most intense policy implementation and significant economic disruption (Figure 2). Seven studies extended their analysis to include data from 2021 to 2022.[19,22,24,37,39,41,53] Out of the 42 included studies, 33 (78.6%) focused on economic indicators associated with mitigation strategies implemented at the national level,[9-11,16-21,23-25,28-30,32-35,38-44,46-48,51-54] while the remaining 9 (21.4%) were based on subnational analyses, focusing on individual states or specific region.[22,26,27,31,36,37,45,49,50] The studies assessed a variety of containment and closure policies. The most common interventions assessed in these studies were stay-at-home orders ($N = 38$, 90.5%),[9-11,16,17,19-42,44-46,48,49,51-54] followed by workplace closures ($N = 37$, 88.1%),[10,11,17-27,30-46,48-54] school closures ($N = 14$, 33.3%),[19-21,24,28,31,34-36,39,41,47,49,52] and restrictions on gatherings size ($N = 11$, 26.2%). The methodological approaches used in the included studies varied but were predominantly observational. The most commonly employed econometric techniques were difference-in-differences ($N = 14$, 33.3%),[9-11,16-18,22,28,35-38,43,52] panel regression ($N = 14$, 33.3%),[10,18,20-22,24,32,34,39,40,42,46-48] and event study model ($N = 13$, 31.0%).[9-11,16,18,21,25,27,29,31,32,38,52]

Economic indicators

The economic indicators examined across the studies were grouped into 6 categories, reflecting the multidimensional nature of the economic changes associated with COVID-19 containment measures: employment and labor market indicators, business operations, consumer behavior and spending, economic fundamentals, market and financial indicators, and proxies for economic activity (Table 2).

Employment and labor market indicators were the most frequently reported, with 16 (38.1%) studies examining outcomes such as employment rates, unemployment insurance claims, unemployment rates, and hours worked.[9-11,16,18,19,21,24,26,28,31,33,38,41,46,49] Business operations were another key focus of the included studies. Indicators in this category, assessed by 9 (21.4%) studies, included the number of active business owners, business registrations, business revenue, and firm closures.[9,10,17,21,26,38,40,50,53] Most of these studies assessing either employment and labor market or business operations highlighted the impacts of containment measures on small and medium-sized enterprises, which often lacked the financial resilience to withstand prolonged periods of reduced or no revenue.[9,11,17,18,21,28,38,46,50] Two studies also examined

Table 1. Study characteristics of included studies.

Author (year)	OxCGRT mitigation strategies	Scope of study	Level of analysis	Method
Ali et al. (2021)[16]	C6	National	National	DID, ESM
Balla-Elliott et al. (2021)[17]	C2, C6	National	National	DID, IV
Barrot et al. (2023)[18]	C2	National	Subnational (commuting zone)	DID, ESM, Panel regression
Bartik et al. (2020)[9]	C6	National	Subnational (State)	DID, ESM
Bollyky et al. (2023)[19]	C1, C2, C4, C6	National	Subnational (State)	CSA
Buechler et al. (2022)[20]	C1-C8	Global	Country	Panel regression
Chen et al. (2020)[21]	C1, C2, C4, C6	Global	Country	Panel regression, CSA, ESM
Dean et al. (2023)[22]	C2, C6	State (UT)	Subnational (UT)	DID, Panel regression, TS
Dhakal et al. (2022)[23]	C2, C4, C6	National	National	2-Part model
Dreger and Gros (2021)[24]	C1, C2, C4, C6	National	Subnational (State)	Panel regression, CSA
Dunphy et al. (2022)[10]	C2, C6	National	Subnational (State)	DID, ESM, Panel regression
Fairlie (2020)[26]	C2, C6	National	National	Descriptive
Fairlie and Fossen (2022)[25]	C2, C6	State (CA)	Subnational (CA)	ESM, CSA
Gabe and Crawley (2021)[27]	C2, C6	State (ME)	Subnational (ME)	TS, ESM
Gupta et al. (2022)[11]	C2, C6	National	Subnational (State)	DID, ESM
Heggeness (2020)[28]	C1, C6	National	National	DID, DDD
Joshi and Musalem (2021)[29]	C6, C7, C8	Global	National	ESM
Kim and Kwan (2021)[30]	C2, C6	National	Subnational (County)	MLM
Kong and Prinz (2020)[31]	C1, C2, C4, C6	State (CA)	Subnational (CA)	ESM
Laeven (2022)[32]	C2, C6	National	National	Panel regression, ESM
Leukhina and Yu (2020)[33]	C2, C6	National	National	Descriptive
Li et al. (2022)[34]	C1-C8	Global	Country	Panel regression
Ligo et al. (2021)[35]	C1-C6	National	Subnational (State)	DID
Lou et al. (2021)[36]	C1, C2, C6	State (AZ&IL)	Subnational (AZ&IL)	DID, RDiT
Lu and Giuliano (2023)[37]	C2, C6	County (Los Angeles County, CA)	Subnational (Los Angeles County, CA)	DID
O'Flaherty (2022)[38]	C2, C3, C6	National	Subnational (State)	DID, ESM
Odusami and Mansur (2022)[39]	C1, C2, C4, C6	National	Subnational (State)	Panel regression
OECD (2021)[40]	C2, C6	Global	Country	Panel regression
Parolin and Lee (2022)[41]	C1, C2, C6	National	National	Descriptive
Polat and Sevil (2022)[42]	C2, C6	Global	Country	Panel regression, ARDL
Restrepo et al. (2020)[43]	C2	National	National	DID, IV
Rose et al. (2023)[44]	C2, C6	National	National	MLM, GLM
Serrano-Calvo et al. (2023)[45]	C2, C6	Regional (Permian Basin)	Subnational (Permian Basin)	Emission flux analysis
Sjoquist and Wheeler (2021)[46]	C2, C6	National	Subnational (State)	Panel regression
Verschuur (2021)[47]	C1, C5, C7	Global	Country and Port	Panel regression
Wallingford et al. (2023)[48]	C2, C6	Global	Country	Panel regression
White et al. (2023)[49]	C1, C2, C4, C6	Regional (Metro& Coastal regions, GA)	Subnational (County)	Joinpoint regression, GLM
Yi et al. (2022)[50]	C2	City (New York City)	Subnational (New York City)	CSA
Yilmazkuday (2021)[51]	C2, C6, C7	National	Subnational (County)	PPML
Yortuk (2022)[52]	C1, C2, C4, C6	National	Subnational (Metropolitan Areas)	DID, ESM
Zhai and Yue (2022)[53]	C2, C6	National	Subnational (County)	Spatiotemporal
Zhong et al. (2022)[54]	C2, C6	Global	Regional (San Franciso Bay area)	Spatiotemporal

Abbreviations: ARDL, autoregressive distributed lag model; AZ, Arizona; C1 School closing, C2 Workplace closing, C3 Cancel Public events, C4 Restriction on gathering size, C5 Close public transport, C6 Stay at home requirements, C7 Restrictions on internal movement, C8 Restrictions on international travel; CA, California; CSA, cross-sectional analysis; DDD, triple difference model; DID, difference-in-difference; ESM, event study method; GA, Georgia; GLM, generalized linear regression; IL, Illinois; IV, instrumental variable analysis; ME, Maine; MLM, multilevel model; OxCGRT, Oxford COVID-19 Government Response Tracker; PPML, pseudo-Poisson maximum likelihood; RDiT, regression discontinuity in time; TS, time-series analysis; UT, Utah.
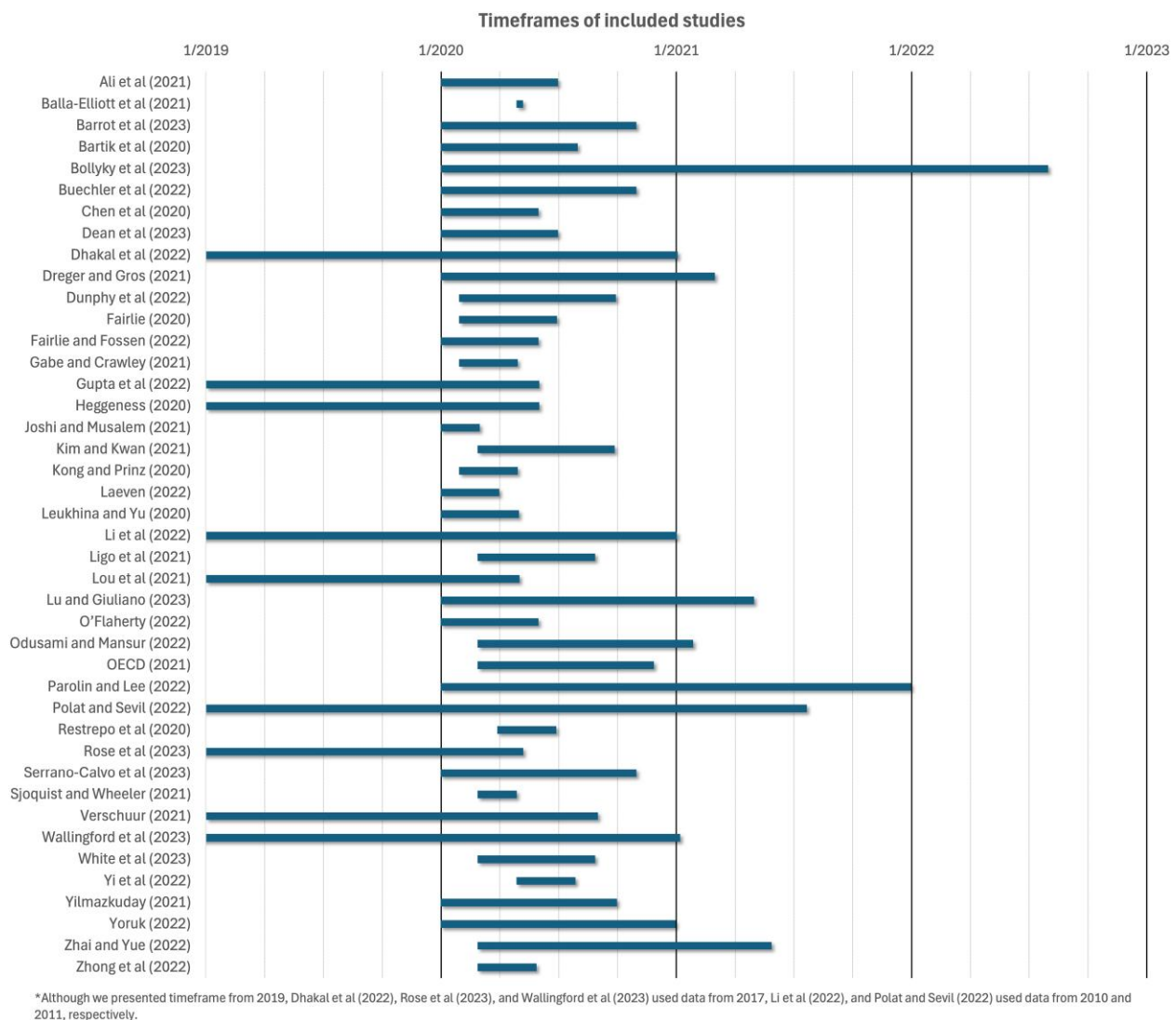
Figure 2. Timeframes of included studies.

the role of government support programs, such as the Paycheck Protection Program, in mitigating the negative effects of containment policies on business survival,[46] or Child Tax Credit benefits to help alleviating the economic strain for families with child during pandemic.[41] Consumer behavior and spending were assessed in 10 (23.8%) studies.[10,22,23,27,33,35,38,41,43,44] Indicators in this category included credit and debit card transactions, and expenditures on goods and services. Some of these studies reported not only the change of spending amount but the shifts in consumer spending patterns during the pandemic, particularly in response to lockdowns and mobility restrictions.[22,23,27,43,44] For example, 2 studies documented a sharp decline in discretionary spending on services, such as dining and entertainment, alongside an increase in spending on essential goods like groceries.[22,27] Economic fundamentals, including broader macroeconomic indicators such as GDP, inflation, trade balances, and fiscal deficits, were analyzed in 9 (21.4%) studies.[19,20,22,25,39,41,42,46,47] These studies provided a more comprehensive view of the macroeconomic impacts of containment policies, highlighting the deep recessions experienced in the US economy during the

pandemic. Market and financial indicators, analyzed in 5 (11.9%) studies, included stock market performance, bond yields, and corporate debt levels.[32,39,42,48,52] One study in this category documented significant volatility in stock markets, particularly during the early stages of the pandemic, when uncertainty about the trajectory of the virus and the economic outlook was at its peak.[39] Another study explored the effects of containment policies on specific sectors of the stock market, such as technology and healthcare, which experienced gains during the pandemic, in contrast to sectors like hospitality and travel, which were severely affected.[32] In addition to these traditional economic indicators, several studies (31.0%, 13/42) used proxies for economic activity, such as mobility data, electricity usage, and traffic volumes, to estimate the associations with containment policies.[9,11,20,21,27,29,30,34,36,37,45,51,54]

Summary of key findings

Stay-at-home orders, the most frequently studied intervention, were associated with significant decreases in employment and labor market activity. Multiple studies using unemployment insurance claims, employment rates, and hours worked

Table 2. Summary statistics from the included studies regarding mitigation strategy, outcomes, data source, and decision relevance.

Variables (n, %)	Total (N = 42)	Scope of study	
		National (N = 33)	Subnational (N = 9)
Mitigation strategies studied[a]			
C1 School closing	14 (33.3%)	11 (33.3%)	3 (33.3%)
C2 Workplace closing	37 (88.1%)	28 (84.8%)	9 (100%)
C3 Cancel Public events	4 (9.5%)	4 (12.1%)	0 (0%)
C4 Restriction on gathering size	11 (26.2%)	9 (27.3%)	2 (22.2%)
C5 Close public transport	5 (11.9%)	5 (15.2%)	0 (0%)
C6 Stay at home requirements	38 (90.5%)	30 (90.9%)	8 (88.9%)
C7 Restrictions on internal movement	5 (11.9%)	5 (15.2%)	0 (0%)
C8 Restrictions on international travel	3 (7.1%)	3 (9.1%)	0 (0%)
Economic indicators included			
Employment and labor market	16 (38.1%)	14 (42.4%)	2 (22.2%)
Business operations	9 (21.4%)	8 (24.2%)	1 (11.1%)
Consumer behavior and spending	10 (23.8%)	8 (24.2%)	2 (22.2%)
Economic fundamentals	9 (21.4%)	7 (21.2%)	2 (22.2%)
Market and financial indicators	4 (9.5%)	4 (12.1%)	0 (0%)
Economic activity proxies	13 (31.0%)	9 (27.3%)	4 (44.4%)
Data sources attributes			
Include publicly accessible data only	26 (61.9%)	20 (60.6%)	6 (66.7%)
Include nonpublicly accessible data	16 (38.1%)	13 (39.4%)	3 (33.3%)
Using data that is COVID-specific collection	8 (19.0%)	5 (15.2%)	3 (33.3%)
Unit of analysis provided by data sources			
Use national-level only data as unit of analysis	5 (11.9%)	5 (15.2%)	0 (0%)
Use national and subnational level data as unit of analysis	35 (83.3%)	30 (90.9%)	5 (55.6%)
Use subnational-level only data as unit of analysis	5 (11.9%)	0 (0%)	5 (55.6%)
Relevance to policy decision making			
Funded by policy-relevant institute	10 (23.8%)	8 (24.2%)	2 (22.2%)
Authors have policymaking-relevant affiliations	5 (11.9%)	3 (9.1%)	2 (22.2%)

[a]Mitigation strategies were categorized based on the Oxford COVID-19 Government Response tracker (OxCGRT).

as indicators found negative associations with stay-at-home orders, indicating job losses and reduced working hours during these periods.[9-11,16,19,21,24,26,28,31,33,38,41,46,49] Workplace closures were also frequently examined and found to be associated with negative impacts on business operations. Indicators such as business revenue or active business owners showed declines associated with workplace closure policies.[10,21,26,38,40,50,53] Studies focusing on small and medium-sized enterprises particularly highlighted the vulnerability of these businesses to workplace closures.[9,17,18,21,25,26,38] Moreover, economic activity proxies, such as mobility data, electricity usage, and traffic volumes, consistently showed reductions associated with stringent containment policies, validating their use as real-time indicators of economic contraction during policy implementation.[11,20,21,27,29,30,34,36,37,45,51,54] While the magnitudes of associations varied across studies due to differences in methodology, data, and geographic focus, the overall findings converge in demonstrating that COVID-19 containment policies were associated with significant impacts across a range of macroeconomic indicators in the United States, particularly in employment, business operations, and consumer spending.

Data sources

The studies included in this review utilized a wide range of data sources to assess the economic impacts of COVID-19 containment measures (Table 3). The majority of included studies used publicly accessible data only (61.9%, 26/42),[10,11,16-20,22-31,33-35,37,40-43,46-49] while the remaining 18 studies relied on restricted-access datasets.[9,21,32,36,38,39,44,45,50-54] Eight studies (19%) utilized data specifically collected or

published during the COVID-19 pandemic, reflecting the rapidly evolving economic conditions and demand on data at that time.[10,17,20,22,29,30,49,50] The data sources used by the studies varied in terms of their geographic granularity, with some focusing on national-level data and others incorporating subnational or even local-level data. For example, the US Bureau of Labor Statistics and the US Census Bureau were commonly used sources for national and state-level economic indicators, while private data providers like SafeGraph and Opportunity Insights provided real-time data on mobility, consumer spending, and business operations at more localized levels. Some studies assessing nitrogen dioxide emission as a proxy of economic activity used data observed from satellite, which provide real-time data by geographical grid.[34,45] Finally, about one thirds of studies (13/42, 31.0%) relied on traditional data (eg, US Census, Surveys conducted by US Bureau of Labor Statistics),[9,11,19-24,26,28,33,41,43] while 19 studies used at least one type of high-frequency data such as Homebase, SafeGraph, and Google Mobility.[9-11,18,20,29,30,32,35,37-39,42,44,49,51-54] Such high-frequency data have relatively small unit of observation time such as the day or week.

Relevance to policymaking

While all of the included studies evaluated economic outcomes related to COVID-19 containment strategies, 12 (28.6%) studies engaged directly with policymakers.[9,22,24,25,28,34,35,43,45,47,48,50] Specifically, 10 (23.8%) studies received funding from policy-relevant institutions,[9,24,28,34,35,43,45,47,48,50] and just 5 (11.9%) had authors affiliated with policymaking organizations.[22,24,25,43,47] Studies that did engage with policy discussions tended to focus on the broader implications of their findings for

Table 3. Data sources used in the included studies from a national scope of analysis.

Data source[a]	Geographical granularity	Public availability	COVID-specificity	Example of economic indicators
National level of economic data available				
OECD Annual Business Survey	National	Yes	No	New business entries[40]
OECD	National	Yes	No	CCI; CPI; GDP; Interest rates[42]
UN Comtrade	National	Yes	No	Trade flow (by sector)[47]
Bloomberg Professional Service	National	No	No	Municipal bond total return index; Stock market index; Volatility index[39]
Food and Agricultural Organization (FAO)	National	Yes	No	CPI; FPI[48]
DataStream	National	Yes	No	Travel and leisure sector index[42]
Compustat	National	No	No	ROA, Stock price (by firm, sector)[18,32]
National and subnational level of economic data available				
Alignable Survey data	National, State and County	No	Yes	Business responses to containment (reopening plan, etc.)[17]
SafeGraph	National, State, county, city and CBG	No	No	Business closures[53]
SafeGraph COVID-19 Data consortium	National, State, county, city and CBG	Yes[b]	No	Mobility[9,37,54]
Opportunity Insights Economic Tracker	National, state, county and ZIP	Yes	Yes	Business revenue; Consumer spending; Employment; Unemployment insurance claims[10,35,38,49]
Homebase	National, state, and commuting zone	No	No	Business closures; Hours worked; Number of employees; Wages[9,18,21,38]
Current Population Survey	National, State, and MSA	Yes	No	Business closures; Earnings; Employment; Hours worked; Poverty rates[9,11,26,28,33,41]
Consumer Expenditure Diary Survey	National, Regional, State, and MSA	Yes	No	Consumer spending (by household)[23]
Facetus Transaction Data	National, State, and County	No	No	Consumer spending; Sales transactions (in-store; online)[44]
Census Household Pulse Survey	National, State, and MSA	Yes	No	Food hardship; Food spending (Total; Food at home; Food away from home)[41,43]
American Time Use Survey	National, State, MSA	Yes	No	Hours spent (market; home production; leisure)[33]
US Energy Information Administration	National and State	Yes	No	Electicity consumption; Oil and Gas Production[20,21,45]
OMNO2d (Ozone monitoring instrument, NASA Earth Observing System Aura satellite	National, International, Regional, and Grid cell[c]	Yes	No	Nitrogen dioxide emissions[34]
TROPOMI Satellite data	National, International, Regional, and Grid cell[d]	Yes	No	Nitrogen dioxide emissions[45]
Descartes Labs Mobility Data	National, state, and county	Yes	Yes	Mobility (Distance traveled)[30]
Enverus DrillingInfo	National, State, County, Basin, and custom area	No	No	Drilling activity[45]
Google COVID-19 Community Mobility Reports	National, State, County, City, and Census tract	Yes	Yes	Mobility[9,37,54]
PlaceIQ Smartphone Data	National, State, County, City, ZIP, and custom area	No	No	Mobility (Reductions intercounty and intracounty travel)[51]
Small Business Administration Paycheck Protection Program	National and State	Yes	No	Federal CARES Act support[46]
Tax Foundation	National and State	Yes	No	Economic fundamentals (tax burden, tax collection, debt per capita, etc)[39]
US Treasury Data	National and State	Yes	No	Child Tax Credit (CTC) benefits[41]
Automatic Identification System (AIS) data (via UN Global Platform)	National, International and Port	Yes	No	Maritime trade (Imports and exports)[47]
US Bureau of Economic Analysis	National, state, county	Yes	No	GDP; Personal consumption expenditures[19,20,22]
Federal Reserve economic data	National and state	Yes	No	Employment rate[19]
US Bureau of Labor Statistics	National and state	Yes	No	Unemployment insurance claims[11,21,24,46]
Economic Modeling Specialists International Data	National, Regional, State, MSA, and County	No	No	Online job postings for Early Care and Education (ECE)[16]

Table 3. Continued

Data source[a]	Geographical granularity	Public availability	COVID-specificity	Example of economic indicators
Google Trends	National, State, and Designated Market Area	Yes	No	Search for unemployment related terms (eg, benefit, claims filing)[11,31]
Zillow Research Data	National, State, County, City, and MSA	No	No	Housing market indicators (median price, etc); Web traffics[52]
Subnational level of economic data available				
Google Street View Virtual Walks	Neighborhood (New York City, New York)	Yes	No	Business closures[50]
New York City Health Department Restaurant Inspections Database	Neighborhood (New York City, New York)	No	Yes	Business closures[50]
Maine Revenue Services	State	Yes	No	Sales (Hospitality sales)[27]
The Utah Economic Survey	State	No	Yes	Consumer spending[22]
Maine Department of Transportation	State	Yes	No	Mobility (Daily traffic)[27]
Smart Meter Data	State, County, ZIP, and Household	No	No	Electicity consumption (Residential, Commercial)[36]
Administrative data from State of Utah	State and City	Yes	No	Sale tax revenue (by sector)[22]
California Department of Tax and Fee Administration	State, County, and City	Yes	No	Taxable sales (total; by sector)[25]

[a]The statistical rigor and the reporting of uncertainty (eg, standard errors, confidence intervals) may vary across these data sources, with some providing measures of statistical uncertainty while others are primarily descriptive. [b]SafeGraph COVID-19 Data consortium provided mobility data publicly. [c]Grid cell size was 0.25° latitude by 0.25° longitude. [d]Grid cell size was 5.5*3.5 km.
Abbreviations: CARES, the coronavirus aid, relief, and economic security; CBG, census block group; CCI, consumer confidence index; CPI, consumer price index; FPI, food price index; GDP, gross domestic production; MSA, metropolitan statistical areas; ROA, return on assets.

future pandemic preparedness and response. For example, several studies highlighted the need for more balanced approaches to containment, which account for both public health outcomes and the economic costs of such measures.

Discussion

This scoping review underscores the critical importance of understanding macroeconomic indicators not just for economic stability, but for population health. Our review identified key economic indicators and data sources within studies analyzing the macroeconomic impacts of COVID-19 containment strategies in the United States, revealing the profound and interconnected nature of economic and health outcomes during the pandemic. The most frequently examined interventions were stay-at-home orders and workplace closures, widely implemented in early pandemic phases. Employment and labor market indicators were the most frequently reported economic outcomes, reflecting sectoral disruptions due to these policies. Among the 42 studies in this review, 42 unique economic data sources were utilized, most publicly available. Studies applied methodologies like difference-in-difference, panel regression, and event study models to distinguish the economic impacts of the pandemic itself from containment policies. Some studies used high-frequency data, such as mobility, electricity usage, and transaction data, which provided real-time insights into the impacts of mitigation strategies. These sources captured rapid changes in consumer behavior, business operations, and mobility, supplying policymakers with timely decision-making information. Traditional economic indicators (eg, GDP, inflation, and unemployment rates) were widely utilized but often lagged in capturing early impacts.

This is the first scoping review summarizing all economic indicators assessed for US containment policies during the COVID-19 pandemic. While another review focused on specific measures, such as international travel restrictions,[13] its focus was on global trade and tourism. Our review reported localized impacts on labor markets, business operations, and consumer spending. Notably, although financial market performance was frequently assessed in prior reviews,[13] only a handful of studies (5/42) using this measure were included in our review.[32,39,42,48,52] This may be due to our focus on US economic impacts, allowing for direct economic indicators like employment rates. Additionally, we examined all containment policies, not only travel restrictions. Thus, studies included in this review used macroeconomic measures broadly, capturing the overall impact rather than sector-specific measures like tourism income or stock market returns. The limited research on financial market response suggests a need for further investigation into the long-term economic effects of COVID-19 policies, including investor sentiment and credit markets.

Our findings highlight a scarcity of studies on the economic changes associated with public health measures during the pandemic. Despite a comprehensive search, only 42 studies assessed the economic indicators associated with US containment policies, including working papers.[21,26,38,40] This reflects the fact that COVID-19 mitigation policies were introduced primarily for urgent public health needs, with economic effects considered secondary. Although containment policies successfully controlled early COVID-19 spread, they had broad and disproportionate economic impacts. Our findings show that many studies focused on small businesses, especially in hospitality, highlighting challenges faced by small businesses and hourly workers due to closures and reduced demand.[9,10,17,25-27] As this review targeted economic indicators, we did not capture distributional impacts or measures like the Gini coefficient. Nonetheless, aggressive public health measures likely had a greater effect on less resilient businesses, potentially widening economic disparities. These findings underscore the importance of considering both overall and

disproportionate economic consequences when preparing future pandemic policies. Understanding what and how to measure these impacts can help policymakers anticipate economic consequences before policy implementation.

Our findings highlight the potential of high-frequency data, such as mobility data and unemployment insurance claims, as early warning indicators of economic distress during a pandemic, which can be useful for policymakers. Public health agencies can utilize these indicators to proactively anticipate potential health-related consequences, such as increased depression or disruptions in healthcare access. Moreover, understanding the disproportionate economic impacts of containment policies on various sectors and populations is crucial for designing targeted interventions. Policymakers can use this information to develop targeted economic support programs, such as sector-specific grants or unemployment benefits, to mitigate negative health impacts in vulnerable populations who face job losses and income insecurity. Finally, this review underscores the need for a balanced and integrated approach to pandemic policymaking. When considering future NPIs, policymakers should simultaneously assess both epidemiological and macroeconomic indicators to understand the broader health and economic consequences. This integrated assessment can inform the design of policies that optimize public health outcomes while minimizing negative economic and social impacts. For instance, implementing proactive economic safety nets and support systems alongside NPIs can help mitigate adverse effects on social determinants of health.

The effectiveness of these policy recommendations, however, must be interpreted within the context of how they are implemented and enforced. The COVID-19 containment policies in the United States were introduced and enforced at federal, state, and local levels with varying degrees of strictness, timelines, and public adherence. Further, research has shown that how individuals respond to policy differs by the level of government due to how it updates their beliefs about the state of the world.[55] This heterogeneity of policy implementation indicates that a single recommendation will not be effective or applicable in all contexts. Therefore, to ensure effective public health policy, policymakers are required to adapt policy recommendations to local contexts, needs, and enforcement capabilities, which highlights the needs of engagement of policymakers when conducting the research on containment policies. Nevertheless, our review found that only a small portion of studies engaged stakeholders, especially policymakers, as part of the process of their study conduct or dissemination. This lack of direct engagement with policymakers may reduce the relevance and utility of research findings, limiting the potential to effectively incorporate evidence into decision-making processes. For example, studies focusing on a particular economic indicator may lack relevance to policymakers who look at multiple endpoints to make a decision, or studies relying on data sources that are not readily available for policymakers might reduce the applicability of findings. To improve the relevance and uptake of research findings, future studies should actively engage policymakers throughout the research process to identify key policy-relevant questions, co-develop research methodologies, and facilitate the translation of evidence into practical guidelines.

Our study has several limitations. First, quality assessment for individual studies was not conducted during the screening process as the goal of this scoping review was to provide an overview of the available literature rather than evaluate the methodological quality of individual studies. Second, this review was limited to studies conducted in the United States and focused exclusively on containment and closure policies. Although we included international studies with US data, this may have excluded studies evaluating other types of mitigation policies such as vaccination. Additionally, by restricting the review to only empirical studies, studies based on simulation models were excluded, which may have limited the breadth of the findings. Third, while this review captures the short-term economic impacts of COVID-19 containment policies, the long-term consequences, such as impacts on economic distribution or social determinants of health, were not explored in depth. Lastly, we acknowledge that the reliance on published literature may be susceptible to publication bias, as studies with null or negative findings may be underrepresented. Thus, it may affect the underreporting of some economic indicators relevant to the policymakers but not showing significant findings.

Our review highlighted a wide range of macroeconomic indicators that captured various aspects of economic activity during COVID-19 containment measures. These indicators have direct and indirect implications for public health that need careful consideration. For example, decreased economic activity can be measured through NO_2 emission, which is also associated with improved air quality, offering a potential pathway for immediate public health benefits. At the same time, we also highlighted the association of COVID-19 policies with employment and business activity, which are crucial social determinants of health, potentially impacting access to health services and chronic disease management. As shown in our review, understanding the relationship between macroeconomic indicators and public health is critical for designing holistic and effective public health policies. Future research should aim to assess both health and economic outcomes of containment measures to provide a more balanced understanding of the trade-offs involved. Moreover, to leverage these findings to enhance the policymaking process, researchers should collaborate or engage with policymakers during future pandemic preparedness activities. There is also a need for further research on underexplored economic aspects, which can be financial market responses, or even long-term impacts. Expanding the focus beyond immediate economic impacts to include long-term consequences, such as changes in economic inequality, will provide a more comprehensive understanding of the effects of containment policies. Integrating high-frequency data with traditional economic indicators could enhance the ability to monitor economic conditions in real time and could complement the traditional economic indicators. Moreover, public health researchers developing simulation models should consider the integrating economic endpoints into their simulation model, which may help policymakers implement the findings from the simulation model.

Conclusion

This scoping review provides a comprehensive overview of the economic indicators associated with COVID-19 containment and closure policies in the United States with emphasizing the importance of balancing public health measures with economic sustainability in future pandemic responses. Researchers should leverage various data to assess the multidimensional impacts of mitigation strategies and enhance collaboration with

policymakers to ensure the relevancy and applicability of their findings to be implemented in future pandemic preparedness.

Supplementary material

Supplementary material is available at *Health Affairs Scholar* online.

Funding

Conflicts of interest

Please see ICMJE form(s) for author conflicts of interest. These have been provided as supplementary materials.

All authors declare that they have no conflict of interest.

Disclaimer

This paper was made possible by cooperative agreement NU38FT000009-01-00 from the CDC's Center for Forecasting and Outbreak Analytics. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention.

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