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Decomposition of inflationary processes. Input – output approach.

Abstract

The dissertation attempts to apply the input-output price model to determine the role of individual price-setting factors in the inflation process. This tool captures all the main sources of cost inflation: wage growth, increase in the prices of raw materials and imported products, or increase in taxes, and enables the analysis of price-setting processes at the sectoral level in accordance with the classification of economic activity (NACE Rev.2).

Studies on the causes of inflation have been published many times, but the input-output price model seems to be an underestimated tool in this regard. Previous research using this model was based solely on tables included in current prices (also used in complex multi-sector models, e.g. CGE). Input-output tables expressed in constant prices, despite the existence of appropriate documentation describing their creation, are developed by very few statistical centres. The limited availability of these tables is an important factor limiting the development of theoretical and empirical research on their use. The potential inherent in them has not escaped the attention of researchers analysing economic processes in real terms, but these studies are still scarce. So far, however, there have been no studies in the literature indicating the possibility of using tables expressed in constant prices for modelling prices. This dissertation is an attempt to fill this gap. The motivation to undertake the research was also the desire to draw attention to the possibilities inherent in the analysis of inter-industry links for the purposes of price modelling even in the absence of information expressed in constant prices. Taking into account the fact that the currently functioning inflation models are mainly of a macroeconomic nature, the approach based on the input-output table may be a valuable supplement to them, giving the opportunity to analyse price relationships at the level of product groups.

The main objective of the work is to isolate the factors influencing price changes by applying the structural decomposition method, which simultaneously uses information contained in input-output tables expressed in current and constant prices. The main research hypothesis is that the use of information contained in the tables expressed in fixed prices significantly increases the analytical capabilities of the input-output price model as a tool for detailed observation of inflationary processes taking place in branches of the economy and at

the macroeconomic level. The main hypothesis formulated in this way allowed the following detailed hypotheses to be formulated:

1. Including the information contained in the tables expressed in constant prices in the input-output price model enables the use of decomposition methods in order to deepen the analysis of price-setting processes.

2. External (international) price shocks are an important source of subsequent domestic inflationary processes.

The essence of the applied decomposition method allows the interpretation of the obtained results as ex post forecasts and related errors. This leads to the adoption of a secondary research objective, which is the assessment of the forecasting properties of the considered input-output price model. Therefore, it seems reasonable to put forward the third detailed hypothesis that the price model may be a starting point for the development of tools enriching the existing inflation forecasting methods. It should be emphasized, however, that due to the limited statistical material, the verification of this hypothesis is difficult, and this hypothesis itself can be treated as an extension of hypothesis 1.

As part of the decomposition procedure, the forecasting properties of the input-output price model were analysed by estimating the errors of the forecasts obtained and indicating their sources. The ex post forecasts obtained were compared with the officially published consumer price indexes (CPI). The study was based on data compiled by the Danish Statistical Office. These are currently one of the few published resources of input-output tables expressed in constant prices and allow to verify the properties of the price model in accordance with the proposed procedure on the basis of a sufficiently long time trial.

The dissertation consists of four chapters. The first chapter is an introduction to the subject of price change research. It presents the main theoretical trends, i.e. the monetary, demand and cost approaches, with particular attention being paid to the latter. Then, the methods of measuring inflation are described, and the characteristics of the most frequently used price indices are given. Particular attention was paid to the consumer price index (CPI), also taking into account the sources of its burden. This results from the scope of the dissertation and the empirical research presented below. In the further part, reference is made to selected inflation trends in Europe and in the world, and international price shocks are characterized as one of the sources of inflation processes. The first chapter closes with an outline of the research

on the nature and strength of the mechanisms for transferring international price shocks, using econometric methods.

The second and third chapters present the basic issues related to input-output modelling, which is the main element of the research method used. The second chapter presents input-output tables with a detailed description of individual components and elementary identities. Next, the Leontief and Ghosh models are discussed, and then - the main areas and research trends using these models. The last part of the second chapter is devoted to the description of the structural decomposition method. The third chapter contains a detailed description of the input-output price model, which is the main analytical tool of this work. In addition to defining the model, examples of its application in economic research, especially in the context of the analysis of price-setting processes, were indicated. At the same time, tools with a more complex structure, such as CGE models or integrated models (e.g. INFORUM), were also presented.

The fourth chapter proposes a method of decomposing inflationary processes. The calculation sequence is discussed together with an empirical example of its application. Possibilities of interpretation of the obtained results were also presented. The initial part of the fourth chapter is devoted to the discussion of the data source.

The main objective of the dissertation has been achieved - price-setting factors have been isolated by using the decomposition method. The obtained results were compared with the officially published CPI for the Danish economy for the period 1981 - 2021. The achievement of the main goal was possible primarily thanks to the positive verification of the first detailed hypothesis, which states that the use of information contained in the tables expressed in constant prices enables the use of decomposition methods in order to deepen the analysis of price-setting processes.

Apart from the technical component resulting from the differences in the methods of estimating the consumption deflator based on the input-output and CPI tables, the other factors distinguished in the input-output model have a clear economic significance. Unit value added, expressing labor and capital costs per unit of production, has the greatest share in shaping the inflation rate. However, it should be remembered that this component, included in the model as an exogenous variable, in fact adjusts to some extent to changes in the prices of imported goods and services. A similar impact is observed in the case of the component expressing changes in production technology. The component reflecting changes in import prices is the second largest element of the decomposition, but in fact its importance as a source of impulse initiating the

aforementioned adjustments is much greater. The model used does not allow to distinguish the effects of price-setting mechanisms, which are caused by changes in import prices, from autonomous changes, resulting, for example, from changes in the structure of household consumption or the current monetary policy. The second hypothesis, which states that international price shocks are the main source of inflationary processes in the economy, has not been fully verified.

From the point of view of assessing the forecasting properties of the model, the value of the component is particularly important here, which indicates the size of the forecast error resulting from maintaining a constant structure of material inputs (from the previous period). This value turned out to be relatively small. This means that the assumption of the stability of the production technology, considered to limit the applicability of input-output models, is not a significant source of error in this case.

The scope of the study, necessarily limited to the Danish economy, prompts caution in formulating general conclusions as to the scale of model errors. Nevertheless, taking into account the possibility of combining the model with an approach based on econometric analysis of time series, the results lead to the conclusion that the third detailed hypothesis can be considered as initially verified.

The performed decomposition may direct further research on pass-through processes. The finding of a correlation between changes in import prices and the structure of household consumption is an indication to deepen research on the interactions between these factors. In addition, the proposed method, due to the high level of detail in the description of inter-industry links formalized in the form of a model reflecting the cost theory, creates opportunities for drawing conclusions and recommendations in the process of building more complex inflation models, especially those based on the cost theory. This also applies to the CGE models and multi-sector econometric models mentioned in the dissertation.

The main research hypothesis was confirmed. The inclusion of information contained in the tables expressed in constant prices significantly increases the possibilities of using the input-output price model as a tool for analysing inflationary processes taking place in branches of the economy and at the macroeconomic level. In the recent period, events that are difficult to predict, such as a pandemic or armed conflicts, disrupting production and trade processes, have highlighted the sensitivity of economies to supply-side impulses. The high dynamics of inflation that we are currently observing largely confirms the truth of the cost theory, as it results

mainly from the reconfiguration of global supply chains. Since input-output tables are one of the basic tools for tracking these chains, input-output models are gaining more and more importance in research on explaining and forecasting production processes.

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