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# Systemically Significant Prices in the US Between 1947-1996

Discussions of inflation often take the form of causal stories between aggregate macroeconomic variables such as employment, output, wages, *the* money supply, *the* interest rate, *the* price level, and aggregate demand and supply. Aggregate theories of inflation date back to the specie flow theory of David Hume in the 18th century and persist in contemporary analyses employing theories based on the quantity of money, Keynesian capacity utilization, or the Phillips curve that relates unemployment to inflation. An alternative view of inflation that has reappeared during the recent inflationary period beginning in 2021 takes a more disaggregated view of the economy and highlights the role of supply bottlenecks at the sectoral level in causing price indices to rise. These sectoral theories of inflation have gained traction due to the widespread reporting on production and transportation disruptions that followed in the wake of the pandemic. Despite the seeming heterodox nature of sectoral theories they too have an intellectual tradition. Indeed, even aggregate inflation theorists have sought to explain the empirical pattern of increased variance in relative prices that has historically accompanied periods of increased inflation. As this paper will discuss, sectoral price movements were keenly observed by policymakers during inflations in the US following WWII. These sectoral approaches, however, fell out of prominence as the politics of the anti-inflation policies that they entailed, incomes policy or wage and price controls, were deemed as failed forms of economic regulation.

One recent analysis of sectoral inflationary mechanisms performed by Weber et al. couples the sectoral view of price increases with an input-output analysis to determine which industries can be categorized as having "systemically significant prices" (SSP), a term they adopt from legal scholars Robert Hockett and Saule Omarova. These systemically significant industries are defined by their outsized impact on price indices given their share of consumption and inter-industry linkages. Weber et al. find that the industry prices that could be inferred as systemically significant in the pre-Covid period, using input-output data from 1997-2019, were the same as those detected when analyzing the price movements during the inflation that began in 2021. From this analysis Weber et al. conclude that sectoral price movements, and accompanying sectoral anti-inflation policies, ought to be given greater attention in the understanding and prevention of inflation.

This paper seeks to expand on the promising approach of Weber et al. and apply their method of determining systemically significant prices to historical US input-output data from 1947-1996. In doing so it arrives at several results. First, looking at the entire period as whole, this analysis shows that a stable set of systemically significant sectors exists across the entire fifty year period in question. The set includes Finance and Insurance, Food and Beverage and Tobacco Products, Food Services and Drinking Places, Healthcare and Social Assistance, Other Services, Real Estate, and Retail Trade. Second, through analyzing moments of rising inflation, specifically 1950-51, 1956-58, 1967-70, 1973-75, and 1978-80, this analysis demonstrates that the systemically significant sectors during each moment comprised a combination of industries that were significant over the whole period as well some period-specific industries. Additionally, the analysis of inflationary moments also demonstrates that the industries that were systemically significant in each period were often detectable beforehand. This final result complements the

results in Weber et al. and contributes to the input-output literature by further demonstrating the utility of this method of sectoral analysis to policymakers looking for intervention points in the economy.

The remainder of the paper proceeds as follows. First, the literature on input-output analyses of sectoral shocks is briefly reviewed and the history of US sectoral inflation policy is summarized. Next, the model, data, and analyses included in this paper are described. Lastly, the results are presented and discussed along with directions for future research.

## Literature Review

The approach to inflation analysis taken in this paper follows in the tradition of economic thought that incorporates sectors of production into an understanding of inflation rather than homogenizing all economic activity into aggregate "output". In light of the economic conditions following the COVID-19 pandemic, the sectoral lens of analysis has gained a renewed following, among both academic and policy-focused economists.[1] The crux of the view is that relative price changes occurring between industries can generate knock-on dynamics that lead to a rise in the average price level. This sectoral view highlights the role that industrial production networks, supply chains, play in propagating these price increases across the economy. The methodologies in this body of work contain both formal modeling as well as descriptive accounts of recent price dynamics in specific sectors. For example, in his recent analysis Schneider develops a DSGE model to demonstrate the ability of sectoral price changes to durably affect the aggregate price level.[2] He finds the model is able to explain both the inflationary period of the 1970s as well as the onset of inflation in 2021. A similar analysis performed in an article by Castro finds that in a New Keynesian model of inflation with multiple sectors the efficacy of monetary policy is

[1] Employ America. "The Physical Capacity Shortage View of Inflation,"
[2] Schneider, Jan David. "The Sectoral Origins of Current Inflation"

reduced compared to an aggregate-only model.[3] Other works combine a conceptual model with descriptive data analyses of trends in key industries during an inflationary period. Weber and Wasner argue that the profit and wage movements in systemically significant industries, which they identify using the method from Weber et al., since 2021 fit the profile of a sellers' inflation, a cost-push channel for inflation originally put forward by Abba Lerner.[4] In a sellers' inflation firms in concentrated sectors take cost increases as a signal to increase prices and protect their margins. These price increases, along with catch-up wage increases, ripple into other industries connected along the supply chain and generate increases in aggregate inflation.

Weber and Wasner's utilization of Lerner's theory point to the history of sectoral theories of inflation. Another early theorist who took a sectoral view was the Polish economist Michal Kalecki. He demonstrated a link between relative prices and inflation in a simple two sector model.[5] Kalecki's model is noteworthy because of his place among heterodox economists and the degree to which the economic heterodoxy, much like the mainstream, tends to also focus on aggregate theories of inflation.[6] Some recent work has attempted to reconcile the theories of inflation across schools of thought. For example, Steve Mann argues that all theories of inflation reduce down to sectoral theories of cost-push inflation when the causal mechanism in each model is sufficiently described. Mann's argument is inspired by the notion that "every theory of inflation implies a theory of price setting". Therefore, a proper theory of inflation would need to explain what signals price setters receive and how they react to them. In his view, so-called demand-pull theories that posit an unclear causal link between increases in demand and increases

[3] Castro, Nicolas. "The Importance of Production Networks and Sectoral Heterogeneity for Monetary Policy."
[4] Weber and Wasner, "Sellers' Inflation, Profits and Conflict: Why Can Large Firms Hike Prices in an Emergency?", Weber, Isabella M, et al. "Inflation in Times of Overlapping Emergencies: Systemically Significant Prices from an Input-Output Perspective"
[5] Vernengo, Matías. "Money and Inflation: A Taxonomy"
[6] Vernengo, Matías. "Money and Inflation: A Taxonomy"; Laidler, David, and Michael Parkin. "Inflation: A Survey."

in prices do not meet that mark. The locus of these decisions for Mann, and therefore the proper unit of analysis, is the firm embedded within a supply chain.[7]

Outside the realm of pure economic theory, the examination of links between sectoral price changes and general inflation has been flourishing in the field of input-output analysis. While often presented from the point of view of quantities, the input-output modeling framework can be equally applied to changes in prices. Such price models have naturally lent themselves to economists for the analysis of inflation, both hypothetical and historical. Most recently, Weber et al. used the input-output price model as means of identifying systemically significant prices in the 21st century US economy.[8] The work of Weber et al. follows in the line of research beginning with Wasily Leontief, the 20th century economist who created the input-output framework. After developing the framework, Leontief spent much of his career leading efforts to compile input-output tables for the US economy. Due to the limitations of computing capabilities throughout much of the 20th century, input-output tables were often compiled with a lag time on the order of years or decades. As such, much of Leontief's work was backward looking.[9] This limitation of input-output research has been alleviated since the turn of the century. The advance of computing power and the increased frequency with which government statistical agencies are able to compile and publish input-output tables has led to increased use of more contemporaneous input-output tables to evaluate near-term economic scenarios. Examples of this type of near-term input-output research include Valadkhani and Mitchell's study of the effects of petroleum price shocks on inflation in Australia and Pichler and Farmer's analysis of how different rationing schemes interact with supply and demand shocks in the input-output tables of

[7] Mann, Steve. "Notes Toward a Theory of Inflation" Strange Matters
[8] Weber, Isabella M, et al. "Inflation in Times of Overlapping Emergencies: Systemically Significant Prices from an Input-Output Perspective"
[9] Leontief, "Input-Output Economics."

several European countries.[10] Unlike these near-term studies, this paper takes a backward looking view and uses input-output analysis to contribute to the literature on historical periods of US inflations. In that way, this paper follows work such as Abildgren's century-long input-output study of inflation in Denmark and Bilgen and Yilmaz's analysis of producer price shocks in the post-war US.[11] Bilgen and Yilmaz's study parallels this one closely in that they use the same dataset and study the same phenomenon, albeit by applying the alternative methodology of network connectedness.

Backward looking input-output studies of production networks like those cited above are not only empirically insightful, they also bear a strong resemblance to analytic frameworks contemporaneously employed by policymakers throughout periods of the postwar US. This tradition of sectoral thought was crystalized during WWII when rationing, price controls, and supply bottlenecks all had to be carefully managed to balance consumption with production for the war effort. The level of direct economic control undertaken by the federal government in this period required a plethora of new public institutions, such as the Office of Price Administration, capable of making price and quantity decisions that were previously left to market dynamics. This wartime economic experience, along with the accompanying spread of Keynesian economic theory, bore an entire generation of policymakers that saw a permanent full employment economy as both a desirable goal and one achievable through the proper government management of sectoral balance. This strain of economic policymaking manifested in several iterations of institutions and laws between 1947-1997. However, its influence waned over the decades as the political challenges of coordinating the economic demands of labor and capital

[10] Valadkhani, Abbas, and William F. Mitchell. "Assessing the Impact of Changes in Petroleum Prices on Inflation and Household Expenditures in Australia."; Pichler, Anton, and J. Doyne Farmer. "Simultaneous Supply and Demand Constraints in Input–Output Networks: The Case of Covid-19 in Germany, Italy, and Spain."
[11] Abildgren, Kim. "Input–Output Based Measures of Underlying Domestic Inflation: Empirical Evidence from Denmark 1903–2002."
Bilgin, Melisa, and Kamil Yilmaz. "Producer Price Inflation Connectedness and Input-Output Networks."

accumulated and aggregate theories of inflation, and their corresponding fiscal and monetary policy tools, came to dominate explanations of the 1970s. Nevertheless, the influences of this sectoral framework are evident in the policy actions and discourse during each of the inflationary periods analyzed in this paper.

For example, during the early 1950s the US went to war against North Korea and leaders again contemplated the use of price controls. This war was the precipitating cause of the inflationary period between 1950-51. In this context of war mobilization panic buying spread and fueled the year of high rising prices. Returning to their WWII policy toolkit Congress passed the Defense Production Act and gave the president the power to set price controls. Fearful of upsetting business investment by using his price control authority, President Truman opted for the often employed strategy of "jawboning", appeals for voluntary price restraint from corporate and labor leaders.[12] This strategy initially had some success, however, it was not uniformly followed among industries. Eventually, the President authorized the implementation of price controls. As historian Andrew Elrod writes of this moment, this act "displaced conflict from the marketplace and into the new stabilization bureaucracy".[13] As would happen in future attempts at sectoral stabilization, what followed was a period of intense political and economic debate and lobbying over the formulas and exceptions that would form the price regulations. Those sectors with high connectedness in supply chains, such as steel, received extra scrutiny over their price changes. Fearful of rising steel prices' potential contribution to cost-driven inflation, President Truman even went so far as to seize the property of 71 steel companies when they refused to abide by the pricing formulas.[14]

[12] Elrod, "Stabilization Politics in the Twentieth-Century United States: Corporatism, Democracy, and Economic Planning, 1945-1980." 315
[13] Elrod, "Stabilization Politics in the Twentieth-Century United States: Corporatism, Democracy, and Economic Planning, 1945-1980." 319
[14] Elrod, "Stabilization Politics in the Twentieth-Century United States: Corporatism, Democracy, and Economic Planning, 1945-1980." 333

Analyses of sectoral cost-push inflation also marked the inflationary period between 1956-58. This period of rising inflation began during a period of economic expansion following the end of the Korean War. Cost-push theories initially gained purchase during this period as a means of explaining continued rising prices despite interest rate increases by the Federal Reserve. They grew even greater in appeal following the onset of recession in 1958 as unemployment reached new postwar highs and prices continued rising at an elevated pace.[15] Part of the reason for the spread of cost increases as an explanation for inflation is the influential set of the economists at the time who championed the story. The set included Leon Keyserling, former chairman of the Council of Economic Advisers (CEA) under Truman, John Kenneth Galbraith, an administrator of WWII price controls, and Gardiner Means, a New Deal economist who originated the theory of "administered prices".[16] Members of government also took steps to investigate cost increases across the economy's supply chains. For example, in 1957 Wyoming Senator Joseph O'Mahoney asked the Federal Trade Commission to investigate price increases in the meat packing and chain-retail industries and also called for price controls in the oil industry.[17] Likewise, the executive branch also recognized that a sectoral approach was necessary to taming inflation. A quote from a 1957 CEA report highlights the sectoral thinking and skepticism of aggregate policy surrounding the President, "The full burden of avoiding price inflation, which is an ever present hazard in an expanding economy operating close to capacity, cannot be successfully carried by fiscal and monetary restraints alone."[18] Like Truman before him, Eisenhower resorted to jawboning and attempted to initiate tripartite pricing discussions between labor and industry leaders across sectors.

[15] Takami, "The Baffling New Inflation." 652
[16] Takami, "The Baffling New Inflation." 613
[17] Elrod, "Stabilization Politics in the Twentieth-Century United States: Corporatism, Democracy, and Economic Planning, 1945-1980." 359
[18] Elrod, "Stabilization Politics in the Twentieth-Century United States: Corporatism, Democracy, and Economic Planning, 1945-1980." 355

The 1960's sectoral inflation policy saw informal jawboning formalized into wage and price guideposts. While technically voluntary, industry adherence to these guideposts was a priority for the government. On a number of occasions, attempts by companies to raise prices above those rates set in the guidepost prompted a more direct government response. For example, in 1962 US Steel announced a price increase in violation of the guideposts. In response, Secretary of Defence McNamara announced that the Department of Defense would cease making contracts with steel companies violating the guidelines. The Department would also make a new $5 million purchase of steel from a firm that followed the guidelines. US Steel and its competitors quickly rescinded their price increases.[19] A similar situation arose in 1965 when Alcoa, one of the country's largest aluminum producers decided to raise prices. In this instance, the Pentagon announced that it would begin selling its aluminum stockpile on the open market. With the threat of a large supply entering the market and driving down prices, Alcoa backpedaled on its price increase.[20] The guideposts were also the primary sectoral policy during the inflationary period between 1967-70 during the scale up of the Vietnam War.

The 1970's began with the Nixon price freeze in 1971. Despite this bold and direct intervention into sectoral prices, the remainder of the 1970's saw sectoral policy and its analytical frameworks diminish in favor of aggregate policy frameworks. These aggregate policy frameworks accompanied the turn toward interest rate policy as the dominant means of taming the decade's high inflation driven by OPEC price increases. Still, several attempts at sectoral policy were proposed and attempted during the 1970's. The first that will be mentioned here is the never-implemented Office of National Economic Planning (ONEP) that was proposed in

[19] Elrod, "Stabilization Politics in the Twentieth-Century United States: Corporatism, Democracy, and Economic Planning, 1945-1980." 384
[20] Elrod, "Stabilization Politics in the Twentieth-Century United States: Corporatism, Democracy, and Economic Planning, 1945-1980." 420

1975 as part of the Balanced Growth and Economic Planning Act. Unlike previous iterations of price monitoring institutions in past decades, the ONEP would not only monitor prices but also gather capacity utilization data from firms as well as keep records on their quantities of inputs and outputs. In this sense the ONEP would have collected much of the same information that is present in modern input-output tables.

A second example of sectoral policy during the 1970's was the Federal Reserve's credit reporting program. In 1974, due to pressure from elected officials, the Federal Reserve launched a voluntary credit reporting program that solicited information from banks on the uses their customers were putting bank credit towards. The reporting questions asked banks how much of their credit was being put towards financial or speculative purchases, such mergers or other asset purchases, as well as how much credit was used to expand business capacity and invest in productivity-enhancing capital goods. The program was ultimately a failure, however, due to its voluntary designs and low participation from banks. Many banks did not want to divulge this kind of information and others cited their own capacity limits in complying with the report.

Both of these policies demonstrate the continued debate over sectoral policy that persisted into the 1970s. As the decade passed and no coalition of elected officials could be formed to implement stronger sectoral and incomes policy, aggregate policy frameworks solidified among policymakers. What remained of sectorally focused policy took the form of deregulation policy in the 1980's and 1990's. As this study will demonstrate below, a sectoral approach to economic analysis of the time period between 1947-1996 is still capable of providing useful insight.

## Methodology

### Method

This study follows the method of analysis developed in Weber et al., which was focused on the examination of systemically significant prices during the 2021 inflationary period following the onset of the COVID-19 pandemic. The foundational method for the analysis is a short run cost-push inflation simulation based on a Leontief price model. The price model is derived from the general Leontief model in value terms:

$$XP = XA'P + V + M$$

In the case of many industries matrix notation is used. $X$ is a diagonal matrix containing the quantities of total output in each sector. $P$ is a vector of sector prices, $A$ is a matrix of domestic direct technical coefficients, $V$ is a vector of a value added (wages and profit) for each sector, and $M$ is the value of imports in each sector. The $A$ matrix of direct domestic technical coefficients specifies, for all sectors, the value of inputs from each sector needed in order to produce one dollar's worth of increased output in a given sector.

Dividing by quantities on both sides of the value equation results in the following equation containing only units of price per unit of output. Given that input-output information is only reported in value terms ($XP$), fractional units of output (the amount of steel $1 buys) are adopted in place of natural units of output (1 ton of steel) so that conversion between price and quantity models is easily facilitated.

$$P = A'P + v + m$$

This price equation expresses that the price per unit of output is a sum of the price of intermediate goods plus value added plus imports. From here the price equation can be re-expressed in terms of a joint direct and indirect, rather than only direct, technical coefficients matrix:

$$P = (I - A')^{-1}(v + m)$$

Industry prices are now expressed as the sum of direct value added and import prices for an industry and the indirect value added and import prices for all industries that generate inputs for an industry. Expressing prices in this way allows for the simulation of the consequences of a price change in one industry on the total price vector. When the price of one industry's output increases, based on the short run assumptions of the cost-push input-output model where quantities are constant and prices vary, the prices of the output of the industries which it supplies will also increase leading to price changes in more than just the initially shocked industry.

In order to simulate a price shock, industries are divided into exogenous and endogenous industries. This division can be represented with partitioned matrix notation:

$$\begin{bmatrix} P_X \\ P_E \end{bmatrix} = \begin{bmatrix} A'_{XX} & A'_{EX} \\ A'_{XE} & A'_{EE} \end{bmatrix} \begin{bmatrix} P_X \\ P_E \end{bmatrix} + \begin{bmatrix} v_X \\ v_E \end{bmatrix} + \begin{bmatrix} m_X \\ m_E \end{bmatrix}$$

Here $P_X$ and $P_E$ are the price vectors for exogenous and endogenous industries, respectively. Likewise $v_X$, $v_E$, $m_X$, $m_E$ are the vectors of endogenous and exogenous value added and import vectors. The $A'$ matrix is partitioned into four components:

- $A'_{XX}$ is the matrix containing the direct input requirements of exogenous industries from exogenous industries.
- $A'_{EX}$ is the matrix containing the direct input requirements of the exogenous industries from the endogenous industries.
- $A'_{XE}$ is the matrix containing the direct input requirements of the endogenous industries from the exogenous industries.
- $A'_{EE}$ is the matrix containing the direct input requirements of endogenous industries from endogenous industries.

Isolating the effect of exogenous price changes on endogenous industry prices results in the following equation:[21]

$$P_E = (I - A'_{EE})^{-1} A'_{XE} P_X + (I - A'_{EE})^{-1} (v_E + m_E)$$

Only the first term on the right hand side contains the price vector for exogenous industries, $P_X$, so the equation can be simplified and re-expressed in terms of price changes rather than price levels:

$$\Delta P_E = (I - A'_{EE})^{-1} A'_{XE} \Delta P_X$$

Now the total price effect of each industry on all other industries can be considered in turn by sequentially treating each industry as exogenous, applying a price shock $\Delta P_X$, and calculating the resulting change in the endogenous price vector $\Delta P_E$. It is worth noting that although price shocks associated with inflation are often thought to be caused by increased wage demands from workers (e.g. the Phillips curve), the price shocks modeled here do not assume any specific cause of the initial price increase. Indeed, the shock could theoretically also be the result of an industry's firms raising prices in the face of an increase in demand and order backlog.

Converting the simulated price changes into a simulated inflation impact measurement is done through the creation of a synthetic CPI that is constructed using the personal consumption expenditure shares, $C$, for each industry. The total inflation measurement can also be decomposed into a direct inflation impact measurement, based on the exogenous price change, and an indirect inflation impact measurement, based on the endogenous prices changes. With $x$

[21] For the derivation of this step see Appendix A in Weber, Isabella M, et al. "Inflation in Times of Overlapping Emergencies: Systemically Significant Prices from an Input-Output Perspective."

referring to the subscript of the industry set as exogenous for the purpose of the simulation, the impact measurements can be described as follows:

$$Impact_{dir} = c_x \Delta P_x$$

$$Impact_{ind} = \sum_{i \neq x} c_i \Delta P_i$$

$$Impact_{total} = c_x \Delta P_x + \sum_{i \neq x} c_i \Delta P_i$$

This paper further follows Weber et al. in differentiating industries based on their cost and price dynamics. Weber et al. adopt a Kaleckian approach and divide industries into those in which price follows cost through markup-based pricing and those in which supply and demand interactions dominate and price and cost are less related, such as auction-like markets. In the second category Weber et al. include commodity industries and the finance, insurance, and real estate industries. Because there is reason to believe that prices of industries in this second category will not necessarily respond to cost increases by raising prices, industries in this second category are set as always exogenous during any price shock simulations. Setting them as always exogenous means that price increases propagating along a supply chain cease when they reach these industries, limiting the higher order effects of the interaction between price increases and inter-industry linkages. See the appendix for the list of sectors set to always exogenous.

The systemic significance of prices is considered in this paper, like in Weber et al., to be an ordinal concept. To generate this ordinal ranking of industries an industry-specific price shock (more detail on this below) is simulated for each industry and the total inflation impact of that price shock on the synthetic CPI is calculated. Industries are then ranked in order of highest total inflation impact. The top industries in this ranking are the most systemically significant such that

their combination of price shock magnitude, inter-industry linkages, and share in personal consumption expenditure result in them having the greatest impact on measured inflation in the short run.

**Data**

The method as explained above requires four sets of data:

1) A set of annual industry-by-commodity input-output make and use tables. The make table indicates how much of each commodity each industry produces. The use table measures how much each industry uses of each commodity as well as the final demand of each commodity. These tables are used to calculate the direct technical coefficients table.
2) An annual vector of personal consumption expenditure for each industry. This vector forms the basis of the synthetic CPI measurement. It is calculated from the personal consumption expenditure final demand column in the use table along with an industry-by-commodity market share matrix derived from the make table.
3) A table of annual industry output price indices. These price indices are used to generate price shock magnitudes.
4) An annual import use table containing the value of commodities imported by each industry.

This study analyzes systemically significant prices in the US during the 50 year span of 1947-1996. This beginning of this time period is chosen due to data availability from the Bureau of Economic Analysis (BEA), the US government agency which regularly compiles and releases input-output data. The chosen ending point of this time period also serves as a complement to the analysis period, 1997-2021, used in Weber et al. The first three required data sets are available on the BEA website. For the years 1947-1962 data is published at an aggregation level of 47

industries and between 1963-1996 the published data is aggregated up to 65 industries. All data sets use NAICS industry codes.

The fourth required data set, the commodity-by-industry import use table, is unavailable prior to 1997. The import table is needed for the analysis in order to be able to create a domestic direct technical coefficients table ($A$). A domestic coefficient table is preferred to a total coefficient table because it allows for the isolation of domestic pricing effects, whereas using a total coefficient table would impose the assumption that import and domestic prices move in step together. Because the import use table is unavailable for the years under consideration in this study, an import use table is imputed following a similar methodology to the one used by the BEA to impute the published import use table starting in 1997. The BEA imputes imports by first calculating the total-import-to-total-domestic-supply ratio for each commodity. The total domestic supply of a commodity is calculated as the total produced output of a commodity plus imports minus exports. This ratio is then assumed to apply uniformly to all industries using a given commodity, such that if the ratio is equal to 10% for a given commodity then all industries that use the commodity are assumed to import 10% of their inputs of that commodity. The BEA is able to estimate this ratio using unpublished use tables that are less aggregated than the final published version. Once imports for each industry are imputed at this less aggregated level, the imputed imports table is aggregated up to the final, published aggregation level.[22] Because the published, more coarsely aggregated use table is the only data set publicly available, this study imputes imports for each industry and commodity pairing with an estimated imports-to-domestic-supply ratio calculated at the published aggregation level. For this reason the estimates of 1947-1996 imports used in this study are likely less accurate than the post-1997 imputed imports published by the BEA.

[22] Personal correspondence with BEA

For the exact details on how BEA data is transformed into the components needed for the analysis described below, the reader is directed to the methods section and Appendix A of Weber et al. A textbook source for input-output analysis and price models is Blair and Miller.[23]

**Analyses**

The two types of analyses performed in this paper are 1) a long period analysis of systemically significant prices from 1948-1996 and 2) a period analysis of systemically significant prices during the following inflationary periods: 1950-51, 1956-58, 1967-70, 1973-75, and 1978-80. The long period analysis uses input-output data aggregated up to 47 industries. A table describing how input-output data reported between 1963-1996, which are aggregated up to 65 industries, are reduced to 47 industries using the NAICS hierarchy is provided in Appendix A. The long period analysis uses annual changes in price indices and annual input-output data to rank industries in terms of systemic significance for each year. This analysis seeks to determine stability of systemically significant industries over the postwar decades in the US. In the 1950s Leontief proposed that the input-output structure of the economy was slowly changing and inter-industry linkages remained stable over short time spans.[24] Working under this proposition, and lengthy delays in input-output data production, Leontief often relied on input-output tables from previous decades when performing his analyses. This long period analysis of systemically significant prices combines input-output data with price and consumption data in order to see if the stability of input-output relations also implies the stability of systemically significant prices.

The second type of analysis contained in this study, the period analyses of specific inflationary moments, complements the long period analysis. The period analyses seek to answer

[23] Miller and Blair, *Input-Output Analysis: Foundations and Extensions*
[24] Leontief, "Input-Output Economics."

two questions: a) how do systemically significant prices compare across inflationary moments and b) were systemically significant prices detectable prior to the inflationary periods such that policy makers could have successfully used a similar analysis to inform their responses. To that end these analyses calculate the ranking of systemically significant industry prices based on average annual price change during the inflationary period and the input-output data from the last year of period. This ranking of industries that is contemporary to the period being analyzed is compared to calculations of "latent" systemically significant prices that are estimated based on price shock set equal to the average price volatility in the years preceding the onset of the inflationary period and the input-output data from the year prior to the period.[25] The industry rankings and magnitudes of the inflation impacts are compared across the pre-inflationary and inflationary periods in order to assess the stability of systemically significant prices and their detectability by policy makers. Industry rankings are also compared across inflationary periods in order to determine the evolving role of the sectors that are most systemically significant in each period.

It should be noted that one alternative to industry-specific price shocks, both the contemporary shocks based on average annual price change and the latent price shocks based on average price volatility, is to use uniform price shocks of, for example, 1% across all industries. Applying uniform price shocks would allow for the isolation of the effects of only inter-industry linkages and industry share in consumption on industry inflation impact. Contemporary industry-specific price shocks are used in this paper as a means of determining how impactful the actual price changes were based on the input-output model and consumption data. Industry-specific price shocks based on historical industry price volatility are used because they

[25] For a mathematical description of the latent price shock calculation see footnote 8 in Weber, Isabella M, et al. "Inflation in Times of Overlapping Emergencies: Systemically Significant Prices from an Input-Output Perspective."

act as an approximation to the scale of price shocks likely to occur within an industry. Based on these related but different rationales, the SSP rankings with price shocks set to average annual price changes over a period are best understood as an ex-post analysis of the inflation impact that did occur, based on the model. In contrast, the SSP rankings with price shocks set to average historical price volatility are best understood as ex-ante estimations of the inflation impact potential of industries.

## Results

### Long Period Analysis

The long period analysis results demonstrate the persistence of systemically significant prices and industries as a feature of the 20th century US economy. The analysis also illustrates the stability of several industries as high inflation impact industries across the decades. Figure 2 depicts the total inflation impact of each sector over the 20th century. Several aspects of the figure are noteworthy. First, total inflation impact varies over the decades with some industries exhibiting higher variability in their impact than others. Industries with the highest variance of inflation impact include: Chemical Products, Farms, Food and Beverage and Tobacco Products, Healthcare and Social Assistance, Oil and Gas Extraction, Petroleum and Coal Products, Real Estate, Retail Trade, Utilities, and Wholesale Trade. Second, some industries remain among the set of industries with the highest inflation impact across time while others have consistently low inflation impact or fluctuate in their impact ranking. This second result is highlighted in Figure 3, which depicts the top ten industries with the highest inflation impact for each year. Despite the fact that the magnitude of total inflation impact varies over the decades, the relative systematic significance of several industries remains stable. The seven industries exhibiting highly stable systemic significance include: Finance and Insurance, Food and Beverage and Tobacco Products,

Food Services and Drinking Places, Healthcare and Social Assistance, Other Services, Real Estate, and Retail Trade.

Examination of the component data points that determine a sector's inflation impact (annual price change, share of consumption, and inter-industry linkages as shown in Figure 4) clarifies why these industries maintained a high inflation impact. Each of the stable systemically significant industries exhibited annual price changes that usually either tracked or exceeded the median price change among the other sectors. A couple stable systemically significant industries were almost always above the median price change, including Finance and Insurance, Food Services and Drinking Places, and Healthcare and Social Assistance. These large magnitude price changes certainly contributed to the inflation impacts of these seven industries, however the share of personal consumption and the inter-industry linkages of these industries were more influential factors. All of the seven stable systemically significant industries captured relatively large shares of personal consumption expenditure across the decades. While some maintained stable consumption shares, such as Food Services and Drinking Places and Real Estate, others saw their shares grow or shrink over time, such as Healthcare and Social Assistance which saw its share rise from below 5% in 1950 to 15% by 1995 and Retail Trade which started at nearly 20% in 1950 and fell to 13% by the mid 1990s. In several cases these large shares of captured consumption expenditure compensated for the fact that an industry had low inter-industry linkages, such as Healthcare and Social Assistance which had one of the lowest degrees of inter-industry linkage for the entire period. Some industries did maintain high degrees of inter-industry linkage through the period. These industries include Finance and Insurance, which was a top ten inter-linked industry for fifty years, as well as Real Estate and Food and Beverage and Tobacco Products, which both stayed in the top half of linkage rankings. These

comparatively high levels of inter-industry linkage meant that price changes in these industries would have had greater ripple effects on prices in other industries.

In addition to industries that remained systemically significant for most of the period, the analysis depicted in Figure 3 also reveals several industries that exhibited systemic significance in specific sub-periods. These industries maintained high relative inflation impact for a sustained sub-period of the fifty year window under examination. Examples of industries that exhibited this type of systemic significance include Information, Utilities, Wholesale Trade, and Professional and Scientific Technical Services. Figure 5 shows the component breakdown for these significant industries. Notably, none of these industries captured a share of consumption expenditure over the period that matched the stable systemically significant industries. The Information industry was systemically significant between 1958-64 and 1982-86. These periods were precisely when the industry's price changes were higher than average and its share of captured consumption expenditure and degree of inter-industry linkage had reached their highest levels. The Utilities sector was systemically significant between 1974-84 which is also when all its SSP component measurements were at their highest levels. Wholesale trade was systemically significant between 1963-1969. Wholesale Trade remained one of the top interlinked industries across the entire analysis period. Likewise, its price changes between 1963-69 are not different from the average price changes occurring in other industries. The industry's significance during this time period is explained entirely by its slight increase of consumption expenditure. In addition to the longest sub-periods in which Information, Wholesale Trade, and Utilities temporarily remained systemically significant, each of these three industries also moved in and out of the top ten set across the decades. This pattern places them in contrast with Professional and Scientific Technical Services which was systemically significant only between 1982-87 and

1991-96. Professional and Scientific Technical Services began the analysis period at almost a 0% share of consumption. By 80s and 90s it had almost reached 1.5% of consumption and its inter-industry linkage rank surged from between 15 and 20, where it ranked before 1980, to one of the top five interlinked industries by 1990.

With several industries remaining systemically significant across decades, the results from the long period analysis confirm this paper's hypothesized extension of Leontief's notion of a slowly changing input-output structure to a slowly changing set of systemically significant prices. However, the set of industries that moved in and out of the top ten set examined in Figure 3 point to the punctuated impact that industries can play in certain periods. This aspect of systemically significant prices is examined further in the short period analyses of inflationary moments in the postwar 20th century US economy.

**Short Period Analysis**

In the long period analysis the top ten highest inflation impact sectors in each year were labeled the systemically significant industries. This labeling was performed for its convenience in analyzing fifty years of SSP measurements. The short period analyses below proceed along lines that more closely follow the visual method of analysis in Weber et al. This method of analysis allows for a more case-by-case approach in understanding systemically significant prices. In each short period analysis the ranking and magnitude of all industry total inflation impacts are examined for both sets of measurements, pre-inflationary and inflationary. The determination of the set of systemically significant industries is based on natural groupings of inflation impact that appear among the ranked industries. These natural groupings are somewhat subjective, however they are motivated by a result common to all of the distributions of industry inflation impact across all periods under analysis, namely the fact that there are always a handful

of standout industries with comparatively high inflation impact (Figures 6-10). After systemically significant industries are identified they are then compared between the pre-inflationary period measurements and the inflationary period measurements to see how informative these SSP simulations would have been to policymakers at the time.

The first inflationary period analyzed is between 1950-51, the beginning of the Korean War. Based on the ranking of industry inflation impacts in Figure 6, three sectors stand out as significant between 1950-51: Food and Beverage and Tobacco Products, Farms, and Retail Trade. Of note is also a second cluster of industries, Real Estate, Apparel and Leather and Allied Products, and Wholesale Trade, which have total inflation impacts that are less than the top three but still above the other industries. These six industries vary in the degree to which their total inflation impact is composed of direct and indirect price effects. For example, Food and Beverage and Tobacco Produces and Retail Trade appear in among the top industries because the magnitude of the direct price shock in those industries was large between 1950-51. On the other hand, Farms is ranked second in inflation impact due to its larger network of inter-industry linkages and indirect price effects on other industries. This mixture of both predominantly direct and indirect price effects is a common aspect of all short period systemically significant prices analyzed in this paper. The final result of the analysis of this period is that the set of significant sectors identified during the inflationary period were almost all among the inferred set using data prior to the onset of inflation. The exceptions are Petroleum and Coal Products, which was identified as systemically significant based on pre-inflation data, and Wholesale Trade, which became significant during the period but did not stand out in the pre-inflation rankings.

The next period in question is the more mildly inflationary post Korean war recovery between 1956-58. Four industries standout as systemically significant in this inflationary period:

Food and Beverage and Tobacco Products, Retail, Real Estate, and Farms. These four industries also appear in the top set of the pre-inflationary period impact rankings. In this sense, the significant industries derived from the pre-inflationary data could have played a useful role for policymakers. However, these positive predictive results are mixed with some negative predictive results. Systemically significant industries derived from the pre-inflationary period data could also reasonably include Petroleum and Coal Produces, Oil and Gas Extraction, Apparel and Leather and Allied Products, Wholesale Trade, and Chemical Products. All of these industries drastically decreased in their impact rankings during the inflationary period.

Looking at the inflationary period between 1967-70 (Figure 8), the ramp up of the Vietnam War, the set of systemically significant industries include: Retail Trade, Real Estate, Food and Beverage and Tobacco Products, Food Services and Drinking Places, Other Services Except Government, Federal Reserve Banks Credit Intermediation, Hospitality and Nursing and Residential Care Facilities, and Ambulatory Health Services. Retail Trade, Real Estate, and Food and Beverage and Tobacco Products, the top three highest impact industries, also rank highest in the rankings based on pre-inflationary period data. However, other highly ranked industries in the pre-inflationary period, which include commodity industries such Farms, Oil and Gas Extraction, and Petroleum and Coal Products along with Wholesale Trade, Chemical Products, and Motor Vehicles, are replaced in the inflationary period rankings with healthcare, services, and credit industries. Particularly striking is the decrease in impact of the oil, petroleum, and chemical industries during the inflationary moment compared to the impact implied by pre-inflationary input-output data and price volatility.

The penultimate period analyzed in this paper is the rise in inflation between 1973-75. This rise is the first of two periods of climbing inflation during the 1970s that are associated with

the OPEC oil price shocks (Figure 9). Seven industries stand out as systemically significant in this period: Retail Trade, Petroleum and Coal Products, Food and Beverage and Tobacco Products, Real Estate, Oil and Gas Extraction, Chemical Products and Utilities. Each of these industries appears among the top ranked industries in the pre-inflationary period impact rankings. Much like in analysis of the period 1967-70, some industries that appear to be systemically significant based on pre-inflationary data do not actually turn out to be so during the inflationary period. In this case the Farms sector is again indicated to be most impactful but falls sharply in its inflationary period ranking.

The second period of climbing inflation in the 1970s was between 1978-80 (Figure 10). In this period four industries are clearly systemically significant: Petroleum and Coal Products, Retail Trade, Oil and Gas Extraction, and Real Estate. Again the pre-inflationary period impact rankings proved to be useful in predicting the set of the inflationary period systemically significant industries. Of note in this period, and in the preceding one, is that the Petroleum and Coal Products and Oil and Gas Extraction sectors, which often appear significant in the pre-inflation rankings, continued to be significant in the inflationary period rankings. This pattern makes sense given the role of the OPEC shocks in the 1970s inflations.

In summary, the short period analyses reveal that several industries were systemically significant across inflationary periods (Figure 11). These industries include Real Estate, Food and Beverage and Tobacco Products, and Retail Trade. Each of these sectors were also identified as systemically significant in the long period analysis. Other industries, such as those involved in fossil fuel production, food services, and credit services, appeared as systemically significant in specific periods but not others. This combination of both stable and specific industries being systemically significant in each period suggests that inflations are driven by a combination of

slowly changing, structural sectoral relationships as well as period-specific sectoral shocks. Additionally, the set of systemically significant industries that could be identified prior to each of the inflationary periods proved to often contain many of the industries significant during the inflationary period. These results complement the analysis in Weber et al. and further suggest that an input-output analysis of systemically significant prices could act as a useful policy tool for future inflations.

## Discussion

In viewing the results of this paper in relation to the broader literature on input-output price model analyses, it is interesting to compare the sectors identified in this study with those identified in the analysis of systemically significant prices during the post COVID inflation in Weber et al. Weber et al. identify four categories of systemically significant prices during the COVID inflationary period, with nearly all of the industries in these categories being predictable based on the pre-inflationary data. The four categories are energy, containing the sectors Petroleum and coal products, Oil and gas extraction, and Utilities, basic necessities, containing Farms, Food and beverage and tobacco products, and Housing, commercial and financial infrastructure, containing Credit intermediation and Wholesale trade, as well as basic production inputs other than energy, containing Chemical products. Several industries in this set of systemically significant prices match the set of industries identified in the long period analysis in this paper. The matches include Credit intermediation, which is a more finely aggregated category within Finance and Insurance, Housing, which is a more finely aggregated category within Real Estate, and Food and Beverage and Tobacco Products. Of course, the differing degrees of aggregation in these two analyses has some effect on the results. Nevertheless, the fact that three industries in the analysis performed by Weber et al. match those identified in this study

indicates that a long period analysis that includes data from the 21st century would prove to be useful (and relatively simple to implement since the data is available on the BEA website). Moreover, the combination of industries in the set identified in Weber et al. matches the pattern of industries which were found to be significant in the short period analyses performed in the paper. Specifically, the set identified in Weber et al. contains some industries identified in this paper's long period analyses as well as some industries which were found to be significant only during specific historical inflationary periods, such as Farms, Petroleum and coal products, and Oil and gas extraction.

One appeal of the work of Weber et al. is that several of the industries they identify as systemically significant are industries that are very much topics of discussion in the contemporary policy discourse that is attempting to understand the current inflation. Placing the industries identified in this paper into historical context, while not living through the discourses of those inflations, is more challenging and requires further historical research. The history of 20th century US sectoral policy summarized above points to the fact that policymakers at the time were including the sectoral view of the economy in their analytical toolkit. However, the industries that were prioritized in historical policy discussions, and therefore appear more readily in the secondary literature on this period, were not necessarily those with the highest degree of industrial inter-linkages or share in consumption. In certain instances, an industry's place in the production network was the primary reason it received policy attention, such as the case of US Steel's 1962 attempted guidepost-violating price increase. In many other cases though, industries received federal attention due to their degree of unionization. Union contracts and demands were closely monitored because of the knock-on effect that wage increases in one highly unionized sector might have on the rest of the economy.

These facts point to several future directions of research, namely the potential expansion of the model used in this paper to account for sectoral union density as well as other characteristics of market structure such as market concentration. This kind of model expansion would further benefit from greater primary source research into the exact sectoral analyses that were considered in historical policy discussions. Along these lines of research, one wealth of information is the BEA's Survey of Current Business, a monthly publication put out by the BEA beginning at least as early as 1920 that often contained the agency's remarks on conditions in several sectors of the economy. Additionally, it would be worthwhile to further research the history of market developments in specific sectors, such as those identified as systemically significant in this paper. This kind of historical research would also provide the added benefit of filling in some of the methodological gaps inherent to an ex-post analysis of historical price movements. One of the primary gaps in this paper's current methodology is the fact that industries which were viewed as akin to systemically significant at the time were more likely to be intervened upon and therefore have smaller historical price movements. This pattern could prevent those industries from appearing systemically significant in the current analysis. Complementing an input-output analysis with this kind of historical research would allow more confident causal claims to be made about the source of each period of inflation, a goal that the analyses contained in this paper only gesture toward.

## Conclusion

In summary, this study used a cost-push input-output model to examine systemically significant prices in the period between 1947-1996 from two perspectives. First, systemically significant prices were estimated for each year in the period and long term trends in systemic significance were identified. Seven industries were identified as being systemically significant

for almost the entire fifty year period. This set of industries includes Finance and Insurance, Food and Beverage and Tobacco Products, Food Services and Drinking Places, Healthcare and Social Assistance, Other Services, Real Estate, and Retail Trade. These industries maintained their systemic significance across the decades through a combination of high consumption share and high inter-industry linkages. This result confirms the widespread principle in the input-output literature that production networks evolve slowly. Second, systemically significant prices were estimated during five periods of rising inflation, 1950-51, 1956-58, 1967-70, 1973-75, and 1978-80, and a common pattern was identified across inflationary periods. Each period's set of systemically significant industries contained a combination of industries that maintained long term significance across the entire fifty year period as well as industries whose systemic significance was isolated to specific moments. Moreover, across all five periods the set of industries that were identified as systemically significant using data from during the inflationary period were, in many cases, also able to be identified from data available prior to each period's rise in inflation. Together these results indicate that input-output models, such as the one used in this study, are a useful policy tool for analyzing inflation, both contemporary and historical. Furthermore, this study also demonstrates the utility of input-output models in identifying sets of industries worthy of further research. Both of these use cases of input-output analysis can play a valuable role in tackling future periods of inflation that are bound to arise in the transition to a green economy.

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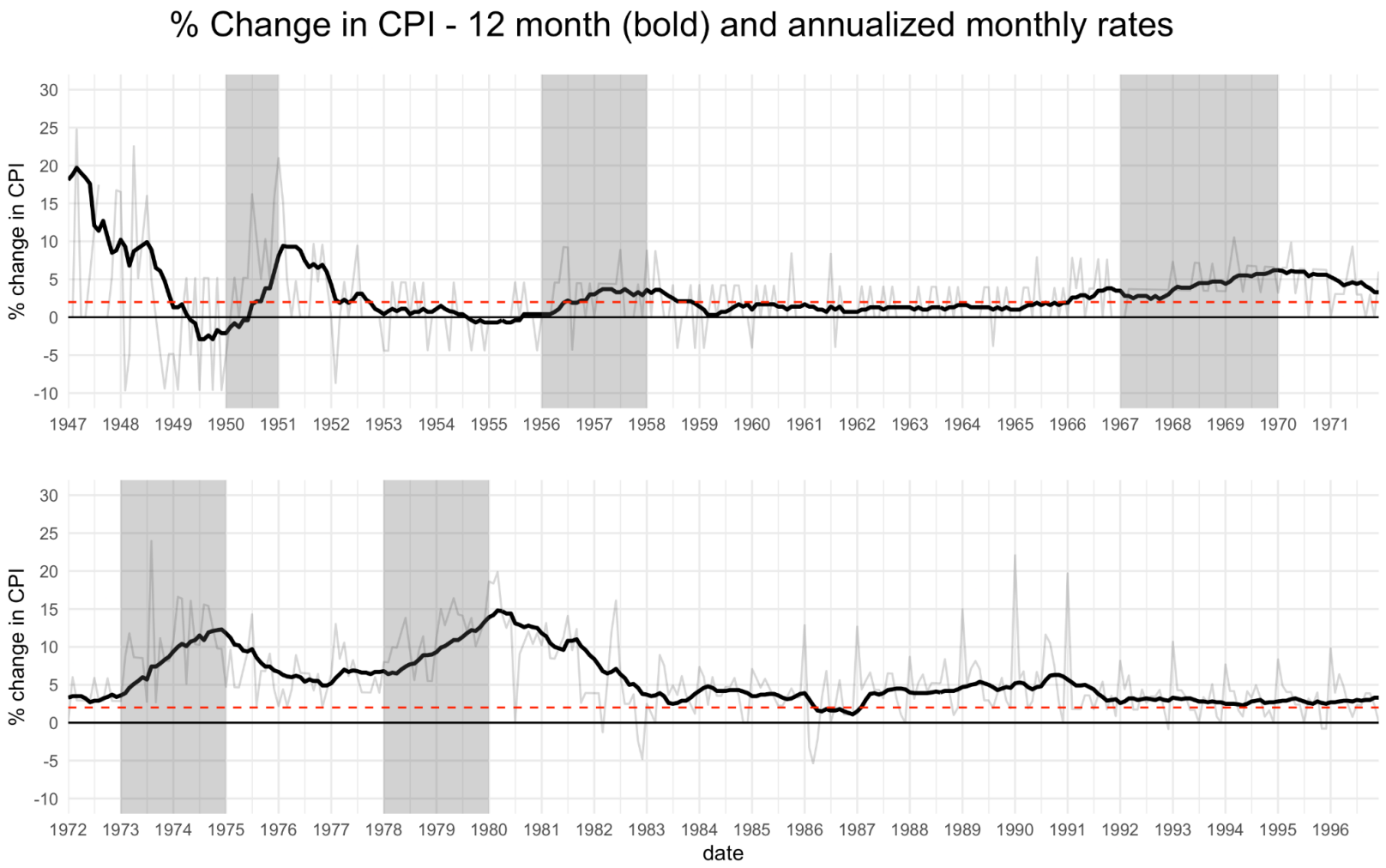


(Shaded regions indicate inflationary periods analyzed)

**Figure 1**

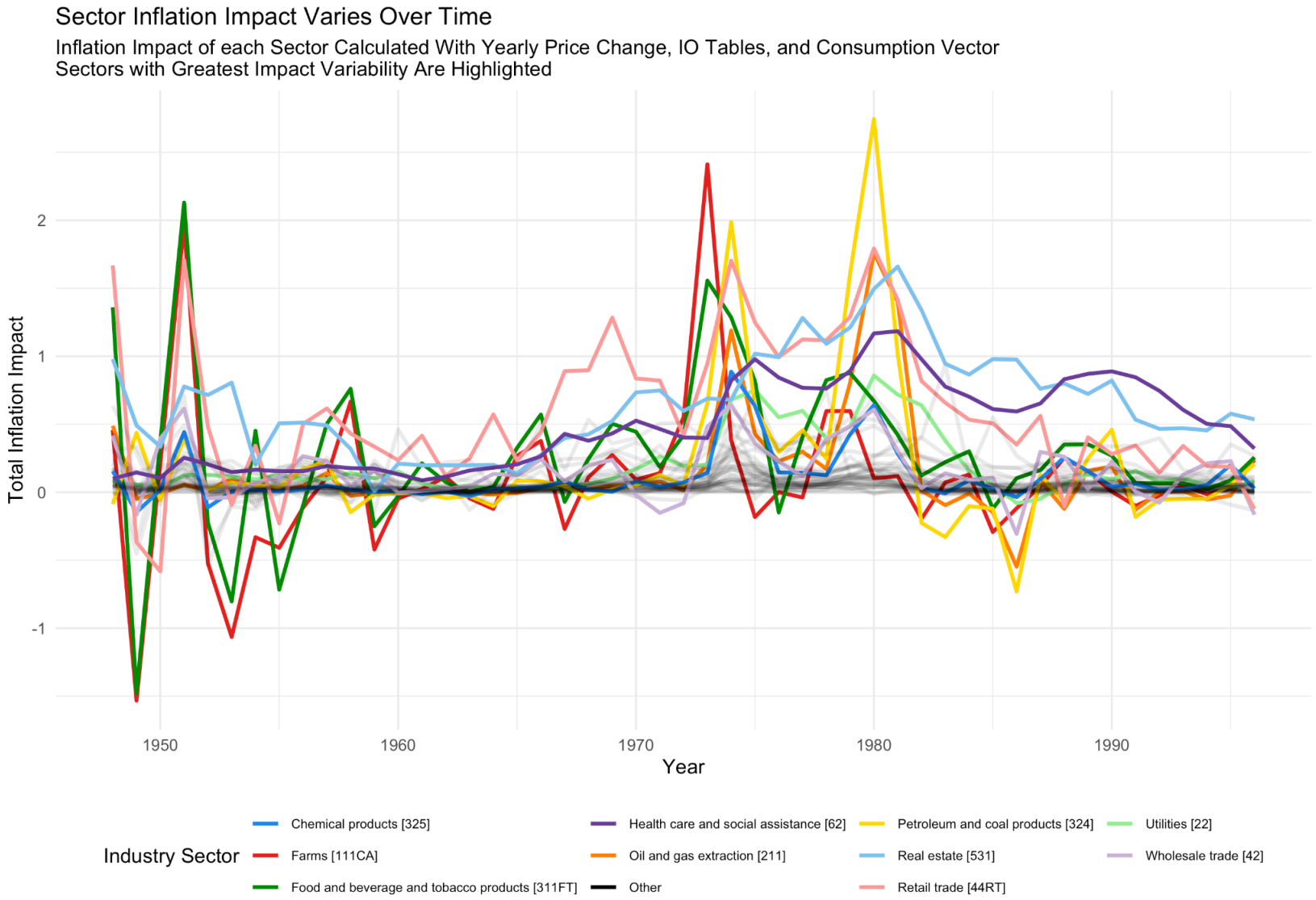
Sector Inflation Impact Varies Over Time
Inflation Impact of each Sector Calculated With Yearly Price Change, IO Tables, and Consumption Vector
Sectors with Greatest Impact Variability Are Highlighted
Total Inflation Impact
2
1
0
-1
1950
1960
1970
1980
1990
Year
Industry Sector
Chemical products [325]
Farms [111CA]
Food and beverage and tobacco products [311FT]
Health care and social assistance [62]
Oil and gas extraction [211]
Other
Petroleum and coal products [324]
Real estate [531]
Retail trade [44RT]
Utilities [22]
Wholesale trade [42]

**Figure 2**

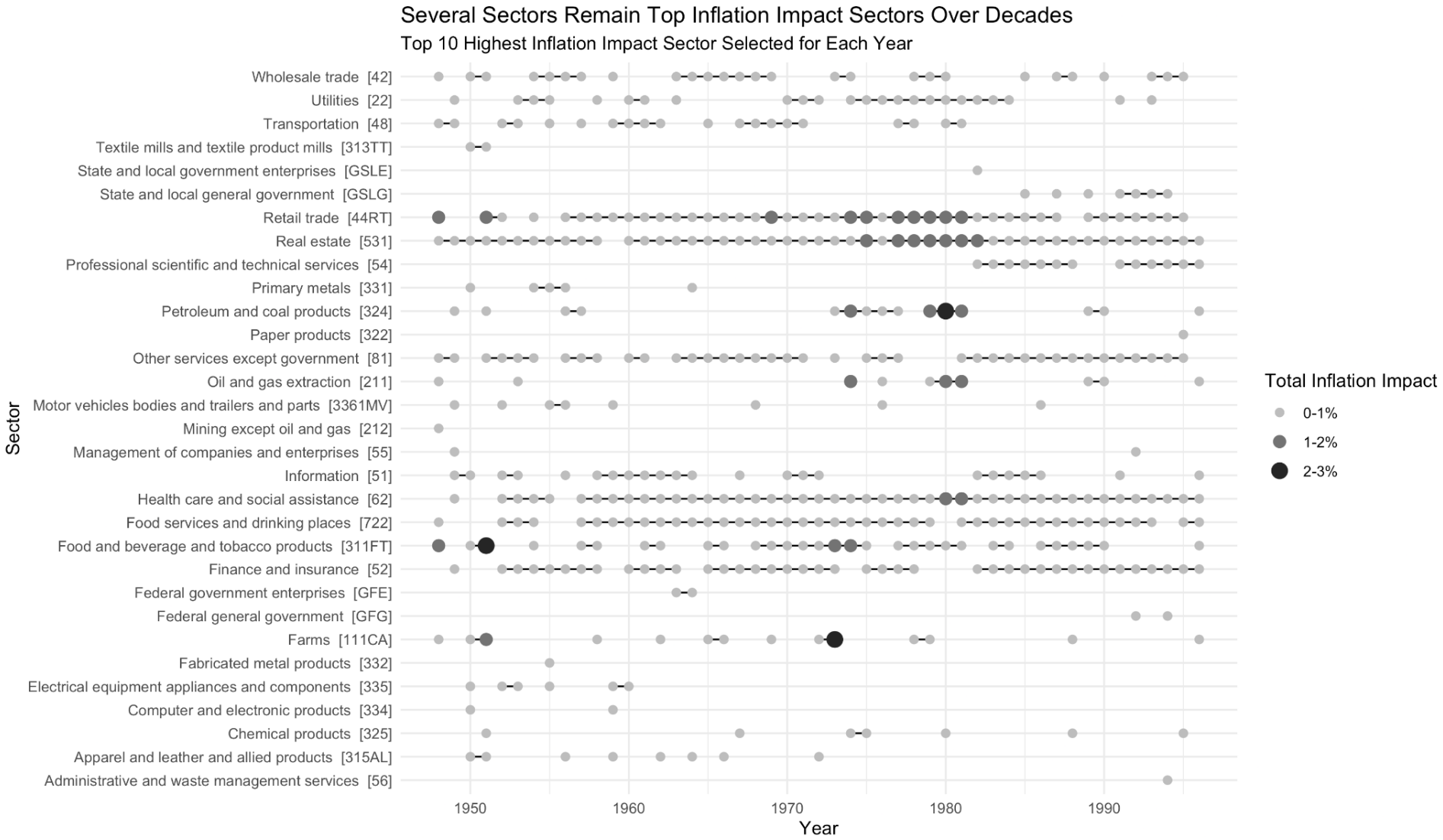
Several Sectors Remain Top Inflation Impact Sectors Over Decades
Top 10 Highest Inflation Impact Sector Selected for Each Year
Wholesale trade [42]
Utilities [22]
Transportation [48]
Textile mills and textile product mills [313TT]
State and local government enterprises [GSLE]
State and local general government [GSLG]
Retail trade [44RT]
Real estate [531]
Professional scientific and technical services [54]
Primary metals [331]
Petroleum and coal products [324]
Paper products [322]
Other services except government [81]
Oil and gas extraction [211]
Motor vehicles bodies and trailers and parts [3361MV]
Mining except oil and gas [212]
Management of companies and enterprises [55]
Information [51]
Health care and social assistance [62]
Food services and drinking places [722]
Food and beverage and tobacco products [311FT]
Finance and insurance [52]
Federal government enterprises [GFE]
Federal general government [GFG]
Farms [111CA]
Fabricated metal products [332]
Electrical equipment appliances and components [335]
Computer and electronic products [334]
Chemical products [325]
Apparel and leather and allied products [315AL]
Administrative and waste management services [56]
Sector
1950
1960
1970
1980
1990
Year
Total Inflation Impact
0-1%
1-2%
2-3%

**Figure 3**

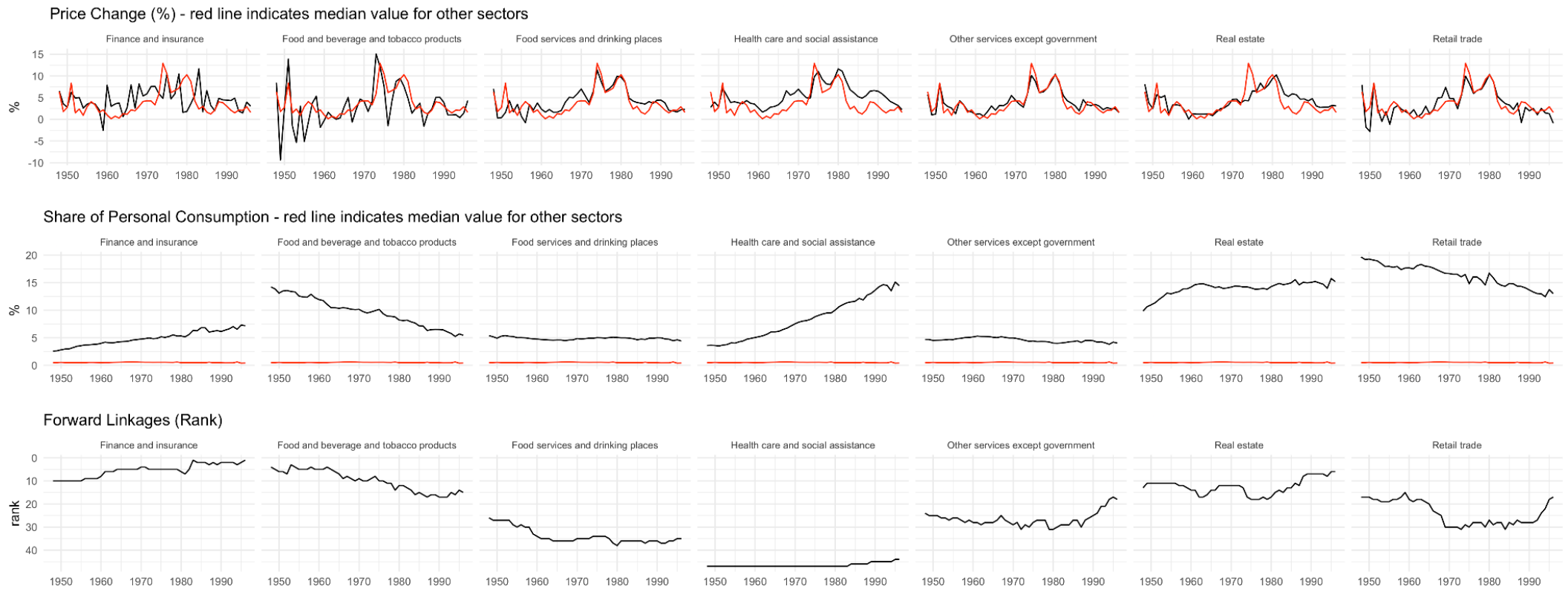
Price Change (%) - red line indicates median value for other sectors
Finance and insurance
Food and beverage and tobacco products
Food services and drinking places
Health care and social assistance
Other services except government
Real estate
Retail trade
%
Share of Personal Consumption - red line indicates median value for other sectors
Forward Linkages (Rank)
rank
1950
1960
1970
1980
1990

**Figure 4**

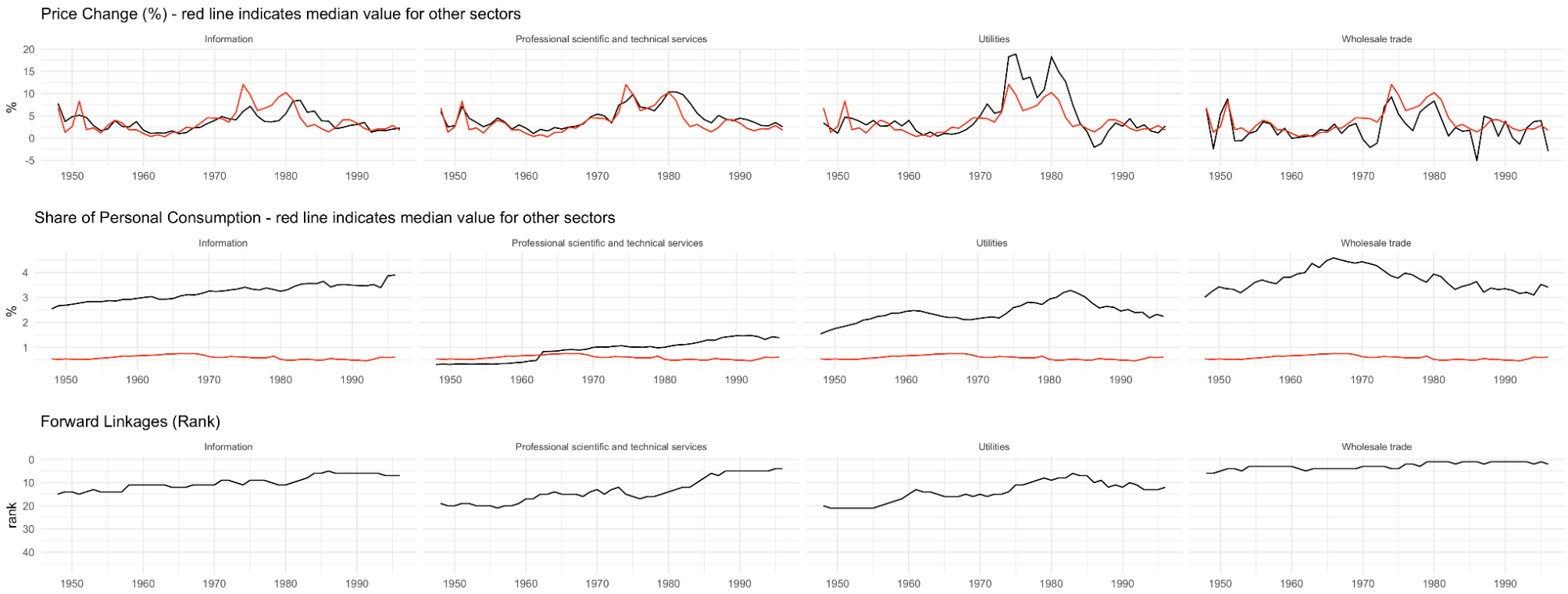
Price Change (%) - red line indicates median value for other sectors
Information
Professional scientific and technical services
Utilities
Wholesale trade
%
Share of Personal Consumption - red line indicates median value for other sectors
Information
Professional scientific and technical services
Utilities
Wholesale trade
%
Forward Linkages (Rank)
Information
Professional scientific and technical services
Utilities
Wholesale trade
rank
1950
1960
1970
1980
1990

**Figure 5**

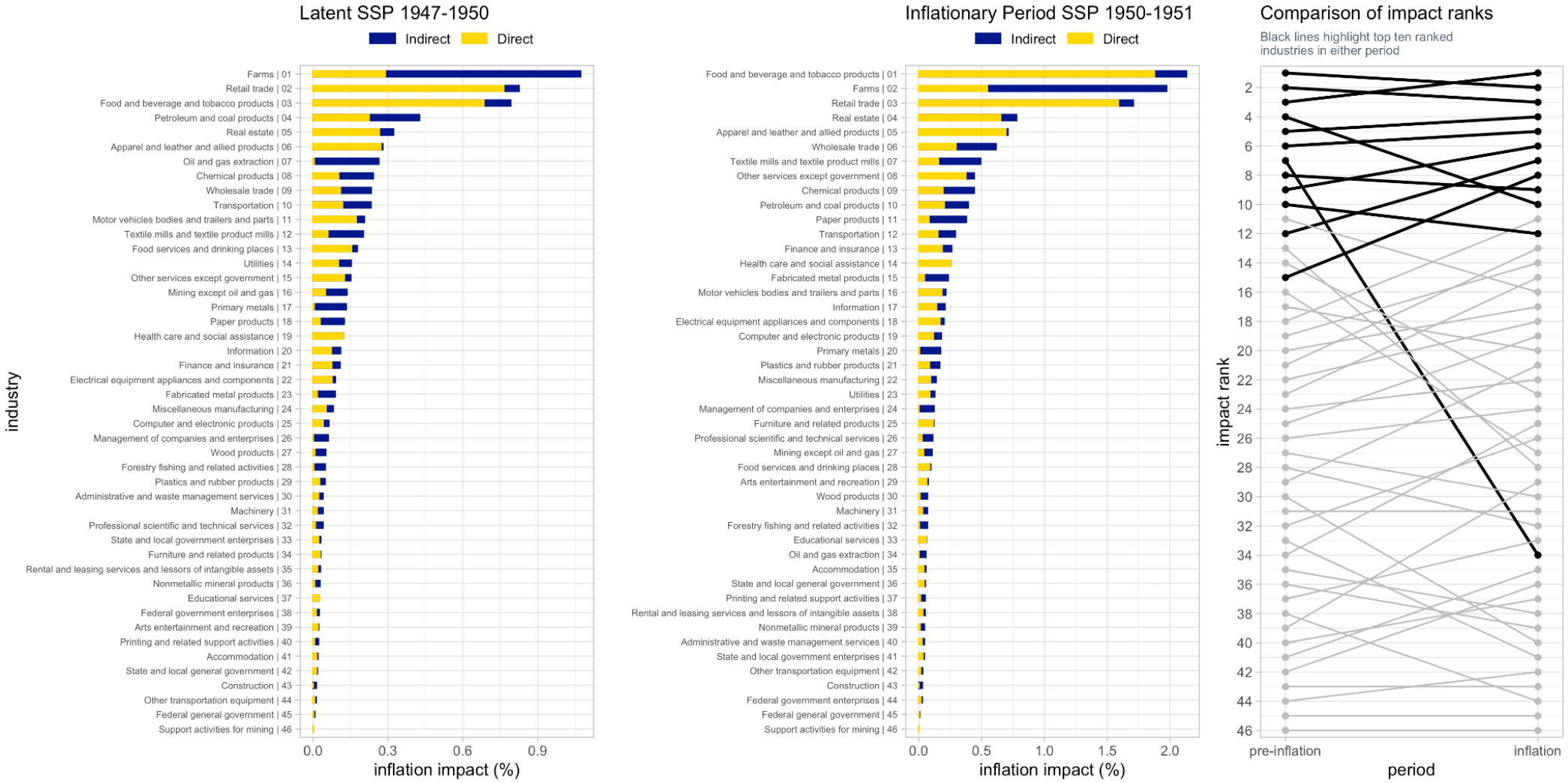
Latent SSP 1947-1950
Indirect
Direct
industry
Farms | 01
Retail trade | 02
Food and beverage and tobacco products | 03
Petroleum and coal products | 04
Real estate | 05
Apparel and leather and allied products | 06
Oil and gas extraction | 07
Chemical products | 08
Wholesale trade | 09
Transportation | 10
Motor vehicles bodies and trailers and parts | 11
Textile mills and textile product mills | 12
Food services and drinking places | 13
Utilities | 14
Other services except government | 15
Mining except oil and gas | 16
Primary metals | 17
Paper products | 18
Health care and social assistance | 19
Information | 20
Finance and insurance | 21
Electrical equipment appliances and components | 22
Fabricated metal products | 23
Miscellaneous manufacturing | 24
Computer and electronic products | 25
Management of companies and enterprises | 26
Wood products | 27
Forestry fishing and related activities | 28
Plastics and rubber products | 29
Administrative and waste management services | 30
Machinery | 31
Professional scientific and technical services | 32
State and local government enterprises | 33
Furniture and related products | 34
Rental and leasing services and lessors of intangible assets | 35
Nonmetallic mineral products | 36
Educational services | 37
Federal government enterprises | 38
Arts entertainment and recreation | 39
Printing and related support activities | 40
Accommodation | 41
State and local general government | 42
Construction | 43
Other transportation equipment | 44
Federal general government | 45
Support activities for mining | 46
0.0
0.3
0.6
0.9
inflation impact (%)
Inflationary Period SSP 1950-1951
Indirect
Direct
Food and beverage and tobacco products | 01
Farms | 02
Retail trade | 03
Real estate | 04
Apparel and leather and allied products | 05
Wholesale trade | 06
Textile mills and textile product mills | 07
Other services except government | 08
Chemical products | 09
Petroleum and coal products | 10
Paper products | 11
Transportation | 12
Finance and insurance | 13
Health care and social assistance | 14
Fabricated metal products | 15
Motor vehicles bodies and trailers and parts | 16
Information | 17
Electrical equipment appliances and components | 18
Computer and electronic products | 19
Primary metals | 20
Plastics and rubber products | 21
Miscellaneous manufacturing | 22
Utilities | 23
Management of companies and enterprises | 24
Furniture and related products | 25
Professional scientific and technical services | 26
Mining except oil and gas | 27
Food services and drinking places | 28
Arts entertainment and recreation | 29
Wood products | 30
Machinery | 31
Forestry fishing and related activities | 32
Educational services | 33
Oil and gas extraction | 34
Accommodation | 35
State and local general government | 36
Printing and related support activities | 37
Rental and leasing services and lessors of intangible assets | 38
Nonmetallic mineral products | 39
Administrative and waste management services | 40
State and local government enterprises | 41
Other transportation equipment | 42
Construction | 43
Federal government enterprises | 44
Federal general government | 45
Support activities for mining | 46
0.0
0.5
1.0
1.5
2.0
inflation impact (%)
Comparison of impact ranks
Black lines highlight top ten ranked industries in either period
impact rank
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
pre-inflation
inflation
period

**Figure 6**

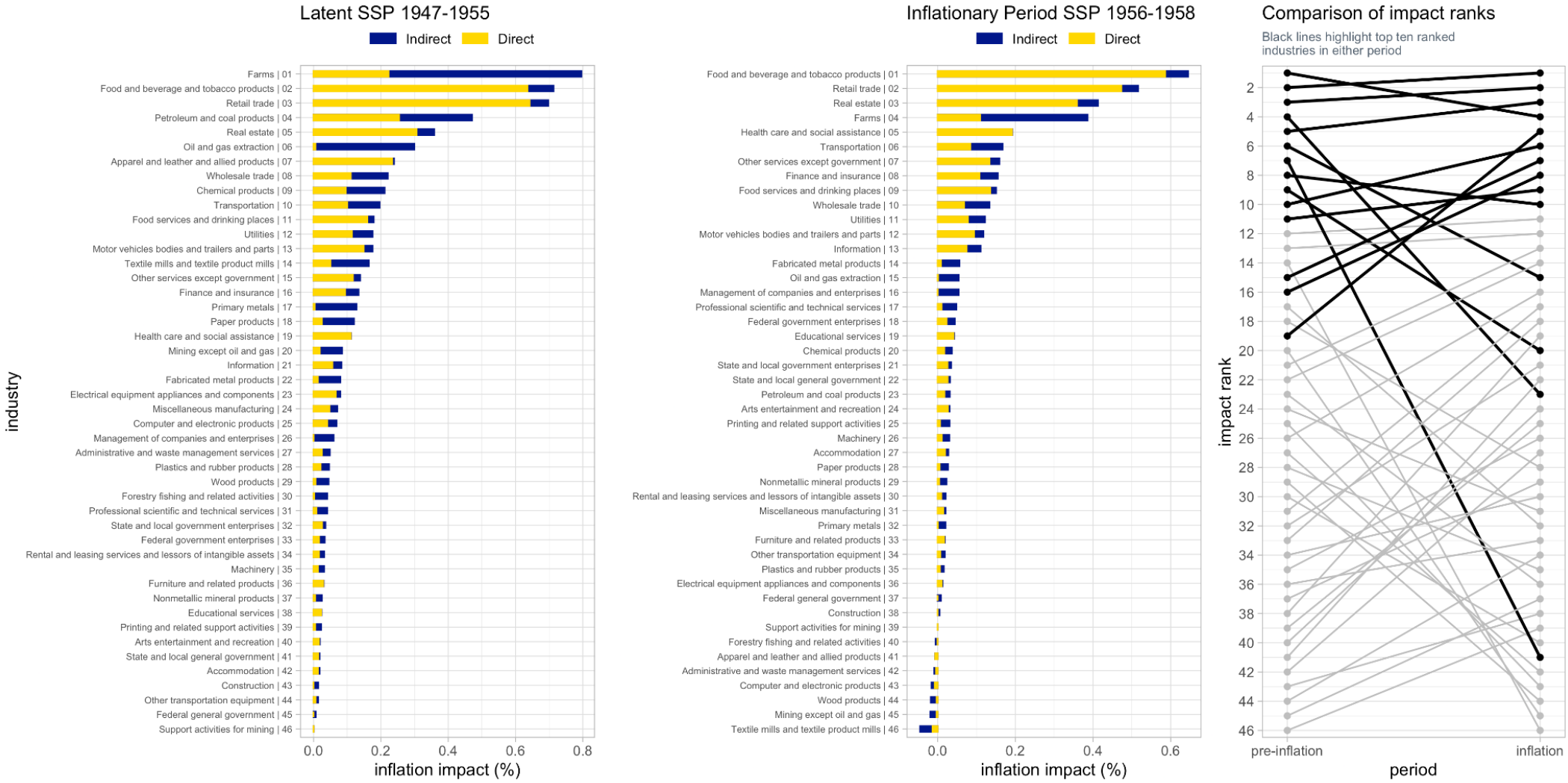
Latent SSP 1947-1955
Indirect
Direct
industry
Farms | 01
Food and beverage and tobacco products | 02
Retail trade | 03
Petroleum and coal products | 04
Real estate | 05
Oil and gas extraction | 06
Apparel and leather and allied products | 07
Wholesale trade | 08
Chemical products | 09
Transportation | 10
Food services and drinking places | 11
Utilities | 12
Motor vehicles bodies and trailers and parts | 13
Textile mills and textile product mills | 14
Other services except government | 15
Finance and insurance | 16
Primary metals | 17
Paper products | 18
Health care and social assistance | 19
Mining except oil and gas | 20
Information | 21
Fabricated metal products | 22
Electrical equipment appliances and components | 23
Miscellaneous manufacturing | 24
Computer and electronic products | 25
Management of companies and enterprises | 26
Administrative and waste management services | 27
Plastics and rubber products | 28
Wood products | 29
Forestry fishing and related activities | 30
Professional scientific and technical services | 31
State and local government enterprises | 32
Federal government enterprises | 33
Rental and leasing services and lessors of intangible assets | 34
Machinery | 35
Furniture and related products | 36
Nonmetallic mineral products | 37
Educational services | 38
Printing and related support activities | 39
Arts entertainment and recreation | 40
State and local general government | 41
Accommodation | 42
Construction | 43
Other transportation equipment | 44
Federal general government | 45
Support activities for mining | 46
0.0
0.2
0.4
0.6
0.8
inflation impact (%)
Inflationary Period SSP 1956-1958
Indirect
Direct
Food and beverage and tobacco products | 01
Retail trade | 02
Real estate | 03
Farms | 04
Health care and social assistance | 05
Transportation | 06
Other services except government | 07
Finance and insurance | 08
Food services and drinking places | 09
Wholesale trade | 10
Utilities | 11
Motor vehicles bodies and trailers and parts | 12
Information | 13
Fabricated metal products | 14
Oil and gas extraction | 15
Management of companies and enterprises | 16
Professional scientific and technical services | 17
Federal government enterprises | 18
Educational services | 19
Chemical products | 20
State and local government enterprises | 21
State and local general government | 22
Petroleum and coal products | 23
Arts entertainment and recreation | 24
Printing and related support activities | 25
Machinery | 26
Accommodation | 27
Paper products | 28
Nonmetallic mineral products | 29
Rental and leasing services and lessors of intangible assets | 30
Miscellaneous manufacturing | 31
Primary metals | 32
Furniture and related products | 33
Other transportation equipment | 34
Plastics and rubber products | 35
Electrical equipment appliances and components | 36
Federal general government | 37
Construction | 38
Support activities for mining | 39
Forestry fishing and related activities | 40
Apparel and leather and allied products | 41
Administrative and waste management services | 42
Computer and electronic products | 43
Wood products | 44
Mining except oil and gas | 45
Textile mills and textile product mills | 46
0.0
0.2
0.4
0.6
inflation impact (%)
Comparison of impact ranks
Black lines highlight top ten ranked industries in either period
impact rank
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
pre-inflation
inflation
period

**Figure 7**

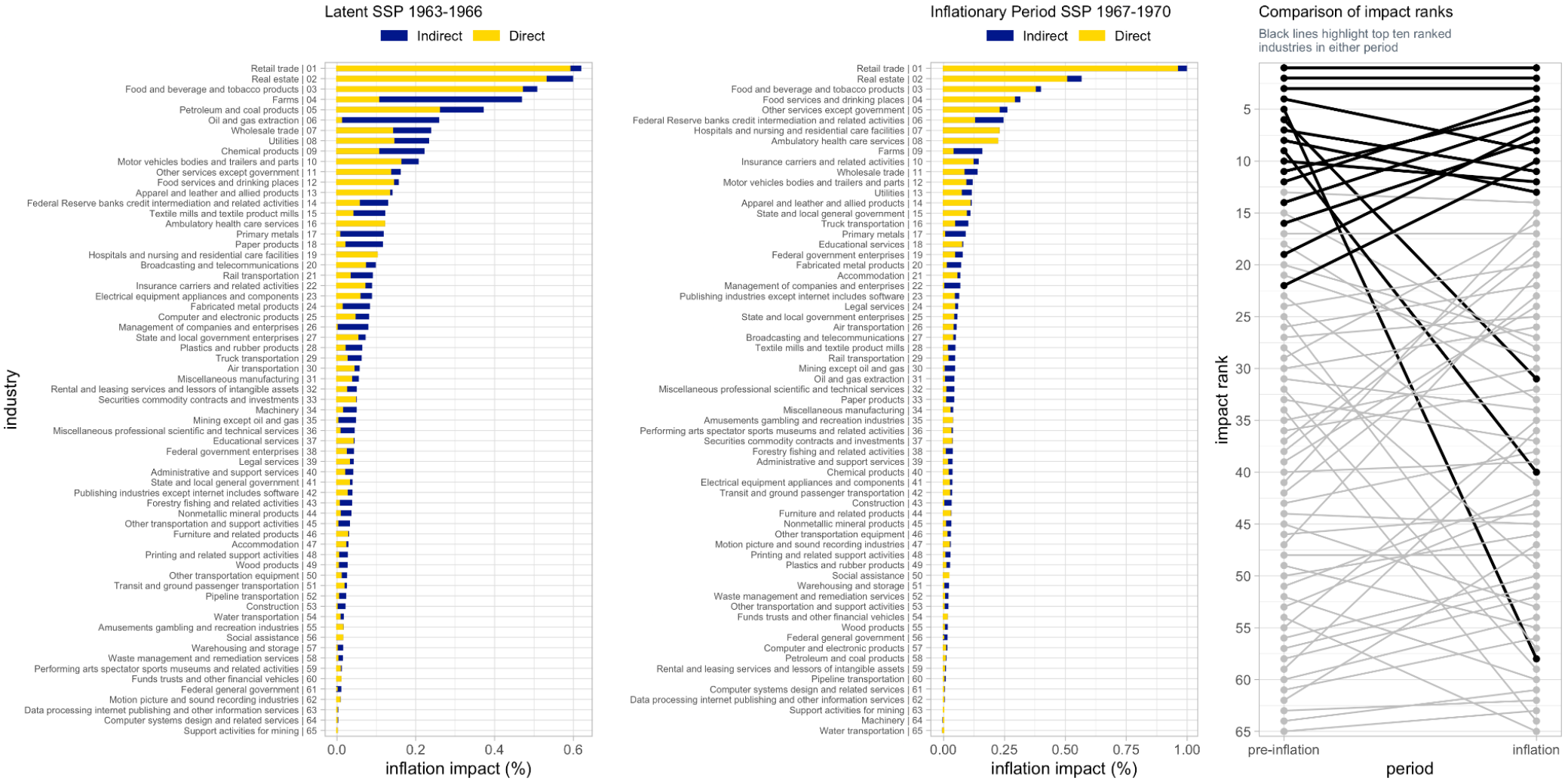
Latent SSP 1963-1966
Indirect
Direct
industry
Retail trade | 01
Real estate | 02
Food and beverage and tobacco products | 03
Farms | 04
Petroleum and coal products | 05
Oil and gas extraction | 06
Wholesale trade | 07
Utilities | 08
Chemical products | 09
Motor vehicles bodies and trailers and parts | 10
Other services except government | 11
Food services and drinking places | 12
Apparel and leather and allied products | 13
Federal Reserve banks credit intermediation and related activities | 14
Textile mills and textile product mills | 15
Ambulatory health care services | 16
Primary metals | 17
Paper products | 18
Hospitals and nursing and residential care facilities | 19
Broadcasting and telecommunications | 20
Rail transportation | 21
Insurance carriers and related activities | 22
Electrical equipment appliances and components | 23
Fabricated metal products | 24
Computer and electronic products | 25
Management of companies and enterprises | 26
State and local government enterprises | 27
Plastics and rubber products | 28
Truck transportation | 29
Air transportation | 30
Miscellaneous manufacturing | 31
Rental and leasing services and lessors of intangible assets | 32
Securities commodity contracts and investments | 33
Machinery | 34
Mining except oil and gas | 35
Miscellaneous professional scientific and technical services | 36
Educational services | 37
Federal government enterprises | 38
Legal services | 39
Administrative and support services | 40
State and local general government | 41
Publishing industries except internet includes software | 42
Forestry fishing and related activities | 43
Nonmetallic mineral products | 44
Other transportation and support activities | 45
Furniture and related products | 46
Accommodation | 47
Printing and related support activities | 48
Wood products | 49
Other transportation equipment | 50
Transit and ground passenger transportation | 51
Pipeline transportation | 52
Construction | 53
Water transportation | 54
Amusements gambling and recreation industries | 55
Social assistance | 56
Warehousing and storage | 57
Waste management and remediation services | 58
Performing arts spectator sports museums and related activities | 59
Funds trusts and other financial vehicles | 60
Federal general government | 61
Motion picture and sound recording industries | 62
Data processing internet publishing and other information services | 63
Computer systems design and related services | 64
Support activities for mining | 65
0.0
0.2
0.4
0.6
inflation impact (%)
Inflationary Period SSP 1967-1970
Indirect
Direct
Retail trade | 01
Real estate | 02
Food and beverage and tobacco products | 03
Food services and drinking places | 04
Other services except government | 05
Federal Reserve banks credit intermediation and related activities | 06
Hospitals and nursing and residential care facilities | 07
Ambulatory health care services | 08
Farms | 09
Insurance carriers and related activities | 10
Wholesale trade | 11
Motor vehicles bodies and trailers and parts | 12
Utilities | 13
Apparel and leather and allied products | 14
State and local general government | 15
Truck transportation | 16
Primary metals | 17
Educational services | 18
Federal government enterprises | 19
Fabricated metal products | 20
Accommodation | 21
Management of companies and enterprises | 22
Publishing industries except internet includes software | 23
Legal services | 24
State and local government enterprises | 25
Air transportation | 26
Broadcasting and telecommunications | 27
Textile mills and textile product mills | 28
Rail transportation | 29
Mining except oil and gas | 30
Oil and gas extraction | 31
Miscellaneous professional scientific and technical services | 32
Paper products | 33
Miscellaneous manufacturing | 34
Amusements gambling and recreation industries | 35
Performing arts spectator sports museums and related activities | 36
Securities commodity contracts and investments | 37
Forestry fishing and related activities | 38
Administrative and support services | 39
Chemical products | 40
Electrical equipment appliances and components | 41
Transit and ground passenger transportation | 42
Construction | 43
Furniture and related products | 44
Nonmetallic mineral products | 45
Other transportation equipment | 46
Motion picture and sound recording industries | 47
Printing and related support activities | 48
Plastics and rubber products | 49
Social assistance | 50
Warehousing and storage | 51
Waste management and remediation services | 52
Other transportation and support activities | 53
Funds trusts and other financial vehicles | 54
Wood products | 55
Federal general government | 56
Computer and electronic products | 57
Petroleum and coal products | 58
Rental and leasing services and lessors of intangible assets | 59
Pipeline transportation | 60
Computer systems design and related services | 61
Data processing internet publishing and other information services | 62
Support activities for mining | 63
Machinery | 64
Water transportation | 65
0.00
0.25
0.50
0.75
1.00
inflation impact (%)
Comparison of impact ranks
Black lines highlight top ten ranked industries in either period
impact rank
5
10
15
20
25
30
35
40
45
50
55
60
65
pre-inflation
inflation
period

**Figure 8**

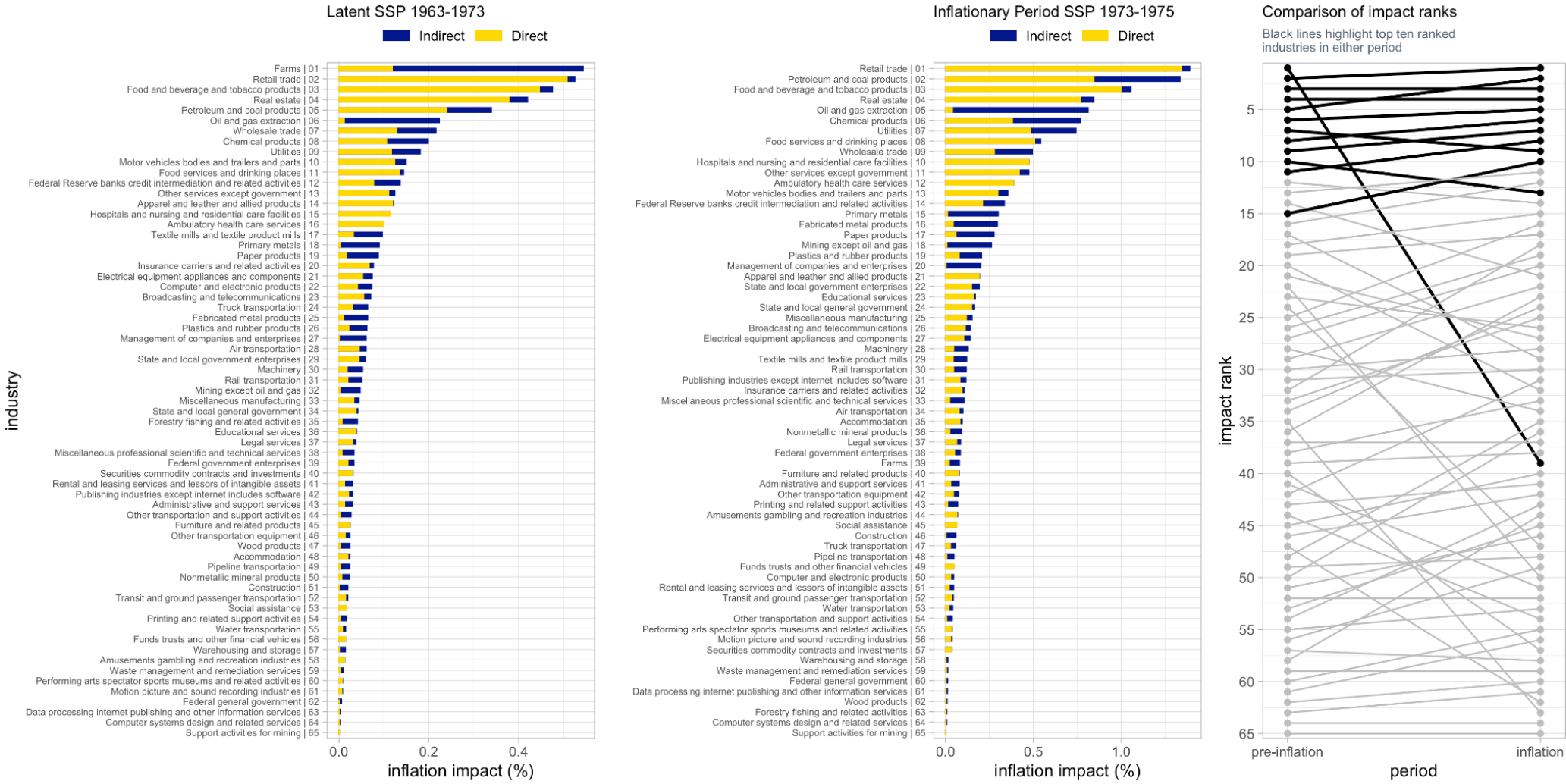
Latent SSP 1963-1973
Indirect
Direct
industry
Farms | 01
Retail trade | 02
Food and beverage and tobacco products | 03
Real estate | 04
Petroleum and coal products | 05
Oil and gas extraction | 06
Wholesale trade | 07
Chemical products | 08
Utilities | 09
Motor vehicles bodies and trailers and parts | 10
Food services and drinking places | 11
Federal Reserve banks credit intermediation and related activities | 12
Other services except government | 13
Apparel and leather and allied products | 14
Hospitals and nursing and residential care facilities | 15
Ambulatory health care services | 16
Textile mills and textile product mills | 17
Primary metals | 18
Paper products | 19
Insurance carriers and related activities | 20
Electrical equipment appliances and components | 21
Computer and electronic products | 22
Broadcasting and telecommunications | 23
Truck transportation | 24
Fabricated metal products | 25
Plastics and rubber products | 26
Management of companies and enterprises | 27
Air transportation | 28
State and local government enterprises | 29
Machinery | 30
Rail transportation | 31
Mining except oil and gas | 32
Miscellaneous manufacturing | 33
State and local general government | 34
Forestry fishing and related activities | 35
Educational services | 36
Legal services | 37
Miscellaneous professional scientific and technical services | 38
Federal government enterprises | 39
Securities commodity contracts and investments | 40
Rental and leasing services and lessors of intangible assets | 41
Publishing industries except internet includes software | 42
Administrative and support services | 43
Other transportation and support activities | 44
Furniture and related products | 45
Other transportation equipment | 46
Wood products | 47
Accommodation | 48
Pipeline transportation | 49
Nonmetallic mineral products | 50
Construction | 51
Transit and ground passenger transportation | 52
Social assistance | 53
Printing and related support activities | 54
Water transportation | 55
Funds trusts and other financial vehicles | 56
Warehousing and storage | 57
Amusements gambling and recreation industries | 58
Waste management and remediation services | 59
Performing arts spectator sports museums and related activities | 60
Motion picture and sound recording industries | 61
Federal general government | 62
Data processing internet publishing and other information services | 63
Computer systems design and related services | 64
Support activities for mining | 65
0.0
0.2
0.4
inflation impact (%)
Inflationary Period SSP 1973-1975
Indirect
Direct
Retail trade | 01
Petroleum and coal products | 02
Food and beverage and tobacco products | 03
Real estate | 04
Oil and gas extraction | 05
Chemical products | 06
Utilities | 07
Food services and drinking places | 08
Wholesale trade | 09
Hospitals and nursing and residential care facilities | 10
Other services except government | 11
Ambulatory health care services | 12
Motor vehicles bodies and trailers and parts | 13
Federal Reserve banks credit intermediation and related activities | 14
Primary metals | 15
Fabricated metal products | 16
Paper products | 17
Mining except oil and gas | 18
Plastics and rubber products | 19
Management of companies and enterprises | 20
Apparel and leather and allied products | 21
State and local government enterprises | 22
Educational services | 23
State and local general government | 24
Miscellaneous manufacturing | 25
Broadcasting and telecommunications | 26
Electrical equipment appliances and components | 27
Machinery | 28
Textile mills and textile product mills | 29
Rail transportation | 30
Publishing industries except internet includes software | 31
Insurance carriers and related activities | 32
Miscellaneous professional scientific and technical services | 33
Air transportation | 34
Accommodation | 35
Nonmetallic mineral products | 36
Legal services | 37
Federal government enterprises | 38
Farms | 39
Furniture and related products | 40
Administrative and support services | 41
Other transportation equipment | 42
Printing and related support activities | 43
Amusements gambling and recreation industries | 44
Social assistance | 45
Construction | 46
Truck transportation | 47
Pipeline transportation | 48
Funds trusts and other financial vehicles | 49
Computer and electronic products | 50
Rental and leasing services and lessors of intangible assets | 51
Transit and ground passenger transportation | 52
Water transportation | 53
Other transportation and support activities | 54
Performing arts spectator sports museums and related activities | 55
Motion picture and sound recording industries | 56
Securities commodity contracts and investments | 57
Warehousing and storage | 58
Waste management and remediation services | 59
Federal general government | 60
Data processing internet publishing and other information services | 61
Wood products | 62
Forestry fishing and related activities | 63
Computer systems design and related services | 64
Support activities for mining | 65
0.0
0.5
1.0
inflation impact (%)
Comparison of impact ranks
Black lines highlight top ten ranked industries in either period
impact rank
5
10
15
20
25
30
35
40
45
50
55
60
65
pre-inflation
inflation
period

**Figure 9**

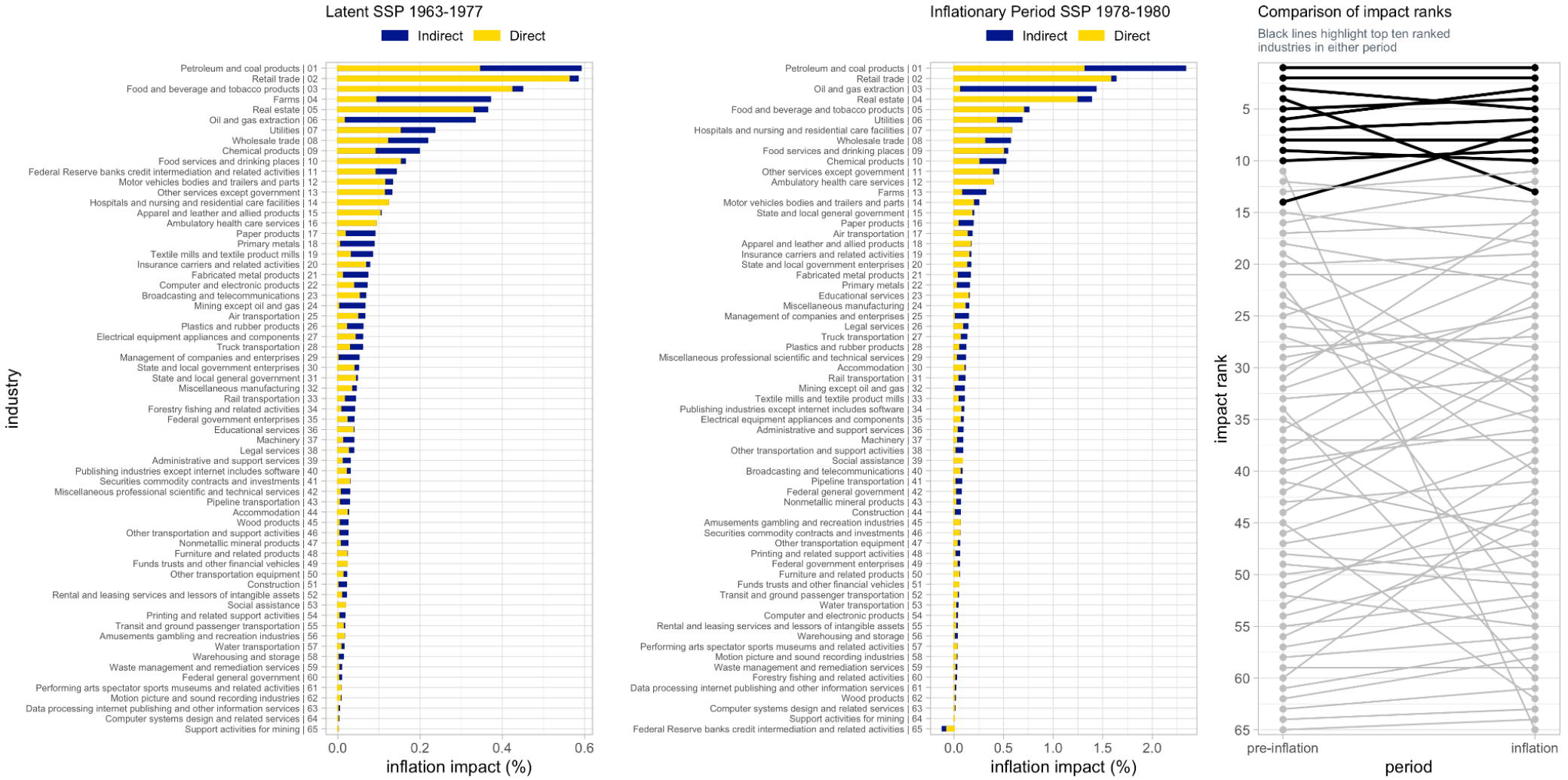
Latent SSP 1963-1977
Indirect
Direct
industry
Petroleum and coal products | 01
Retail trade | 02
Food and beverage and tobacco products | 03
Farms | 04
Real estate | 05
Oil and gas extraction | 06
Utilities | 07
Wholesale trade | 08
Chemical products | 09
Food services and drinking places | 10
Federal Reserve banks credit intermediation and related activities | 11
Motor vehicles bodies and trailers and parts | 12
Other services except government | 13
Hospitals and nursing and residential care facilities | 14
Apparel and leather and allied products | 15
Ambulatory health care services | 16
Paper products | 17
Primary metals | 18
Textile mills and textile product mills | 19
Insurance carriers and related activities | 20
Fabricated metal products | 21
Computer and electronic products | 22
Broadcasting and telecommunications | 23
Mining except oil and gas | 24
Air transportation | 25
Plastics and rubber products | 26
Electrical equipment appliances and components | 27
Truck transportation | 28
Management of companies and enterprises | 29
State and local government enterprises | 30
State and local general government | 31
Miscellaneous manufacturing | 32
Rail transportation | 33
Forestry fishing and related activities | 34
Federal government enterprises | 35
Educational services | 36
Machinery | 37
Legal services | 38
Administrative and support services | 39
Publishing industries except internet includes software | 40
Securities commodity contracts and investments | 41
Miscellaneous professional scientific and technical services | 42
Pipeline transportation | 43
Accommodation | 44
Wood products | 45
Other transportation and support activities | 46
Nonmetallic mineral products | 47
Furniture and related products | 48
Funds trusts and other financial vehicles | 49
Other transportation equipment | 50
Construction | 51
Rental and leasing services and lessors of intangible assets | 52
Social assistance | 53
Printing and related support activities | 54
Transit and ground passenger transportation | 55
Amusements gambling and recreation industries | 56
Water transportation | 57
Warehousing and storage | 58
Waste management and remediation services | 59
Federal general government | 60
Performing arts spectator sports museums and related activities | 61
Motion picture and sound recording industries | 62
Data processing internet publishing and other information services | 63
Computer systems design and related services | 64
Support activities for mining | 65
0.0
0.2
0.4
0.6
inflation impact (%)
Inflationary Period SSP 1978-1980
Indirect
Direct
Petroleum and coal products | 01
Retail trade | 02
Oil and gas extraction | 03
Real estate | 04
Food and beverage and tobacco products | 05
Utilities | 06
Hospitals and nursing and residential care facilities | 07
Wholesale trade | 08
Food services and drinking places | 09
Chemical products | 10
Other services except government | 11
Ambulatory health care services | 12
Farms | 13
Motor vehicles bodies and trailers and parts | 14
State and local general government | 15
Paper products | 16
Air transportation | 17
Apparel and leather and allied products | 18
Insurance carriers and related activities | 19
State and local government enterprises | 20
Fabricated metal products | 21
Primary metals | 22
Educational services | 23
Miscellaneous manufacturing | 24
Management of companies and enterprises | 25
Legal services | 26
Truck transportation | 27
Plastics and rubber products | 28
Miscellaneous professional scientific and technical services | 29
Accommodation | 30
Rail transportation | 31
Mining except oil and gas | 32
Textile mills and textile product mills | 33
Publishing industries except internet includes software | 34
Electrical equipment appliances and components | 35
Administrative and support services | 36
Machinery | 37
Other transportation and support activities | 38
Social assistance | 39
Broadcasting and telecommunications | 40
Pipeline transportation | 41
Federal general government | 42
Nonmetallic mineral products | 43
Construction | 44
Amusements gambling and recreation industries | 45
Securities commodity contracts and investments | 46
Other transportation equipment | 47
Printing and related support activities | 48
Federal government enterprises | 49
Furniture and related products | 50
Funds trusts and other financial vehicles | 51
Transit and ground passenger transportation | 52
Water transportation | 53
Computer and electronic products | 54
Rental and leasing services and lessors of intangible assets | 55
Warehousing and storage | 56
Performing arts spectator sports museums and related activities | 57
Motion picture and sound recording industries | 58
Waste management and remediation services | 59
Forestry fishing and related activities | 60
Data processing internet publishing and other information services | 61
Wood products | 62
Computer systems design and related services | 63
Support activities for mining | 64
Federal Reserve banks credit intermediation and related activities | 65
0.0
0.5
1.0
1.5
2.0
inflation impact (%)
Comparison of impact ranks
Black lines highlight top ten ranked industries in either period
impact rank
5
10
15
20
25
30
35
40
45
50
55
60
65
pre-inflation
inflation
period

**Figure 10**

SSPs Across Inflationary Periods

| Sector | 1950-51 | 1956-58 | 1967-70 | 1973-75 | 1978-80 |
|---|---|---|---|---|---|
| Retail Trade | ✓ | ✓ | ✓ | ✓ | ✓ |
| Real Estate | ✓ | ✓ | ✓ | ✓ | ✓ |
| Food and Beverage and Tobacco Products | ✓ | ✓ | ✓ | ✓ | |
| Farms | ✓ | ✓ | | | |
| Petroleum and Coal Products | | | | ✓ | ✓ |
| Oil and Gas Extraction | | | | ✓ | ✓ |
| Apparel and Leather and Allied Products | ✓ | | | | |
| Wholesale Trade | ✓ | | | | |
| Food Services and Drinking Places | | | ✓ | | |
| Other Services Except Government | | | ✓ | | |
| Federal Reserve Banks Credit Intermediation | | | ✓ | | |
| Hospitality and Nursing and Residential Care Facilities | | | ✓ | | |
| Ambulatory Health Services | | | | ✓ | |
| Chemical Products | | | | ✓ | |
| Utilities | | | | ✓ | |

**Figure 11**

## Appendix A - NAICS Aggregation and Exogenous Sector

| Industries 1963-96 | | | Aggregation up to 1947 industry set | | |
|---|---|---|---|---|---|
| NAICS Code | Industry | Exogenous | NAICS Code | Industry | Exogenous |
| 111CA | Farms | | 111CA | Farms | |
| 113FF | Forestry fishing and related activities | | 113FF | Forestry fishing and related activities | |
| 211 | Oil and gas extraction | ✓ | 211 | Oil and gas extraction | ✓ |
| 212 | Mining except oil and gas | ✓ | 212 | Mining except oil and gas | ✓ |
| 213 | Support activities for mining | | 213 | Support activities for mining | |
| 22 | Utilities | | 22 | Utilities | |
| 23 | Construction | | 23 | Construction | |
| 321 | Wood products | | 321 | Wood products | |
| 327 | Nonmetallic mineral products | | 327 | Nonmetallic mineral products | |
| 331 | Primary metals | | 331 | Primary metals | |
| 332 | Fabricated metal products | | 332 | Fabricated metal products | |
| 333 | Machinery | | 333 | Machinery | |

| Industries 1963-96 | | | Aggregation up to 1947 industry set | | |
|---|---|---|---|---|---|
| NAICS Code | Industry | Exogenous | NAICS Code | Industry | Exogenous |
| 334 | Computer and electronic products | | 334 | Computer and electronic products | |
| 335 | Electrical equipment appliances and components | | 335 | Electrical equipment appliances and components | |
| 3361MV | Motor vehicles bodies and trailers and parts | | 3361MV | Motor vehicles bodies and trailers and parts | |
| 3364OT | Other transportation equipment | | 3364OT | Other transportation equipment | |
| 337 | Furniture and related products | | 337 | Furniture and related products | |
| 339 | Miscellaneous manufacturing | | 339 | Miscellaneous manufacturing | |
| 311FT | Food and beverage and tobacco products | | 311FT | Food and beverage and tobacco products | |
| 313TT | Textile mills and textile product mills | | 313TT | Textile mills and textile product mills | |
| 315AL | Apparel and leather and allied products | | 315AL | Apparel and leather and allied products | |
| 322 | Paper products | | 322 | Paper products | |
| 323 | Printing and related support activities | | 323 | Printing and related support activities | |
| 324 | Petroleum and coal products | | 324 | Petroleum and coal products | |
| 325 | Chemical products | | 325 | Chemical products | |

| Industries 1963-96 | | | Aggregation up to 1947 industry set | | |
|---|---|---|---|---|---|
| NAICS Code | Industry | Exogenous | NAICS Code | Industry | Exogenous |
| 326 | Plastics and rubber products | | 326 | Plastics and rubber products | |
| 42 | Wholesale trade | | 42 | Wholesale trade | |
| 44RT | Retail trade | | 44RT | Retail trade | |
| 481 | Air transportation | | 48 | Transportation | |
| 482 | Rail transportation | | 48 | Transportation | |
| 483 | Water transportation | | 48 | Transportation | |
| 484 | Truck transportation | | 48 | Transportation | |
| 485 | Transit and ground passenger transportation | | 48 | Transportation | |
| 486 | Pipeline transportation | | 48 | Transportation | |
| 487OS | Other transportation and support activities | | 48 | Transportation | |
| 493 | Warehousing and storage | | 493 | Warehousing and storage | |
| 511 | Publishing industries except internet includes software | | 51 | Information | |
| 512 | Motion picture and sound recording industries | | 51 | Information | |

| Industries 1963-96 | | | Aggregation up to 1947 industry set | | |
|---|---|---|---|---|---|
| NAICS Code | Industry | Exogenous | NAICS Code | Industry | Exogenous |
| 513 | Broadcasting and telecommunications | | 51 | Information | |
| 514 | Data processing internet publishing and other information services | | 51 | Information | |
| 521CI | Federal Reserve banks credit intermediation and related activities | ✓ | 52 | Finance and insurance | ✓ |
| 523 | Securities commodity contracts and investments | ✓ | 52 | Finance and insurance | ✓ |
| 524 | Insurance carriers and related activities | ✓ | 52 | Finance and insurance | ✓ |
| 525 | Funds trusts and other financial vehicles | ✓ | 52 | Finance and insurance | ✓ |
| 531 | Real estate | ✓ | 531 | Real estate | ✓ |
| 532RL | Rental and leasing services and lessors of intangible assets | ✓ | 532RL | Rental and leasing services and lessors of intangible assets | ✓ |
| 5411 | Legal services | | 54 | Professional scientific and technical services | |
| 5415 | Computer systems design and related services | | 54 | Professional scientific and technical services | |
| 5412OP | Miscellaneous professional scientific and technical services | | 54 | Professional scientific and technical services | |
| 55 | Management of companies and enterprises | ✓ | 55 | Management of companies and enterprises | ✓ |
| 561 | Administrative and support services | | 56 | Administrative and waste management services | |

| Industries 1963-96 | | | Aggregation up to 1947 industry set | | |
|---|---|---|---|---|---|
| NAICS Code | Industry | Exogenous | NAICS Code | Industry | Exogenous |
| 562 | Waste management and remediation services | | 56 | Administrative and waste management services | |
| 61 | Educational services | | 61 | Educational services | |
| 621 | Ambulatory health care services | ✓ | 62 | Health care and social assistance | ✓ |
| 622HO | Hospitals and nursing and residential care facilities | ✓ | 62 | Health care and social assistance | ✓ |
| 624 | Social assistance | | 62 | Health care and social assistance | ✓ |
| 711AS | Performing arts spectator sports museums and related activities | | 71 | Arts entertainment and recreation | |
| 713 | Amusements gambling and recreation industries | ✓ | 71 | Arts entertainment and recreation | |
| 721 | Accommodation | | 721 | Accommodation | |
| 722 | Food services and drinking places | ✓ | 722 | Food services and drinking places | ✓ |
| 81 | Other services except government | | 81 | Other services except government | |
| GFG | Federal general government | | GFG | Federal general government | |
| GFE | Federal government enterprises | | GFE | Federal government enterprises | |
| GSLG | State and local general government | | GSLG | State and local general government | |