

Core prices or more prices? Extending the concept of inflation beyond consumer prices

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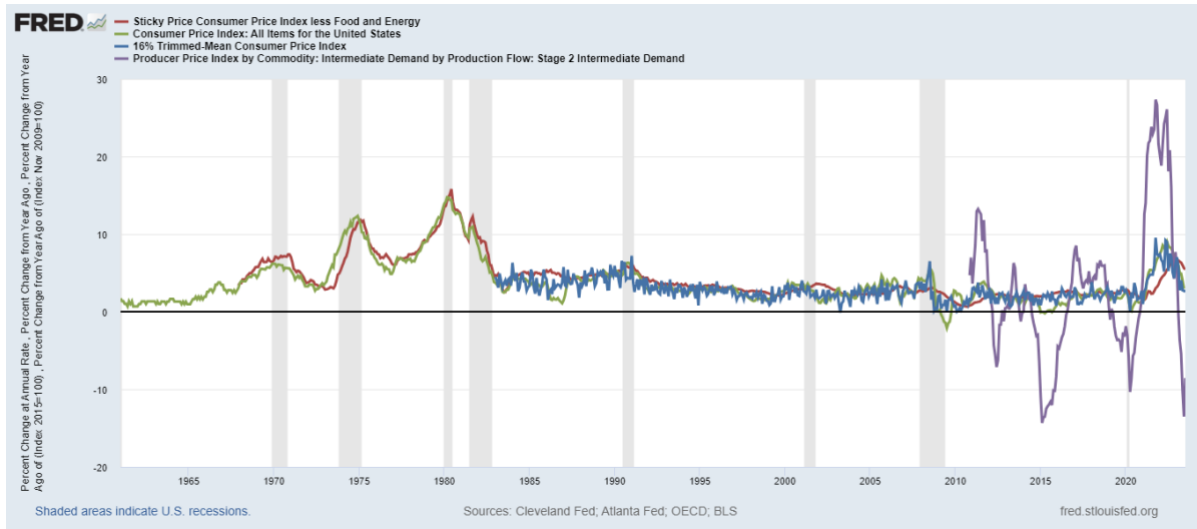
1. Introduction

The recent inflationary episode has ignited considerable public and scientific discussion. Much of the discussion on social media like 'X' (formerly Twitter) but also in the numerous scientific articles already published is focused on just a subset of prices, aggregated in the consumer price index (CPI).² Or even on more limited subsets of prices of this index like 'core prices' (consumer prices excluding food and energy prices), 'trimmed mean' prices (an index which [excludes 8% of the CPI components with the highest and lowest one-month price changes from each tail of the price-change distribution](#)) and others. This is remarkable as inflation is supposed to be a process that affects the entire monetary economy, not just consumer spending. Instead of focusing on a subset of a subset of prices or, as in the case of 'super core prices', on a subset of a subset of a subset, focusing on more prices and other subsets might yield additional insights. Graph 1 shows the large differences between on one side different subsets of the CPI mentioned above on one side and one of the price indexes of producer prices or, in the language of the national accounts, 'intermediate expenditure' on the other side. The graph shows so-called 'stage 2' producer prices. These are conceptualized, estimated, and published by the USA Bureau of Labor Statistics (BLS) to get a clearer view of 'cost push' inflation. I'll return to this. At this moment it's important to note that, large differences exist: at the time of writing this article, USA consumer price inflation was still positive but 'stage 2' producer prices showed 10% deflation!

¹ Merijn Knibbe is an independent economic historian. He published on historical factor prices like land rents, interest rates and wages as well as on producer prices of agricultural products. At this moment he's working on 19th century insurance prices of hay which have to be understood as gift exchange prices, not market exchange prices.

² An overview of a number of recent articles on inflation and the inflation metric used in these articles will be available on the internet.

Graph 1. Subsets of consumer price index inflation compared with a stage 2 supply chain focused producer price inflation metric



Source: The Saint Louis Fed ‘Fred’ database and graphing facility. The organizations originating these statistics are mentioned at the bottom of the graph, additional information is available on the ‘Fred’ website.

Aside from these producer prices, there are more kinds of prices and price indexes. We can think of income prices like wages and land rents but also of series of other kinds of final expenditure besides consumer expenditure, like business and government investment or exports. All of these series show a different dimension of the monetary economy and, hence, a different dimension of inflationary processes. As a metric enabling the calculation of household purchasing power, the consumer price index is invaluable. As a tool to investigate inflationary episodes, it is, considering the differences shown in the graph and the tinkering with it mentioned above, wanting. A broader perspective is needed, based upon more price indexes – which of course has to be based on a coherent, consistent, and complete concept of the money economy. Below, I’ll provide such a perspective.

This is important as the concept of price indexes, the price level, and inflation are not arcane subjects discussed by waning old men. Economic statistics and how we define and use these have real consequences. An example: in September 2022 consumer price inflation in the Netherlands reached an unexpected peak of 14.5%.³ Or, did it? Dutch inflation was, compared with neighboring countries, remarkably high. This made the Dutch Centraal Bureau voor de Statistiek (CBS), which constructs and publishes the Dutch consumer price index, investigate its method. Based on this investigation, the method was changed and in June 2023 a new official rate was published, which would have shown a peak of 11.6% in January 2023 – more in line with neighboring countries and quite a bit lower and later

³ The data used in this article will be mainly based upon USA statistics, because availability and the ease of access of this data. The supply chain-based producer price series and the total wage series are constructed by the USA BLS, the valuable ‘land and natural resource rent’ data which enable a ‘classical’ political economy break down of inflation-induced changes in the distribution of factor income are part of the financial accounts of the USA, the other series are part of the national accounts of the USA. To prevent too much emphasis on the USA, some information on the Netherlands will be added. The choice for information on the Dutch situation as a kind of counterweight is because these are the data I’m most familiar with.

than the peak of the original index.⁴ And ‘would have’ as the new data were not officially backcast – leading to problems for users of this particular statistic! The difference between the new and the old: instead of using energy prices in *new contracts offered by energy suppliers* to calculate the (energy)price level the CBS switched to using energy prices *actually paid by households* which were often based on contracts with a duration of one or even several years. This operational change brought the Dutch consumer price index closer to one of the core concepts on which the consumer price index is based: a gauge that helps us to calculate the purchasing power of households based on prices paid, not a variable intended to track changes of bid prices as fast as possible. In the meantime, however, the high rates of September 2022 had been used by quite a number of (more than fully funded) Dutch pension funds as a basis for the indexation of (millions of!) nominal pensions. Operationalizations matter! However, operationalizations are based on concepts meaning that concepts matter, too. In my opinion, the ‘purchasing power’ concept should be leading for the definition, operationalization, measurement, and interpretation of the consumer price index. But other concepts however exist and influence results.⁵ The Dutch CBS temporarily strayed from the purchasing power concept and introduced elements based on the idea of a kind of short-term supply bid prices tracker instead of looking at prices actually paid by households. This was more in line with the use, by many economists, of the consumer price index as a gauge of economy-wide inflationary pressures instead of as a gauge of household purchasing power.⁶ The speed with which the CBS returned to the time tried purchasing power concept when things really mattered is remarkable and shows that the consumer (the concept of) the consumer price index is a socially and politically embedded statistic, an element of a continuous development of ideas and, indeed, political struggle. It, however, also shows that *the very existence* of a price index and, hence, the concept and its embeddedness in society, and not just the details of its construction, matters⁷. People and organizations incorporate such data in their decision-making process. To take this one step further: if the conceptualization and operationalization of statistics matter, it also matters which statistics *do not* exist (for economists: without a price index no Philips curve...). It also matters which metrics do exist and are published by perfectly accepted institutions using an integrated framework of the economy but does not get due attention as (the situation in economics) much of the analysis is not based on such an integrated framework of the economy but on a simpler view of the economy. The Dutch CBS does, for instance, publish a ‘dashboard’ of prices not just based on consumer expenditure prices but also on import prices, producer prices, the interest rate, and other prices – but it gets scant attention. Even when the general public is right to focus on consumer price inflation as it’s directly relevant to their purchasing power it’s less understandable (even when explicable) that economists have a comparable myopia. The importance paid by the public to the consumer price index and the role it plays in the indexation of pensions or wages of course makes it an

⁴ Centraal Bureau voor de Statistiek, ‘CBS switches to a new method for calculating energy prices in the CPI’, 30-06-2023, [to be found here](#).

⁵ One example: many consumer price indexes contain ‘imputed rent’ for owner-occupied dwellings. This is not a measurement based on prices actually paid by households but an assumption made by statisticians. The EU Harmonized Index of Consumer Prices (HICP index) however excludes these imputations as it is supposed to be a monetary-based index, not a neoclassical utility based index. An excellent investigation of the struggle and strive behind the conceptualization of and the influence of economic theory on the USA price index: T. A. Stapleford, *The cost of living in America. A political history of economic statistics, 1880-2000* (Cambridge: Cambridge University Press 2009).

⁶ One is reminded of the discussion amongst USA economists about ‘house rents actually paid’ in the USA CPI

⁷ In the Netherlands, consumer prices had been gathered since the end of the 19th century. Modern price indexes based on consumer budgets and regular and timely gathering of a complete set of prices was, however, mainly a post 1940 development. Centraal Bureau voor de Statistiek, ‘De consumptieve uitgaven in Nederland 1923-1939’, *Statistische en econometrische onderzoekingen, nieuwe reeks, jaargang 4 no. 3* 99-143. Centraal Bureau voor de Statistiek, ‘Prijzbeweging van levensmiddelen *Maandschrift 18 no 6* pp. 342-354 (Den Haag 1913).

item of special interest. But even taking account of this, it's only one kind of final expenditure. Other kinds are, as stated, different kinds of government expenditure, business investment, and exports while intermediate expenditure prices exist too and are related to final expenditure meaning that price shocks will be propagated (but how...?), just like income prices exist. It's obvious that a serious analysis of inflationary periods should be based on an interrelated analysis of all these prices, which does not happen often enough.⁸

2. Data and methods

These musings leads to the following question:

“Which subsets of prices, covering the entirety of an integrated framework of the economy, have to be used to enable, contrary to the consumer price index, a broad, economy-wide picture of inflationary periods?”

To be clear: this article is *not* an analysis or interpretation of these series, it will only look if an integrated framework can be provided. When answering this question I will restrict myself to available price indexes and base myself on an accepted integrated framework of the economy, using the following concepts:

- a) Based on the system of national accounts I'll use the accounting identity

Total nominal expenditure = Total nominal production = total nominal income.

This identity enables us to compare expenditure-based price indexes like the consumer price index and fixed investments price index with production-chain based indexes and income indexes (wages, profits, rents, interest). Whenever nominal final expenditure increases because of sudden and large price increases of final products and services, nominal production and as well as nominal income will, by accounting necessity, increase too⁹. Even when the logic of accounting theoretically enables a situation where expenditure increases because of higher prices while incomes increase because of increases in input (more people receiving lower income to produce more expensive items, imagine a drought leading to a decline of agricultural production despite additional labor input) it's hard to conceive that recent double-digit expenditure inflation did not also have a counterpoint in unusual large price increases in producer prices or at least some incomes.

- b) Based upon the classical production function $Y = f(\text{Labor, Capital, Land, and natural resources})$ I will couple this to indexes of labor income (wages), capital income (profit) and 'Land and natural resources' income (rent):¹⁰

⁸ It did happen in: Keynes, J.M., *How to Pay for the War: A Radical Plan for the Chancellor of the Exchequer* (London 1940). His method was the road not chosen in economics.

⁹ For people not acquainted with this kind of thinking: there are some accounting conventions used to enable this identity to be true. One example: changes in business stocks are defined to be part of business investment and hence expenditure, meaning that production not sold is, despite this, included in total expenditure. This is not just a trick: it does show on business balance sheets.

¹⁰ The neoclassical production function excludes 'Land' meaning that ownership (and the connected flow of income), depletion, and geopolitical aspects connected to the production of non-reproducible factors of production like oil, copper, and phosphate are defined away.

This enables a direct coupling of inflation to income distribution. High expenditure inflation because of high energy prices might be connected to 'Land-based inflation', like an increase in rents for owners of subterranean oil like the population of Norway and the royal family of Saudi Arabia. Or, in 2023, owners of solar panels or windmills (both very much land-based ways to produce energy). A common component of the production of fossil energy as well as renewable energy is a low wage component of value added and a large land component and hence a high share of rent in total income meaning that price increases accrue to land owners (including owners of subterranean natural resources).

- c) Based upon the supply chain concept and the idea of intermediate production of the national accounts and the input-output idea behind these accounts I will present indexes showing price developments in different stages of the production chain.

Such metrics exist, are published as a matter of routine by the BLS, and are designed to enable an analysis of the reverberations of price shocks through the supply chains.

- d) Based on the national accounts and economic textbooks I will look at different kinds of final demand, like business fixed investment, government consumption expenditure (i.e. household consumption financed by the government¹¹ (streetlights, large parts of education etc.) government investments (like in almost all countries: sewer systems) and exports.¹²

This approach contrasts with much of the macroeconomics guiding the present focus on the consumer price index by economists and, indeed, central banks, which is based on an economic model that, to give it the benefit of the doubt, is a crude approximation of a 19th-century economy, characterized by much lower relative levels of investment and government expenditure and much higher relative levels of consumption spending than modern economies.¹³ This holds even more for countries like India (35%) and China (42%).¹⁴ Modern economies are also characterized by more complicated and globalized

¹¹ It would have been nice to have specific price indexes for US government consumption and government investment. It seems that these are not available. On Eurostat, data on total household consumption price indexes (i.e. consumer expenditure prices plus government individual consumption expenditure prices are available as part of the calculations of Actual Individual Consumption (AIC), i.e. consumption financed by consumers themselves plus individual consumption financed by the government.

¹² The examples between the parentheses are necessary as many neoclassical macro models assume that all government expenditure (all of it) is wasteful by definition. It isn't.

¹³ On the social media site formerly called Twitter an interesting discussion about this can be found. Olivier Blanchard, an economist and textbook writer [stated](#): '*1. Triggered by the exchange with @R2Rsquared @AngelUbide, @Guido Lorenzoni and others: The discussion was at the core of macro. The nature of the determinants of the price level is THE fundamental issue in thinking about short run fluctuations, not a marginal or esoteric issue.*' Paul Krugman, winner of the economics Nobel, a textbook writer and extra ordinarily talented when it comes to investigating economic statistics and taking these seriously responded to this by stating: '[The amazing thing about this debate is that it's the same debate we've been having for almost 50 years, since Olivier and I were grad students](#)'. According to Blanchard, the discussion was about the nature of prices: sticky or not, Krugman adds that an influential group of economists states that prices aren't sticky while he and Blanchard go for 'sticky prices' (surely in the short run). Both Krugman and Blanchard focus on consumer prices.

¹⁴ Historical series stretching back to the beginning of the 19th century showing the ups and downs of the rate of fixed investment are to be found in: Knibbe, M. [The growth of capital: Piketty, Harrod-Domar, Solow and the long run development of the rate of investment](#), *Real World Economics Review* 69 (2014) pp. 100-121. Updates of the series can be found in Knibbe, M., 'Long term changes in the western rate of 'Gross Fixed Capital Formation'. Patterns and anomalies', *Real World Economics Review blog* 25 May 2022. The importance of Government expenditure on private consumption as part of total private consumption (called Actual Individual consumption by economic statisticians is shown for EU countries in Eurostat, '[GDP per capita, consumption per capita and price](#)

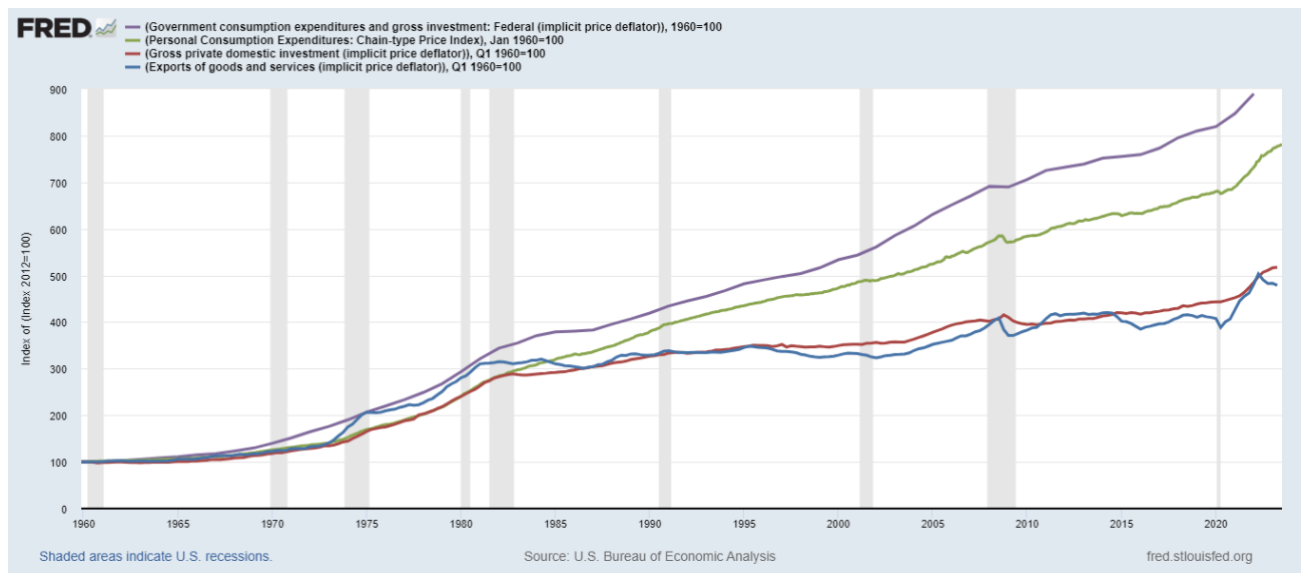
chains of production than 19th century economies, surely for the lower 80% of income earners.¹⁵ This, however, does not show in the neoclassical macro models. These started out with a ‘one person one good’ Robinson Crusoe model of the economy. Even when more recent variants do include more persons and goods, thinking about ‘the’ price level is still very much influenced by this ‘one person, one good (and hence one price level)’ idea of thinking. But the economy and, as the existence of readily available price series indicates, economic statisticians too, have moved beyond the 19th century concepts for a long time. Instead of looking at one price level – be it the consumer price level or the core price level or service prices or whatever - we have to look at basically all prices using an integrated and complete description of the economy to define the subsets. Or at least to look at a number of subsets which can be expected to be a reasonable approximation of all prices.

3. Results

3.1 Final expenditure inflation

Final expenditure consists of consumer spending, business investment (including change in stocks), government investment, exports and government consumption expenditure (again: household consumption financed by the government, not consumption by the government itself). When we show the development of the price levels and year-to-year changes we see profound differences. USA business investment knew, at least during the last decades, a much lower level of inflation than consumer spending while the same holds for export prices which are also clearly more volatile. Despite this, the recent bout of inflation was clearly led by export and business investment expenditure inflation!

Graph 2. Final expenditure price levels, USA (1960-01-01 = 100).

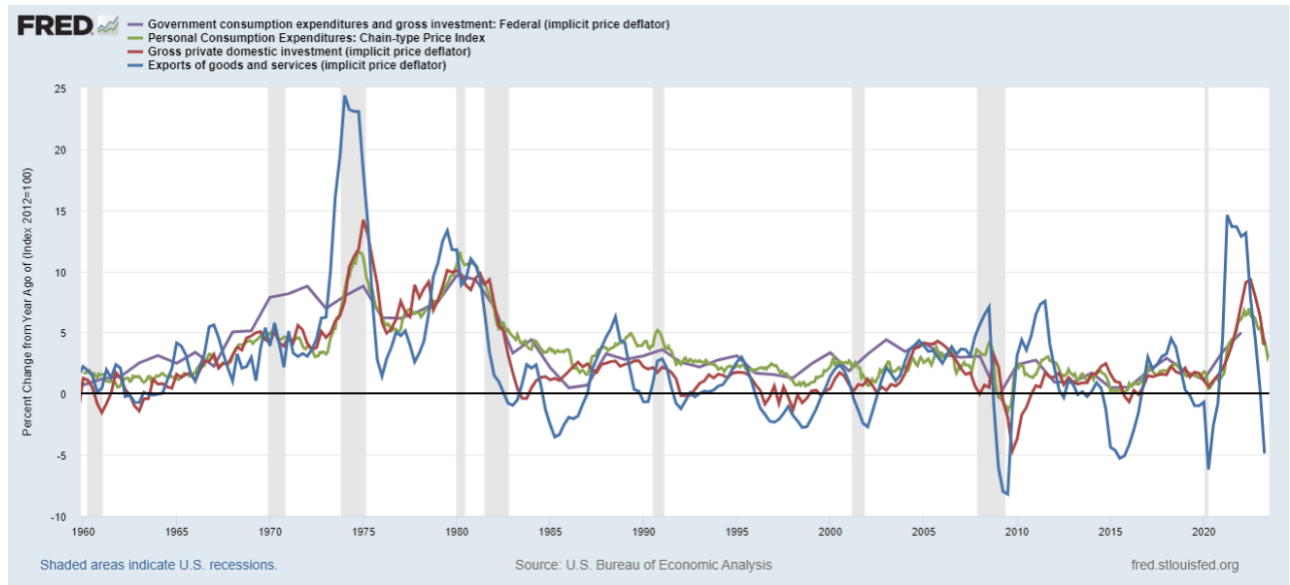


Source: See graph 1

[level indices](#), Statistics explained. Data from 20 June 2023, planned update of data 13 December 2023. Note that the article uses a price level index based upon a combination of household consumption expenditure and government consumption expenditure.

¹⁵ An extensive discussion of these models: Knibbe, M., *Macroeconomic measurement versus macroeconomic theory* (Routledge: Abingdon/New York 2020)

Graph 3. Final expenditure inflation (YoY % changes), USA.



Source: See graph 1

3.2 Intermediate expenditure or 'production stage' inflation

Final expenditure is not the only kind of expenditure. Another kind is intermediate expenditure which is roughly defined as business-to-business commerce except expenditure on fixed capital formation and (often unanticipated) changes in stocks. Consistent with this idea the USA 'Bureau of Labor Statistics' (BLS) and 'Bureau of Economic Analysis' (BEA) do not only distinguish different kinds of final demand but also draw attention to the relation between prices of final demand goods and services and prices of intermediate demand goods and services, with the express goal of being able to track the movement of prices and price shocks through the economy (emphasis added):

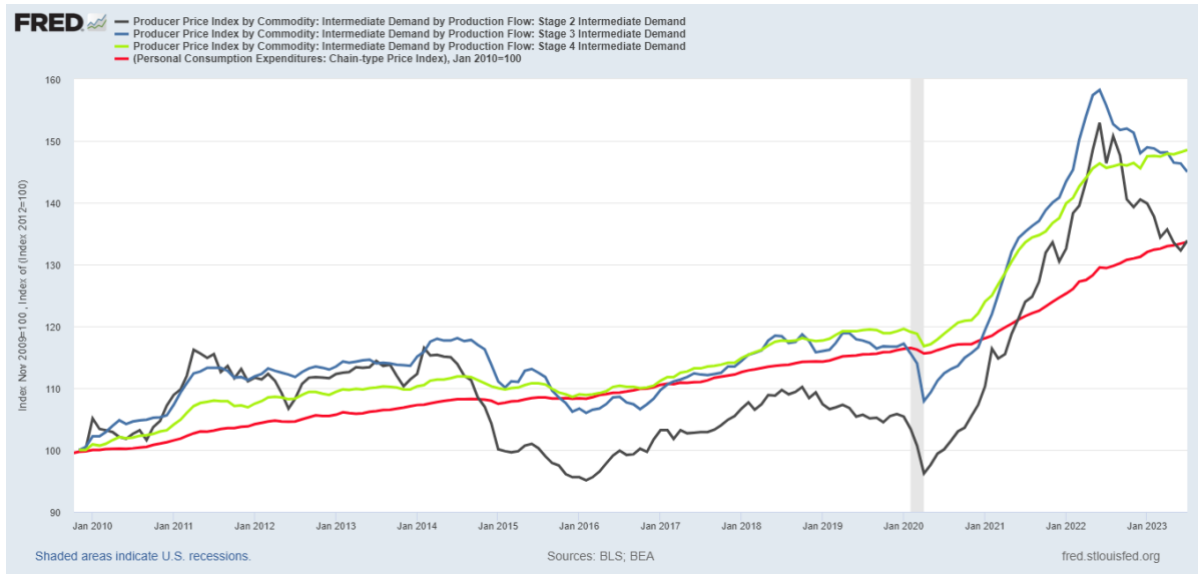
"The intermediate demand portion of the FD-ID system tracks price change for goods, services, and construction products sold to businesses as inputs to production, excluding capital investment. "The system includes two parallel treatments of intermediate demand. The first treatment organizes intermediate demand commodities by type. The second organizes intermediate demand commodities into production stages, **with the explicit goal of developing a forward-flow model of production and price change.**"¹⁶

In this model, consumer price increases are not the consequence of 'demand-pull' but of 'cost-push' (even when modeling cost-push does not preclude an analysis of additional demand-pull or monopoly power induced cost increases per production stage). Importantly, the forward linkages are based on input-output analysis of the relations between sectors, not just on theory. Using this analysis, the supply chain is divided in 4 stages. Stage 4 is statistically closest to 'final expenditure', stage 1 is least close (and, following the BLS, not included in the graphs). Looking at the graphs the volatility of the indexes is notable even when stage 4 volatility is clearly lower than stage 2 volatility – this seems to be one of

¹⁶ Bureau of Labor Statistics, 'PPI Final Demand-Intermediate Demand (FD-ID) System', <https://www.bls.gov/ppi/fd-id/ppi-final-demand-intermediate-demand-indexes.htm>, Last modified on September 4, 2017, consulted on August 21 2023

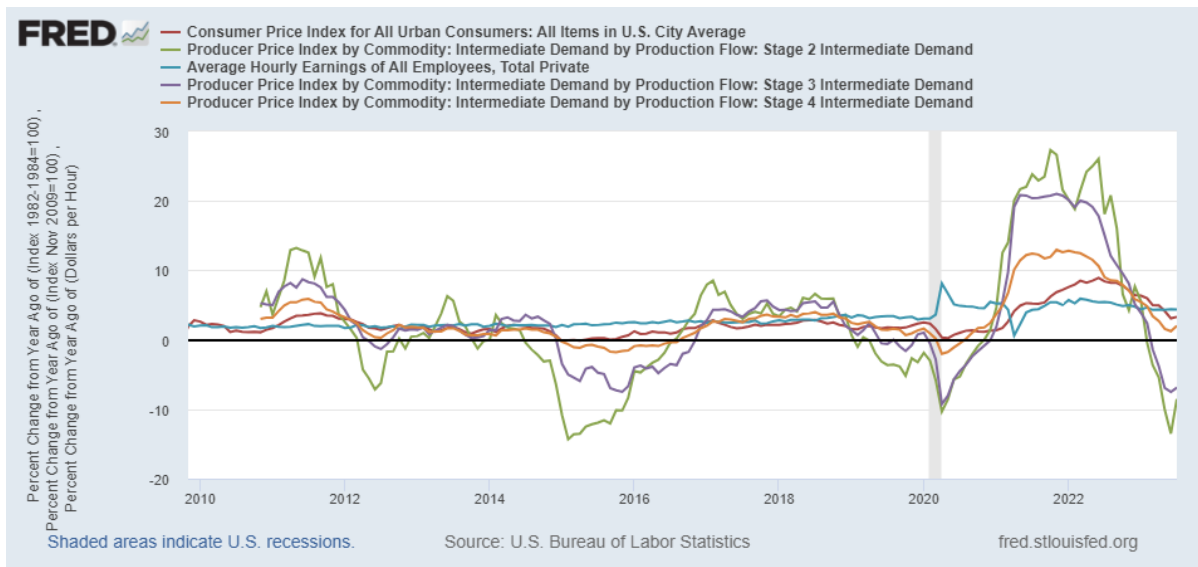
the fundamental aspects of price shock propagation! Looking at their relation with one of the components of final demand, consumer expenditure, they also seem to drag consumer price inflation up and (albeit a little less so) down. Remarkably, stage 2 and 3 prices did despite some short term volatility on the whole not increase between 2011 and 2021 – while seeing a brutal increase thereafter.¹⁷

Graph 4. Intermediate demand price levels per stage of the supply chain.



Source: See graph 1.

Graph 5. Intermediate demand inflation per stage of the supply chain and wage inflation



Source: See graph 1

¹⁷ Long term stability is not exceptional for producer prices. Milk prices in the Netherlands (closely related to world market prices) did despite some shorter-term volatility not really change between 1987 and the beginning of 2021.

The BLS research output comparable to the work of Weber et al and yields comparable results, even when Weber et al also point out specific sectors with a large influence on consumer prices like oil, food and wholesale trade, wholesale trade may be comparable to 'stage 4' prices of the BLS.¹⁸ Somewhat comparable are Borio e.a. who use also use factor analysis to compare different subsets of consumer prices. They find two inflation phases: one low inflation phase characterized by largely 'individual' movements of prices and a high inflation phase, where subset price-indexes move much more in tandem. The graphs above however indicate that during phases of high inflation producer prices show much higher increases but afterwards also decreases than consumer prices while it also seems hard for consumer prices to decrease suggesting an asymmetric pattern of drag: a (large) increase of producer prices may have a larger and more universal impact on consumption prices than a large decrease.¹⁹

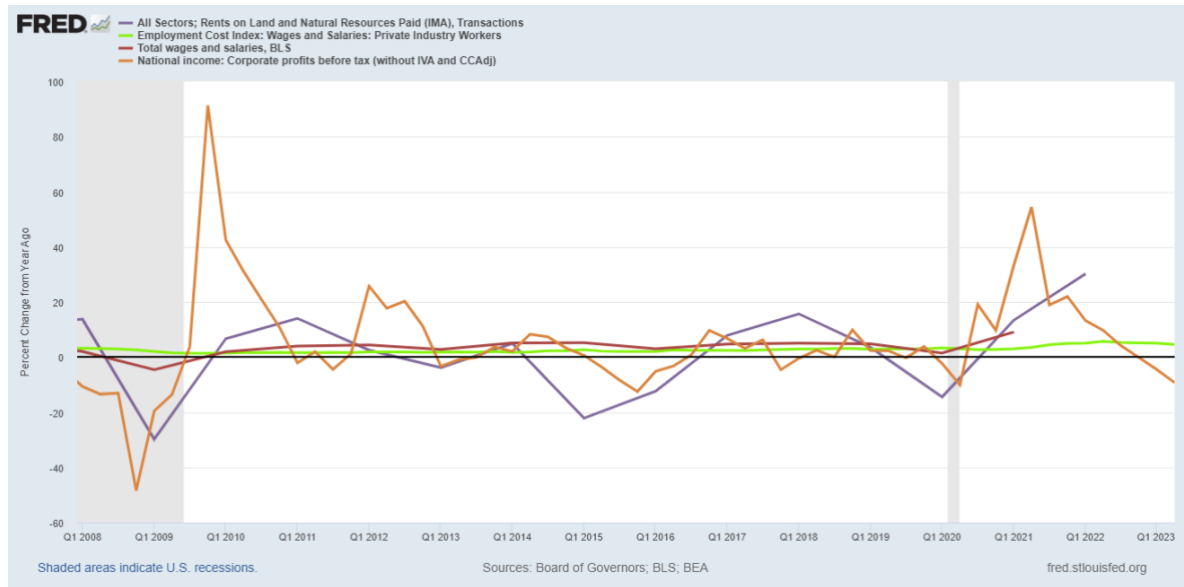
3.3 Income inflation: rents, wages, profit

To estimate income inflation, a graph has been made of changes of *total* wages, profits and 'land and natural resources' rents, there will be some double counting between total profits and 'land and natural resources' rents, for the sake of brevity I'll refrain from interest income. I've chosen to look at totals as profit has no 'price' as there no natural unit for profit like wages per hour or per person and rent per hectare per year. For the sake of comparison I did add wages per hour; differences between wages per hour and total wages are caused by increases and decreases in employment and hours worked. Looking at the recent inflationary episode, it's clear that the increase in total income which, by accounting necessity, had to take place was, in a relative sense, disproportionately distributed to an unusual concomitant increase in profits and 'land and natural resources' rents, even when total wages also showed an unusually strong rise.

¹⁸ Weber, I. M.; Jauregui, J. L.; Teixeira, L. and Nassif Pires, L. 'Inflation in Times of Overlapping Emergencies: Systemically Significant Prices from an Input-output Perspective' (2022). *Economics Department Working Paper Series*. 340.

¹⁹ Borio, C., Lombardi, M., Yetman, J. and E. Zakrajšek, E. 'The two-regime view of inflation: a synopsis' in: Takáts, E. (ed.) *A new age of central banking in emerging markets* (Budapest 2023). Their factor analysis method can be used to investigate the complete set of national accounts price data of 106 Dutch National Accounts product categories in: CBS, 'private consumption expenditure and price index numbers for the Netherlands 1951-1977', *Statistical studies no. 33* (Voorburg/Heerlen 1982).

Graph 6. Year on year changes of different income categories



Source: See graph 1

4. Discussion and conclusion

According to the national accounts, total nominal production equals total nominal final expenditure as well as total nominal income. Final expenditure can be subdivided into consumer expenditure, government and business investment, exports, and government consumption. Production can be subdivided into sectors (as Weber e.a. do) and in stages (as the BLS does) while income can be subdivided into labor income (wages), capital income (profit) and Land and natural resources income (rent). Even when the three major categories increase and decrease in tandem, by accounting necessity not all subcategories mentioned have to change in the with the same magnitude. In one period, inflationary tendencies might increase profits (as is often the case in wars), in another period it might increase land rent (as is often the case in periods of food or oil shortages) and in yet another period it might increase wages, as is sometimes the case in periods with tight labor markets and rapid increases of productivity. But that's the point. To understand inflationary episodes, we'll have to look at the forest as well as the trees. Which is entirely possible. Existing statistics provide a fully defined, operationalized, coherent and estimated model of the three major categories as well as of the subcategories, a clear alternative to the 'one person-one product-one price' crude approximation of a 19th-century economy which is characteristic of many neoclassical macro models.²⁰ The statistics can be criticized. The labor

²⁰ The use of the consumer price index is often defended by stating that it's consistent with ordinal utility. Al, Balk, de Boer and den Bakker however show this idea to be a distraction. Al, P; Balk, B.M; de Boer, S. and den Bakker, G.P., 'The use of chain indices for deflating the national accounts', *CBS NR reeks Wetenschappelijke discussie-nota's over het systeem der National Rekeningen 2* (Voorburg/Heerlen 1983). One of the problems of composite price indexes is the joint change of volumes and prices. The volumes (in fact: volumes times prices) are often used as weights to average prices in different periods. If volumes do not change, this leads to an estimate of average price changes with a clear interpretation as it's solely based on changes in prices. When volumes in two periods also change this procedure however runs amok as estimated price changes are the consequence of volume as well as price changes. Several kinds of price indexes have been developed to deal with this problem, which are sometimes theoretically consistent with 'constant ordinal utility' – which is supposed to solve this problem. Al e.a. show that constant utility is a void concept, as the very changes in volumes might influence individual utility (if it

income of the self-employed should be a separate category. Rent income related to patents and copyrights should be a separate category. Quality adjustments are a notorious problem for price indexes. Even when total expenditure and income and production rise by the same magnitude, elements thereof might not rise with the same magnitude and cause imbalances – the accounting identities are not an example of Say's law. When, as the data suggest, total labor income as well as wages per hour are (for whatever reason) less variable than rent and profit income, severe inflation will almost by definition lead to an increase of profit and rent income. Funding of transactions in times of price increases during inflationary periods is an interesting problem. Sectors with below-average income growth may become indebted or may have to draw down liquid savings. Looking at the Eurozone monetary statistics, debts are declining and money is shifted from payment accounts to savings accounts instead of the other way around. High inflation while the amount of transaction money decreases... Remarkable. The point: it is even possible to add the multi-dimensional inflation statistics to monetary data on debt and borrowing, resulting in an even deeper understanding of inflationary episodes: inflation is not always and everywhere driven by monetary expansion. It is, however, always and everywhere a multi-dimensional event, connected to monetary developments. This leads to the following conclusions:

- Readily available statistics enable a multi-dimensional, granular view of the inflationary process based on interconnected expenditure, production, and income data which can be analyzed using connecting monetary data.
- When it comes to final expenditure inflation, quite some differences in trends exist. For the USA it turns out that in the long run export and business fixed investment prices rose much less than consumer prices, meaning that consumer price inflation overstated total expenditure inflation. During the recent bout of inflation, all expenditure prices however increased.
- Producer prices are much more volatile than wages and consumer prices, at least in the short run they seem to drag the consumer price level up and down. The most recent data indicate a strong downward drag.
- Inflation in a monetary economy is *by accounting necessity* a distributional phenomenon. Total income increases but not all constituent elements of total income will increase with the same magnitude. Of all income prices, wages are in the short run clearly the least volatile component meaning that expenditure price shocks result in higher rents and profits, at least in the short run. This idea surely holds for the most recent period.
- Producer prices show sectoral differences while linkages of sectors to final expenditure prices differ. A strong price increase in one sector has other consequences than an increase in another sector.

One policy consideration: periods with unexpected high inflation are, to prevent unwanted changes in functional income distribution, *the* time to increase wages.

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SUGGESTED CITATION:

Merijn Knibbe , "Core prices or more prices? Extending the concept of inflation beyond consumer prices", *real-world economics review*, issue no. 105, October 2023, pp. 46–56, <http://www.paecon.net/PAERreview/issue105/Knibbe>

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even exists) while no aggregation procedure for individual utility exists. And even when individual utility (which isn't measured) would not change, aggregated utility would change because of demographic and other changes.