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Import Dependence in the Danish Production Structure: Evidence from Input-Output Analysis and Econometric Modeling

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Abstract

This paper aims to develop an Almost Ideal Demand System (AIDS) model with an Input-Output (IO) framework to investigate the underlying demand patterns within the Danish production structure. From this, the import dependence of five selected industries is derived. This sectoral-level analysis of import dependence forms the basis for assessing the aggregate import reliance of the Danish economy. The model structure is divided into two blocks: i) the domestic production block, describing total production and production costs for five selected industries, and ii) the final aggregate demand block, which highlights the role of consumption, government spending, investment, inventories, and exports. The industries that have been selected are i) Pharmaceuticals, ii) Food products, beverages, and tobacco, iii) Transportation, iv) IT & Electronics, and v) Other industries. The model is built and estimated using annual input-output data from 1966 to 2023 provided by Statistics Denmark.

The study found that the estimated price effects revealed a varying degree of import dependence across the industries under investigation. The Pharmaceutical industry was the least import dependent industry since the primary inputs were characterized as substitutes. The Food products, beverages, and tobacco industry only showed one statistically significant cross-price effect, thereby making it difficult to conclude. However, the one statistically significant effect showed signs of complementarity and constituted one-fourth of the total expenditure within the industry, thereby highlighting some degree of import dependence. The Transportation industry also revealed a low degree of import dependence, again because of substitutability. The IT & Electronics industry was highly import dependent, which was driven by the complementarity characterizing four of the five estimated cross-price effects. Lastly, 'Other industries' also revealed a high degree of import dependence, again due to complementarity within the primary inputs. Based on this, the Danish economy was found to be highly import dependent. This was because the import dependent industries constituted a total of around 84 percent of the Danish production in 2023. Hence, the majority of Danish economic output was produced within industries that showed signs of import dependence. By removing the first seven observations and re-estimating the model, the same conclusions were reached regarding the import reliance, thereby strengthening the robustness of the results.

Therefore, the study concludes that import dependence is present within the Danish production structure. However, given that the majority of Denmark's imports originate from the EU, it is challenging to draw definitive conclusions regarding the potential vulnerabilities arising from import dependence, given the EU's role as a low-risk and integrated trade partner. If the critical

inputs are sourced from outside the EU, they pose a greater risk and vulnerability to the Danish economy. Following this, the robustness of the results and the choice of industries were discussed to highlight the reliability of the obtained results.

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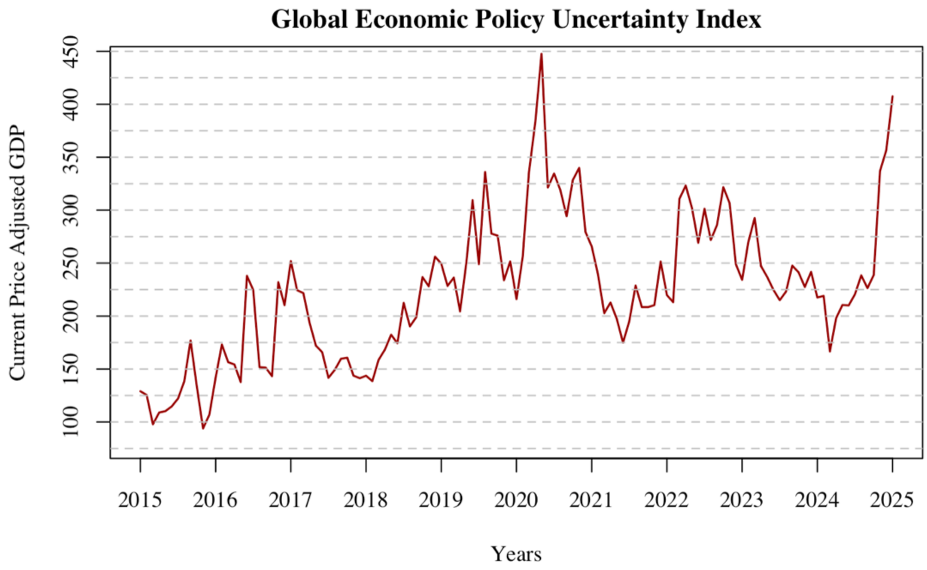
1. Introduction

The global economy is undergoing profound changes, characterized by significant uncertainty, threats of declining global trade, rising geopolitical tensions, and an increasing focus on economic security. Well-established business models are being challenged, and economic interdependencies are now regarded as geopolitical vulnerabilities (Draghi, 2024a, p. 1). What is currently considered a vulnerability has historically served as a driver of economic growth in the global economy. Nonetheless, the growing interconnectedness of economies has also increased the speed and scale at which economic shocks and crises can spread. This interconnectedness stems from networks that link nations through the flow of goods, services, capital, and information. These connections are essential for enabling global trade and investment, but they also serve as channels through which disruptions in one part of the world can spread across borders and affect other economies (Office for Budget Responsibility, 2022, pp. 57-63).

For small, open economies like Denmark, trade openness represents both a strength and a vulnerability in a world where geopolitical considerations increasingly shape economic decisions. Over the last three years, these geopolitical tensions have intensified starting with the Russian invasion of Ukraine in 2022, and more recently, with the election of Donald Trump as president of the United States in 2025 and the implementation of his protectionist trade policy. These events will affect international cooperation, and increase the risks associated with economic reliance on key global actors. Russia's invasion of Ukraine has not only disrupted European energy markets but also raised concerns about supply chain security and economic stability within the European Union (Nguyen, 2022). This is in line with the findings in the most recent report on the future of European competitiveness. The report underscores the urgent need for the European Union to reduce its dependencies and states that for Europe to remain free, it must become more independent, with a focus on securing critical raw materials and enhancing production capacity in strategic sectors (Draghi, 2024b, pp. 7-8). Furthermore, a shift towards protectionist policies in the United States under President Donald Trump's leadership could create trade barriers, thereby posing challenges for small, open economies like Denmark (CEPR, 2025). Donald Trump has imposed a 10 percent tariff on all countries and even higher individual reciprocal tariffs on the countries with which the United States has the largest trade deficits (The White House, 2025). This reinforces global uncertainty and adds to the fragility of international interdependencies.

This heightened level of uncertainty in the global economy is reflected in the Global Economic Policy Uncertainty Index. As shown in Figure 1 below, the index has experienced significant spikes during the above-mentioned key global events, notably the outbreak of the COVID-19 pandemic in 2020, the Russian invasion of Ukraine in February 2022, and the period surrounding the re-election of Donald Trump in 2025. These fluctuations in uncertainty highlight the significant and immediate impact that geopolitical and economic shocks can have on the interconnected world economy.

Figure 1: Global Economic Uncertainty Index



Source: Federal Reserve Economic Data (2025)
Compiled by the authors

These vulnerabilities underscore how crucial it is to examine the trade dependence of the Danish economy. Since Denmark is a small, open economy, the consequences of disrupted supply chains and global fragmentation, where the global economy becomes more divided, may be severe. Denmark has some large multinational companies like Novo Nordisk and A.P. Møller Mærsk, employing a large number of workers in Denmark, with 30,000 and 15,820 employees respectively (Novo Nordisk, 2025; Maersk, 2024, p. 120). Therefore, the Danish economy may be severely affected if some of the large multinational companies experience an economic downturn due to this. A study performed by the Danish National Bank (2024) finds that increased fragmentation can increase economic losses and lead to upward pressure on consumer prices in Denmark. Moreover, the study finds that changing trade patterns can have economic consequences for the Danish economy despite the absence of a decline in global trade. The Danish production and import may be at risk because of a dependence on critical strategic inputs such as raw materials, chemicals, and technological components. Particularly, Danish shipping is highly dependent on imported inputs, which for example include inputs such as fuel, port and terminal operations, and leasing of foreign-owned vessels. The pharmaceutical industry is also reliant on crucial imported inputs as they import active pharmaceutical ingredients from China and India (The Danish National Bank, 2024, p. 12).

These examples illustrate that important Danish industries rely heavily on inputs sourced from abroad. In light of the growing geopolitical uncertainty and global supply chain vulnerabilities, it has become crucial to assess the extent to which the Danish economy is exposed to such dependencies. Addressing this matter is the objective of this study. The thesis will contribute to the discussion by providing the first formal econometric investigation of Denmark's trade dependencies using historical input-output data in combination with a statistical model. By employing a statistical model on input-output data, this paper offers new empirical insights into the Danish production structure and import dependencies. The thesis provides a disaggregated view of how different industries respond to changes in input prices. Input-output data is especially well-suited for this type of analysis, as it offers a comprehensive representation of the inter-industry flows and the structure of production in the Danish economy. This analytical framework was originally developed by the economist Wassily Leontief to study the interdependencies of economic sectors (Leontief, 1936). The input-output framework captures the interdependencies between industries in an economy, thereby enabling a detailed analysis of both domestic and imported flows within the Danish economy. The IO-data represents, in monetary value, how goods and services are exchanged between suppliers and demanders. It applies that the input-output table is an integrated part of the national accounts statistics. Therefore, the data will be consistent with the national accounts in both individual years and over time (Statistics Denmark, 2020).

Other studies have similarly used input-output data to investigate vulnerabilities in critical trade relationships. Arriola et al. (2024) investigate how reduced trade flows between OECD and major non-OECD (MNOE) countries impact global value added. The study finds a high degree of interdependence between the OECD and MNOE countries, particularly between China and OECD countries. The findings emphasize that these economies are highly dependent on each other for trade, with significant linkages in both imports and exports. In another study, Ayas (2017) also uses the input-output framework to investigate the import dependence of the Turkish economy. The study finds that the textile and transportation sectors were found to be the most import dependent, and their continued growth suggests that import dependence in the

Turkish economy will likely rise unless action is taken to encourage the domestic production of intermediate inputs, particularly within manufacturing. The paper concludes that reducing import dependence could lead to benefits such as higher employment and a reduction in trade deficits, emphasizing the need for a shift towards greater domestic input use in the Turkish economy. The applied method in the two studies will be further explained in the literature review in section 3. To the best of our knowledge, the sensitivity of production input demand to price changes in Denmark has not yet been investigated using input-output analysis in connection with a statistical model. Therefore, this thesis will build upon the described input-output framework and further incorporate a statistical model to explore the underlying demand dynamics within the Danish production structure. This thesis will thus provide an additional methodological contribution by combining econometric estimation techniques that are compatible with input-output data.

Integrating input-output data in an econometric framework requires substantial pre-processing and methodological effort. The data must be carefully structured and aligned with the model, while theoretical restrictions must also be satisfied. The integration allows for an estimation of the underlying input demand structures in the Danish economy, which is the main objective. The focus of this paper will be on the following five industries within the Danish economy: i) Pharmaceuticals, ii) Food products, beverages, and tobacco, iii) Transportation, iv) IT & Electronics, and v) Other industries. These industries are selected based on several criteria: first, their importance for Danish exports; second, they represent different aspects of Danish production; and third, other studies have found that they rely on critical imported inputs. The motivation will be further elaborated in section 5.1.

As mentioned, the thesis aims to gain a deeper understanding of Denmark's import reliance and the underlying demand mechanisms. In section 2, the research question of the thesis is outlined. In section 3, existing literature and methodological approaches to examining import dependence are reviewed. In section 4, the scientific theoretical considerations that have been made in the preparation of this paper are outlined. In section 5, the empirical methodology and the data preparation processes are presented. In section 6, a general representation of the econometric framework carried out in this paper is presented along with an empirical estimation of the statistical models. In addition, a comparative analysis is conducted, where the results of the statistical models are compared across two different data periods to determine whether the obtained estimates are sensitive to the duration of the data period. In section 7, the methodology and the obtained results are discussed. Section 8 concludes this paper.

2. Research question

Based on the preceding introduction, the thesis's research question is:

- To what extent is the Danish production structure dependent on imported inputs, and how can this be examined using input-output analysis and econometric modeling?

3. Literature Review

In this section, the existing literature is reviewed with a focus on studies that apply input-output (IO) analysis, as well as some of the few studies that combine input-output analysis with Almost Ideal Demand System (AIDS) models to analyze trade and import dependencies. The aim is to identify key approaches, methodological choices, and significant findings in previous studies examining trade and import dependence to establish a solid foundation for further analysis.

As mentioned in the introduction, Arriola et al. (2024) examine the evolution of trade dependencies between the OECD countries and major non-OECD countries (MNOE), including Brazil, China, India, Indonesia, Russia, and South Africa. The study is motivated by recent concerns about supply chain disruptions caused by geopolitical tensions and natural events, highlighting the need to identify vulnerabilities in critical trade relationships. To analyze these dependencies, the study applies three empirical approaches, including input-output analysis. The input-output analysis, in particular, captures both direct and indirect trade links. The authors reduce trade flows between OECD and MNOEs by 10 percent to measure the economic impact on global value added. This method helps identify the broader economic consequences of disruptions in trade, focusing on the changes in value added across industries and countries. The analysis uses OECD TiVA data from 2019, covering 75 sectors, to show global trade linkages and the potential impact of reduced trade flows on economies, based on the most recent data unaffected by the pandemic. All three methodologies, including input-output analysis, show a high degree of interdependency between the OECD and MNOE countries, particularly between China and OECD countries. The finding emphasizes that these economies are highly dependent on each other for trade, with significant linkages in both imports and exports (Arriola et al., 2024, pp. 76-88).

In another study, Ayas (2017) uses an input-output analysis to investigate the import dependence of the Turkish economy between 1995 and 2011. The analysis is carried out by utilizing the National Turkish Input-Output Tables from the World Input Output Database (WIOD). The study focuses on sectoral import dependence and explores key factors influencing the total import effect on sectors. These include import intensity, the sectors' share of total output, and inter-sectoral input-output relationships. The study finds that the production structure of the Turkish economy changed between 1995 and 2011, with an increase in both imported and domestic input levels. Furthermore, the results show that the value-added intensity of production decreased, indicating a growing reliance on imported intermediate inputs. The textile and transportation sectors were found to be the most import dependent, and their continued growth suggests that import dependence in the Turkish economy will likely rise unless action is taken to encourage the domestic production of intermediate inputs, particularly within manufacturing. The paper concludes that reducing import dependence could lead to benefits such as higher employment and a reduction in trade deficits, emphasizing the need for a shift towards greater domestic input use in the Turkish economy (Ayas, 2017, p. 13).

A study conducted by the Danish National Bank (2024) examines the potential challenges that the fragmentation of global trade may pose to the Danish economy. In this context, fragmentation of global trade refers to disruptions in supply chains and increasing geopolitical tensions. Part of the analysis in the study is based on the BF model, developed by Baqaee and Farhi, which is an input-output model that describes the global economy with trade links between sectors across different economies. The model can be used to analyze the effects of changes in trade patterns, accounting for both direct and indirect trade relationships through global supply chains (The Danish National Bank, 2024, p. 22). The model is calibrated using the Asian Development Bank Multiregional Input-Output Database from 2019, consisting of 73 countries and 35 sectors. The model findings suggest that a more fragmented global economy could lead to significant economic losses and higher consumer prices, both globally and in Denmark. In the short term, certain sectors may be more exposed to these disruptions, particularly those reliant on critical imports. The study emphasizes that fragmentation could significantly disrupt production and the economy, especially if strategic goods like raw materials, chemicals, and technological components become harder to source. Furthermore, the findings suggest that the potential for permanent economic losses and price increases is particularly pronounced in Denmark, which relies heavily on global trade (The Danish National Bank, 2024).

Thanagopal and Housset (2017) analyze French imports across five regions by utilizing sectoral data from the World Input-Output Database. The study applies a quality adjusted Almost Ideal Demand System (AIDS) model to perform an empirical analysis of price and quality competitiveness across five exporting regions towards France. This is done by estimating price and quality elasticities on French imports and subsequently comparing these elasticities between the services and goods sectors. The estimates reveal that price elasticities are higher for homogeneous products, while quality plays a larger role for differentiated goods and services. The estimated cross-price and cross-quality elasticities illustrate the strength of competitiveness of exporting regions towards France. For emerging countries, competition is primarily in terms of price. In contrast, competition is primarily in terms of quality for developed countries. However, the study reveals some signs of increased focus on quality and hence a changed strategy for some of the emerging countries (Thanagopal & Housset, 2017).

In addition, a study by Turkmen-Ceylan et al. (2025) examines the import demand for four key agricultural commodities in Turkey. These include i) cereals and preparations, ii) meat and meat preparations, iii) sugar and honey, and iv) vegetable oils. These commodities are chosen because they constitute a total of 90 percent of Turkey's food import budget. The import demand is analyzed using a Linear Almost Ideal Demand System (AIDS) model, which is estimated by using the Seemingly Unrelated Regression (SUR) method. Data obtained from FAOSTAT's database on international trade of agricultural output, spanning 35 years from 1986 to 2020, is used. The study finds significant long-run own-price elasticities, where both i) vegetable oils and ii) cereals and preparations are particularly price sensitive. Consequently, i) meat and meat preparations and ii) sugar and honey imports show minimal price elasticities, which indicates stable consumption hereof. The study concludes that the Turkish economy is vulnerable to global price fluctuations. This finding applies in particular to vegetable oils. Therefore, the study encourages policies that can stabilize exchange rates and inflation. At the same time, it emphasizes the importance of enhancing domestic agricultural productivity to mitigate the risk (Turkmen-Ceylan et al., 2025).

A recent study by Naqvi (2025) examines how global demand and supply elasticities vary across intermediate versus final goods in domestic and foreign sectors. Furthermore, the study examines how these elasticities shape the economic impact of trade shocks, such as the imposition of tariffs. To examine this, the study applies a Quadratic Almost Ideal Demand System (QUAIDS) model to the Asian Development Bank's Multi-Region Input-Output (MRIO) dataset, focusing on pooled data from 2021-2023. The findings show that demand is generally more responsive to income changes, while supply reacts more strongly to price changes, particularly for intermediate goods. The findings also highlight a growing dependence on foreign inputs with low substitutability. The study demonstrates potential global welfare losses of around 1.3 percent, with the highest losses up to 5.6 percent in countries that heavily rely on

U.S. imports for a simulated trade conflict between the US and the rest of the world. Contrary, the U.S. only experiences minor welfare losses. Therefore, the study provides a framework for how monitoring elasticities can help policymakers adapt to potential trade-related price shocks (Naqvi, 2025).

These studies form the foundation for the methodology applied in this paper, which combines input-output analysis with the statistical framework of the Almost Ideal Demand System (AIDS) model. By employing this approach, the study aims to investigate the import dependence of the Danish economy with a focus on the underlying demand patterns within the production structure across five selected industries.

Building on the existing literature, the next section outlines the scientific theoretical considerations underlying the chosen analytical approach.

4. Methodological considerations

This section will outline the scientific theoretical considerations that have been made in the preparation of this thesis.

As outlined in the introduction and reflected in the research question, the thesis investigates the Danish production structure with a focus on its degree of import dependence. The analysis is carried out through an econometric approach, where data processing and statistical estimation are the methodological framework. Therefore, the analysis is methodologically rooted in a positivistic approach. This is because the positivistic approach generally focuses on identifying relationships through quantitative approaches that utilize large sample sizes (Park et al., 2020, p. 690). In this paper, the estimated statistical AIDS models are quantitative, econometric tools that rely on input-output data to identify and estimate demand relationships with a focus on substitutability and complementarity of production inputs within the industries of the Danish economy. Therefore, the methodological framework carried out in the thesis is positivistic.

Even though the methodological foundation in the thesis is positivistic, it is important to also draw upon the ideas of the fundamental uncertainty framework, which has been proposed by the Post-Keynesian school of thought. As stated in the introduction, the world is characterized by rising uncertainty due to threats of declining global trade, rising geopolitical tensions, and an increasing focus on economic security. Because future events are fundamentally unknown, it is difficult to account for such fundamental uncertainty within the framework of the model applied in this paper (Ferrari-Filho & Conceicao, 2005). The estimated AIDS models are built upon historical data, thereby providing insights into the structural evolvement of the Danish production structure. The model does not account for sudden exogenous shocks such as unforeseen supply chain disruptions and wars that can lead to changes in behavior and demand, thereby affecting the obtained results from the analysis carried out in this paper. Based on this, the model provided in this paper will best illustrate demand patterns under normal circumstances. Therefore, the findings of this paper will only contribute insights into the underlying dynamics of the Danish production structure.

In line with the positivist approach, which emphasizes a quantitative and observable methodology, the next section will present how the applied input-output data has been collected, processed, and applied to understand the underlying demand patterns of the Danish production structure and its reliance on imports.

5. Empirical methodology

This section will specify the empirical methodology and present the data preparation processes. The section will begin with a description of the processed input-output data. Hereafter, the processed data is depicted in an input-output table to provide a comprehensive picture of the inter-industry and final-demand flows of the Danish economy. Next, these flows will be depicted in Sankey diagrams, clarifying the magnitude of the economic value moving between different industries. Hereafter, technical coefficients are calculated, representing the proportion of total inputs used by specific industries in their production. These are important for the estimation of the statistical model applied later in the analysis. Next, price indices are calculated as they allow us to calculate the deflated values of the input-output tables in 2010 prices. Therefore, the input-output tables are converted from nominal to real values, as Statistics Denmark only provides nominal input-output tables. This is done to distinguish between unit changes and price changes in the model. Lastly, by using the technical coefficients and price indices, one aggregate price for each industry for each year is calculated. This ensures a simplified and meaningful interpretation.

5.1 Data processing

Input-output data from Statistics Denmark is used for the period 1966-2023, reported as annual data. The original input-output dataset from Statistics Denmark consists of 69 different industries, which have been aggregated into five broader industry categories to simplify the analysis. The five aggregated industries for the Danish production sector are: i) Pharmaceuticals, ii) Food products, beverages & tobacco, iii) Transportation, iv) IT & Electronics, and v) Other industries, which contain all remaining industries within the Danish economy. These selected industries have been carefully chosen based on the following reasons.

First, the Pharmaceutical industry has come to play a crucial role in the Danish economy, as it has contributed significantly to overall economic growth in recent years (Statistics Denmark, 2024). In addition, this industry was selected because Denmark is critically dependent on specific imports, such as antibiotics and vitamins, from countries with potentially conflicting political interests. These goods are essential for the healthcare sector and other vital functions, which makes Denmark vulnerable to disruptions in supply chains (The Danish National Bank, 2024, p. 25). Second, the industry of Food products, beverages & tobacco was selected because it represents a large share of consumer spending in the Danish economy, thereby ensuring a larger inclusion of consumer behavior in the analysis (Statistics Denmark, 2023). Third, the Transportation industry was selected because of its important role in imports and exports within the Danish economy (Statistics Denmark, 2025c). Furthermore, it was selected because a study performed by the Danish National Bank (2024) found that Danish shipping is particularly dependent on imported inputs. Fourth, the IT & Electronics industry was selected due to the European Union's heavy dependence on imports of digital technology, as highlighted by the former president of the European Central Bank, Mario Draghi. Europe relies on a few suppliers, especially China, for critical materials and a large share of global chip production is concentrated in Asia (Draghi, 2024b, p. 7). The last industry, 'Other industries', aggregates all remaining industries of the Danish economy that are not included in the first four industry groups. This ensures that the entire Danish economy is represented in the analysis. Based on this, it applies that the industries have been selected due to their economic relevance and already established import reliance.

The first industry, i) Pharmaceuticals, consists solely of one category from Statistics Denmark, labeled 'Pharmaceuticals'. The second industry, ii) Food products, beverages, and tobacco, is also represented by a single category from Statistics Denmark, namely 'Manufacture of food products, beverages, and tobacco'. The third industry, iii) Transportation, includes several subcategories within Transportation covering 'Land transportation and transport via pipelines', 'Water transport', 'Air transport', 'Support activities for transportation', and lastly 'Postal and courier activities'. The fourth industry, iv) IT & Electronics, consists of several industries from Statistics Denmark, namely 'Manufacture of electronic components', 'Electrical equipment', and 'IT and information service activities'. The fifth industry, v) Other industries, covers all the 59 remaining industries in the data from Statistics Denmark.

The dataset captures the flows of goods and services from the 69 supplying industries to 121 demanding entities for each year. Hence, for each year, the dataset comprises 69 supplying industries multiplied by 121 demanding entities, resulting in (69 x 121) = 8,349 observations per year. As the dataset spans over 58 years from 1966 to 2023, this amounts to a total of (8,349 x 58) = 484,242 observations. A table with 484,242 observations is available for both domestic production and imports in respectively current prices and in constant prices of the previous year, resulting in the database consisting of four separate datasets, each consisting of 484,242 observations. The 121 demanding entities have been aggregated into ten different types of users: the five industries that have already been defined and the five final demand categories, including consumers, government spending, investment, inventories, and exports.

During the data processing phase, several discrepancies were identified between the constructed industry-level values and the official values reported by Statistics Denmark. A detailed examination of the discrepancies revealed that there were two main issues that caused inconsistencies in the data. First, duplicate entries related to government consumption were identified. In the original dataset, certain components of government consumption were counted multiple times in the total government consumption calculation. This led to an overestimation of the value. To address this, the redundant entries were removed, which ensured that each value was only counted once. This adjustment was essential in order to align our dataset with the official figures from Statistics Denmark. Second, the initial data for gross capital formation was included both as an aggregate value and in its disaggregated form. Therefore, the same data was counted twice, once as part of the total gross capital formation and again through its components. As a result, the total value of production was overestimated. To correct this issue, the aggregate value was retained, and the disaggregated components were removed to avoid double-counting. This approach ensured that the dataset was consistent with the official figures from Statistics Denmark. Having addressed these data discrepancies, the conducted database has become aligned with the official numbers from Statistics Denmark. Accordingly, the process has been both extensive and demanding. The next step involves presenting an input-output table to visualize the dynamics of the conducted database.

5.2 Input-Output Matrix

This section presents the processed data described above in an input-output table. For demonstration, a specific year has been chosen to explain in depth how the calculations are carried out. The most recent year, 2023, has been chosen. An input-output table provides a comprehensive picture of the total economic activity within a country. This is achieved because the table not only shows the flows of goods and services used as intermediate consumption between industries but also shows how the final production of the economy is utilized. Below, Table 1 presents a general representation of the input-output flows. As can be seen, a 5 by 5 matrix captures the inter-industry flows, and the final demand flows are captured by a matrix of the same size, 5 by 5. Furthermore, flows from imports used in domestic production are represented in a 5 by 5 matrix. The same applies to the final demand for specified imports. As mentioned above, the final demand block consists of consumption, government spending, investment, inventories, and exports. The totals are represented in the last row and column (Thomsen et al., 2025, pp. 6-8).

Table 1: Input-Output Matrix in general representation

General	Pharmaceuticals	Food products, beverages & tobacco	Transportation	IT & electronics	Other Industries	Cons	Gov	Inv	Inventories	Ex	Totals
Flow: Pharmaceuticals											
Flow: Food products, beverages & tobacco											
Flow: Transportation			Intermediate flows					Final demand for domestic products			Total Production
Flow: IT & electronics											
Flow: Other industries											
Im Flow: Pharmaceuticals											
Im Flow: Food products, beverages, and tobacco											
Im Flow: Transportation			Specified imports used in domestic production					Final demand for specified imports			Total specified imports
Im Flow: IT & electronics											
Im Flow: Other industries											
Totals			Total outlays					Total aggregate demand			

Source: Compiled by the authors

By examining the components that make up final demand in the input-output table, the table's data can be directly linked to the fundamental equation for Gross Domestic Product (GDP) as shown in equation 1 below. However, it should be noted that the input-output data applied in this study does not account for all flows within the Danish economy. The omitted flows include changes in unspecified imports, import duties, commodity taxes, VAT, other production taxes, compensation of employees, gross operating surplus, and mixed income. The calculation of GDP from the input-output table provided in this paper will therefore deviate slightly from the accurate number of GDP, as not all flows are taken into account. If all components and flows had been included, it would have been possible to accurately derive GDP since the input-output table measures the total value of the final demand for goods and services within a country during a given period. The table generally provides the detailed data necessary for calculating the overall level of economic activity, GDP, using the demand approach (Insee Méthodes, 2014):

$$GDP = C + G + I + X - M \quad \text{(equation 1)}$$

Building upon a general understanding of the input-output table, the focus shifts from a general representation of the input-output matrix to the Danish context. Table 2 displays an input-output table based on Danish data for 2023, presented in nominal values. In this table, the rows indicate the sales of each industry to other sectors. For example, the first row reflects the production of the Pharmaceutical industry. Industries produce both intermediate goods, which are sold to other industries for use in their production processes (captured by the two matrices of 5 by 5 highlighted in light blue and light purple), and final goods, which are sold to different institutional sectors, including exports (captured by the two matrices of 5 by 5 highlighted in darker blue and darker purple). These contribute to the total final demand. When looking at the columns, they show the cost structure of each domestic industry's production process. For instance, the first column outlines the costs for the Pharmaceutical industry, which include domestic and imported inputs.

As an example, it can be observed that the Pharmaceutical industry sells inputs worth 0.597 million DKK to the Food products, beverages & tobacco industry. Simultaneously, the Pharmaceutical industry purchases inputs from the Food products, beverages & tobacco industry for 1.309 million DKK.

Table 2: Input-Output Matrix of 2023

Year 2023	Pharmaceuticals	Food products, beverages & tobacco	Transportation	IT & electronics	Other industries	Cons	Gov	Inv	Inventories	Ex	Totals
Flow: Pharmaceuticals	11.039	0.597	0.090	0.236	7.926	1.669	1.228	16.013	5.416	235.775	279.392
Flow: Food products, beverages & tobacco	1.309	16.618	0.168	0.294	25.334	35.790	0.038	0.690	-0.162	103.535	183.615
Flow: Transportation	0.598	4.091	47.363	1.847	76.586	28.073	4.509	1.771	-3.403	420.897	582.334
Flow: IT & electronics	0.938	0.562	4.788	19.504	68.214	4.145	0.231	24.752	0.116	78.066	201.315
Flow: Other industries	22.651	80.709	54.559	48.570	1111.253	905.538	624.401	426.864	0.548	695.502	3970.594
Im Flow: Pharmaceuticals	64.218	1.432	0.024	0.196	15.592	4.806	2.597	13.441	2.020	20.462	124.788
Im Flow: Food products, beverages, and tobacco	1.536	18.860	0.120	0.236	26.129	41.660	0.062	0.000	-0.047	19.545	108.102
Im Flow: Transportation	0.462	2.604	9.030	0.882	45.190	2.665	0.001	0.000	0.000	12.710	73.543
Im Flow: IT & electronics	0.830	0.388	2.483	14.105	50.145	7.103	0.276	13.533	0.100	21.262	110.226
Im Flow: Other industries	10.762	18.407	15.745	18.268	425.041	110.924	1.009	81.833	2.261	229.226	913.475
Totals	114.343	143.670	134.370	104.137	1851.410	1142.373	634.354	578.898	6.850	1836.979	6547.383

Note: All the flows from 2023 are presented in nominal values in millions DKK

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

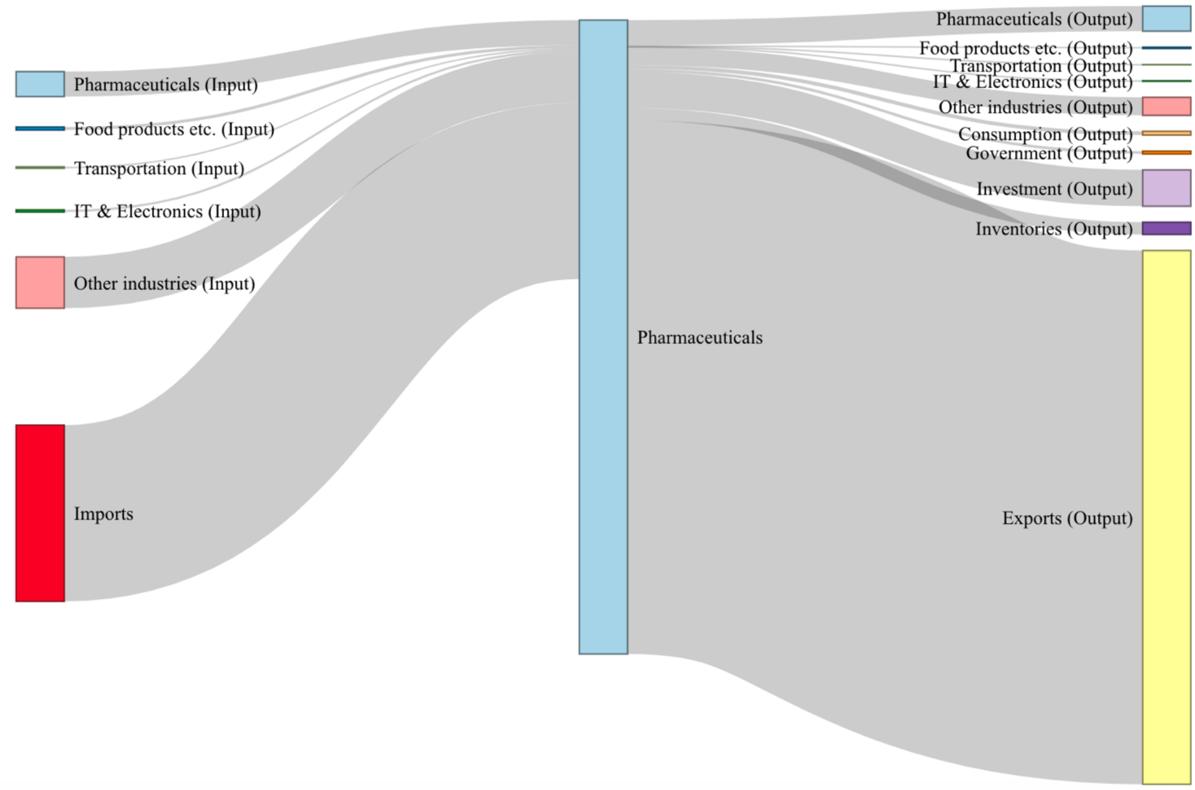
As mentioned above, Table 2 illustrates the industry-level data in nominal terms, which serves as the foundation for the input-output analysis. Before introducing the price indices used to adjust the nominal values in the input-output table, the following section will illustrate the flow of goods and services between domestic and foreign industries based on Table 2. The input-output matrix for 2023 in nominal values will therefore be visualized through Sankey diagrams for each of the five industries in the subsequent sections.

5.3 Visualization of input-output flows

Below, the input-output data from Table 2 is depicted in a Sankey for each of the five industries for 2023 in nominal values. A Sankey diagram is a visual representation of the input and output flows for each industry. On the left-hand side of the specific industry, the flow of inputs is illustrated. On the right-hand side, the flow of sales can be seen. The flow of imports has been aggregated to simplify the visualization, thereby ensuring a clearer understanding of the aggregated flows. It applies that the width of each flow in the diagram is proportional to the magnitude of the economic value moving between the different industries (Lupton & Allwood, 2017).

First, the input-output flows for the Pharmaceutical industry is presented in the figure below.

Figure 2: Input-output flows for Pharmaceuticals

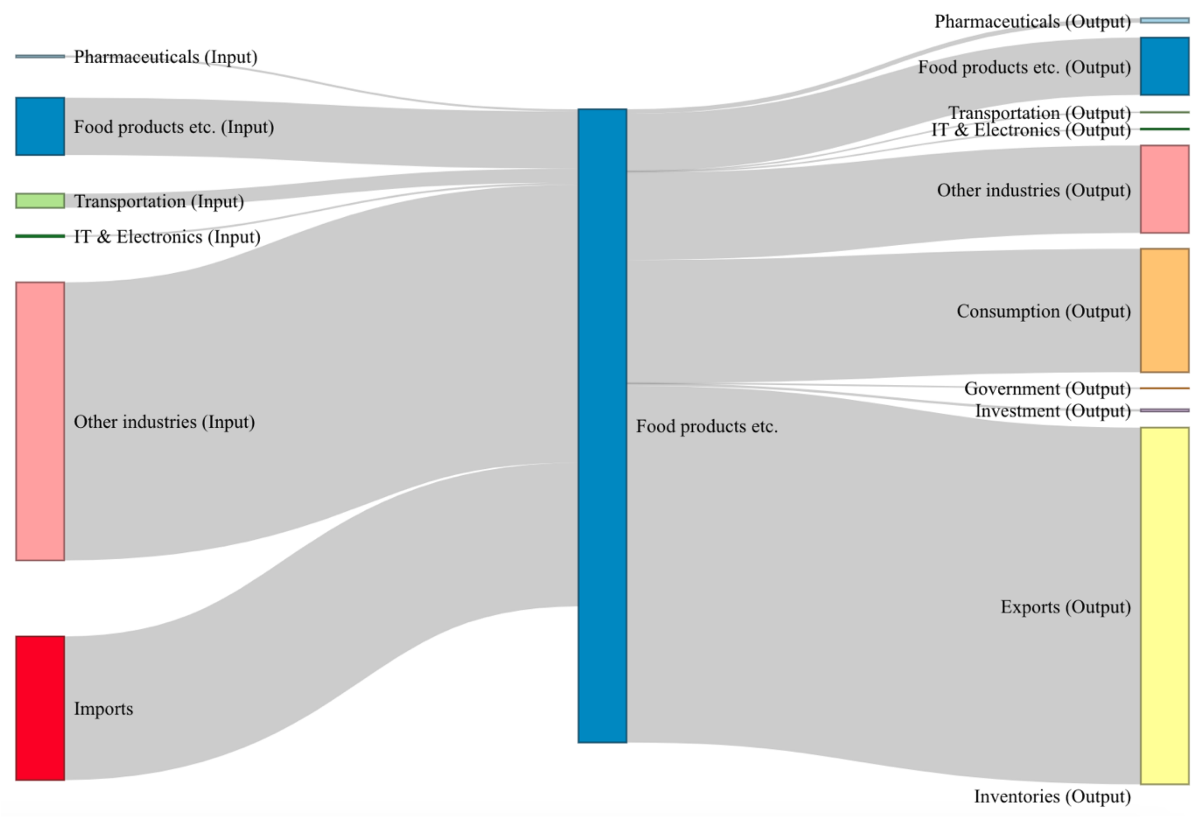


Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

This Sankey diagram depicts the primary economic flows into and out of the Danish Pharmaceutical industry. The largest inflows to this industry originate from imports, ‘Other industries’, and the domestic Pharmaceutical industry itself. The large internal inflow reflects the utilization of the sector's output as intermediate consumption within its production stages. Furthermore, the substantial flow from imports highlights the industry's dependence on internationally produced inputs. The right-hand side of the diagram is dominated by sales to exports. This underscores the importance of the Danish Pharmaceutical industry in foreign markets, thus illustrating the industry's importance for the Danish GDP as mentioned in section 5.1.

Moving on, the figure below depicts the input and output flows of the Danish Food products, beverages, and tobacco industry.

Figure 3: Input-output flows for Food products, Beverages, and Tobacco



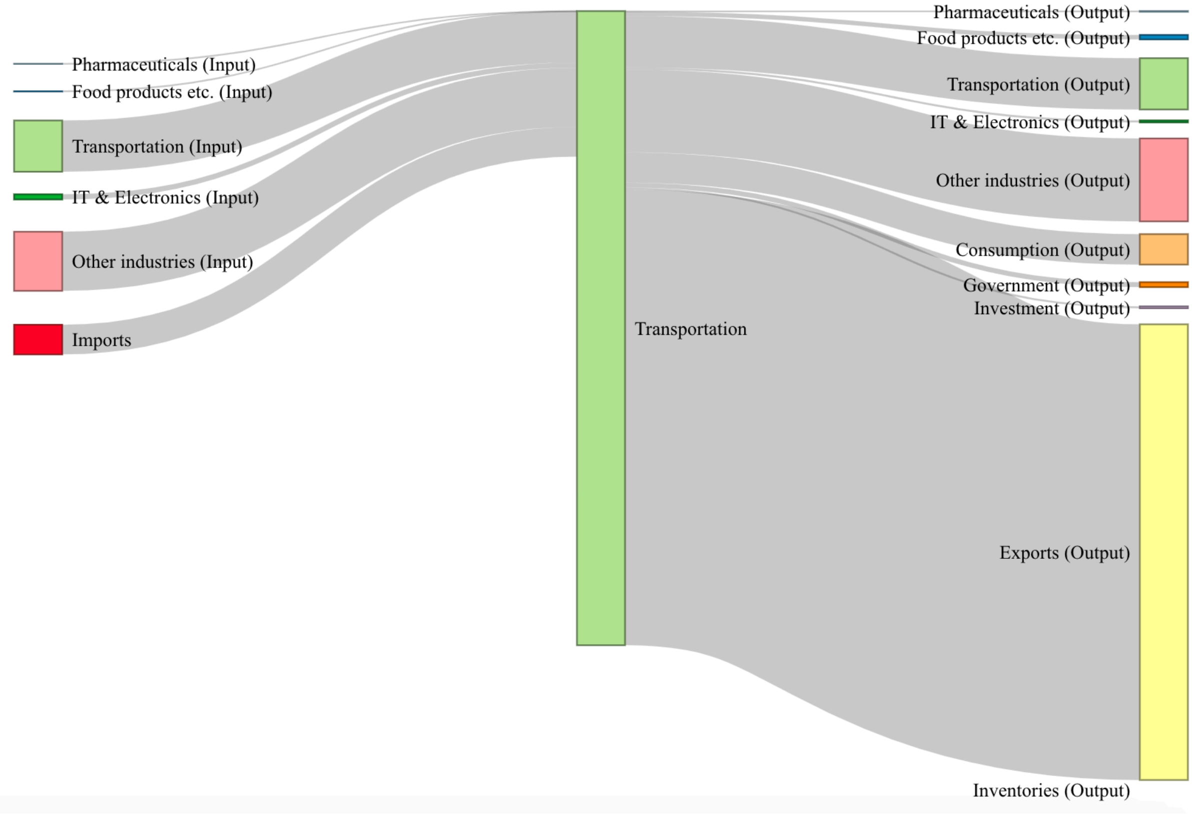
Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

From the figure above, it can be noted that a significant portion of the Food products, beverages, and tobacco industry's input is sourced from 'Other industries' and imports, which indicates that the industry has a significant reliance on inputs from a diverse range of other domestic industries as well as international sources. In addition, smaller input flows are observed from the Food products, beverages, and tobacco industry itself, which indicates internal transactions and interdependencies.

Regarding the output flows, the primary destinations for food products, beverages, and tobacco are consumers, as expected since they are fundamental consumer goods, and exports, which highlights the industry's importance in Denmark's international trade. Moreover, there is a notable output that is directed back to the domestic Food products, beverages, and tobacco industry, which indicates internal transactions.

The figure below illustrates the input and output flows of the Transportation industry.

Figure 4: Input-output flows for Transportation



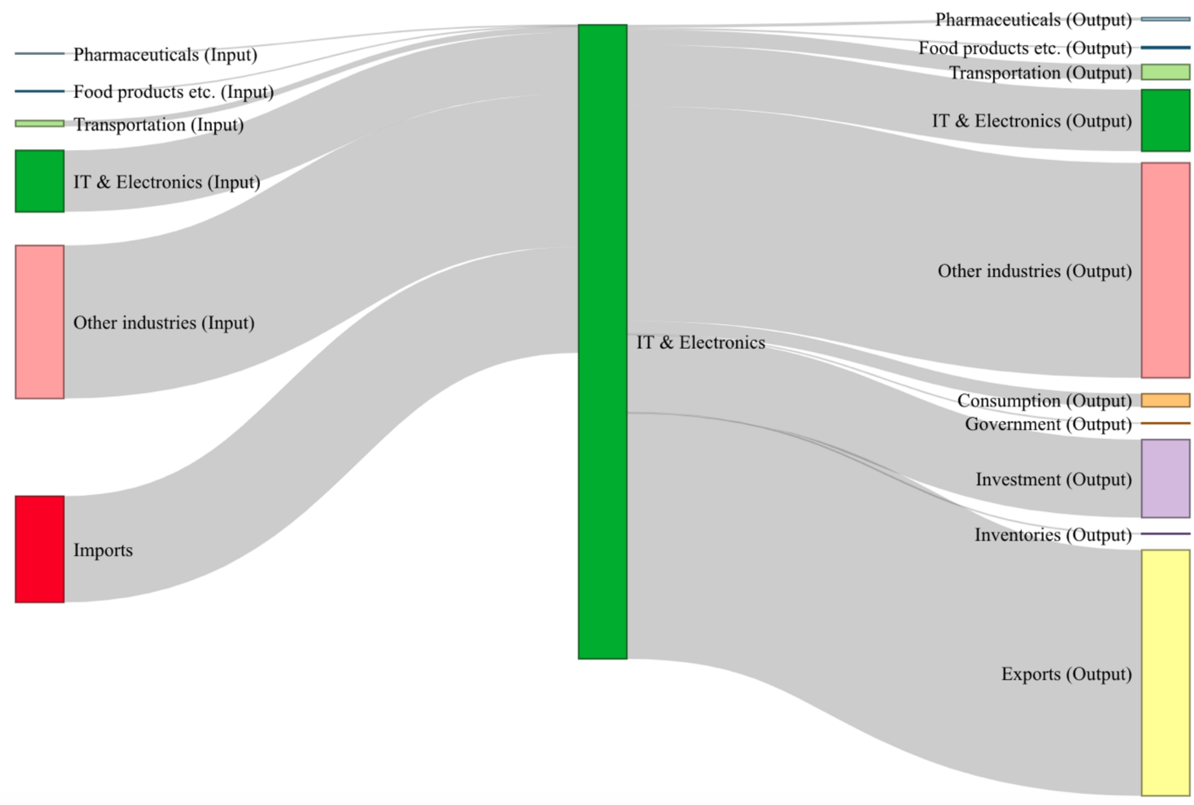
Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The figure reveals that the Danish Transportation industry relies mostly on inputs from 'Other industries' and the Transportation industry itself, with a smaller fraction of the inputs originating from imports. The Transportation industry is therefore reliant on inputs from a diverse range of other domestic industries, as well as internationally produced goods to a smaller extent. Also, there is a degree of interdependency within the Transportation industry.

The outputs of the Transportation industry reveal that a large fraction consists of exports, thereby indicating the industry's importance for Denmark's trade. Additionally, the outputs of the Transportation industry go to 'Other industries', the Transportation industry itself, and directly to consumers.

Moving on to the next industry, the figure below depicts the economic flows into and out of the Danish IT & Electronics industry.

Figure 5: Input-output flows for IT & Electronics



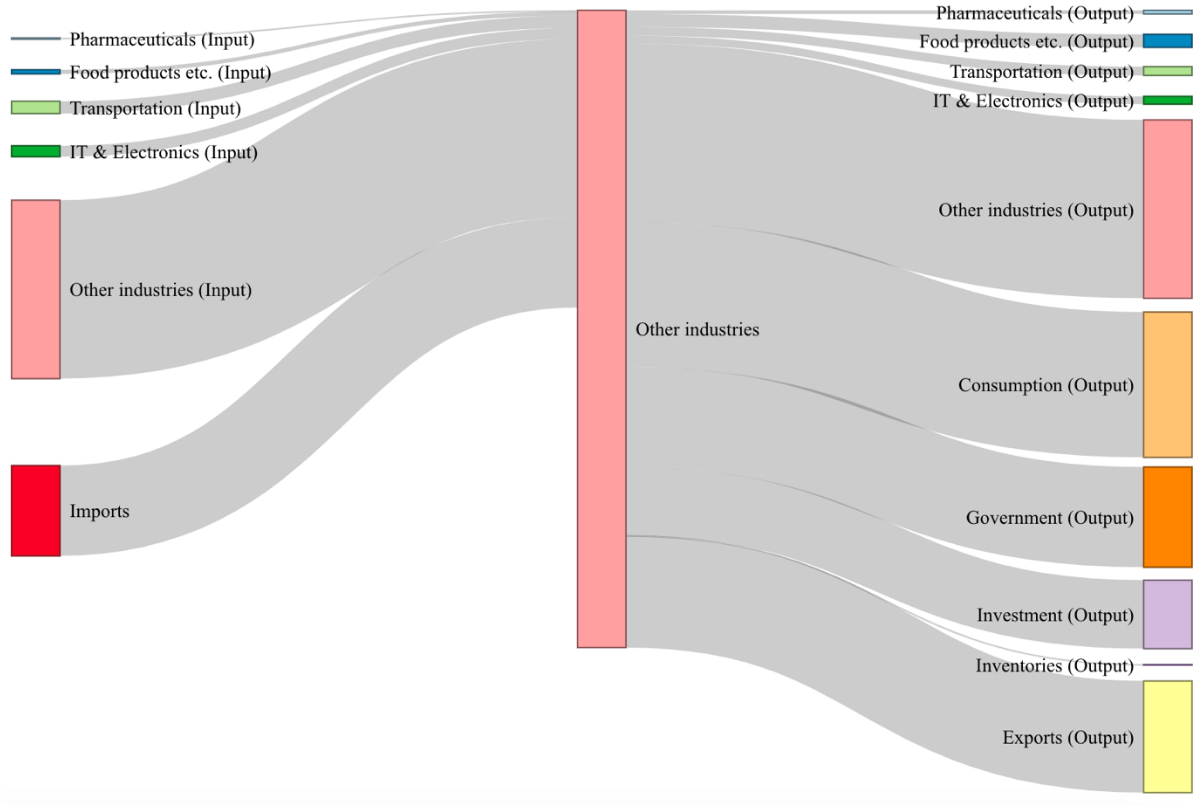
Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

As shown in the figure above, the largest inputs to the IT & Electronics industry are sourced from 'Other industries', imports, and the IT & Electronics industry itself. This highlights the industry's reliance on a wide range of domestic suppliers, international sourcing, and internal transactions.

On the other hand, the outputs from the IT & Electronics industry show that the primary destinations are exports and 'Other industries'. Following these two largest output destinations, the IT & Electronics industry itself and investment make up the second-largest amount of the output flow. Thus, this industry is an important international player for the Danish economy and an important supplier to other domestic industries.

The final Sankey diagram examines the 'Other industries' sector. This particular industry is significant as it encompasses the remaining industries within the Danish economy, thereby reflecting a substantial portion of the overall economic activity in Denmark.

Figure 6: Input-output flows for 'Other industries'



Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The Sankey diagram reveals that the most significant inputs to 'Other industries' come from 'Other industries' itself and from imports. This finding makes sense as the industry includes many different industries across the Danish economy, pointing to a high level of exchange and dependence between the industries in this group. At the same time, the reliance on imports highlights that 'Other industries' are connected to global supply chains and depend on foreign goods and services.

The output flows from this industry are spread across many different sectors, which indicates that it supplies many sectors. Again, this is expected, as the industry includes a wide range of industries and makes up a large share of the overall Danish economy.

Across all five examined industries, a clear pattern can be observed in the input flows. The main inputs come from imports, ‘Other industries’, and the industry itself. This pattern is evident for all industries, which indicates a high degree of internal connections within the industries as well as a significant reliance on both domestic and international supply chains.

Having established a pattern for the inputs used in each of the five industries, the focus will now turn to the calculation of technical coefficients.

5.4 Technical coefficients

Moving on, this section will introduce technical coefficients for each of the five industries. Calculating technical coefficients is a standard practice in input-output analysis (Raa, 1994, p. 3). The technical coefficients are calculated as they are essential for later estimation of the statistical Almost Ideal Demand System (AIDS) model where the technical coefficients serve as the dependent variable in the system of demand equations.

The technical coefficients for a specific industry represent the proportion of total costs allocated to each input type. In order to obtain the technical coefficients for each of the five industries, the total input costs for each industry are first calculated. This is given by the following equation:

$$\textit{Total input cost} = \textit{Total cost of domestic inputs} + \textit{total cost of imported inputs} \qquad \text{(equation 2)}$$

It should be noted that when referring to industry-specific costs, one must consider the column in the input-output table corresponding to a given industry. Specifically, the first five rows within each column in the input-output table reflect expenditures on domestic inputs, whereas the subsequent five rows represent expenditures on imported inputs. By summing the total cost of domestic inputs and the total cost of imported inputs, the total input cost for a given industry is calculated. From these, technical coefficients are derived, representing the proportion of total costs allocated to each input type.

The technical coefficients of each industry (both domestic and imported inputs) are calculated as follows (Eurostat, 2008, p. 484):

$$w_{ij}^{dom} = \frac{Expenditure\ of\ industry\ j\ on\ purchasing\ domestic\ input\ i}{Total\ input\ cost\ of\ industry\ j} \qquad \text{(equation 3)}$$

$$w_{ij}^{im} = \frac{Expenditure\ of\ industry\ j\ on\ purchasing\ imported\ input\ i}{Total\ input\ cost\ of\ industry\ j} \quad \text{(equation 4)}$$

Each industry will have 10 technical coefficients (five domestic and five imports), one for each of the underlying supplying industries. This applies to all years from 1966 to 2023. In the data, this is reflected by a three-dimensional matrix of dimensions 10 (inputs) x 5 (industries) x *T* (years), where each element represents the technical coefficient from a specific industry (domestic or imported) used in the production of a specific industry in a given year. This is represented by the matrices below, where each matrix consists of 10 inputs (rows) across 5 industries (columns) from 1966 up until 2023:

Table 3: Technical Coefficient Matrix

Technical Coefficient Matrix for 1966

$$\begin{bmatrix} w_{11}^{(1966)} & w_{12}^{(1966)} & \cdots & w_{14}^{(1966)} & w_{15}^{(1966)} \\ w_{21}^{(1966)} & w_{22}^{(1966)} & \cdots & w_{24}^{(1966)} & w_{25}^{(1966)} \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ w_{10,1}^{(1966)} & w_{10,2}^{(1966)} & \cdots & w_{10,4}^{(1966)} & w_{10,5}^{(1966)} \end{bmatrix}$$

$$\vdots$$

Technical Coefficient Matrix for 2023

$$\begin{bmatrix} w_{11}^{(2023)} & w_{12}^{(2023)} & \cdots & w_{14}^{(2023)} & w_{15}^{(2023)} \\ w_{21}^{(2023)} & w_{22}^{(2023)} & \cdots & w_{24}^{(2023)} & w_{25}^{(2023)} \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ w_{10,1}^{(2023)} & w_{10,2}^{(2023)} & \cdots & w_{10,4}^{(2023)} & w_{10,5}^{(2023)} \end{bmatrix}$$

Source: Compiled by the authors

Taking industry 1, Pharmaceuticals, as an example, the following calculations are performed to obtain the technical coefficients. By using the input-output data presented in Table 2, the calculations are as follows:

$$w_{11}^{dom} = \frac{11.039}{114.343} = 0.09654 \quad \text{(equation 5)}$$

$$w_{61}^{im} = \frac{64.218}{114.343} = 0.56163 \quad \text{(equation 6)}$$

Besides the two technical coefficients shown above, eight others are also calculated for the Pharmaceutical industry to represent all inputs used for production, covering both domestic and imported inputs. It should be noted that all the technical coefficients within a given industry sum to 1, as they represent the total input cost. The table below presents the technical coefficients for all five industries for the year 2023. They are depicted to provide insights into the most recent input composition.

As an example, it can be observed that the Pharmaceutical industry spends 56.16 percent of its total input costs on imported pharmaceutical inputs and 1.15 percent on domestically produced food products, beverages & tobacco inputs.

Table 4: Technical coefficients for 2023

Year 2023	Pharmaceuticals	Food products, beverages & tobacco	Transportation	IT & electronics	Other industries
Domestic: Pharmaceuticals	0.09654	0.00414	0.00067	0.00227	0.00428
Domestic: Food products, beverages & tobacco	0.01145	0.11519	0.00125	0.00282	0.01368
Domestic: Transportation	0.00523	0.02836	0.35248	0.01774	0.04137
Domestic: IT & electronics	0.00820	0.00389	0.03563	0.18729	0.03684
Domestic: Other industries	0.19809	0.55944	0.40604	0.46640	0.60022
Import: Pharmaceuticals	0.56163	0.00992	0.00018	0.00188	0.00842
Import: Food products, beverages, and tobacco	0.01343	0.13073	0.00090	0.00227	0.01411
Import: Transportation	0.00404	0.01805	0.06720	0.00847	0.02441
Import: IT & electronics	0.00726	0.00269	0.01848	0.13545	0.02708
Import: Other industries	0.09412	0.12759	0.11718	0.17542	0.22958
Totals	1.00000	1.00000	1.00000	1.00000	1.00000

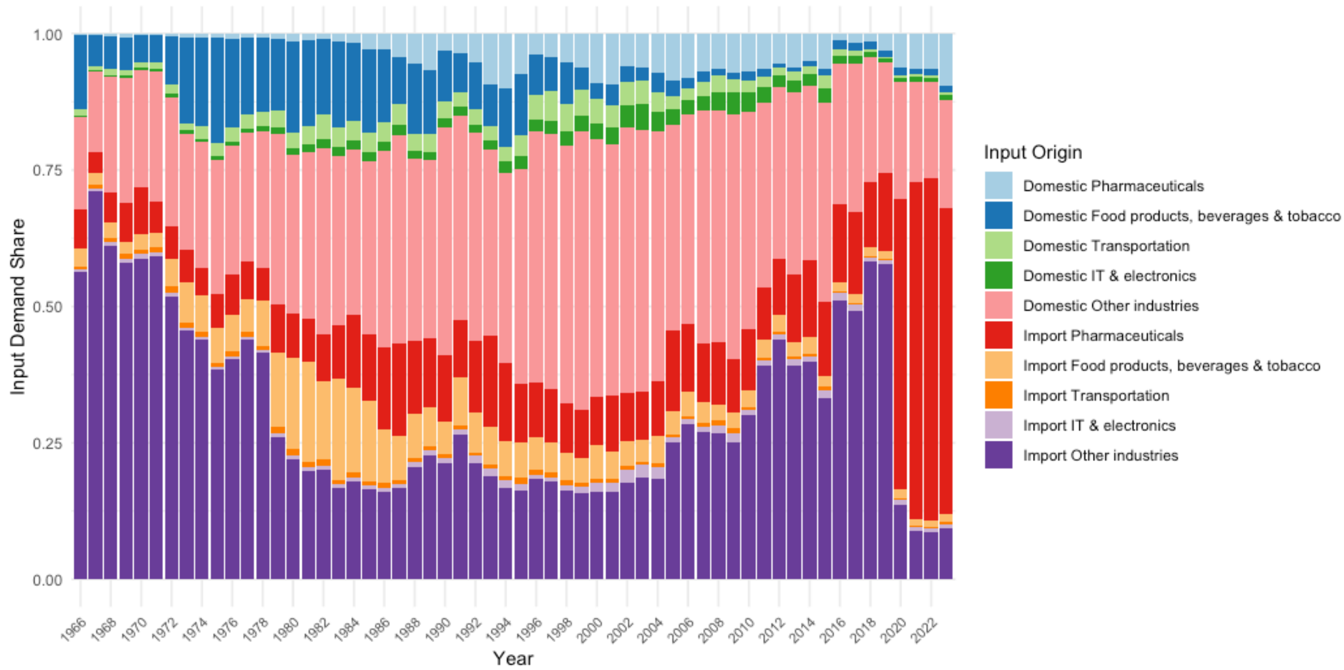
Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

Throughout the remainder of this paper, the technical coefficients will be referred to as input demand shares, as they essentially indicate how much each industry demands of the underlying inputs.

Building upon the calculated coefficients shown in the table above, the following figures provide a stacked bar plot of each of the five industries, illustrating the development of the input demand shares for the period 1966-2023.

The figure below depicts the input demand shares for the Pharmaceutical industry.

Figure 7: Input Demand Shares for Pharmaceuticals (1966-2023)

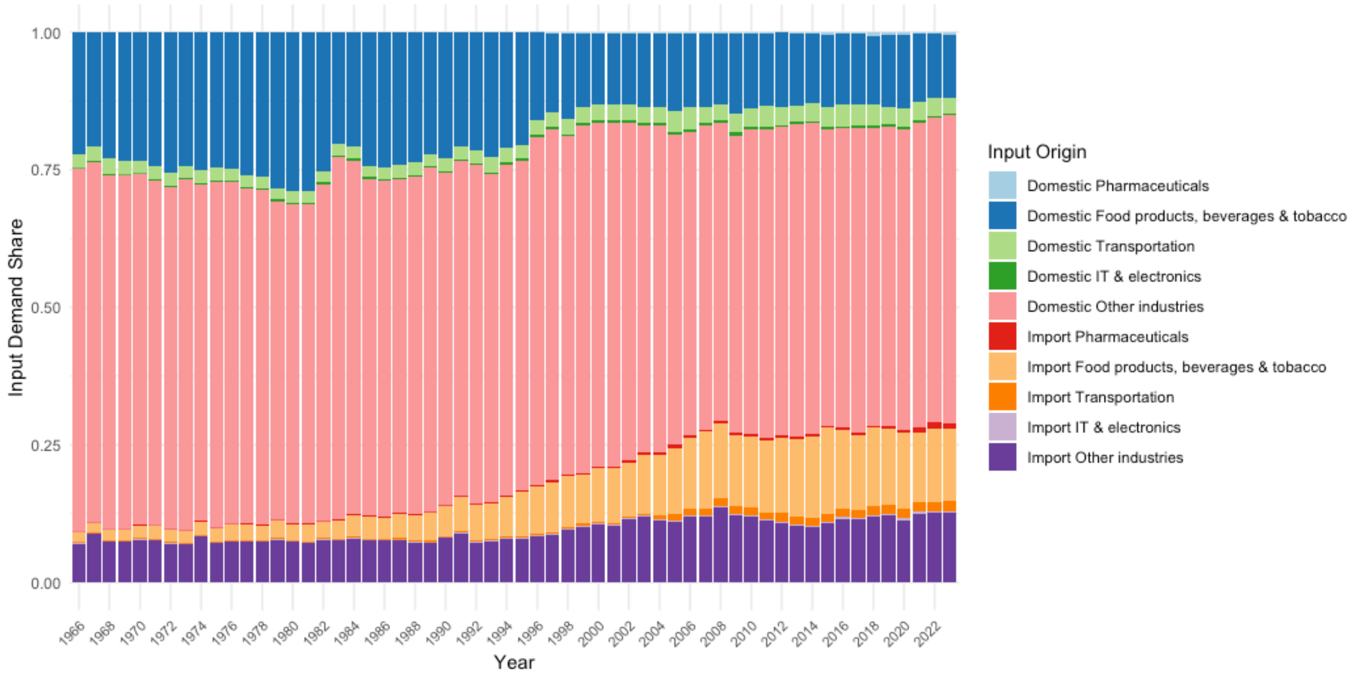


Source: Compiled by the authors using data from Statistics Denmark (2025a)

The plot shows that the inputs used by the Pharmaceutical industry have shifted over the years. At the beginning of the period, imported inputs made up the largest share of the total inputs demanded by the Pharmaceutical industry. From the early 1970s through the 1990s, the share of imported inputs decreased substantially, while the share of domestically sourced inputs increased. Therefore, domestic inputs became the dominant category in the middle of the sample. Following the 1990s, the trend reversed so that the share of domestic inputs declined, while the share of imported inputs increased. This results in imported inputs regaining their position as the dominant category in the later part of the period. It should also be noted that the Pharmaceutical industry has relied on imported inputs from 'Other industries' throughout a large part of the period. However, over the past couple of years, the fraction of imported inputs from 'Other industries' has declined, while inputs from imported Pharmaceuticals now seem to be very important for the production of pharmaceuticals in Denmark.

The figure below depicts the input demand shares for the industry of Food products, beverages, and tobacco.

Figure 8: Input Demand Shares for Food products, beverages, and tobacco (1966-2023)

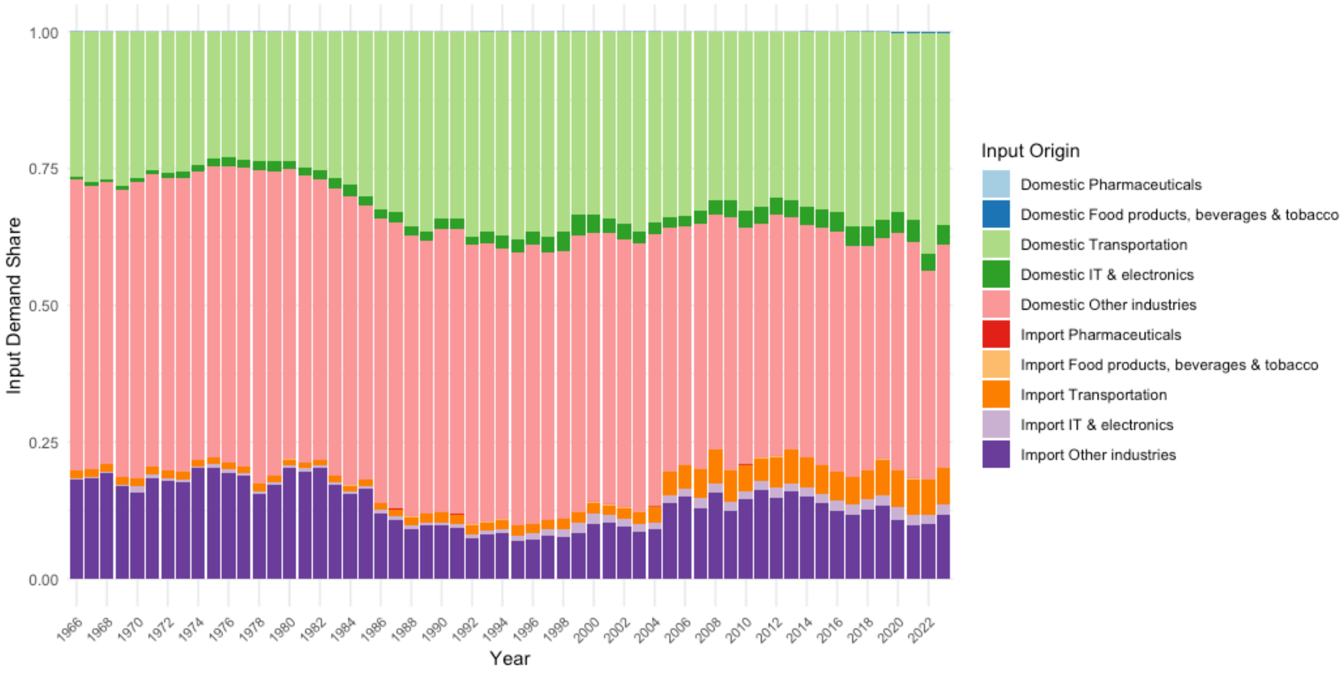


Source: Compiled by the authors using data from Statistics Denmark (2025a)

The figure illustrating the input demand shares for Food products, beverages, and tobacco reveals a stable pattern throughout most of the period. The Danish production of Food products, beverages, and tobacco is mostly reliant on domestic inputs, mainly from 'Other industries' and Food products etc. However, it should be noted that inputs from imported Food products etc., have gradually increased since the 1990s, making the industry more reliant on imported inputs. Nonetheless, the share of domestic inputs remains the dominant category throughout the entire period from 1966-2023.

Next, the following figure illustrates the input demand shares for the Transportation industry.

Figure 9: Input Demand Shares for Transportation (1966-2023)

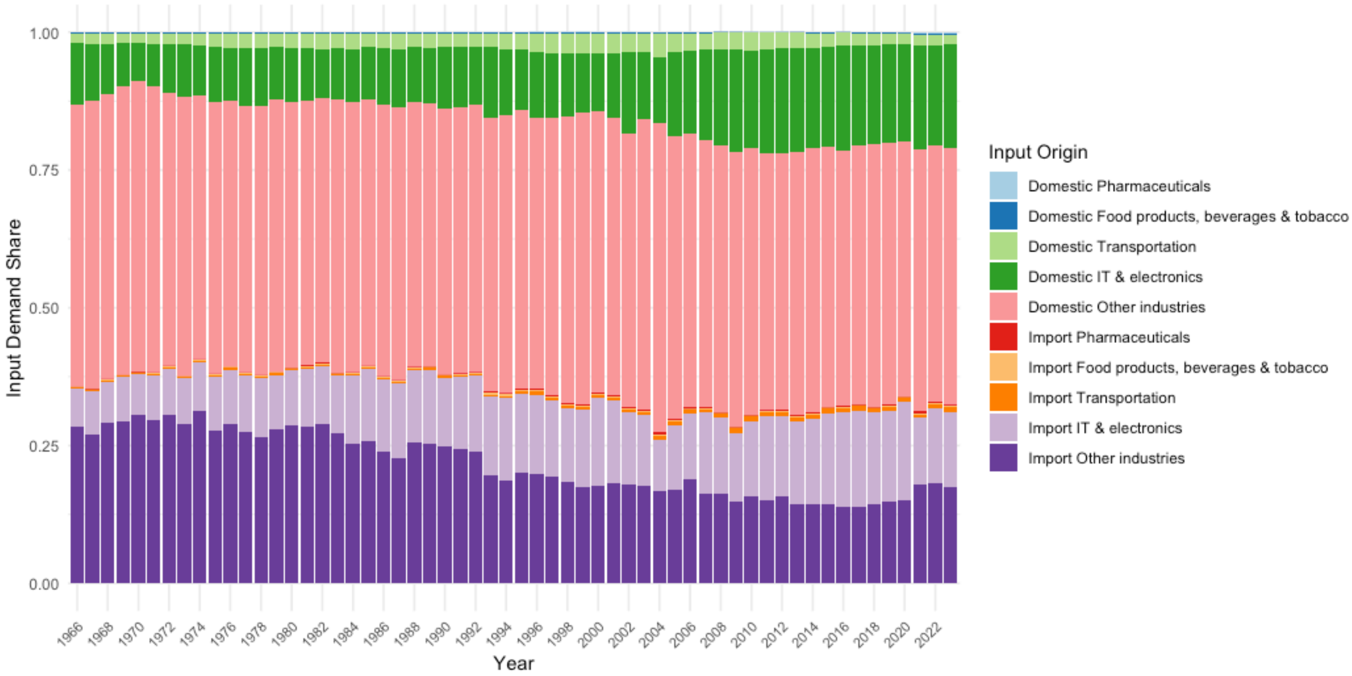


Source: Compiled by the authors using data from Statistics Denmark (2025a)

The evolution of the input demand shares for the Transportation industry also reveals a relatively stable pattern throughout the period from 1966 to 2023. The Transportation industry in Denmark is mainly reliant on inputs from domestic Transportation, domestic 'Other industries', and imported 'Other industries'. Nonetheless, the industry has become more reliant on imported inputs from Transportation and IT & Electronics since the mid-1990s. However, domestic inputs remain the dominant category compared to imported inputs.

The figure below illustrates the development of input demand shares in the IT & Electronics industry.

Figure 10: Input Demand Shares for IT & Electronics (1966-2023)

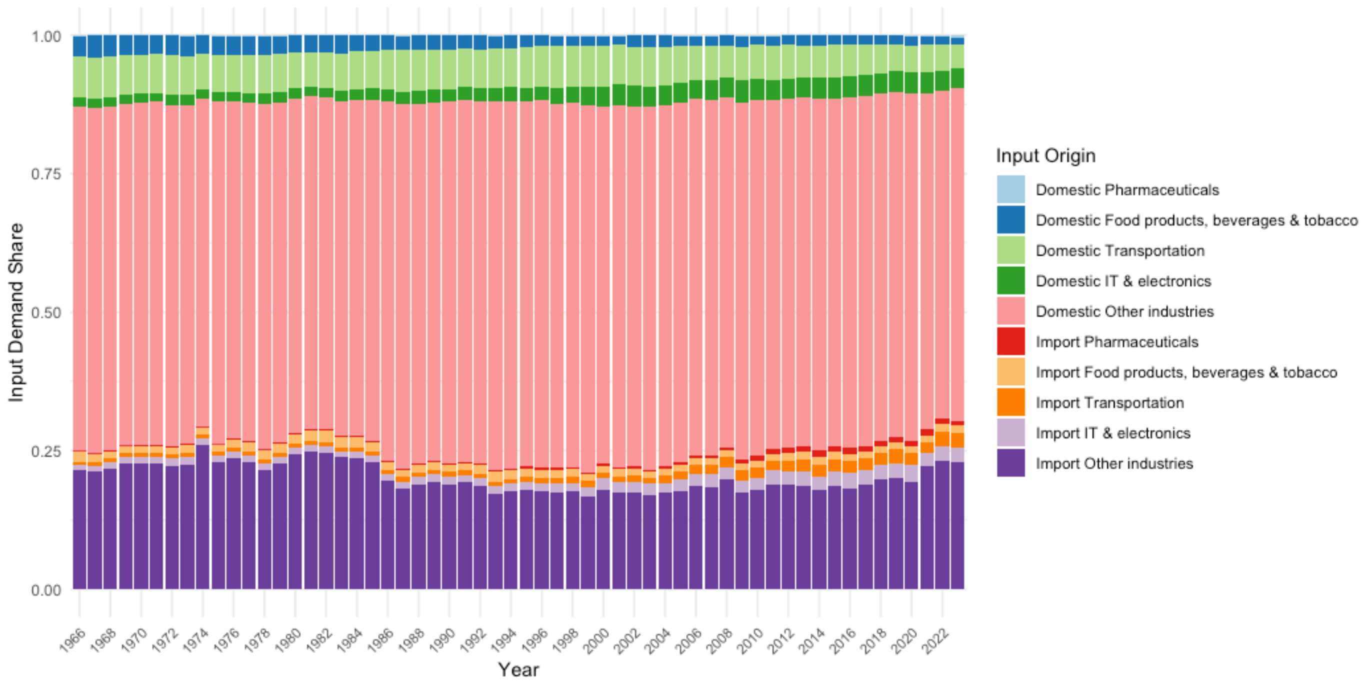


Source: Compiled by the authors using data from Statistics Denmark (2025a)

The development of the input demand shares for the IT & Electronics industry also reveals a relatively stable pattern throughout the years 1966 to 2023. The domestically sourced inputs make up the largest share for all years, with inputs from 'Other industries' and IT & Electronics dominating. Regarding the imported inputs, the largest contributions come from 'Other industries' and IT & Electronics. As illustrated by the figure, the inputs from 'Other industries' make up the largest part of imported inputs at the beginning of the period, but a shift occurs in the remaining years, with imported inputs from IT & Electronics becoming increasingly significant.

The figure below illustrates the development of input demand shares in 'Other industries'.

Figure 11: Input Demand Shares for 'Other industries' (1966-2023)



Source: Compiled by the authors using data from Statistics Denmark (2025a)

Above, the figure reveals that the inputs demanded by 'Other industries' remain relatively consistent throughout the period from 1966 to 2023. The domestically sourced inputs make up the largest share of all inputs, making them the dominant category. Also, it should be noted that the broad category of 'Other industries' is mainly reliant on domestic inputs from 'Other industries' followed by imported inputs from 'Other industries'. This pattern is expected due to the broad nature of this category, which captures a wide variety of inputs not classified elsewhere.

As mentioned earlier in section 5.3, a clear pattern can be observed in the input structure for all industries. Each industry's main inputs come from imports, 'Other industries', and the industry itself.

5.5 Price indices

This section will show the calculation of price indices as Statistics Denmark only provides nominal input-output tables. Therefore, price indices will be calculated to deflate input-output tables in 2010 prices. The year 2010 is used as the base year due to the same practice in a similar study using Danish input-output data (Thomsen et al., 2025, p. 9).

The price indices are calculated using data from Statistics Denmark. As mentioned in section 5.1, input-output data from the period 1966-2023, reported on an annual basis, is used in both current and last year's prices. Therefore, the Paasche price index technique can be used to calculate a price index. The change in price (P) is calculated for each industry (I) and each time period (t). This is done by dividing the value in current prices $(I_t P_t)$ by the value of last year's prices $(I_t P_{t-1})$. This provides GF_t, which is the price growth factor (Thomsen et al., 2025, p. 9):

$$GF_t = \frac{I_t P_t}{I_t P_{t-1}} = \frac{P_t}{P_{t-1}} \quad \text{(equation 7)}$$

As an example, the following results are obtained for the Pharmaceutical industry for a subset of the years:

2008:

$$GF_{2008} = \frac{48.60401}{47.04981} = 1.033033 \quad \text{(equation 8)}$$

2009:

$$GF_{2009} = \frac{49.82911}{48.68580} = 1.023484 \quad \text{(equation 9)}$$

2010:

$$GF_{2010} = \frac{61.32694}{58.19412} = 1.053834 \quad \text{(equation 10)}$$

2011:

$$GF_{2011} = \frac{64.30141}{65.38000} = 0.983494 \quad \text{(equation 11)}$$

2012:

$$GF_{2012} = \frac{73.25165}{72.99596} = 1.003503 \quad \text{(equation 12)}$$

After obtaining the price growth factor, GF_t, 2010 is chosen as the base year and a price index is defined by setting 2010 equal to 1:

$$Index_{2010} = 1 \quad \text{(equation 13)}$$

For each year after 2010, the price index is computed by multiplying the previous year's index by that year's growth factor.

$$Index_{t\,(After\ 2010)} = Index_{t-1} \cdot GF_t \qquad \text{(equation 14)}$$

For example, this is how it is calculated for 2011 and 2012:

$$Index_{2011} = Index_{2010} \cdot GF_{2011} = 1 \cdot 0.98324 = 0.983494 \qquad \text{(equation 15)}$$

$$Index_{2012} = Index_{2011} \cdot GF_{2012} = 0.983494 \cdot 1.003503 = 0.986939 \qquad \text{(equation 16)}$$

For each year before 2010, the price index is calculated by dividing the subsequent year's index by that year's growth factor.

$$Index_{t\,(before\ 2010)} = \frac{Index_{t+1}}{GF_{t+1}} \qquad \text{(equation 17)}$$

Below, the calculations for 2008 and 2009 are illustrated:

$$Index_{2009} = \frac{Index_{2010}}{GF_{2010}} = \frac{1}{1.053834} = 0.9489 \qquad \text{(equation 18)}$$

$$Index_{2008} = \frac{Index_{2009}}{GF_{2009}} = \frac{0.9489}{1.023484} = 0.9271 \qquad \text{(equation 19)}$$

The resulting price indices are summarized in the table below:

Table 5: Summarized statistics for the Pharmaceutical industry

Year	Last Year's Price	Current Price	Growth Factor	Price Index
2008	47.0498	48.6040	1.0330	0.927
2009	48.6858	49.8291	1.0235	0.949
2010	58.1941	61.3269	1.0538	1.000
2011	65.3806	64.3014	0.9835	0.983
2012	72.9960	73.2517	1.0035	0.987

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The same procedure is applied for each industry for both domestic and imported inputs. Therefore, 10 price indices are computed in total for each year. These can be seen in Table 6. Thus, there will be 58 matrices in total with 10 price indices. In Table 6, py_t^1 represents the domestic producer price index for the total production of industry 1, Pharmaceuticals, and pim_t^1 represents the import price index for industry 1, Pharmaceuticals, in producer prices.

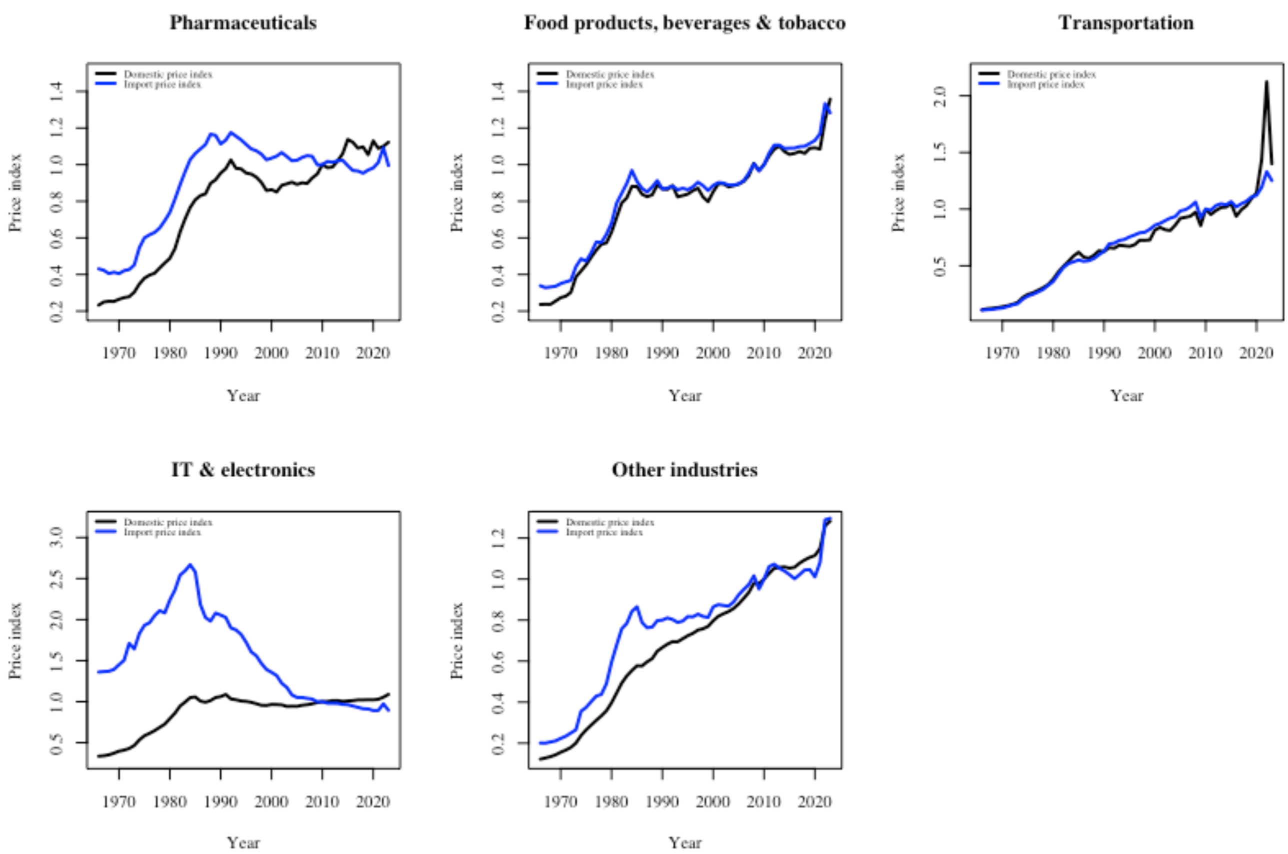
Table 6: Price indices in IO

General	Pharmaceuticals	Food products, beverages & tobacco	Transportation	IT & electronics	Other Industries	Consumption	Government	Investments	Inventories	Exports	Totals
Flow: Pharmaceuticals	py_1	py_1	py_1	py_1	py_1	py_1	py_1	py_1	py_1	py_1	py_1
Flow: Food products, beverages & tobacco	py_2	py_2	py_2	py_2	py_2	py_2	py_2	py_2	py_2	py_2	py_2
Flow: Transportation	py_3	py_3	py_3	py_3	py_3	py_3	py_3	py_3	py_3	py_3	py_3
Flow: IT & electronics	py_4	py_4	py_4	py_4	py_4	py_4	py_4	py_4	py_4	py_4	py_4
Flow: Other industries	py_5	py_5	py_5	py_5	py_5	py_5	py_5	py_5	py_5	py_5	py_5
Im Flow: Pharmaceuticals	pim_1	pim_1	pim_1	pim_1	pim_1	pim_1	pim_1	pim_1	pim_1	pim_1	pim_1
Im Flow: Food products, beverages & tobacco	pim_2	pim_2	pim_2	pim_2	pim_2	pim_2	pim_2	pim_2	pim_2	pim_2	pim_2
Im Flow: Transportation	pim_3	pim_3	pim_3	pim_3	pim_3	pim_3	pim_3	pim_3	pim_3	pim_3	pim_3
Im Flow: IT & electronics	pim_4	pim_4	pim_4	pim_4	pim_4	pim_4	pim_4	pim_4	pim_4	pim_4	pim_4
Im Flow: Other industries	pim_5	pim_5	pim_5	pim_5	pim_5	pim_5	pim_5	pim_5	pim_5	pim_5	pim_5
Totals											

Source: Compiled by the authors

The 10 price indices are presented graphically in the figure below for the five industries.

Figure 12 - Price indices for each industry



Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

From the above, it can be derived that the domestic price and the import price for the Pharmaceutical industry follow a similar trend. Both price indices experienced a rapid increase from 1970 to 1990. This may be explained by the implementation of the Kefauver-Harris Amendments of 1962 which required pharmaceutical companies to test their drugs before selling them to consumers. This increased development times and R&D costs, thereby leading to an upward pressure on prices (Kennedy, 2019, p. 16). Hereafter, the trend has been more stable. The import prices have exceeded the domestic prices for the entire period except for the period after 2010. For the Food products, beverages, and tobacco industry, it applies that the domestic and import prices follow the same trend for the entire period. The import prices are slightly higher than the domestic prices in the entire period. In the 1970s, the domestic and import prices are characterized by high inflation. The high inflation was caused by bad weather conditions in the US and the rest of the world, which sent food prices spiking (Blinder, 1982, p. 265). For the Transportation industry, the domestic and import prices follow the same trend for the entire period. However, the domestic prices within this industry experienced a spike in 2022, which may stem from the rising gas and electricity prices caused by Russia's invasion of Ukraine (The Danish National Bank, 2023). For the IT & Electronics industry, it applies that import prices consistently exceeded the domestic prices up until 2010. Hereafter, the domestic prices are slightly higher than the import prices, but overall, they have followed the same trend in recent years. The downward trend for prices of IT & Electronics since the 1980s is explained by technological advancements and innovation (Rosoff, 2015). For 'Other industries', it is the case that domestic and import prices follow the same overall trend for the period. Again, the import prices are higher compared to the domestic prices, with a few exceptions in certain years.

Moving on, the calculated input demand shares and price indices are used to create one aggregated price for each industry in the following section.

5.6 Aggregate price deflators

Building upon the preceding calculations of input demand shares and price indices, this section will outline how one aggregate price is calculated for each of the five industries. The aim is to estimate one single aggregate price for each of the five industries, even though the underlying assumption of the data is that each industry sets its own individual price. As a result, there are practically 10 different prices within each industry, as there is a distinct price for each of the five domestic and five imported inputs. The decision to calculate one aggregate price per industry is driven by the practical necessity of managing the dimensions of the matrix, which would otherwise become too complex to allow for a meaningful computation. By employing a weighted aggregate price, the complexity of the statistical model, which will be estimated later, is reduced. This enables a more meaningful analysis of the demand structure across all five industries. The calculation of one aggregate price per industry is carried out by taking the geometric mean and performing the following:

$$P_i = \prod_{i=1}^{5} (py_i)^{w_i^{dom}} \cdot \prod_{j=1}^{5} (pim_j)^{w_{j+5}^{im}} \quad \text{(equation 20)}$$

This calculation is performed for each individual industry for each year. Thus, there will be 5 aggregate price deflators in total for each year (1966 to 2023). Taking 2023 as an example, the aggregate price deflators are presented below in Table 7:

Table 7: Aggregate price deflators for 2023

Industries	Aggregate price deflators
Pharmaceuticals	1.095856
Food products, beverages & tobacco	1.289592
Transportation	1.305901
IT & Electronics	1.187891
Other industries	1.267161

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

At this point, all data has been processed and all parameters prepared for the estimation of a statistical Almost Ideal Demand System (AIDS) model. The following section will therefore present the general representation of an AIDS model, the empirical estimation process, and its strengths and weaknesses.

6. Almost Ideal Demand System (AIDS) model

Building on the insights given by the input-output analysis of the Danish production structure, this section will introduce the statistical Almost Ideal Demand System (AIDS) model. For our analysis of the Danish production structure and its import dependencies, an AIDS model is preferable, as it provides insights into the underlying demand patterns for the choice between domestic or imported inputs. Therefore, this statistical framework provides insights into the dynamics that the thesis aims to explore. The purpose of this model is to specifically investigate how changes in relative prices impact the demand for inputs produced domestically versus those imported.

6.1 General representation of the AIDS model

To provide a clear understanding of the analytical framework used in this paper, the following section will outline the general representation of the AIDS model. The Almost Ideal Demand System model can be used in demand analysis (Deaton & Muellbauer, 1980) with its general representation as:

$$\omega_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln(p_j) + \beta_i \ln\left(\frac{X}{P}\right) + \mu_i \qquad \text{(equation 21)}$$

Where:

- ω_i is the input demand share for input i,
- p_j is the price of input j,
- X represents total expenditure,
- P is a price index, and
- μ_i is an error term.

The AIDS model must satisfy three theoretical restrictions, which are as follows:

Firstly, the **adding-up** restriction:

$$\sum_{i=1}^{n} \omega_i = 1 \qquad \text{(equation 22)}$$

This restriction states that the sum of all input demand shares must be equal to one. This implies that the total input cost is fully allocated across all the considered inputs (Deaton & Muellbauer, 1980, p. 314).

Secondly, the **homogeneity** restriction:

$$\sum_{j=1}^{n} \gamma_{ij} = 0, \text{ for } i = 1, \ldots, n \qquad \text{(equation 23)}$$

This restriction states that the sum of the price coefficients in each equation must be zero. This means that if all prices and total expenditures change by the same proportion, the quantities demanded remain unchanged. For instance, if the price of all inputs (domestic and foreign) doubles, and simultaneously, the total input cost also doubles, the theory suggests that the proportion of expenditure allocated to domestic versus foreign inputs should not change. Therefore, consumers will only respond to relative prices and real purchasing power. Thereby, the restriction is in line with economic theory, and it prevents the model from responding to purely nominal changes in the economic environment (Deaton & Muellbauer, 1980, p. 314).

Thirdly, the **symmetry** restriction:

$$\gamma_{ij} = \gamma_{ji}, \text{ for } i \neq j \qquad \text{(equation 24)}$$

This restriction states that the cross-price coefficients are symmetric. This condition reflects that the effect of a change in the price of input j on the quantity demanded of input i, when utility is held constant, should be equal to the effect of a change in the price of input i on the quantity demanded of input j under the same conditions. For instance, one could consider a scenario where an increase in the price of imported inputs leads to an increased demand for domestically produced substitutes. Here, the symmetry restriction implies that a similar increase in the price of domestic inputs would have a symmetrically related effect on the demand for imported inputs (Deaton & Muellbauer, 1980, p. 314).

It applies that the price index P in an AIDS model is often computed as a Stone Price Index (Selvanathan et al., 2023, p. 95). Therefore, the same method is applied in our estimation. The Stone Price Index is represented as:

$$\ln(P) = \sum_{i=1}^{n} \omega_i \ln(p_i) \qquad \text{(equation 25)}$$

The Stone Price Index is a share-weighted geometric average of prices. This index is introduced due to its ability to linearize the model in its parameters, thereby simplifying its computation and estimation using simple econometric techniques (Moschini, 1995).

Having reviewed the general methodology, the following section will clarify how the AIDS models are specified in this particular study.

6.2 Specification of the applied AIDS model

This section aims to explain the underlying dynamics when estimating the empirical AIDS models in this study. For the empirical estimation of the AIDS model, it is standard practice to drop one of the n equations in the system so that the adding-up condition is automatically satisfied (Avouyi-Dovi et al., 2019). In this particular case, where the demand for domestic and foreign inputs across five different industries is considered, this would initially suggest a system of ten share equations within each industry (5 domestic and 5 imported). Therefore, one equation (ω_{10}) will be omitted from the estimation process, and the estimation in this study will proceed with a system of nine equations. The coefficients for the omitted equation are recovered as:

$$\gamma_{10j} = -(\gamma_{1j} + \gamma_{2j} + \gamma_{3j} + \gamma_{4j} + \gamma_{5j} + \gamma_{6j} + \gamma_{7j} + \gamma_{8j} + \gamma_{9j}) \quad \text{(equation 26)}$$

and

$$\alpha_{10} = 1 - (\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 + \alpha_5 + \alpha_6 + \alpha_7 + \alpha_8 + \alpha_9) \quad \text{(equation 27)}$$

and

$$\beta_{10} = -(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9) \quad \text{(equation 28)}$$

The AIDS model will be estimated for ω_1, ω_2, ω_3, ω_4, ω_5, ω_6, ω_7, ω_8, and ω_9, while the results for ω_{10} will be derived from the above.

To estimate the AIDS model for each of the five industries, the input demand shares for all ten industries (5 domestic and 5 foreign) are extracted. These are depicted earlier in Table 4. As stated above, only nine of the ten equations will be estimated to ensure that the adding-up restriction is satisfied. Therefore, nine equations with the following form, where i represents the input demand shares (ω_1, …, ω_9), for a given industry, j will be estimated:

$$\begin{aligned}\omega_{i,j} = \alpha_i &+ \gamma_{i1}\ln(p_1) + \gamma_{i2}\ln(p_2) + \gamma_{i3}\ln(p_3) + \gamma_{i4}\ln(p_4) + \gamma_{i5}\ln(p_5) \\ &+ \gamma_{i6}\ln(p_6) + \gamma_{i7}\ln(p_7) + \gamma_{i8}\ln(p_8) + \gamma_{i9}\ln(p_9) \\ &+ \gamma_{i10}\ln(p_{10}) + \beta_i\left[\frac{X}{P}\right] + u_i\end{aligned} \quad \text{(equation 29)}$$

In order to align the estimation of the model with theory, the restrictions from the previous section must be imposed. In the system of nine equations, this translates into 36 symmetry restrictions (e.g., $\gamma_{ij} = \gamma_{ji}$) and 9 homogeneity restrictions (e.g., $\sum_{j=1}^{9}\gamma_{ij} = 0$). A full specification of these restrictions can be found in Appendix 11.1 and 11.2.

An AIDS model is estimated for each of the five selected industries using the Seemingly Unrelated Regressions (SUR) technique. The application of the SUR method, introduced by Zellner (1962), is particularly useful when analyzing a system of demand equations such as the AIDS model. This is due to the fact that the system of input demand share equations in the AIDS model is likely to exhibit contemporaneous correlation, which means that error terms across the different equations are not independent within the same period. To account for this potential correlation and to improve the efficiency of the estimates, the SUR method is applied. The SUR method estimates all input demand share equations simultaneously. This allows for the use of different factors to explain each share and takes into account any relationship between the residuals of the equations. Consequently, the SUR approach provides more accurate estimates by leveraging this additional information. In contrast to this, the Ordinary Least Squares (OLS) estimation estimates each equation individually (Cadavez & Henningsen, 2011/12, p. 2).

Building on the above, the following section will outline the strengths and limitations associated with the chosen application of the AIDS model. This is done to highlight why this particular model is well-suited to address our research question before conducting the empirical estimation.

6.3 Strengths and limitations

In this section, the advantages and disadvantages of using an Almost Ideal Demand System (AIDS) model in economic analysis will be presented.

The AIDS model by Deaton and Muellbauer (1980) offers several advantages for demand analysis. First, one of the advantages of the AIDS model is its ability to provide an arbitrary first-order approximation of any demand system, thereby reflecting many types of demand behaviors. Second, the model satisfies the axioms of choice, which ensures consistency with rational behavior. Third, the model aggregates perfectly over consumers in a way that does not require parallel linear Engel curves. Hence, the model captures that consumers react differently to changes in their income. Concerning the specific research carried out in this paper, the model can capture that industries react differently to changes in their input costs. Fourth, the AIDS model allows for a simple estimation, since it avoids the need for non-linear estimation to a high degree. Lastly, the framework makes it possible to test for the restrictions of adding-up, homogeneity, and symmetry, thereby ensuring the theoretical consistency of the model. This verifies that the model makes reliable and consistent predictions about demand responses when prices and income change (Deaton & Muellbauer, 1980, p. 312).

On the other hand, the static AIDS model also has some disadvantages. First, the static AIDS model fails to consider short-run consumer responses to income and price changes. This is due to the assumption that when income and price change, consumers immediately and fully adjust to a new consumption equilibrium level. However, this assumption does not always apply in a real-life context, because it takes time for consumers to reach a new equilibrium consumption level in each time period. This delay is caused by short-term factors such as adjustment costs, unexpected real price levels, incorrect expectations, and habit formation (Selvanathan et al., 2023). Furthermore, in the original paper, Deaton & Muellbauer (1980) highlight that even though the model is an improvement compared to previous demand models, it should still not, particularly in its static form, be regarded as a fully satisfactory explanation of consumers' behavior (Deaton & Muellbauer, 1980, p. 312).

Despite certain limitations, the advantages of employing the AIDS model are considered to outweigh its drawbacks. This is due to the fact that the statistical framework enables a detailed analysis of the underlying demand patterns within the five industries regarding the choice between domestic or imported inputs.

Building upon the theoretical foundation for estimating the demand system, the analysis now turns to its practical application in the context of the five industries under study. The subsequent sections will present the estimation results for each of the five industries, followed by a detailed presentation and interpretation of the empirical findings.

6.4 Empirical AIDS models (1966-2023)

6.4.1 AIDS model for the Pharmaceutical industry

This section will present the results from a static AIDS model for the Pharmaceutical industry. A static framework is applied in this analysis due to the complexity associated with estimating and managing a dynamic model. The static framework is appropriate and sufficient for the purpose of analyzing structural relationships at a given point in time, as the focus is not on the dynamic adjustments of prices. The static model estimates the sensitivity of the Pharmaceutical industry's demand to price changes in both domestic and imported production inputs. The estimates provide an understanding of how the industry adjusts its demand for inputs in response to price changes. This allows for a derivation of the import dependence within this industry.

The estimated static AIDS model for the Pharmaceutical industry provides the following price effects shown in Table 8 below. As seen below, the estimated price effects are depicted in a 10-by-10 matrix, where each row corresponds to an input demand share equation ω_1, ω_2, ω_3, ω_4, ω_5, ω_6, ω_7, ω_8, ω_9 and ω_{10}, and each column represents the logged price regressors for both imported and domestically produced inputs $ln(py_1)$, $ln(py_2)$, $ln(py_3)$, $ln(py_4)$, $ln(py_5)$, $\ln(pim_1)$, $\ln(pim_2)$, $\ln(pim_3)$, $\ln(pim_4)$, and $\ln(pim_5)$. The estimation of the AIDS model yields similar 10-by-10 matrices of price effects for each of the five industries, which are all depicted in Appendix 11.3.

Table 8: Price effects of the Pharmaceutical industry

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0674·	0.0198	-0.0794***	-0.0383*	-0.0241	0.2039***	-0.0410	0.0700*	-0.0620**	0.0185
Dom Food etc. (w2)	0.0198	0.2586**	-0.0239	-0.0580*	-0.3917***	0.0279	-0.1889***	0.0278	0.0391	0.2895***
Dom Transportation (w3)	-0.0794***	-0.0239	-0.0457	-0.0363**	-0.1891***	0.3341***	-0.0806**	-0.0235	-0.0257	0.1702**
Dom IT Electronics (w4)	-0.0383*	-0.0580*	-0.0363**	0.0312	0.0433	0.0049	0.0228	0.0329	-0.0462*	0.0438
Dom Other industries (w5)	-0.0241	-0.3917***	-0.1891***	0.0433	0.3406*	-0.0008	-0.4216***	0.2385***	-0.0051	0.4099**
Im Pharmaceuticals (w6)	0.2039***	0.0279	0.3341***	0.0049	-0.0008	-0.1158	0.0663	-0.4192***	0.1642***	-0.2654*
Im Food etc. (w7)	-0.0410	-0.1889***	-0.0806**	0.0228	-0.4216***	0.0663	-0.1099**	0.0515	-0.0078	0.7093***
Im Transportation (w8)	0.0700*	0.0278	-0.0235	0.0329	0.2385***	-0.4192***	0.0515	0.1448**	0.0086	-0.1315·
Im IT Electronics (w9)	-0.0620**	0.0391	-0.0257	-0.0462*	-0.0051	0.1642***	-0.0078	0.0086	-0.0347·	-0.0304
Im Other industries (w10)	0.0185	0.2895***	0.1702**	0.0438	0.4099**	-0.2654*	0.7093***	-0.1315·	-0.0304	-1.2140***

Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The diagonal coefficients, also called own-price coefficients, represent how an increase in the price of either domestic or imported inputs impacts the input demand share of that same input. For example, the first diagonal coefficient shows how a domestic price increase in pharmaceutical inputs impacts the input demand share for domestic pharmaceuticals.

The off-diagonal coefficients are also called cross-price coefficients. These coefficients capture the impact of a price change in one input on the demand for another input. The lower off-diagonal triangular coefficients should be equal to the off-diagonal upper triangle. This ensures that the model fulfills the symmetry condition. For instance, a 1 percent price increase in imported pharmaceuticals will increase the input demand share of domestic pharmaceuticals by 0.2039 percentage points. Consequently, it applies that a 1 percent price increase in domestic pharmaceuticals will increase the input demand share of imported pharmaceuticals by 0.2039 percentage points. Therefore, the model satisfies the symmetry condition. A positive cross-price coefficient implies that the inputs are substitutes, while a negative cross-price coefficient indicates complementarity (Auer & Papies, 2019). However, one must keep in mind that the interpretation is not necessarily that simple. When stating complementarity and substitutability, it is assumed throughout this paper that a price change causes a change in demand. However, it is important to acknowledge that the reverse causality may also hold, where changes in demand affect the prices. As an example, assume that imported food inputs and domestic food inputs are complementary inputs. According to the standard interpretation, this would mean that an increase in the price of imported food inputs would result in a decrease in the demand for domestic food inputs. However, this would not necessarily be correct, if the price increase of imported food inputs was caused by an increase in demand. If the higher price is caused by higher demand, a larger quantity of imported food inputs is bought. Therefore, this will result in a greater demand for domestic food inputs (Sexton, 1991).

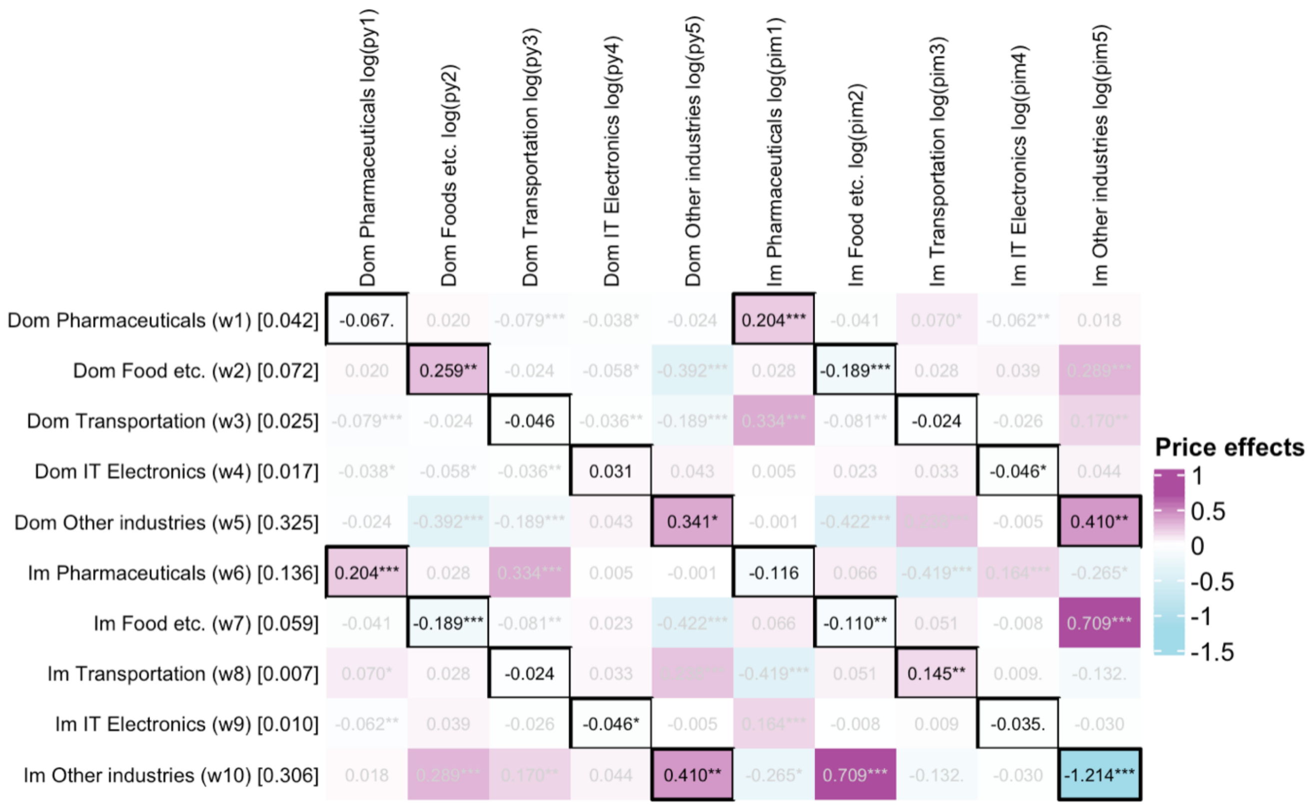
Given the complexity of Table 8, the price effects are visualized in a heatmap below in Figure 13. In this heatmap, the diagonal is highlighted to represent the own-price effects. To address the research question concerning trade dependence, the heatmap also emphasizes the cross-price effects between domestically produced inputs and import prices and vice versa. The main focus will be on the substitution between domestic and foreign inputs of the same industry type. As an example, how the pharmaceutical industry's demand for domestic IT & Electronics inputs will react when the import price of IT & Electronics inputs increases. These crucial price effects are found at positions (1, 6), (2, 7), (3, 8), (4, 9), (5, 10), and their symmetric equivalents at positions (6, 1), (7, 2), (8, 3), (9, 4), (10, 5). These values related to their respective average input demand share reflect the price sensitivity of demand for domestic versus imported inputs in the industry under study, thereby allowing for a derivation of the import dependence. In the analysis of the cross-price effects, only the effects of a change in import prices will be discussed. The colors in the heatmap represent the magnitude and in which direction the price effects go. Darker purples represent larger positive price effects, while a darker blue shade indicates larger negative price effects. The statistical significance of the price estimates is denoted by asterisks. Furthermore, the analysis will only focus on the statistically significant estimates.

It should be noted that the estimate shown in the square bracket in each row represents the mean value of the input demand share for each respective input for the industry under study. The mean is calculated over the period 1966 to 2023. The mean is included to highlight the importance of each input in the total input expenditure of the specific industry. When the mean value is small, the corresponding price effects are expected to be limited. Consequently, a large mean value is assumed to be associated with a larger price effect. Therefore, if only a small share of total expenditure is allocated to a given input, one would not expect price changes to have a large effect on the demand share for that input. For example, the heatmap below reveals that the Pharmaceutical industry purchases 4.2 percent of its input from the domestic Pharmaceutical industry. This is a relatively small share, which is reflected by the low magnitude of the own-price effect (-0.067) at position (1, 1).

In continuation of the above, it is important for the reader to bear in mind that the results are interpreted as a 1 percent increase in relative prices. However, it applies that for some industries a 1 percent increase in relative price may be an extreme increase compared with the actual observed historical fluctuations between import and domestic prices. In section 5.5, Figure 12 reveals that the domestic and import prices are almost one-to-one historically for especially the Food products, beverages, and tobacco and Transportation industries. Therefore, a 1 percent change in relative prices would be an extreme scenario for these two industries. This dynamic can explain why the magnitude of some of the cross-price coefficients may look unrealistic given their mean input demand share values. As an example, the heatmap below shows that a 1 percent increase in the import price of food products etc. will result in a 0.189 percentage point decrease in the input demand share for their domestic counterpart within the Pharmaceutical industry. As the inputs from this industry only constitute 7.2 percent of the total expenditures within the Pharmaceutical industry, one would expect the magnitude of the cross-price effect to be smaller.

Moving on, the estimated price effects for the Pharmaceutical industry will be presented and interpreted.

Figure 13: Heatmap of price effects in the Pharmaceutical industry



Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

Starting at the diagonal in the heatmap, all own-price effects are depicted. The greatest negative price effect is -1.214, which indicates that a 1 percent increase in import prices for ‘Other industries’ will reduce the input demand share of imported inputs from ‘Other industries’ by 1.214 percentage points. This estimate does not align with the economic framework of the model, as input demand shares must lie within the interval of 0 and 1. Therefore, an estimate of -1.214 implies that the input demand share will turn negative, thus indicating a negative share of inputs from imported ‘Other industries’. This is not feasible, which may indicate a potential misspecification of the model. Nevertheless, it should be noted that this is the only estimate that contradicts the model’s underlying economic framework.

The remaining negative own-price effects are of a smaller magnitude. The mean value of input demand shares for these inputs constitutes only a small share of the total inputs used by the

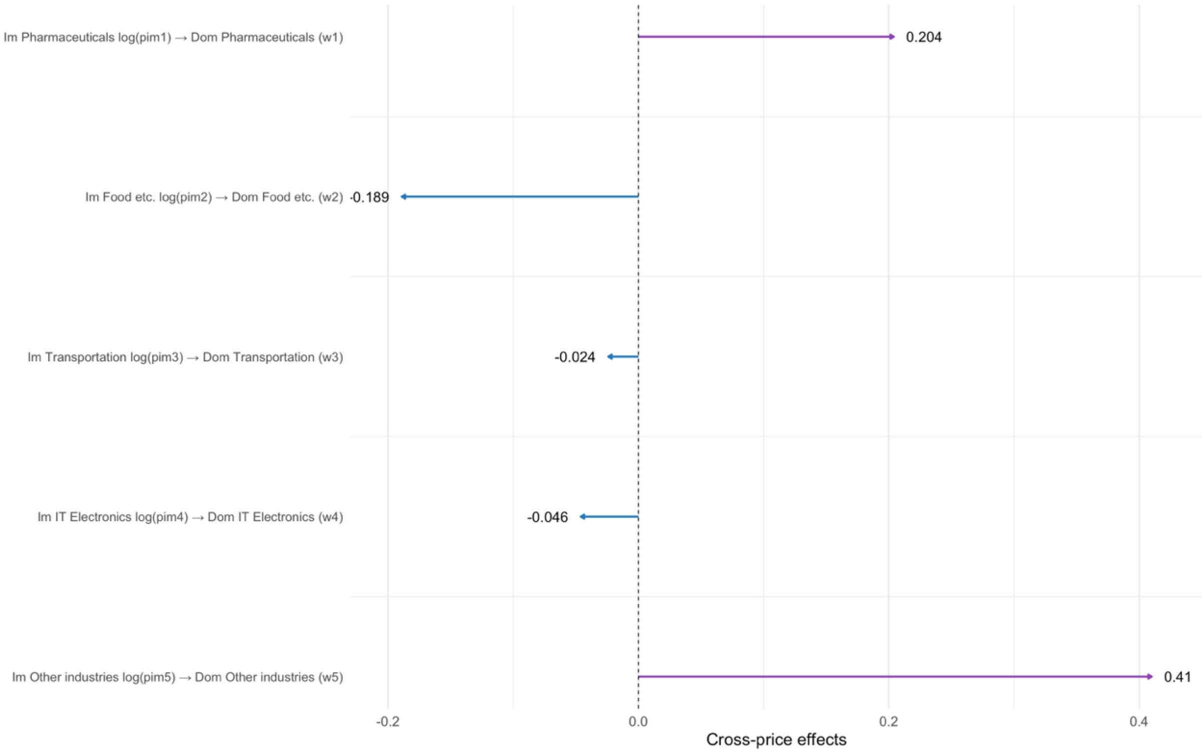
Pharmaceutical industry, which explains the smaller estimated price effects. Focusing on the own-price effect for imported IT & Electronics, it is revealed that a 1 percent increase in the price of these inputs will result in a 0.035 percentage point decrease in demand for imported IT & Electronics. The small magnitude of this estimate is consistent with the fact that these inputs only account for 1 percent of total inputs used by the Pharmaceutical industry.

Conversely, the analysis reveals positive own-price effects for domestic Food products etc., domestic 'Other industries', and imported Transportation. The positive signs contradict economic theory as demand theory typically assumes an inverse relationship between price and quantity demanded. The positive estimates suggest that when the price of these inputs increases, the Pharmaceutical industry's demand for them also increases.

Interestingly, divergent own-price effects based on origin are found for domestic Food products etc. / imported Food products etc., and domestic 'Other industries' / imported 'Other industries'. Thus, an increase in the domestic price of Food products etc. is associated with a positive effect, but an increase in the imported price is associated with a negative effect. The same dynamic applies to 'Other industries'. This dynamic can suggest a potential preference for domestically produced inputs.

The focus now shifts to the specific cross-price effects that are crucial for understanding the Pharmaceutical industry's reliance on imported inputs. Therefore, the relevant cross-price effects are depicted in a vector plot below. The plot shows how the Pharmaceutical industry's demand for Danish inputs changes when the price of the same imported input changes. Due to the symmetry restriction in the AIDS model, a change in the price of domestic inputs will have a similar impact on the demand for imported inputs. The number at the end of each line in the figure represents the price effect, thereby indicating how much the demand for domestic inputs changes in percentage points when the price of imported inputs increases by 1 percent. The purple color reflects a positive price effect, while the blue color denotes a negative price effect. Furthermore, the magnitude of the estimated price effects is represented by the length of the line. A longer line indicates greater absolute price effect values, while a shorter line indicates smaller absolute price effect values.

Figure 14: Vector plot of cross-price effects



Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The estimated cross-price effects reveal statistically significant relationships for all industries except for Transportation, as seen from the heatmap in Figure 13 above.

The positive cross-price effect between the import price of pharmaceutical inputs and the domestic pharmaceutical input demand share (0.204) implies that, within the Danish Pharmaceutical industry, imported pharmaceutical inputs are substitutes for domestic pharmaceuticals. The same applies to the cross-price effect between the import price of inputs from ‘Other industries’ and the domestic input demand share for ‘Other industries’ (0.41). The magnitude of these coefficients provides further insights into the strength of the substitution, which should also be interpreted in relation to the mean value of these input demand shares. The cross-price effect for pharmaceutical inputs of 0.204 implies that a 1 percent increase in the price of imported pharmaceuticals will increase the demand for domestic pharmaceuticals by 0.204 percentage points, thereby indicating a degree of substitutability. The sum of domestic and imported pharmaceutical inputs constitutes a total of 17.8 percent of the total expenditure within the industry, thereby being one of the primary inputs of the industry. Because the domestic pharmaceutical inputs on average constitute 4.2 percent and imported pharmaceutical inputs constitute 13.6 percent, the estimated cross-price effect of 0.204 can be considered relatively large, thereby indicating a relatively elastic response. The price sensitivity appears higher for domestic pharmaceutical inputs, because, relative to their smaller expenditure share, a 1 percent increase in price results in a proportionally larger adjustment in their input demand share compared to imported pharmaceuticals. The observed effect indicates that the demand of the Pharmaceutical industry is not solely dependent on imported pharmaceutical inputs. If the price of imported pharmaceuticals increases, it is possible, to a certain extent, to switch to domestically produced alternatives. Therefore, the result indicates a relatively low import dependence for inputs within this sector.

The larger cross-price effect of 0.41 for 'Other industries' suggests a greater potential for substitution, hence a 1 percent increase in the price of imported inputs from 'Other industries' will result in a 0.41 percentage point increase in demand for domestic alternatives. However, this relatively high estimate can be explained by the fact that domestic and imported inputs from 'Other industries' make up 32.5 percent and 30.6 percent of the total inputs used in the Pharmaceutical industry. Therefore, the relatively large price effect of 0.41 is consistent with the expectations, as these inputs make up a total of 63.1 percent, thereby reflecting that these are the primary inputs. The estimate suggests that the Pharmaceutical industry has some flexibility in its sourcing of the inputs from 'Other industries'.

From the above, it can be inferred that the Danish Pharmaceutical industry is not completely dependent on imported inputs from these two industries, as 80.9 percent of total expenditure is allocated to inputs from the two industries that can be substituted with domestic alternatives. This indicates a reduced reliance on imports, as the ability to switch between domestic and imported inputs implies lower vulnerability to disruptions or price fluctuations in the foreign market. However, it should be noted that these cross-price effects focus on the demand response to price changes, not the supply side. Therefore, it is uncertain whether the domestic supply can match the increases in demand to a full extent when changes in prices occur.

In contrast to the observed substitution patterns, the negative cross-price effect between the import price of Food products etc. and the domestic input demand share (-0.189) and the negative cross-price effect between the import price of IT & Electronics and the domestic input demand share (-0.046) indicate relationships of complementarity. The cross-price effect for Food products etc. suggests that a 1 percent increase in the price of imported inputs from Food products etc. will result in a 0.189 percentage point decrease in demand for domestic alternatives. Given that inputs from domestic Food products etc. on average constitute 7.2 percent and inputs from imported Food products etc. constitute 5.9 percent of the total inputs used by the Pharmaceutical industry, the estimated cross-price effect of -0.189 can be considered relatively large, thereby indicating a relatively elastic response for both inputs. As previously mentioned, the large cross-price effect might be explained by the lack of deviation in relative prices for Food products etc. The estimated effect implies a degree of import dependence as the industry seems to reduce its total food-related expenditure instead of substituting it with alternatives. Consequently, this points to a reliance on specific imported or domestically produced Food products etc., which creates vulnerability related to price shocks in either market. The same logic applies to the cross-price effect for IT & Electronics, where a 1 percent price increase in imported inputs from IT & Electronics will lead to a 0.046 percentage point decrease in the demand for domestic alternatives. The mean value of input demand shares for domestic and imported IT & Electronics is 1.7 percent and 1 percent, respectively. The estimated cross-price effect of -0.046 percentage point is relatively high in relation to the size of the input demand shares, thereby indicating an elastic response to price changes. A price increase in either market will have negative effects on the demand. The findings reveal that the Pharmaceutical industry is, to some degree, reliant on inputs from IT & Electronics. However, since the industry only constitutes a total of 2.7 percent of total expenditure within the Pharmaceutical industry, it has a limited impact on the overall import dependence of the industry.

6.4.1.1 Import dependence of the Pharmaceutical industry

The analysis of the Pharmaceutical industry shows different levels of import dependences of its production inputs across the examined industries. The production inputs from the Pharmaceutical industry and 'Other industries' reveal low import dependence due to the strong substitutability between imported and domestic inputs. On the other hand, the estimates for Food products etc. and IT & Electronics illustrate signs of import dependence, which can be explained by complementarity. Due to insignificant observed effects for the Transportation industry, it is not possible to draw a definitive conclusion regarding the presence of import dependence within this industry.

In Figure 7, the composition and evolvement of inputs in the Pharmaceutical industry can be seen. The composition of inputs in the industry has changed a lot in the period from 1966 to 2023. Therefore, it is of interest to examine whether the conclusion regarding import dependence changes when compared with the most recent year of available data. In recent years, imports have become more dominant. In 2023, pharmaceuticals constitute the primary input, accounting for 65.82 percent, while 'Other industries account for 29.22 percent. Therefore, a shift in the composition of inputs has occurred, as inputs from ‘Other industries’ constituted the primary input on average over the entire data period, followed by inputs from pharmaceuticals as the second largest. However, these two industries still represent the primary inputs for the Pharmaceutical industry. Given that these inputs are substitutes and account for an even larger share in 2023, this underscores the conclusion that the Pharmaceutical industry in Denmark demonstrates a low degree of import dependence.

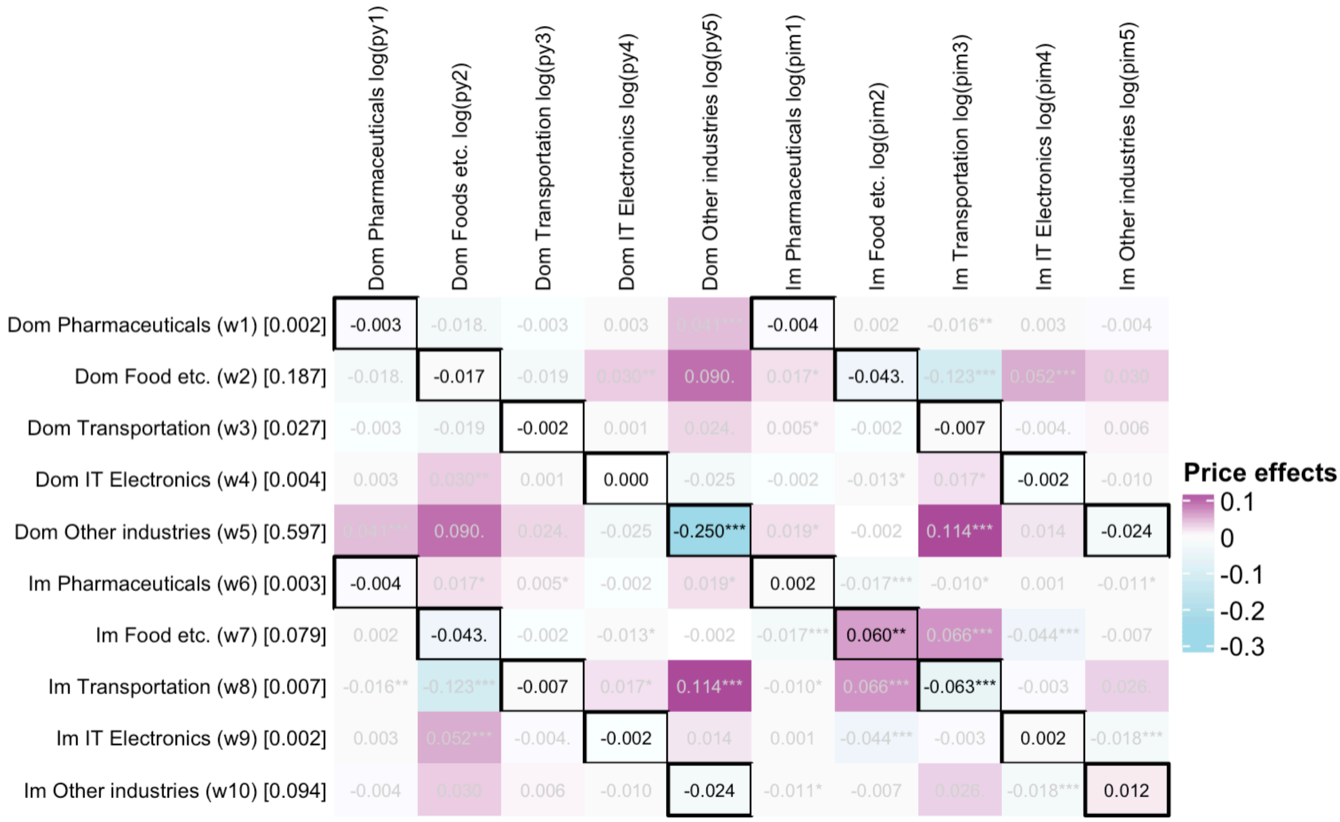
To assess the overall import reliance of the Danish economy, the Pharmaceutical industry’s level of import dependence will be connected to the industry’s share of total Danish production in 2023. The Pharmaceutical industry accounts for 5.4 percent of total Danish production in 2023, based on the input-output data in Table 2. Given that the Pharmaceutical industry constitutes just 5.4 percent of total Danish production, the findings regarding its low import dependence are of limited significance when assessing the overall import dependence of Denmark.

6.4.2 AIDS model for the Food products, beverages, and tobacco industry

This section will present the estimation results from the static AIDS model for the Food products, beverages, and tobacco industry. The findings show the sensitivity of the industry’s demand to price changes in domestic and imported production inputs.

The estimates for this industry are presented in a heatmap in Figure 15 below. Once again, it is of interest to examine the diagonal of own-price effects, and the cross-price effects highlighted in the figure. The analysis will only focus on the statistically significant estimates.

Figure 15: Heatmap of price effects in the Food products, beverages, and tobacco industry



Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

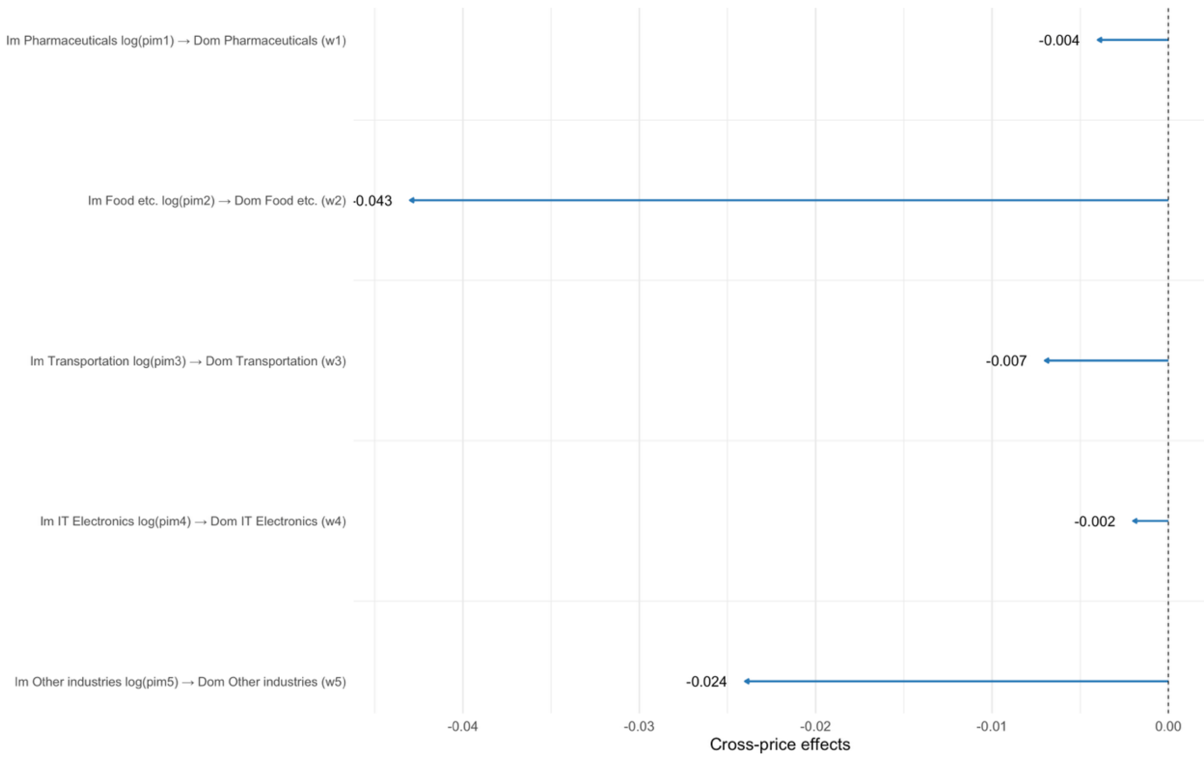
The initial focus of the analysis will be on the diagonal own-price effects. Here it can be noted that only three out of the ten diagonal elements are statistically significant. The greatest negative estimate is -0.25, indicating that a 1 percent increase in the domestic prices for 'Other industries' will reduce the input demand share of domestic goods from 'Other industries' by 0.25 percentage points. The mean value of input demand shares for this input constitutes a large share (59.7 percent) of the total inputs used by the Food products etc. industry, which explains the large price effect. This estimate indicates that the input is relatively price inelastic since the effect is relatively small compared to the mean value.

The remaining statistically significant negative own-price effect is for imported Transportation with a price effect of -0.063. The mean value of input demand shares for this input constitutes only a small share (0.7 percent) of the total inputs. The magnitude of the price effect is relatively high compared to the mean value of the input demand share, thereby indicating high price sensitivity.

On the other hand, the analysis also reveals a positive own-price effect for imported Food products etc. However, this contradicts economic theory that assumes an inverse relationship between price and quantity demanded. The positive own-price effect for imported food products etc. may stem from the fact that imported food products etc. are essential to the production process of Danish food products, beverages, and tobacco.

In addition to the own-price effects, the attention now turns to the specific cross-price effects, which are essential for understanding the industry's dependence on imported inputs. As a result, the relevant cross-price effects are presented in the vector plot in Figure 16 below.

Figure 16: Vector plot of cross-price effects



Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The estimated cross-price effects reveal a statistically significant relationship between the price of imported inputs and the demand for their domestic counterparts in the industry of Food products etc. However, the remaining four industries reveal insignificant cross-price effects. Therefore, based on this model, it is not possible to derive any patterns of the industry's dependence on imported inputs within these four industries.

The cross-price coefficient between the import price of food products etc. and the domestic input demand share for the same industry of -0.043 indicates a complementary relationship. The estimate suggests that a 1 percent increase in the price of imported food products etc. will lead to a 0.043 percentage point decrease in demand for domestic food products etc. Given that domestic food products etc. inputs on average constitute 18.7 percent and imported food products etc. inputs constitute 7.9 percent of the total inputs used by the Food products etc. industry, the estimated cross-price effect of -0.043 can be considered relatively small, thereby indicating a relatively inelastic response. The price sensitivity appears higher for imported food products etc., because, relative to their smaller expenditure share, a 1 percent increase in price results in a proportionally larger adjustment in their input demand share compared to domestic food products etc. The weak complementarity observed for inputs from this industry implies reliance on both domestic and imported inputs. Given relatively low price sensitivity, price changes will have a limited impact on demand, pointing to a degree of import dependence. Because these inputs constitute a total of 26.6 percent of total expenditure within the Food products etc. industry, they represent the second most important input in this industry, thereby highlighting some import dependence in the industry.

6.4.2.1 Import dependence of the Food products, beverages, and tobacco industry

The analysis of the industry of Food products, beverages, and tobacco reveals only one statistically significant cross-price effect, which makes it difficult to draw a conclusion about this industry's overall import reliance. A statistically significant, albeit weak, complementary relationship is observed for imported and domestic food products etc., thereby revealing a level of import dependence.

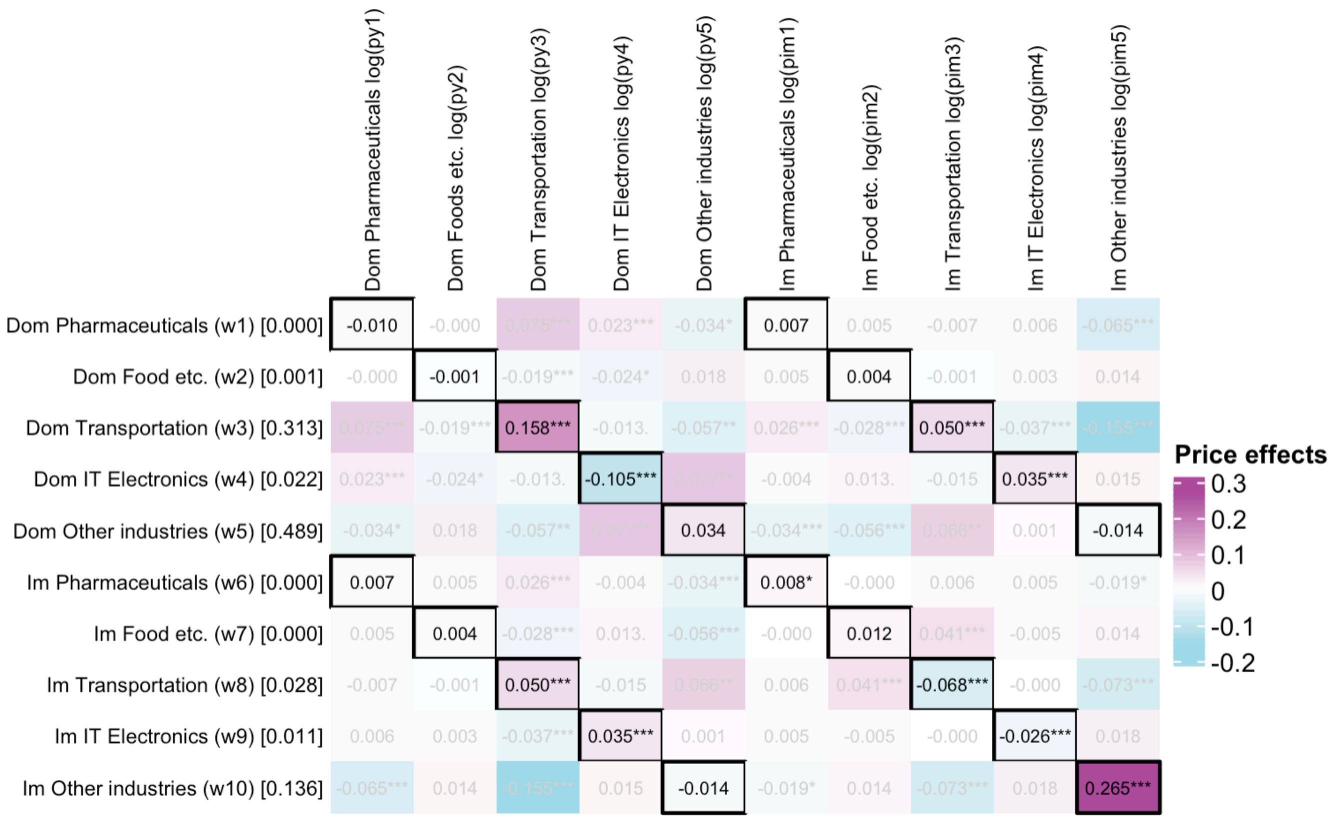
It is of interest to examine whether the conclusion regarding import dependence changes when compared with the most recent year of available data. In Figure 8, the composition of inputs over time in the Food products etc. industry is illustrated. The composition of inputs in the industry has remained almost constant in the period 1966 to 2023, with only small increases in imported inputs from Food products etc. and 'Other industries'. In 2023, food products etc. are still the second most important input, accounting for 24.6 percent. Therefore, the import reliance of this input will still have an impact on the overall import dependence of the industry.

The industry of Food products etc. accounts for 3.52 percent of the total Danish production in 2023, based on the input-output data in Table 2. Therefore, the industry constitutes a small share of the overall economy. The observed degree of import dependence within this industry will therefore have a limited significance on the overall import dependence of Denmark.

6.4.3 AIDS model for the Transportation industry

The following section outlines the results of a static AIDS model for the Transportation industry, demonstrating the demand dynamics within this sector. The findings reveal the sensitivity of the Transportation industry's demand to price changes in both domestic and imported production inputs. Consistent with the previous approach, the results from the model are presented in the heatmap in Figure 17 below.

Figure 17: Heatmap of price effects in the Transportation industry



Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

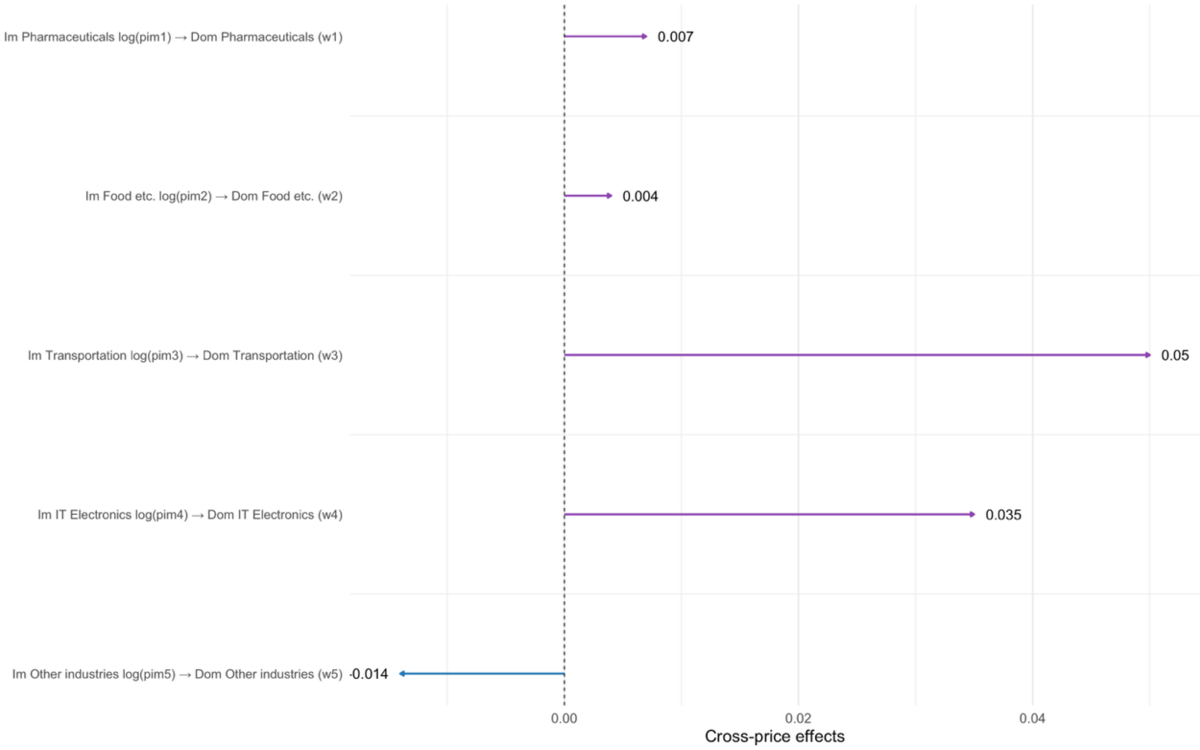
First, the analysis will focus on the diagonal elements. Considering the negative own-price effects, the largest effect is observed for domestic IT & Electronics with an estimate of -0.105. This suggests that a 1 percent increase in domestic prices for IT & Electronics inputs will reduce the input demand share of domestic goods from the IT & Electronics industry by 0.105 percentage points. The mean value of the input demand share for this input constitutes a small share (2.2 percent) of the total inputs used by the Transportation industry. The estimated own-price effect is high relative to the average input demand share, thereby reflecting high price sensitivity. The remaining statistically significant negative own-price effects are observed for imported Transportation and imported IT & Electronics with estimates of -0.068 and -0.026, respectively. The mean value of these input demand shares accounts for 2.8 percent and 1.1 percent, respectively, thus indicating high price sensitivity.

Conversely, the results from the static AIDS model also reveal positive own-price effects with the largest effect observed for imported 'Other industries' of 0.265. The remaining positive own-price effects are for domestic Transportation and imported Pharmaceuticals with estimates of 0.158 and 0.008, respectively. Again, these positive estimates are counterintuitive to the standard law of demand.

A noteworthy finding is the divergence in own-price effects when comparing domestic and imported goods within the Transportation industry. Hence, a price increase of domestic transportation increases the quantity demanded, while an increase in the import price of transportation is associated with a negative effect. Such variation can arise from various factors such as a potential preference for domestically produced inputs.

Moving on from the own-price effects, the analysis will now focus on the cross-price effects, which are essential for understanding the Transportation industry's dependence on imported inputs. As a result, the relevant cross-price effects are presented in Figure 18 below. Here, it should be noted that only the estimates for Transportation and IT & Electronics are statistically significant. Therefore, based on this model, it is not possible to derive any patterns of the Transportation industry's dependence on imported inputs within the remaining three industries: Pharmaceuticals, Food products etc., and 'Other industries'.

Figure 18: Vector plot of cross-price effects



Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The cross-price effect between the import price of transportation and the domestic input demand share for transportation of 0.05 indicates substitutability between imported and domestic transportation inputs. Given that domestic transportation inputs on average constitute 31.3 percent and imported transportation inputs constitute 2.8 percent of the total inputs used by the Transportation industry, the estimated cross-price effect of 0.05 can be considered relatively small for domestic transportation, thereby indicating low price sensitivity. The price sensitivity appears higher for imported transportation inputs, because, relative to their smaller expenditure share, a 1 percent increase in the price results in a proportionally larger adjustment in their input demand share compared to domestic transportation inputs. The substitutability observed for these inputs is positive for the import dependence, as it reflects that the Transportation industry can switch between domestic and imported transportation inputs.

The cross-price effect of 0.035 between the import price of IT & Electronics and the domestic input demand share of the same industry also implies substitutability. The mean value of the input demand share for domestic IT & Electronics is 2.2 percent and 1.1 percent for imported IT & Electronics. The estimated cross-price effect is relatively large compared to the two mean values of input demand shares, thereby indicating high price sensitivity. In relation to import dependence, a high price sensitivity for a substitution relationship is positive, as it suggests a higher degree of substitution between domestic and imported inputs.

Overall, the positive cross-price estimates for inputs from the Transportation and IT & Electronics industries suggest that substitutability exists between imported and domestic inputs within the respective industries. From a trade dependence perspective, this is positive as it suggests that the Transportation industry is not solely reliant on imported inputs from these industries.

6.4.3.1 Import dependence of the Transportation industry

The findings for the Danish Transportation industry indicate a low degree of import dependence due to the presence of substitution. However, the weaker substitutability of domestic transportation inputs implies that the industry might not easily switch to domestic alternatives when import prices increase. This can indicate a degree of dependence on imported transportation inputs. Imported and domestic inputs from IT & Electronics indicate a low degree of import dependence due to the presence of substitutability and high price sensitivity. However, inputs from IT & Electronics only account for 3.3 percent of total expenditure. Consequently, their contribution to the industry's overall import dependence is limited. Due to statistically insignificant observed cross-price effects for inputs from Pharmaceuticals, Food products etc., and 'Other industries', it is not possible to draw a definitive conclusion regarding the presence of import dependence within these industries.

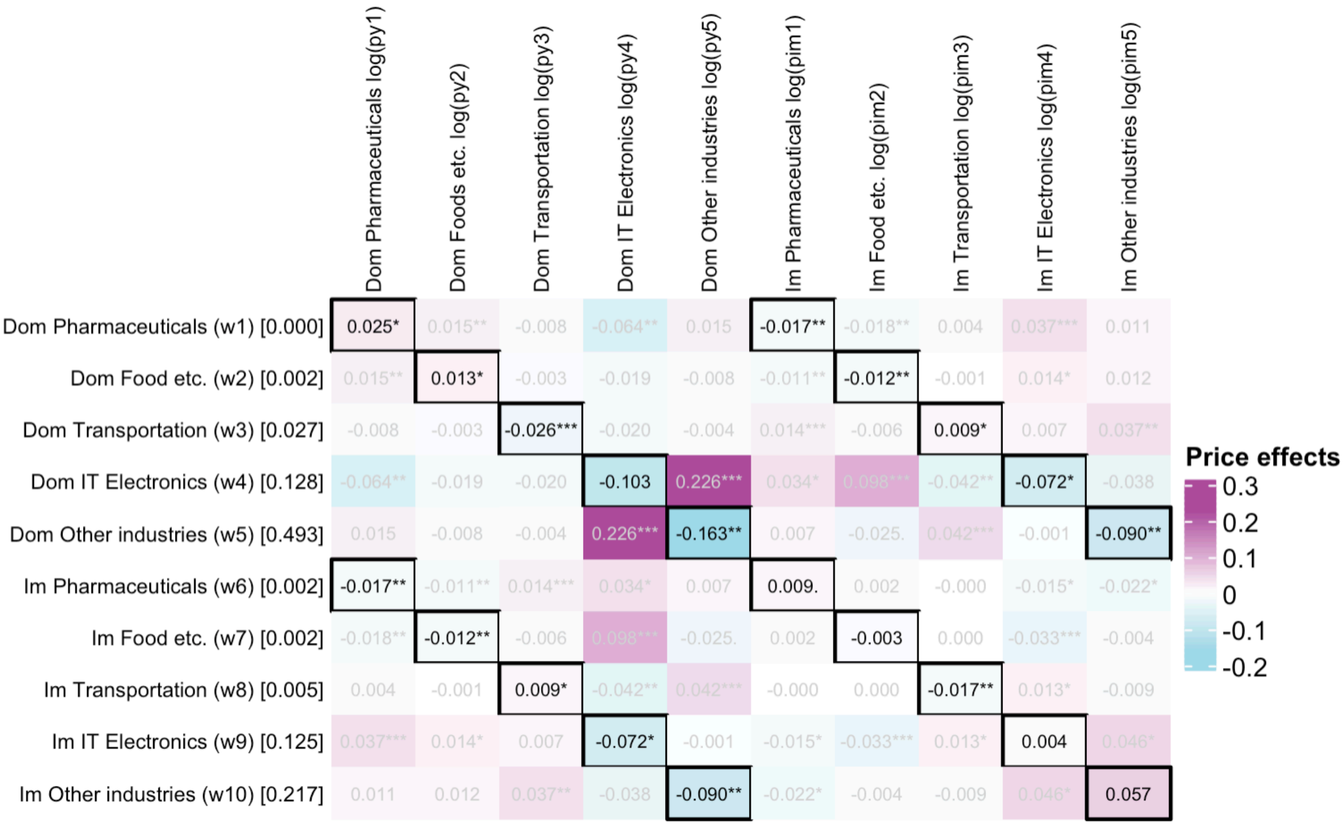
As with the previous industries, it is of interest to examine whether the conclusion regarding import dependence changes when compared with the most recent year of available data. Figure 9 presents the composition of inputs over time in the Transportation industry. The table illustrates that the composition of inputs in the industry has remained relatively stable, with small increases in imported inputs from Transportation and IT & Electronics. In 2023, inputs from Transportation are still the second most important input, accounting for 42 percent, while inputs from IT & Electronics make up 5.4 percent. Therefore, the conclusion about the industry's import dependence remains the same when focusing on the latest data.

In relation to the total Danish production, the Transportation industry constitutes 11.16 percent in 2023, based on the input-output data in Table 2. The observed weak import dependence within this industry helps reduce Denmark's overall reliance on imports.

6.4.4 AIDS model for the IT & Electronics industry

This section will outline the results of a static AIDS model for the IT & Electronics industry, thereby demonstrating the demand dynamics and trade dependence within this industry. Below, the results are represented in a heatmap in Figure 19, revealing the sensitivity of the industry's demand to price changes in both domestic and imported production inputs.

Figure 19: Heatmap of price effects in the IT & Electronics industry



Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

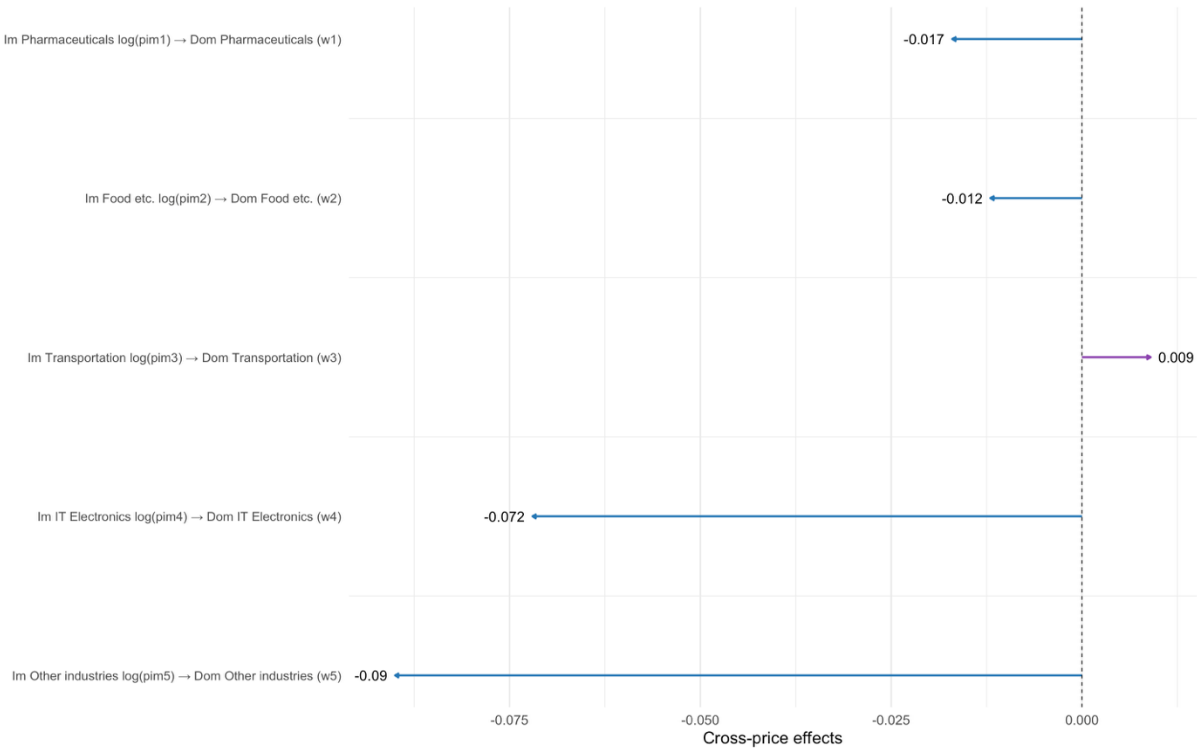
Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

Focusing on the diagonal elements, the greatest negative own-price effect is found for domestic 'Other industries' (-0.163). This suggests that a 1 percent increase in the domestic price of inputs from 'Other industries' will reduce the input demand share of domestic inputs from 'Other industries' by 0.163 percentage points. The mean value of the input demand share for this input constitutes a large average share (49.3 percent) of the total inputs used by the IT & Electronics industry, which explains the larger estimated price effect. Furthermore, statistically significant negative own-price effects are observed for domestic transportation inputs (-0.026) and imported transportation inputs (-0.017). The mean value of the domestic and imported transportation input demand share constitutes 2.7 percent and 0.5 percent, respectively. The small magnitude of these estimates is consistent with the fact that these inputs only account for a small share of total inputs used by the IT & Electronics industry.

Positive own-price effects are observed for domestic pharmaceuticals (0.025), domestic food products etc. (0.013), and imported pharmaceuticals (0.009). Once again, these results appear counterintuitive to standard economic theory and the law of demand, as the small positive price effects suggest that price increases will result in higher demand.

To understand the IT and Electronic industry's dependence on imported inputs, the analysis will now focus on the cross-price effects. The relevant cross-price effects from the heatmap are presented in Figure 20 below. Within this industry, all cross-price effects are statistically significant.

Figure 20: Vector plot of cross-price effects



Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The positive cross-price effect of 0.009 between the price of imported transportation inputs and the input demand share of domestic transportation implies substitutability between imported and domestic inputs. Given that domestic transportation inputs on average constitute 2.7 percent and imported transportation inputs constitute 0.5 percent of the total inputs used by the IT & Electronics industry, the estimated cross-price effect of 0.009 can be considered small, thereby indicating low price sensitivity. The price sensitivity appears higher for imported transportation inputs, because, relative to their smaller expenditure share, a 1 percent increase in price results in a proportionally larger adjustment in their input demand share compared to domestic transportation inputs. However, the substitutability observed for these inputs is overall positive for the import dependence despite the minimal effect.

In contrast to the observed substitution pattern, the negative cross-price effect for IT & Electronics (-0.072) and 'Other industries' (-0.09) reveal relationships of complementarity. Given that domestic IT & Electronics inputs on average constitute 12.8 percent and imported IT & Electronics inputs constitute 12.5 percent of the total inputs used by the IT & Electronics industry, the estimated cross-price effect of -0.072 can be considered relatively small, thereby indicating an inelastic response. The complementarity observed for these inputs is negative for the import dependence. The low price sensitivity implies higher import dependence since the demand will not be affected to a high degree when prices change. In addition, the cross-price effect for 'Other industries' (-0.09) also reveals a relationship of complementarity. Given that domestic inputs from 'Other industries' on average constitute 49.3 percent and imported inputs from 'Other industries' constitute 21.7 percent of the total inputs used by the IT & Electronics industry, the estimated cross-price effect of -0.09 can be considered relatively small, thereby indicating an inelastic response. The complementarity observed for these inputs suggests import dependence. Again, the low price sensitivity implies higher import dependence.

The cross-price effects for Pharmaceuticals (-0.017) and Food products etc. (-0.012) also reveal relationships of complementarity. However, since both inputs only constitute a minimal share (0.2 and 0.4 percent) of the total input costs within the IT & Electronics industry, they will have a minimal impact on the import dependence.

Overall, the four negative cross-price estimates point to a degree of import dependence within the IT & Electronics industry. This is because the industry seems to reduce its total expenditure for domestic inputs from Pharmaceutical, Food products etc., IT & Electronics, and 'Other industries', when the import price of these inputs increases. Therefore, this suggests a reliance on specific imported or domestically produced inputs, which creates vulnerability related to price shocks in both the domestic and foreign markets.

6.4.4.1 Import dependence of the IT & Electronics industry

The results for the Danish IT & Electronics industry reveal a degree of import dependence within its production inputs across the examined industries. The production inputs from the

Transportation industry reveal low import dependence due to substitutability. However, the cross-price effects for IT & Electronics, 'Other industries', Food products etc., and Pharmaceuticals indicate signs of import dependence due to complementarity. However, the inputs from Pharmaceuticals and Food products etc. constitute a small share of the total input costs.

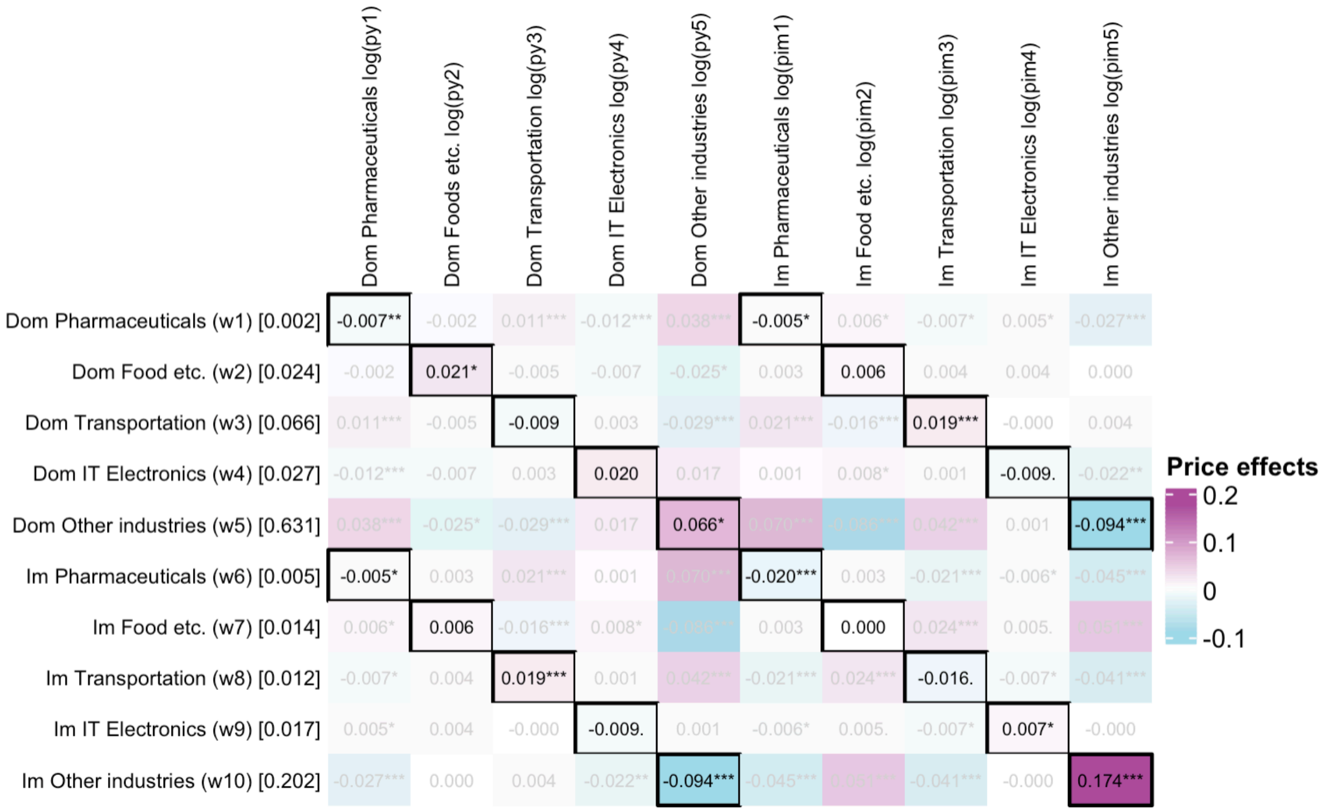
Again, it is of interest to examine whether the conclusion regarding import dependence changes when compared with the most recent year of available data. Figure 10 presents the composition of inputs over time in the IT & Electronics industry. The table illustrates that the composition of inputs in the industry has remained stable. Therefore, the conclusion about the industry's import dependence remains the same when focusing on the latest available data, 2023.

To assess the import dependence of the Danish economy, the IT & Electronics industry's level of import dependence will be connected to the industry's share of total Danish production in 2023. The IT & Electronics industry constitutes 4.03 percent of the total Danish production in 2023, based on the input-output data in Table 2. Therefore, the import reliance within this industry will have a limited impact on the overall import dependence of Denmark.

6.4.5 AIDS model for 'Other industries'

The following section will outline the results of a static AIDS model for the remaining industries in the Danish production structure captured by 'Other industries'. The findings show the sensitivity of the industry's demand to price changes in domestic and imported production inputs. The estimated price effects are represented in a heatmap below in Figure 21.

Figure 21: Heatmap of price effects for Other industries



Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

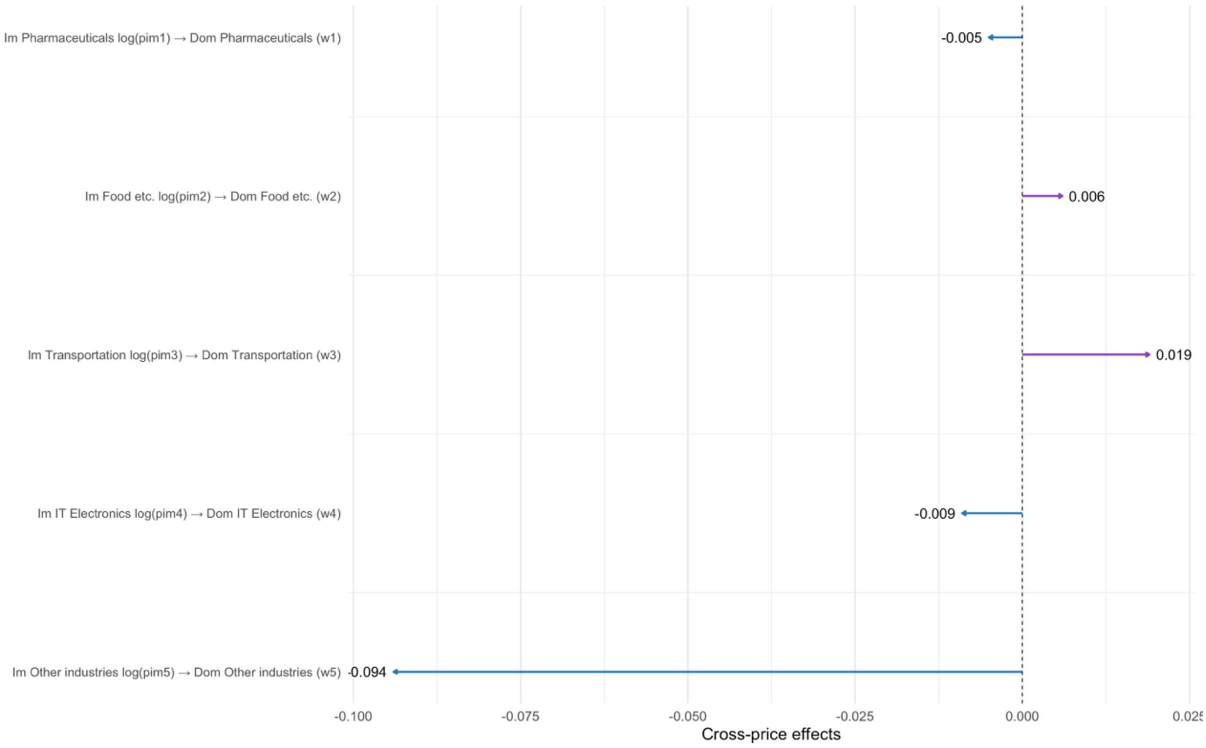
Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

Starting at the diagonal, all own-price effects are depicted within 'Other industries'. The greatest negative estimate is -0.020, indicating that a 1 percent increase in the import price of pharmaceuticals will reduce the input demand share of imported pharmaceutical inputs by 0.020 percentage points. The mean value of the input demand shares for this input constitutes a small share (0.5 percent), thereby indicating that the input is relatively price elastic. The remaining statistically significant negative own-price effects are observed for imported transportation (-0.016) and domestic pharmaceuticals (-0.007). The average input demand share for the two inputs is 1.2 percent and 0.2 percent, respectively. The small magnitude of the price effects is consistent with the small magnitude of the average input demand shares.

The heatmap above also reveals positive own-price effects. The greatest effect is observed for imported 'Other industries' (0.174) followed by domestic 'Other industries' (0.066), domestic Food products etc. (0.021), and imported IT & Electronics (0.007). Once again, it holds that these positive estimates are counterintuitive to standard economic theory.

In addition to the own-price effects, the heatmap also outlines the specific cross-price effects, which are essential for understanding the import dependence within the industry of ‘Other industries’. Therefore, the cross-price effects are presented in the vector plot in Figure 22 below. All cross-price effects are statistically significant except the one for Food products etc.

Figure 22: Vector plot of cross-price effects



Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The positive cross-price effect of 0.019 between the price of imported transportation and the domestic transportation input demand share suggests that within ‘Other industries’, domestic transportation is a substitute for imported transportation. Given that domestic transportation inputs on average constitute 6.6 percent and imported transportation inputs constitute 1.2 percent of the total inputs used by ‘Other industries’, the estimated cross-price effect of 0.019 can be considered more elastic for imported transportation inputs compared to domestic transportation inputs. The substitutability reveals that the industry is not solely dependent on imported transportation, which suggests relatively low import dependence.

In contrast to the positive effect, the negative cross-price effect between the import price of ‘Other industries’ (-0.094) and the domestic ‘Other industries’ input demand share indicates a relationship of complementarity. Given that domestic inputs from ‘Other industries’ on average constitute 63.1 percent and imported inputs ‘Other industries’ constitute 20.2 percent of the total inputs used by ‘Other industries’, the estimated cross-price effect of -0.094 can be considered relatively small. This suggests low price sensitivity. This in connection with the complementarity observed for these inputs is negative for the import dependence. Increases in import prices will only result in a slightly decreased demand for domestic alternatives, thereby illustrating inelastic demand, which indicates a degree of import dependence.

The cross-price effects for Pharmaceuticals (-0.009) and IT & Electronics (-0.005) also reveal relationships of complementarity. However, since both inputs only constitute a minimal share (0.7 and 4.4 percent) of the total input costs within ‘Other industries’, they will have a minimal impact on the import reliance within this industry.

6.4.5.1 Import dependence of ‘Other industries’

The results for ‘Other industries’ indicate a level of import dependence for production inputs across the examined industries. The imported production inputs from the Transportation industry reveal a low degree of import dependence due to substitutability. The cross-price effects for ‘Other industries’, IT & Electronics, and Pharmaceuticals show signs of import dependence due to the observed complementarity. However, the average input expenditure share used on IT & Electronics and Pharmaceuticals within the industry is of a small magnitude. Therefore, they will have a limited effect on the overall import dependence of the industry. Consequently, ‘Other industries’ account for 83.3 percent of the total input expenditure within the industry. The complementary nature of the cross-price effect of this input will therefore have a large impact on the industry’s import dependence. Based on this, it is found that ‘Other industries’ is highly import dependent.

It is of interest to examine whether the conclusion regarding import dependence changes when compared with the most recent year of available data. In Figure 11, the composition of inputs over time in ‘Other industries’ is illustrated. The composition of inputs in the industry has remained almost constant. Therefore, the conclusion regarding import dependence still applies when considering the most recent data, 2023.

To assess the import dependence of the Danish economy, ‘Other industries’ level of import dependence will be connected to the industry’s share of total Danish production in 2023. As ‘Other industries’ constitutes 76.10 percent of the overall Danish production, based on the input-output data in Table 2, the import reliance within this industry will have a notable impact on the overall import dependence of Denmark. This finding aligns with expectations due to the high degree of aggregation within this industry.

6.4.6 Other observed patterns

To further understand the dynamics of the Danish production structure, the following section will focus on another pattern observed in the analysis of the price effects obtained from the estimated AIDS models for all five industries.

In addition to the above findings from the heatmaps, it applies that the greatest cross-price effect with the largest absolute value is often found for inputs originating from the same industry being analyzed. This holds for the following industries: Food products etc., Transportation, and 'Other industries'. For the industries of Pharmaceuticals and IT & Electronics, the largest value is found for inputs from 'Other industries'. However, the inputs originating from the same industry being analyzed are found to have the second greatest value. This is consistent with the observations from sections 5.3 and 5.4. Here, a clear pattern is observed in the input structure for all industries, as each industry's main inputs come from imports, 'Other industries', and the industry itself. This pattern suggests that the industries are highly reliant on their own outputs as inputs, thereby indicating that the companies in the industries are reliant on inputs that are either produced internally or by closely related companies within the same industry. This pattern is also observed in a study by Jia et al. (2022), where it is observed that industries are often reliant on inputs they produce themselves.

Drawing on the above obtained results, the following section will outline the main findings in a concluding subsection.

6.4.7 Sub-conclusion

This section will provide an overview of the obtained results. The table below presents the main findings from the empirical analysis.

Table 9: Summarized findings

Industry	Overall input relationship	Import dependence (Industry)	Relative economic size	Contribution to import dependence (Denmark)
Pharmaceuticals	Substitution	Low	Low	Slightly positive
Food products etc.	Partial complementarity	Moderate	Low	Moderately negative
Transportation	Substitution	Low	Moderate	Positive
IT & Electronics	Complementarity	High	Low	Negative
Other industries	Complementarity	High	High	Strongly negative

Source: Compiled by the authors

Note: A positive (negative) contribution indicates a reduction (increase) in overall import dependence.

From the empirical analysis, it can be concluded that some industries are more dependent on imports than others. The Pharmaceutical industry is the least import dependent industry, since all primary inputs are characterized as substitutes. The import dependence of the Food products etc. industry is difficult to conclude due to only one statistically significant cross-price. However, this cross-price effect for Food products etc. shows a complementary relationship between imported and domestic inputs and constitutes one-fourth of the total input expenditure within the industry. Therefore, it suggests some degree of import dependence. The findings for the Transportation industry show a low degree of import dependence due to substitutability. Consequently, the IT & Electronics industry shows signs of import dependence due to the complementary nature of four cross-price effects and a weak substitution effect. Lastly, 'Other industries' also shows signs of import dependence due to a high degree of complementarity within the primary inputs.

Based on this, it can be concluded that the Danish economy is dependent on imports. The import dependence of the Danish economy is further supported by the fact that the Pharmaceutical and Transportation industries account for only 5.4 percent and 11.16 percent of total economic output, respectively. Hence, the majority of the Danish economic output is produced within industries that shows sign of import dependence.

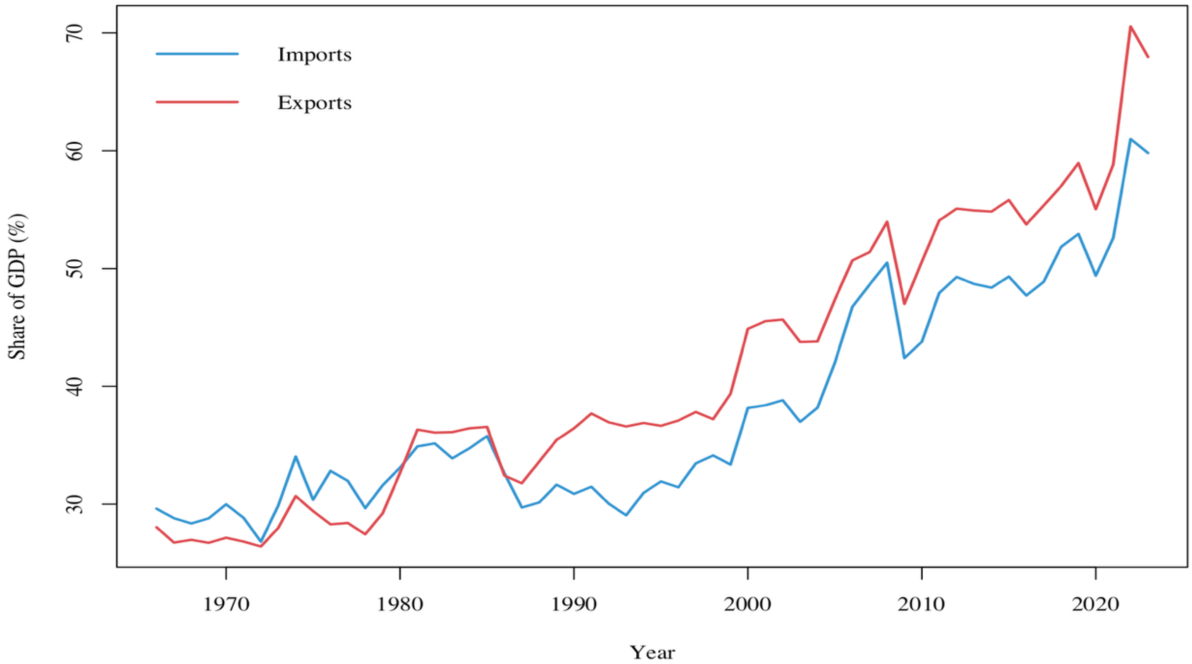
The obtained findings will in the subsequent section be evaluated in a comparative analysis. The data period, on which the model is estimated, is changed to investigate the robustness of the results.

6.5 Empirical AIDS models (1973-2023)

To determine whether the estimated price effects are reliant on the duration of the data period, the original data will be modified. The first seven years will be removed from the data. Following this, an additional AIDS model for each industry, identical in specification to the one previously estimated, will be estimated based solely on data ranging from 1973-2023. By restricting the data from 1973-2023, it allows for an examination of whether the price effects are highly affected by the preceding years (1966-1972).

The selection of 1973 as the separating year is chosen because Denmark entered the European Economic Community (EEC), the predecessor to the European Union. The entry allowed access to a large common market, where tariffs and other trade barriers with member states were eliminated, thereby enhancing trade flows and economic integration (European Parliament, 2024). The importance of entry into the EEC for Danish trade can be inferred from Figure 23 below, which depicts Danish imports and exports of goods and services as a share of GDP from 1966 to 2023. In the year 1973, a spike in both imports and exports occurred, with a positive trend for the remaining period. This visual evidence underscores the positive impact of the EEC membership on Denmark's trade and therefore, the integration of Denmark into the global economy.

Figure 23: Imports and Exports of goods and services as a Share of GDP (1966-2023)



Source: Compiled by the authors by using data from the World Bank Group (2025a, 2025b)

The estimates from the AIDS models covering the period 1973 to 2023 are presented in Appendix 11.4. The following sections will only focus on the cross-price effects for each of the five industries. A comparative analysis will be conducted between the estimates obtained for the shorter sample (1973-2023) and the original sample (1966-2023) to evaluate whether the time frame has a significant impact on the estimates.

In the comparative analysis below, the mean values of input demand shares for the short sample (1973-2023) are consistent with the previously estimated mean values of input demand shares for the original sample (1966-2023). As the deviations are limited, the differences will not be accounted for. Therefore, the comparative analysis will only focus on whether the magnitude of the cross-price effects becomes stronger or weaker. All average input demand shares for both samples are presented in Appendix 11.6.

Building on this, the next section will conduct a comparative analysis of the obtained results for the Pharmaceutical industry. Hereafter, the same analysis is performed for the remaining four industries.

6.5.1 The Pharmaceutical industry

This section will present the cross-price effects obtained from both the short and original sample for the Pharmaceutical industry to highlight any notable differences.

The reported cross-price effects reflect the effect of a change in the price of imported inputs on the input demand share of their domestic counterparts. Due to the symmetry restriction of the AIDS model, the reverse effect also holds.

Table 10: Comparison of cross-price effects for the Pharmaceutical industry

	Original sample (1966-2023)	Shorter sample (1973-2023)
Imported Pharmaceuticals (log(pim1)) → Domestic Pharmaceuticals (w1)	0.204***	0.248***
Imported Food products etc. (log(pim2)) → Domestic Food products etc. (w2)	-0.189***	0.001
Imported Transportation (log(pim3)) → Domestic Transportation (w3)	-0.024	-0.026
Imported IT & Electronics (log(pim4)) → Domestic IT & Electronics (w4)	-0.046*	-0.090***
Imported 'Other industries' (log(pim5)) → Domestic 'Other industries' (w5)	0.410**	0.327*

Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

Comparing the cross-price effects between the price of imported pharmaceuticals and the input demand share of domestic pharmaceuticals, both effects are positive and statistically significant at a 0.1 percent significance level. The positive value implies substitutability. The magnitude is greater in the shorter sample (0.248) compared to the original sample (0.204). This result indicates a slightly strengthened degree of substitution between imported and domestic pharmaceuticals in the period following Denmark's entry into the EEC. The stronger substitutability can be explained by the harmonization of standards, which was created within the union. Furthermore, the membership ensured access to a large common market, which increased the number of competitors and thereby facilitated substitution.

The cross-price effect between the price of imported food products etc., and the input demand share of domestic food products etc., shifts from a statistically significant negative effect, indicating complementarity, to a value close to zero and loses its statistical significance. A reason for the effect to become statistically insignificant in the shorter sample may be because the shorter period contains fewer observations, which can lead to greater statistical uncertainty (Woolridge, 2012, p. 136).

The cross-price effect between the import price of transportation and the input demand share for domestic transportation is negative for both sample periods, -0.024 and -0.026, and statistically insignificant. Given the statistical insignificance of the estimated coefficients in both samples, it is not possible to infer a meaningful relationship between the import price of transportation and the domestic input demand share.

Conversely, the cross-price effects between the import price of IT & Electronics and the domestic input demand share for the same industry are both statistically significant. Both effects are negative, implying complementarity. The magnitude is larger in the short sample (-0.090) and more statistically significant compared to the original sample (-0.046). The coefficient from the short sample is statistically significant at a 0.1 percent significance level, whereas the coefficient from the original sample is statistically significant at a 5 percent significance level. This result suggests a weak complementary relationship that has become stronger after Denmark entered the EEC in 1973 and suggests a degree of technological dependence between domestic and imported IT & Electronics within the Pharmaceutical industry. Both the membership of EEC, increased globalization, and further technological integration may explain the stronger effect in the short sample. With time, production processes have become more complex, but also more reliant on foreign markets through integrated global supply chains, thereby possibly making domestic and imported IT & Electronics inputs less substitutable. Instead, it has created a joint dependence of the two inputs in the production process (The Danish National Bank, 2024, p. 24).

The cross-price analysis for the import price of inputs from 'Other industries' and the domestic input demand share from 'Other industries' reveals a substitution pattern across the original sample (0.410) and the short sample (0.327). There is a slight decrease in the value in the shorter sample. The slightly weaker responsiveness in the more recent period is challenging to draw conclusions about because the industry contains many different industries in Denmark. These industries are likely to react to price changes in very different ways, which makes it hard to generalize the shift in the effect value.

6.5.2 The Food products, beverages, and tobacco industry

This section presents the cross-price effects obtained from both the short and original sample for the industry of Food products etc., to highlight any notable differences.

Table 11: Comparison of cross-price effects for the Food products etc. industry

	Original sample (1966-2023)	Shorter sample (1973-2023)
Imported Pharmaceuticals (log(pim1)) → Domestic Pharmaceuticals (w1)	-0.004	-0.007*
Imported Food products etc. (log(pim2)) → Domestic Food products etc. (w2)	-0.043(·)	-0.043
Imported Transportation (log(pim3)) → Domestic Transportation (w3)	-0.007	-0.006
Imported IT & Electronics (log(pim4)) → Domestic IT & Electronics (w4)	-0.002	-0.006
Imported 'Other industries' (log(pim5)) → Domestic 'Other industries' (w5)	-0.024	-0.005

Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

Starting with the cross-price effects between the import price of pharmaceuticals and the domestic input demand share for pharmaceuticals, both coefficients are negative and close to zero. The complementary relationship suggests that domestic and imported inputs are used jointly in the production in the Food product etc. industry. The coefficient for the short sample (-0.007) is stronger and becomes statistically significant at the 5 percent significance level compared with the original sample (-0.004), which is not statistically significant.

The cross-price effects between the imported price of food products etc., and the domestic input demand share for the same industry are similar, except that the coefficient is statistically significant at a 10 percent significance level for the original sample and statistically insignificant for the short sample. Due to the lack of consistent statistical significance across samples, it is difficult to draw conclusions about the estimates. A reason for the effect to become statistically insignificant in the shorter sample may be because the shorter period contains fewer observations, which can lead to greater statistical uncertainty.

The remaining cross-price effects observed in the table above, are all statistically insignificant. Therefore, it is not possible to rely on the results obtained for the following industries; Transportation, IT & Electronics, and 'Other industries', regardless of which sample is considered.

Overall, Denmark's entry into the EEC did not significantly change the cross-price dynamics within the Food products etc. industry. However, again it must be noted that nearly all of the coefficients are statistically insignificant.

6.5.3 The Transportation industry

This section presents the cross-price effects obtained from both the short and original sample for the Transportation industry to highlight any notable differences.

Table 12: Comparison of cross-price effects for the Transportation industry

	Original sample (1966-2023)	Shorter sample (1973-2023)
Imported Pharmaceuticals (log(pim1)) → Domestic Pharmaceuticals (w1)	0.007	0.005
Imported Food products etc. (log(pim2)) → Domestic Food products etc. (w2)	0.004	-0.000
Imported Transportation (log(pim3)) → Domestic Transportation (w3)	0.050***	0.050***
Imported IT & Electronics (log(pim4)) → Domestic IT & Electronics (w4)	0.035***	0.039***
Imported 'Other industries' (log(pim5)) → Domestic 'Other industries' (w5)	-0.014	-0.059

Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

Table 12 reveals statistically insignificant cross-price effects for pharmaceuticals, food products etc., and 'Other industries' for both the short and original sample.

Comparing the cross-price effects between the price of imported transportation and the input demand share of domestic transportation, both effects are positive, have the same value (0.050), and are statistically significant at a 0.1 percent significance level. The magnitude of the effects implies stable substitutability between domestic and imported inputs from this industry. The persistent effect across the two samples suggests that Denmark's entry into the EEC in 1973 has not had a substantial direct impact on the cross-price effects for domestic versus imported transportation inputs.

The cross-price effects between the import price of IT & Electronics and the domestic input demand share for the same industry, are both positive and statistically significant at a 0.1 percent significance level. The magnitude is slightly greater in the short sample (0.039) compared to the original sample (0.035). The result implies a marginally strengthened degree of substitution between domestic and imported inputs from the IT & Electronics industry in the period following Denmark's entry into the EEC. The increase in substitutability might reflect that the entry into a large common market increased the number of competitors, thereby facilitating substitution between imported and domestic inputs.

6.5.4 The IT & Electronics industry

This section presents the cross-price effects obtained from both the short and original samples for the IT & Electronics industry to highlight any notable differences.

Table 13: Comparison of cross-price effects for the IT & Electronics industry

	Original sample (1966-2023)	Shorter sample (1973-2023)
Imported Pharmaceuticals (log(pim1)) → Domestic Pharmaceuticals (w1)	-0.017***	-0.010(·)
Imported Food products etc. (log(pim2)) → Domestic Food products etc. (w2)	-0.012***	-0.003
Imported Transportation (log(pim3)) → Domestic Transportation (w3)	0.009*	0.006(·)
Imported IT & Electronics (log(pim4)) → Domestic IT & Electronics (w4)	-0.072*	-0.052
Imported 'Other industries' (log(pim5)) → Domestic 'Other industries' (w5)	-0.090**	-0.090*

Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The cross-price effects between the import price of pharmaceutical inputs and the domestic input demand share for the same category are both negative and statistically significant. The magnitude of the two effects varies. The coefficient for the original sample (-0.017) is slightly stronger compared to the coefficient of the short sample (-0.010). In addition, the coefficient for the original sample is more statistically significant (0.1 percent) compared to the short sample (10 percent). Both effects indicate signs of a complementary relationship. However, as stated in section 6.4.4, the pharmaceutical inputs constitute a minimal share of total inputs used in the IT & Electronics industry, thereby explaining the small magnitudes. Therefore, the effects have a minimal impact on the import dependence within this industry.

The cross-price effect between the import price of food products etc. and the domestic input demand share of the same industry shifts from being statistically significant at a 0.1 percent significance level in the original sample to being statistically insignificant in the short sample. Furthermore, the magnitude of the effect decreases. This suggests a loss of statistical confidence in concluding whether a relationship exists. This finding may be due to the reduced number of observations, or it may suggest a weakening or change in the underlying economic relationship in recent decades. As stated in section 6.4.4, the inputs of food products etc. also constitute a minimal share of total inputs used in the IT & Electronics industry.

The same tendency, where the effect becomes less statistically significant, can be observed for the price effect between the import price of transportation inputs and the domestic input demand share of the same industry. The effect for the original sample (0.009) is stronger and statistically significant at a 5 percent significance level compared to the effect for the shorter sample (0.006), which is only statistically significant at a 10 percent significance level. The value of the effects indicates substitutability that has become slightly weaker after 1973. The weaker relationship might indicate increased specialization within the industry.

The cross-price effect for IT & Electronics shifts from being stronger (-0.072) and statistically significant at a 5 percent significance level in the original sample to being weaker (-0.052) and statistically insignificant for the short sample. Both coefficients are negative, thereby indicating a complementary relationship. This finding may be due to the reduced number of observations.

The cross-price effects between the import price of inputs from 'Other industries' and the domestic input demand share for the same industry have the same value (-0.090), but the effect for the original sample is more statistically significant (1 percent) compared to the one for the short sample (5 percent). The effects indicate a complementary relationship between domestic and imported inputs from 'Other industries'. Even though the effect has become less statistically significant, the magnitude is stable, thereby indicating a relatively consistent relationship across the two sample periods.

6.5.5 'Other industries'

This section presents the cross-price effects obtained from both the short and original sample for 'Other industries' to highlight any notable differences.

Table 14: Comparison of cross-price effects for 'Other industries'

	Original sample (1966-2023)	Shorter sample (1973-2023)
Imported Pharmaceuticals (log(pim1)) → Domestic Pharmaceuticals (w1)	-0.005*	-0.002
Imported Food products etc. (log(pim2)) → Domestic Food products etc. (w2)	0.006	-0.003
Imported Transportation (log(pim3)) → Domestic Transportation (w3)	0.019***	0.018***
Imported IT & Electronics (log(pim4)) → Domestic IT & Electronics (w4)	-0.009(·)	-0.010(·)
Imported 'Other industries' (log(pim5)) → Domestic 'Other industries' (w5)	-0.094***	-0.110***

Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

The cross-price effect between the import price of pharmaceutical inputs and the input demand share of domestic pharmaceuticals shifts from being statistically significant at a 10 percent significance level in the original sample to being statistically insignificant in the shorter sample. As suggested earlier on, this may be because the sample size is shorter, thereby leading to greater statistical uncertainty. As stated in section 6.4.5, the inputs of pharmaceuticals constitute a minimal share of total inputs used in 'Other industries', so the effects have a minimal impact on the import dependence within this industry.

The cross-price effect between the import price of food products etc. and the input demand share of domestic food products etc. is found to be nearly zero across both the original (0.006) and shorter (-0.003) sample periods. It should be noted that the signs of the effects change between the two periods. However, the estimates are statistically insignificant for both periods.

The cross-price effect between the import price of transportation inputs and the input demand share of domestic transportation remains almost the same with a coefficient of 0.019 for the original sample and 0.018 for the shorter sample period. Both estimates are statistically significant, suggesting a substitution effect. Therefore, this indicates that Denmark's entry into the EEC has had no substantial effect on this relationship.

Next, the cross-price effects between the import price of IT & Electronics and the domestic input demand share for the same industry, are similar in magnitude. The cross-price effect for the short sample (-0.010) is slightly stronger compared to the effect for the original sample (-0.009). Both coefficients are statistically significant at a 10 percent significance level, thereby suggesting a consistent complementary relationship despite Denmark's entry into the EEC in 1973. As stated in section 6.4.5, the inputs of IT & Electronics constitute a minimal share of total inputs used in 'Other industries'.

Lastly, comparing the cross-price effects between the import price of inputs from 'Other industries' and the domestic input demand share for the same industry, across the two sample periods, both are negative and statistically significant at a 0.1 percent significance level. The coefficient from the short sample (-0.110) is slightly stronger compared to the effect of the original sample (-0.094), thereby both suggesting a complementary relationship. The stronger relationship in the short sample might be explained by a greater interconnectedness and dependency on specific imported inputs within this broad 'industry' after 1973. This could reflect that the European supply chain for 'Other industries' has become more specialized and more integrated with the Danish supply chains. However, again it must be mentioned that it is difficult to draw clear conclusions for this industry due to the complexity and aggregation level of the category of 'Other industries'.

6.5.6 Sub-conclusion: Comparative analysis

From the conducted comparative analysis, it can be concluded that the exclusion of the first seven years of data has had a limited effect on the estimated price effects. This is because the estimated coefficients for the five industries have not changed substantially. However, the findings for the following industries: Food products etc., Transportation, and 'Other industries', reveal smaller changes compared with the two remaining industries. The result indicates that Denmark's entry into the EEC and the increased globalization and trade hereafter have had a limited impact on the relationships between prices and the input demand shares within each of these three industries. This observation suggests a greater robustness in the general price sensitivity for the three industries regarding their choice between domestic and imported inputs, despite the division of the data.

In contrast, the industries of Pharmaceuticals and IT & Electronics show signs of greater price sensitivity as the magnitude of the effects has changed to a higher degree. This might indicate that the industries of both Pharmaceuticals and IT & Electronics are more affected by the exclusion of the first seven years of data. Within the Pharmaceutical industry, the substitution relationship between imported and domestic pharmaceuticals has increased, while the substitution relationship between imported and domestic 'Other industries' has decreased. However, as the magnitudes of the cross-price effects continue to indicate notable substitutability in both cases, the overall pattern observed within the Pharmaceutical industry remains consistent. Within the IT & Electronics industry, the shorter data period has resulted in cross-price effects being closer to zero. This highlights a slightly greater import dependence within the industry.

In addition, the statistical significance has also changed for a number of coefficients, thereby changing the reliability of the estimates across both samples. For instance, the cross-price effect within the Pharmaceutical industry for food products etc. has gone from being negative and highly statistically significant to being statistically insignificant, thereby creating uncertainty about the true effect. The same tendency is observed within the IT & Electronics industry for both the cross-price effects for food products etc. and IT & Electronics. This shift is also observed within 'Other industries' for pharmaceutical inputs. The increased number of statistically insignificant coefficients, when the sample period is shortened, might be a result of fewer data observations, thus creating greater statistical uncertainty.

In connection to the earlier established Danish trade dependence, the findings in the comparative analysis emphasize the notion that the Danish economy is import dependent. The results have remained consistent for the industries of Food products etc., Transportation, and 'Other industries'. As mentioned above, the magnitudes of the price effects within Pharmaceuticals and IT & Electronics have changed for the shorter sample, but the overall conclusion regarding import dependence within each industry remains the same. Therefore, it can be derived that the overall Danish economy is dependent on imports.

The next section will ensure that the estimated results from all AIDS models fulfill the theoretical restrictions that an AIDS model is required to satisfy. Therefore, the following section will test the adding-up, symmetry, and homogeneity restrictions.

6.6 Test of theoretical restrictions

After estimating the AIDS models, it is important to test the robustness of the results. This section will present diagnostic tests that investigate the theoretical conditions of adding-up, homogeneity, and symmetry. Fulfilling the three restrictions ensures that the model is consistent with the principles of consumer and demand theory (Deaton & Muellbauer, 1980). The tests are performed for all the estimated AIDS models for both the original data period (1966-2023) and the shorter data period (1973-2023). For the purpose of demonstration, this section will only consider the diagnostic tests for the Pharmaceutical industry for the original data period from 1966-2023. Appendix 11.5 contains the remaining diagnostic tests for all the other AIDS models.

To ensure that the **adding-up** restriction is satisfied, the sum of all input demand shares must be equal to one:

$$\sum_{i=1}^{n} \omega_i = 1 \qquad \text{(equation 22)}$$

This restriction is fulfilled, as the previously presented stacked bar plots of the input demand shares illustrate that, for each individual industry, the sum of all input demand shares equals one. This is illustrated by the figures presented in section 5.4, where it is evident that all input demand shares sum to 1 for each point in time, thereby fulfilling the adding-up restriction.

To test for symmetry, the matrix of price effects is examined. The estimated 10-by-10 matrix of the price effects for the Pharmaceutical industry is depicted in the following matrix. It is shown in a larger format in Table 8:

Table 15: Price effects of the Pharmaceutical industry

	Dom Pharmaceuticals log(py1)	Dom Foods etc. log(py2)	Dom Transportation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharmaceuticals log(pim1)	Im Food etc. log(pim2)	Im Transportation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0674·	0.0198	-0.0794***	-0.0383*	-0.0241	0.2039***	-0.0410	0.0700*	-0.0620**	0.0185
Dom Food etc. (w2)	0.0198	0.2586**	-0.0239	-0.0580*	-0.3917***	0.0279	-0.1889***	0.0278	0.0391	0.2895***
Dom Transportation (w3)	-0.0794***	-0.0239	-0.0457	-0.0363**	-0.1891***	0.3341***	-0.0806**	-0.0235	-0.0257	0.1702**
Dom IT Electronics (w4)	-0.0383*	-0.0580*	-0.0363**	0.0312	0.0433	0.0049	0.0228	0.0329	-0.0462*	0.0438
Dom Other industries (w5)	-0.0241	-0.3917***	-0.1891***	0.0433	0.3406*	-0.0008	-0.4216***	0.2385***	-0.0051	0.4099**
Im Pharmaceuticals (w6)	0.2039***	0.0279	0.3341***	0.0049	-0.0008	-0.1158	0.0663	-0.4192***	0.1642***	-0.2654*
Im Food etc. (w7)	-0.0410	-0.1889***	-0.0806**	0.0228	-0.4216***	0.0663	-0.1099**	0.0515	-0.0078	0.7093***
Im Transportation (w8)	0.0700*	0.0278	-0.0235	0.0329	0.2385***	-0.4192***	0.0515	0.1448**	0.0086	-0.1315·
Im IT Electronics (w9)	-0.0620**	0.0391	-0.0257	-0.0462*	-0.0051	0.1642***	-0.0078	0.0086	-0.0347·	-0.0304
Im Other industries (w10)	0.0185	0.2895***	0.1702**	0.0438	0.4099**	-0.2654*	0.7093***	-0.1315·	-0.0304	-1.2140***

Signif. Codes: (***) 0.001; (**) 0.01; (*) 0.05; (·) 0.1

Source: Compiled by the authors using IO-data from Statistics Denmark (2025a)

Each row corresponds to a share equation ($\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7, \omega_8, \omega_9, \omega_{10}$), and each column represents the logged price regressors $ln(py_1)$, $ln(py_2)$, $ln(py_3)$, $ln(py_4)$, $ln(py_5)$, $\ln(pm_1)$, $\ln(pm_2)$, $\ln(pm_3)$, $\ln(pm_4)$, and $\ln(pm_5)$.

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j \qquad \text{(equation 24)}$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is 0.0198 and the effect of $\ln(py_1)$ on ω_2 is also 0.0198.
- The effect of $ln(py_3)$ on ω_1 is -0.0794 and the effect of $ln(py_1)$ on ω_3 is also -0.0794.
- The effect of $\ln(py_3)$ on ω_2 is -0.0239 and the effect of $\ln(py_2)$ on ω_3 is also -0.0239.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i \qquad \text{(equation 23)}$$

By summing across each row, the following is retrieved:

$$
\begin{aligned}
w_1: \quad & (-0.0674) + (0.0198) + (-0.0794) + (-0.0383) + (-0.0241) + (0.2039) \\
& + (-0.0410) + (0.0700) + (-0.0620) + (0.0185) = 0 \\
w_2: \quad & (0.0198) + (0.2586) + (-0.0239) + (-0.0580) + (-0.3917) + (0.0279) \\
& + (-0.1889) + (0.0278) + (0.0391) + (0.2895) = 0 \\
w_3: \quad & (-0.0794) + (-0.0239) + (-0.0457) + (-0.0363) + (-0.1891) + (0.3341) \\
& + (-0.0806) + (-0.0235) + (-0.0257) + (0.1702) = 0 \\
w_4: \quad & (-0.0383) + (-0.0580) + (-0.0363) + (0.0312) + (0.0433) + (0.0049) \\
& + (0.0228) + (0.0330) + (-0.0462) + (0.0438) = 0 \\
w_5: \quad & (-0.0241) + (-0.3917) + (-0.1891) + (0.0433) + (0.3405) + (-0.0008) \\
& + (-0.4216) + (0.2385) + (-0.0051) + (0.4099) = 0 \\
w_6: \quad & (0.2039) + (0.0279) + (0.3341) + (0.0049) + (-0.0008) + (-0.1158) \\
& + (0.0663) + (-0.4192) + (0.1642) + (-0.2654) = 0 \\
w_7: \quad & (-0.0410) + (-0.1889) + (-0.0806) + (0.0228) + (-0.4216) + (0.0663) \\
& + (-0.1099) + (0.0515) + (-0.0078) + (0.7093) = 0 \\
w_8: \quad & (0.0700) + (0.0278) + (-0.0235) + (0.0330) + (0.2385) + (-0.4192) \\
& + (0.0515) + (0.1445) + (0.0086) + (-0.1315) = 0 \\
w_9: \quad & (-0.0620) + (0.0391) + (-0.0257) + (-0.0462) + (-0.0051) + (0.1642) \\
& + (-0.0078) + (0.0086) + (-0.0347) + (-0.0304) = 0 \\
w_{10}: \quad & (0.0185) + (0.2895) + (0.1702) + (0.0438) + (0.4099) + (-0.2654) \\
& + (0.7093) + (-0.1315) + (-0.0304) + (-1.2140) = 0
\end{aligned}
$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the estimated matrix containing the price effects for the Pharmaceutical industry respects both the adding-up, symmetry, and homogeneity properties required by demand theory. This validates the robustness and correctness of the AIDS model. The same applies to all the other estimated AIDS models – both the estimated AIDS models with the short and original sample period. Given that the adding-up restriction is met, as shown by the plots in section 5.4, Appendix 11.1 and 11.2 will only present the tests of symmetry and homogeneity for the remaining industries.

All results are now obtained, and they all satisfy the theoretical restrictions. Therefore, the next section seeks to discuss the methodology and the obtained results.

7. Discussion

Based on the above findings, this section seeks to discuss the robustness of the obtained results, focusing on the strengths and weaknesses of the estimation process and the choices made. Hereafter, the chosen industries and the aggregation level are discussed. Following this, the derived import dependence is related to the countries from which Denmark imports the most. This is done to highlight the true degree of Danish import dependence, as the origin of the inputs is an important aspect when discussing import dependence. The final section addresses the study's limitations and outlines how future research may expand or improve upon the current analysis.

7.1 Robustness of the results

The findings from the analysis provide insight into the underlying demand relationship for domestic versus imported inputs within the five chosen industries in the Danish production structure. This section will discuss the robustness of the obtained results, highlighting the reliability of the results.

The analysis of the Danish production structure builds on the full set of available input-output data from Statistics Denmark, which provides a solid empirical foundation for the analysis. As the analysis builds on all available data, it minimizes the risk of drawing conclusions from a selective data sample. Therefore, there are no important time periods that have been excluded, which underscores that the model captures the key economic relationships that are present in the data. However, as the analysis is based on the full available input-output data, there is a risk that it contains outliers and structural breaks, which could potentially bias the results.

The robustness of the obtained results is further supported by the shortening of the sample period. This can be attributed to the fact that the exclusion of the first seven observations (1966-1972) revealed consistent estimates across both sample periods. The fact that the model yields similar estimates when the first seven years are excluded increases confidence in its reliability and suggests that the results are not sensitive to the inclusion of specific time periods. However, it should be acknowledged that other subperiods may affect the results in ways that are not captured by this specific robustness check. The observed minimal divergence of estimates might be explained by the choice of separation year. The choice of separation year may mark a shift in demand patterns and relationships between variables, thereby affecting the obtained result. However, it should be noted that only seven years have been removed from the original dataset which has a total count of 58 years. Therefore, there is an overweight of years that are present in both sample periods, 51 years. For the removal of seven years to have a great impact on the overall result, a strong tendency should be observed in the data before 1973.

The absence of significant differences after splitting the sample in 1973 could also suggest that other later significant global events than Denmark's entry into the EEC might have had a greater impact on international trade patterns and therefore domestic demand patterns, which will be more reflected in the data period. All else equal, it must be assumed that splitting the data in a later year will result in a shorter data period that will be more heavily influenced by trade due to the expansion of globalization. Therefore, another option could be to select the year 1995 as the sample split year due to the establishment of the World Trade Organization (WTO). As globalization rose and international trade expanded, increasingly moving beyond the exchange of tangible goods to also include services and intellectual property, this shift marked a significant evolution in international trade (European Parliament, 2024). Consequently, the application of the year 1995 as the split year could also be an option. However, using 1995 as separation year would result in removing nearly half of the observations, thereby minimizing the sample data to contain 29 years (1995-2023). This could potentially have several important implications. First, a reduced sample size will result in lower statistical power, which will decrease the ability to obtain statistically significant effects. Moreover, it might be challenging to reliably identify the underlying economic structure within a shorter timeframe. Therefore, the conclusions drawn from analyses based on shorter samples are often less robust (Woolridge, 2012, p. 136). Recognizing the implications of sample size limitations, the 1973 division was selected as the basis for the comparative analysis. This, combined with the consistent estimates across both sample periods, reinforces the robustness of the obtained results.

Further evidence of the robustness of the results is provided by the fulfillment of the theoretical restrictions. Both the AIDS models estimated using data from 1966-2023 and the models estimated using data from 1973-2023 fulfill the adding-up, homogeneity, and symmetry restrictions. This ensures that the models are consistent with the principles of consumer and demand theory, thereby highlighting their robustness.

Even though the models fulfill the theoretical restrictions, indicating that the models are theoretically well-specified, some of the obtained own-price effects contradict standard economic demand theory. This results from some of the own-price effects being positive. One would expect the inverse finding, where an increase in price leads to lower demand. Therefore, it demonstrates that while the model structure is robust in theory, some of the estimated effects do not fully align with the theoretical expectations. Hence, it points to potential challenges in the empirical applications.

In the empirical applications, it is found that the price indices do not satisfy the stationarity constraint. However, it must be assumed that the input demand shares are stationary since they are bound to fluctuate between 0 and 1. Therefore, they can only fluctuate to a limited degree. Despite that the price indices exhibit non-stationarity, it must be assumed that the AIDS models do not exhibit spurious regression. This is because the price indices are constructed from the same input-output data as the input demand shares. Therefore, the variables are derived from the same data, thereby indicating that they are empirically linked and not independent processes (Enders, 2014, pp. 195-196). Accordingly, the obtained results can be regarded as reliable.

As mentioned, the estimated AIDS models utilize historical data from 1966 to 2023. In the analysis, average input demand shares are calculated and related to the cross-price effects to investigate the price sensitivity of the inputs. Hereafter, the findings for each industry's price sensitivity and price effects are used to determine the import dependence of each industry. To assess whether the conclusion regarding each industry's import dependence remains valid in the most recent data available, the composition of inputs in 2023, is compared to the mean values. To assess the overall import dependence of the Danish economy, the importance of each industry is assessed based on its share of the Danish economy in 2023. This approach assumes that historical patterns obtained from the AIDS models remain meaningful when applied to today's production structure. However, this might not reflect the actual economic situation, as the economy in 2023 can deviate from the historical observed patterns. However, if the structural patterns underlying the historical data still apply today, a comparison with the most recent year must be assumed to be valid. Therefore, the applied approach provides insight into the import dependence today, but it should be interpreted with caution.

In continuation of the above, it is valuable that the conclusions obtained for the import dependence within the Danish economy are built on the most recent data from Statistics Denmark, which spans up to 2023. However, access to data up to the present day, 2025, would be more desirable, as it would enable an even more accurate and current depiction of the Danish production structure. This arises from the fact that the period after Donald Trump's election as president of the United States of America in 2025 has been characterized by volatility and uncertainty in global markets. As mentioned earlier, Donald Trump has imposed tariffs on all countries in 2025, thereby potentially affecting the flow of goods and services captured in future input-output tables. Tariffs are taxes imposed on imported goods, hence increasing the cost of imports within the country that imposes the tariffs (European Council, 2025). According to standard economic demand theory, a price increase will result in lower demand. The imposed tariffs on goods stemming from the European Union and therefore Denmark might reduce demand for Danish goods and services, leading to negative effects on Danish exports. This could potentially change the input structure of the individual industries in Denmark, as their demand for production inputs is closely tied to the overall demand for their final goods. As the input-output data from Statistics Denmark is reported on an annual basis, it is not yet possible to reflect these events in this analysis.

In relation to the above-mentioned, a study performed by Azzimonti et al. (2025) found that the tariffs the U.S. imposed on imports from China in 2018 and 2019 significantly disrupted supply chains and increased the input costs for American businesses. A significant finding was that many companies responded to the American tariffs by shifting supply chains to other countries. By shifting supply chains to other countries, the composition of inputs may change. This is because the change of import country/supplier can lead to changes in price, quality, and logistics. This can affect the quantity, and the type of inputs imported, thereby affecting the input demand shares of the industries. If a similar trend materializes for Denmark in 2025 due to Donald Trump's imposition of tariffs and the possibility of the EU implementing retaliatory tariffs, it could possibly change the input-output structures in the future.

Taken together, the above suggests that while several factors both support and challenge the robustness of the results, they are overall considered robust. The following section discusses the assumptions underlying these results in relation to the selection of the five aggregated industries.

7.2 Industry choice

This section will now turn to a discussion of the five selected industries used in the analysis: i) Pharmaceuticals, ii) Food products, beverages, and tobacco, iii) Transportation, iv) IT & Electronics, and v) Other industries. As previously mentioned, the original input-output data from Statistics Denmark consists of 69 industries. Therefore, a high degree of aggregation has been necessary to end up with the selected five industries. It is mainly the industries of Transportation, IT & Electronics, and 'Other industries' that are highly aggregated, as the two remaining industries consist of only one sub-industry. In this section, the selected industries and the aggregation level will be discussed, focusing on both the advantages and disadvantages of the methodology.

Starting with the advantages, the high aggregation level allows for a macroeconomic perspective. The broad categories provide an overview of the general tendencies within the Danish economy, focusing on industry trends rather than individual sectors. This aligns with the research question investigating the import dependence within the Danish production structure.

Moreover, the aggregation level contributes to greater simplicity in terms of data management and model estimation, ensuring a more manageable presentation and discussion of the results across industries. This methodology results in reduced complexity and makes comparative analysis more straightforward due to the lower number of price effects that must be compared.

Conversely, the high degree of aggregation is also associated with several limitations. The greatest disadvantage is the loss of detail and specific dynamics within the individual industries. It must be assumed that the aggregated industries contain varying price effects between different sub-industries and input groups. This will affect the overall price effect for the industry and thereby hide the underlying economic mechanisms for more narrowly defined sub-industries. The high degree of aggregation also creates a risk, as the estimated price effects at the aggregated level may not be accurate for individual firms or more specific product groups. Therefore, it should be noted that the interrelationships between the selected industries could be more related. From section 5.4, the plots depicting the input demand shares for the five industries reveal low interconnectedness between some of the industries. For example, the Transportation industry uses a minimal share of inputs from both Pharmaceuticals and Food products etc. The interrelationship between industries would be more present if the industries were chosen based on one single criterion. For example, if the focus was solely on the Pharmaceutical industry and its most important supplying industries. This would ensure a more in-depth analysis of the flows and interconnectedness within this industry. This, however, constrains the potential to generalize the findings to wider economic tendencies, which again is the overall goal of the thesis.

The collection of industries within ‘Other industries’ is a particularly broad category. This category is created to ensure an overall representation of the Danish economy. However, the focus is on the other four industries, as argued in section 5.1. The broadness of ‘Other industries’ creates uncertainty about the internal dynamics. Therefore, it is important to be particularly careful when interpreting the overall effects of this industry.

From the above, it can be deduced that the chosen number of industries and their aggregation level come with both advantages and limitations.

7.3 Risk of import dependence

The empirical analyses carried out in this report find a degree of import dependence within the Danish economy. Nonetheless, it should be noted that the input-output data that has laid the foundation for the analysis fails to capture the specific countries that the Danish economy relies on the most. The origin of the imported inputs is an important aspect when discussing import dependence. This is because not all trade partners are associated with the same level of risk. Denmark is a member of the EU, where the Single Market and the Customs Union reduce barriers to trade between the member countries (Folketinget, 2025a). Furthermore, it applies that the EU conducts trade policy on behalf of Denmark and the rest of the union countries. As a result, trade within the EU involves less risk compared to trade with countries outside this membership. It applies that around 80 percent of Danish international trade is conducted within the Single Market or as a part of one of the EU's trade agreements. Most of the remaining 20 percent of trade is regulated by the rules of WTO (Folketinget, 2025b).

At year-end 2023, figures from Statistics Denmark (2025b) reveal that 55.44 percent of Danish imports originated from the European Union, 10.57 percent were sourced from the United States of America, and China accounted for 4.26 percent of total imports. Therefore, it can be inferred that most Danish imports originate from a strategically reliant trade source, as trade with the European Union must be assumed to be secure due to the common market, common regulation, and political stability. Contrary, inputs imported from countries outside of the European Union can be associated with greater risk. As stated in the introduction, the world is characterized by a high degree of uncertainty because of Donald Trump's protectionist trade policy and general unrest. This in combination with the interdependency of global economies has increased the risk of disruptions of established supply chains, trade flows, and economic activity. Due to this, the former president of the European Central Bank, Mario Draghi, advocates for the importance of reshoring the production of strategically important inputs to the domestic economy or relocating it within the European Union. By doing this, the import dependence will be reduced. However, the implications of securing critical production inputs come at a cost. By diversifying away from countries that have been the cheapest suppliers in the world to producing critical inputs domestically, the production costs will increase (Draghi, 2024a, pp. 6-7). A change in the origin and price of the production inputs will affect the Danish production structure. This is because both factors will affect demand and thereby change the domestic and imported flows within the system.

To sum up, it can be concluded that the Danish economy is dependent on imports. The implications of the import dependence are influenced by the origin of the critical inputs, which is not detailed in the data. If the European Union is the primary supplier of critical inputs, it would be positive for the Danish import dependence. Conversely, if the critical inputs are produced outside of the European Union, greater uncertainty and risk are associated with import dependence. By reshoring the production of critical inputs, the import dependence will be positively affected, but as mentioned, it will come at a cost.

7.4 Limitations and future research

This section will address the main limitations of the analysis conducted in this thesis, followed by suggestions for future research.

In the thesis, only domestic and imported flows for five chosen industries and the final demand categories are included in the input-output data from Statistics Denmark. Therefore, the input-output data does not account for all flows, which include changes in unspecified imports, import duties, commodity taxes, VAT, other production taxes, compensation of employees, gross operating surplus, and mixed income. This focus reflects the overall aim of the thesis, which is to investigate input-based import dependence. Accordingly, the analysis concentrates on domestic and imported input flows, as these are considered the most relevant components for addressing the research question. As a result, not all flows within the Danish economy are included. Future research may consider incorporating all flows to provide a more comprehensive representation of the Danish economy.

Moreover, the estimated AIDS models, used for the analysis of Danish import dependence, are static, which means they capture relationships at one point in time. A static framework of the AIDS models is applied in the analysis due to the complexity associated with estimating and managing a dynamic model. The static framework is appropriate and sufficient for the purpose of analyzing structural relationships at a given point in time, as the focus of this paper is not on the dynamic adjustments of prices. Given the static framework, the models do not account for changes in demand over time. As discussed in section 6.3, factors such as adjustment costs, unexpected real price levels, incorrect expectations, and habit formation may lead to delayed demand responses to price changes, which the static AIDS models fail to capture. To address this limitation, the model could be extended to a dynamic specification. By doing so, the model will be able to capture demand relationships over time that reflect real-life behavior. Future research could advantageously focus on introducing this dynamic structure to enhance the model's ability to explain variations in the data.

The thesis revolves around an input-output analysis of the Danish production structure. In the original input-output data from Statistics Denmark, the Danish economy is divided into 69 individual industries. To keep the analysis manageable, the industries have been aggregated into five separate industries. As discussed in section 7.2, the high degree of aggregation can hide the underlying economic mechanisms of the industries. Therefore, future research could build upon the foundation of this study and expand the model to include both a larger number of industries and more interconnected industries. This could contribute to a more detailed analysis of industry linkages within the Danish production structure.

From the above, it can be concluded that certain limitations were necessary during the execution of the project. These limitations highlight areas where future research may improve, refine, or expand upon the current approach and analysis.

8. Conclusion

This paper developed a static Almost Ideal Demand System (AIDS) model with an Input-Output (IO) framework. The model structure was divided into two blocks: i) the domestic production block, describing total production and production costs for five selected industries, and ii) the final aggregate demand block, which highlights the role of consumption, government spending, investment, inventories, and exports. The industries that have been selected were i) Pharmaceuticals, ii) Food products, beverages, and tobacco, iii) Transportation, iv) IT & Electronics, and v) Other industries. While building the model structure, all the parameters were estimated using annual input-output data from 1966 to 2023 from Statistics Denmark.

We found that the estimated AIDS model correctly captured the underlying demand structures of the Danish production structure. The estimated price effects revealed a varying degree of import dependence across the investigated industries. The Pharmaceutical industry was the least import dependent industry since the primary inputs were characterized as substitutes. The Food products, beverages, and tobacco industry only showed one statistically significant cross-price effect, making it difficult to draw a conclusion. However, the one statistically significant effect showed signs of complementarity and constituted one-fourth of the total expenditure within the industry, thereby highlighting some degree of import dependence. The Transportation industry also revealed a low degree of import dependence, again because of substitutability. The IT & Electronics industry was highly import dependent, which was driven by the complementarity characterizing four of the five estimated cross-price effects. Lastly, 'Other industries' also revealed a high degree of import dependence, again due to complementarity within the primary inputs. Based on this, the Danish economy was found to be highly import dependent. This was because the import dependent industries constituted a total of around 84 percent of the Danish production in 2023. Hence, the majority of the Danish economic output was produced within industries that showed signs of import dependence. By removing the first seven observations and re-estimating the model, the same conclusions were reached regarding the import dependence, thereby indicating robustness of the results.

Therefore, the study concludes presence of import dependence within the Danish production structure. However, given that the majority of Denmark's imports originate from the EU, which is a low-risk and integrated trade-partner, it is challenging to draw definitive conclusions regarding the potential vulnerabilities arising from import dependence. However, if the critical inputs are sourced from outside the EU, they pose a greater risk and vulnerability to the Danish economy.

The research carried out in this paper has provided insights into the import reliance of the production structure of the Danish economy. The developed model offers scope for further research, for instance by incorporating a more detailed industry classification or introducing dynamic features to capture adjustment mechanisms over time. These extensions could contribute to a more comprehensive understanding of the structure of the Danish economy and thereby support future research on structural change and economic vulnerability.

9. Declaration statement

In the preparation of this thesis, assistance was obtained from AI tools, including ChatGPT and Gemini. The assistance has involved coding support, translation, and language refinement, such as rephrasing. While AI tools were used for support, the final content and analysis are entirely authored by the students, Katrine Houmann Jensen and Sofie Hartung Sletskov.

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11. Appendix

11.1 Symmetry restriction

In the estimation of the Almost Ideal Demand System (AIDS) models presented in this paper, the symmetry condition is imposed as a theoretical restriction. Specifically for the AIDS models estimated here with a system of nine equations, this implies that the following symmetry restrictions on the parameters must hold:

$$\begin{array}{llllll}
\gamma_{12}=\gamma_{21}, & \gamma_{18}=\gamma_{81}, & \gamma_{27}=\gamma_{72}, & \gamma_{37}=\gamma_{73}, & \gamma_{48}=\gamma_{84}, & \gamma_{67}=\gamma_{76}, \\
\gamma_{13}=\gamma_{31}, & \gamma_{19}=\gamma_{91}, & \gamma_{28}=\gamma_{82}, & \gamma_{38}=\gamma_{83}, & \gamma_{49}=\gamma_{94}, & \gamma_{68}=\gamma_{86}, \\
\gamma_{14}=\gamma_{41}, & \gamma_{23}=\gamma_{32}, & \gamma_{29}=\gamma_{92}, & \gamma_{39}=\gamma_{93}, & \gamma_{56}=\gamma_{65}, & \gamma_{69}=\gamma_{96}, \\
\gamma_{15}=\gamma_{51}, & \gamma_{24}=\gamma_{42}, & \gamma_{34}=\gamma_{43}, & \gamma_{45}=\gamma_{54}, & \gamma_{57}=\gamma_{75}, & \gamma_{78}=\gamma_{87}, \\
\gamma_{16}=\gamma_{61}, & \gamma_{25}=\gamma_{52}, & \gamma_{35}=\gamma_{53}, & \gamma_{46}=\gamma_{64}, & \gamma_{58}=\gamma_{85}, & \gamma_{79}=\gamma_{97}, \\
\gamma_{17}=\gamma_{71}, & \gamma_{26}=\gamma_{62}, & \gamma_{36}=\gamma_{63}, & \gamma_{47}=\gamma_{74}, & \gamma_{59}=\gamma_{95}, & \gamma_{89}=\gamma_{98}
\end{array}$$

11.2 Homogeneity restriction

In the estimation of the Almost Ideal Demand System (AIDS) models presented in this paper, the homogeneity condition is imposed to ensure that if all prices and income change proportionally, the input demand shares should remain unchanged. In the system of nine equations, this is imposed by:

$$\gamma_{11}+\gamma_{12}+\gamma_{13}+\gamma_{14}+\gamma_{15}+\gamma_{16}+\gamma_{17}+\gamma_{18}+\gamma_{19}=0,$$

$$\gamma_{21}+\gamma_{22}+\gamma_{23}+\gamma_{24}+\gamma_{25}+\gamma_{26}+\gamma_{27}+\gamma_{28}+\gamma_{29}=0,$$

$$\gamma_{31}+\gamma_{32}+\gamma_{33}+\gamma_{34}+\gamma_{35}+\gamma_{36}+\gamma_{37}+\gamma_{38}+\gamma_{39}=0,$$

$$\gamma_{41}+\gamma_{42}+\gamma_{43}+\gamma_{44}+\gamma_{45}+\gamma_{46}+\gamma_{47}+\gamma_{48}+\gamma_{49}=0,$$

$$\gamma_{51}+\gamma_{52}+\gamma_{53}+\gamma_{54}+\gamma_{55}+\gamma_{56}+\gamma_{57}+\gamma_{58}+\gamma_{59}=0,$$

$$\gamma_{61}+\gamma_{62}+\gamma_{63}+\gamma_{64}+\gamma_{65}+\gamma_{66}+\gamma_{67}+\gamma_{68}+\gamma_{69}=0,$$

$$\gamma_{71}+\gamma_{72}+\gamma_{73}+\gamma_{74}+\gamma_{75}+\gamma_{76}+\gamma_{77}+\gamma_{78}+\gamma_{79}=0,$$

$$\gamma_{81}+\gamma_{82}+\gamma_{83}+\gamma_{84}+\gamma_{85}+\gamma_{86}+\gamma_{87}+\gamma_{88}+\gamma_{89}=0,$$

$$\gamma_{91}+\gamma_{92}+\gamma_{93}+\gamma_{94}+\gamma_{95}+\gamma_{96}+\gamma_{97}+\gamma_{98}+\gamma_{99}=0$$

11.3 Estimated AIDS models from 1966 to 2023

11.3.1 Pharmaceuticals

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0674$^{\cdot}$	0.0198	-0.0794***	-0.0383*	-0.0241	0.2039***	-0.0410	0.0700*	-0.0620**	0.0185
Dom Food etc. (w2)	0.0198	0.2586**	-0.0239	-0.0580*	-0.3917***	0.0279	-0.1889***	0.0278	0.0391	0.2895***
Dom Transportation (w3)	-0.0794***	-0.0239	-0.0457	-0.0363**	-0.1891***	0.3341***	-0.0806**	-0.0235	-0.0257	0.1702**
Dom IT Electronics (w4)	-0.0383*	-0.0580*	-0.0363**	0.0312	0.0433	0.0049	0.0228	0.0329	-0.0462*	0.0438
Dom Other industries (w5)	-0.0241	-0.3917***	-0.1891***	0.0433	0.3406*	-0.0008	-0.4216***	0.2385***	-0.0051	0.4099**
Im Pharmaceuticals (w6)	0.2039***	0.0279	0.3341***	0.0049	-0.0008	-0.1158	0.0663	-0.4192***	0.1642***	-0.2654*
Im Food etc. (w7)	-0.0410	-0.1889***	-0.0806**	0.0228	-0.4216***	0.0663	-0.1099**	0.0515	-0.0078	0.7093***
Im Transportation (w8)	0.0700*	0.0278	-0.0235	0.0329	0.2385***	-0.4192***	0.0515	0.1448**	0.0086	-0.1315$^{\cdot}$
Im IT Electronics (w9)	-0.0620**	0.0391	-0.0257	-0.0462*	-0.0051	0.1642***	-0.0078	0.0086	-0.0347$^{\cdot}$	-0.0304
Im Other industries (w10)	0.0185	0.2895***	0.1702**	0.0438	0.4099**	-0.2654*	0.7093***	-0.1315$^{\cdot}$	-0.0304	-1.2140***

11.3.2 Food products, beverages, and tobacco

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0033	-0.0180·	-0.0031	0.0026	0.0407***	-0.0043	0.0021	-0.0164**	0.0032	-0.0036
Dom Food etc. (w2)	-0.0180·	-0.0167	-0.0191	0.0305**	0.0902·	0.0171*	-0.0430·	-0.1231***	0.0520***	0.0301
Dom Transportation (w3)	-0.0031	-0.0191	-0.0015	0.0012	0.0240·	0.0055*	-0.0018	-0.0069	-0.0040·	0.0058
Dom IT Electronics (w4)	0.0026	0.0305**	0.0012	0.0003	-0.0247	-0.0016	-0.0133*	0.0169*	-0.0018	-0.0101
Dom Other industries (w5)	0.0407***	0.0902·	0.0240·	-0.0247	-0.2504***	0.0187*	-0.0015	0.1138***	0.0136	-0.0244
Im Pharmaceuticals (w6)	-0.0043	0.0171*	0.0055*	-0.0016	0.0187*	0.0020	-0.0174***	-0.0102*	0.0010	-0.0108*
Im Food etc. (w7)	0.0021	-0.0430·	-0.0018	-0.0133*	-0.0015	-0.0174***	0.0598**	0.0663***	-0.0443***	-0.0069
Im Transportation (w8)	-0.0164**	-0.1231***	-0.0069	0.0169*	0.1138***	-0.0102*	0.0663***	-0.0634***	-0.0034	0.0264·
Im IT Electronics (w9)	0.0032	0.0520***	-0.0040·	-0.0018	0.0136	0.0010	-0.0443***	-0.0034	0.0022	-0.0184***
Im Other industries (w10)	-0.0036	0.0301	0.0058	-0.0101	-0.0244	-0.0108*	-0.0069	0.0264·	-0.0184***	0.0121

11.3.3 Transportation

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0101	-0.0004	0.0754***	0.0233***	-0.0343*	0.0067	0.0051	-0.0069	0.0062	-0.0649***
Dom Food etc. (w2)	-0.0004	-0.0013	-0.0187***	-0.0238*	0.0178	0.0054	0.0041	-0.0010	0.0034	0.0144
Dom Transportation (w3)	0.0754***	-0.0187***	0.1579***	-0.0131·	-0.0567**	0.0262***	-0.0282***	0.0499***	-0.0374***	-0.1552***
Dom IT Electronics (w4)	0.0233***	-0.0238*	-0.0131·	-0.1053***	0.0766**	-0.0044	0.0128·	-0.0153	0.0345***	0.0146
Dom Other industries (w5)	-0.0343*	0.0178	-0.0567**	0.0766**	0.0335	-0.0343***	-0.0556***	0.0662**	0.0010	-0.0143
Im Pharmaceuticals (w6)	0.0067	0.0054	0.0262***	-0.0044	-0.0343***	0.0082*	-0.0001	0.0062	0.0053	-0.0192*
Im Food etc. (w7)	0.0051	0.0041	-0.0282***	0.0128·	-0.0556***	-0.0001	0.0117	0.0414***	-0.0050	0.0139
Im Transportation (w8)	-0.0069	-0.0010	0.0499***	-0.0153	0.0662**	0.0062	0.0414***	-0.0675***	-0.0003	-0.0726***
Im IT Electronics (w9)	0.0062	0.0034	-0.0374***	0.0345***	0.0010	0.0053	-0.0050	-0.0003	-0.0262***	0.0185
Im Other industries (w10)	-0.0649***	0.0144	-0.1552***	0.0146	-0.0143	-0.0192*	0.0139	-0.0726***	0.0185	0.2649***

11.3.4 IT & Electronics

	Dom Pharmaceuticals log(py1)	Dom Foods etc. log(py2)	Dom Transportation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharmaceuticals log(pim1)	Im Food etc. log(pim2)	Im Transportation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	0.0248*	0.0152**	-0.0080	-0.0639**	0.0152	-0.0172**	-0.0179**	0.0038	0.0365***	0.0114
Dom Food etc. (w2)	0.0152**	0.0134*	-0.0030	-0.0191	-0.0084	-0.0112**	-0.0116**	-0.0008	0.0138*	0.0118
Dom Transportation (w3)	-0.0080	-0.0030	-0.0261***	-0.0203	-0.0036	0.0142***	-0.0065	0.0089*	0.0073	0.0371**
Dom IT Electronics (w4)	-0.0639**	-0.0191	-0.0203	-0.1031	0.2260***	0.0340*	0.0979***	-0.0419**	-0.0721*	-0.0376
Dom Other industries (w5)	0.0152	-0.0084	-0.0036	0.2260***	-0.1628**	0.0070	-0.0247$^{\cdot}$	0.0424***	-0.0011	-0.0901**
Im Pharmaceuticals (w6)	-0.0172**	-0.0112**	0.0142***	0.0340*	0.0070	0.0092$^{\cdot}$	0.0017	-0.0003	-0.0152*	-0.0223*
Im Food etc. (w7)	-0.0179**	-0.0116**	-0.0065	0.0979***	-0.0247$^{\cdot}$	0.0017	-0.0027	0.0003	-0.0326***	-0.0041
Im Transportation (w8)	0.0038	-0.0008	0.0089*	-0.0419**	0.0424***	-0.0003	0.0003	-0.0165**	0.0134*	-0.0092
Im IT Electronics (w9)	0.0365***	0.0138*	0.0073	-0.0721*	-0.0011	-0.0152*	-0.0326***	0.0134*	0.0041	0.0459*
Im Other industries (w10)	0.0114	0.0118	0.0371**	-0.0376	-0.0901**	-0.0223*	-0.0041	-0.0092	0.0459*	0.0572

11.3.5 Other industries

	Dom Pharmaceuticals log(py1)	Dom Foods etc. log(py2)	Dom Transportation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharmaceuticals log(pim1)	Im Food etc. log(pim2)	Im Transportation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0073**	-0.0017	0.0110***	-0.0119***	0.0385***	-0.0047*	0.0056*	-0.0068*	0.0046*	-0.0272***
Dom Food etc. (w2)	-0.0017	0.0211*	-0.0049	-0.0068	-0.0251*	0.0029	0.0056	0.0043	0.0042	0.0003
Dom Transportation (w3)	0.0110***	-0.0049	-0.0087	0.0033	-0.0290***	0.0213***	-0.0158***	0.0194***	-0.0002	0.0037
Dom IT Electronics (w4)	-0.0119***	-0.0068	0.0033	0.0198	0.0170	0.0005	0.0076*	0.0012	-0.0088$^{\cdot}$	-0.0219**
Dom Other industries (w5)	0.0385***	-0.0251*	-0.0290***	0.0170	0.0655*	0.0697***	-0.0860***	0.0424***	0.0014	-0.0944***
Im Pharmaceuticals (w6)	-0.0047*	0.0029	0.0213***	0.0005	0.0697***	-0.0196***	0.0025	-0.0213***	-0.0063*	-0.0449***
Im Food etc. (w7)	0.0056*	0.0056	-0.0158***	0.0076*	-0.0860***	0.0025	0.0003	0.0241***	0.0052$^{\cdot}$	0.0508***
Im Transportation (w8)	-0.0068*	0.0043	0.0194***	0.0012	0.0424***	-0.0213***	0.0241***	-0.0156$^{\cdot}$	-0.0072*	-0.0405***
Im IT Electronics (w9)	0.0046*	0.0042	-0.0002	-0.0088$^{\cdot}$	0.0014	-0.0063*	0.0052$^{\cdot}$	-0.0072*	0.0071*	-0.0000
Im Other industries (w10)	-0.0272***	0.0003	0.0037	-0.0219**	-0.0944***	-0.0449***	0.0508***	-0.0405***	-0.0000	0.1743***

11.4 Estimated AIDS models from 1973 to 2023

11.4.1 Pharmaceuticals

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0688	0.0671*	-0.0931***	-0.0512**	-0.0772	0.2481***	0.0204	0.0763*	-0.0904***	-0.0313
Dom Food etc. (w2)	0.0671*	-0.0792	0.0107	-0.0028	-0.1590$^{\cdot}$	0.0151	0.0010	-0.1158*	0.0823**	0.1806***
Dom Transportation (w3)	-0.0931***	0.0107	-0.0659$^{\cdot}$	-0.0424**	-0.2328***	0.4180***	-0.0172	-0.0262	-0.0547*	0.1038$^{\cdot}$
Dom IT Electronics (w4)	-0.0512**	-0.0028	-0.0424**	0.1172*	-0.0598	0.0361	0.0235	0.0687**	-0.0904***	0.0011
Dom Other industries (w5)	-0.0772	-0.1590$^{\cdot}$	-0.2328***	-0.0598	0.1946	0.2002$^{\cdot}$	-0.4457***	0.2911***	-0.0379	0.3265*
Im Pharmaceuticals (w6)	0.2481***	0.0151	0.4180***	0.0361	0.2002$^{\cdot}$	-0.3519*	-0.0288	-0.4537***	0.2538***	-0.3369*
Im Food etc. (w7)	0.0204	0.0010	-0.0172	0.0235	-0.4457***	-0.0288	-0.0973	0.0884*	0.0001	0.4558***
Im Transportation (w8)	0.0763*	-0.1158*	-0.0262	0.0687**	0.2911***	-0.4537***	0.0884*	0.1215*	0.0216	-0.0718
Im IT Electronics (w9)	-0.0904***	0.0823**	-0.0547*	-0.0904***	-0.0379	0.2538***	0.0001	0.0216	-0.0512$^{\cdot}$	-0.0333
Im Other industries (w10)	-0.0313	0.1806***	0.1038$^{\cdot}$	0.0011	0.3265*	-0.3369*	0.4558***	-0.0718	-0.0333	-0.5946*

11.4.2 Food products, beverages, and tobacco

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0059	-0.0200	-0.0023	0.0031	0.0524**	-0.0066*	0.0041	-0.0199*	0.0051	-0.0100
Dom Food etc. (w2)	-0.0200	-0.0347	-0.0124	0.0516***	0.0998$^{\cdot}$	0.0143	-0.0426	-0.1319***	0.0515***	0.0245
Dom Transportation (w3)	-0.0023	-0.0124	-0.0011	0.0032	0.0230	0.0040	-0.0082	-0.0063	-0.0043	0.0042
Dom IT Electronics (w4)	0.0031	0.0516***	0.0032	0.0117	-0.0384*	-0.0019	-0.0290**	0.0212*	-0.0062	-0.0152*
Dom Other industries (w5)	0.0524**	0.0998$^{\cdot}$	0.0230	-0.0384*	-0.2898**	0.0222$^{\cdot}$	-0.0036	0.1268**	0.0125	-0.0051
Im Pharmaceuticals (w6)	-0.0066*	0.0143	0.0040	-0.0019	0.0222$^{\cdot}$	0.0018	-0.0103	-0.0107$^{\cdot}$	-0.0003	-0.0126*
Im Food etc. (w7)	0.0041	-0.0426	-0.0082	-0.0290**	-0.0036	-0.0103	0.0781**	0.0697***	-0.0449***	-0.0134
Im Transportation (w8)	-0.0199*	-0.1319***	-0.0063	0.0212*	0.1268**	-0.0107$^{\cdot}$	0.0697***	-0.0692**	-0.0019	0.0223
Im IT Electronics (w9)	0.0051	0.0515***	-0.0043	-0.0062	0.0125	-0.0003	-0.0449***	-0.0019	0.0025	-0.0140*
Im Other industries (w10)	-0.0100	0.0245	0.0042	-0.0152*	-0.0051	-0.0126*	-0.0134	0.0223	-0.0140*	0.0192

11.4.3 Transportation

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0120	0.0073	0.0778***	0.0265***	-0.0250·	0.0049	-0.0027	-0.0110	0.0065	-0.0724***
Dom Food etc. (w2)	0.0073	0.0037	-0.0228***	-0.0430***	0.0122	0.0087	-0.0000	0.0040	0.0093·	0.0207*
Dom Transportation (w3)	0.0778***	-0.0228***	0.1568***	-0.0112	-0.0605**	0.0266***	-0.0260***	0.0502***	-0.0391***	-0.1517***
Dom IT Electronics (w4)	0.0265***	-0.0430***	-0.0112	-0.0854**	0.1031***	-0.0230**	0.0067	-0.0231*	0.0394***	0.0099
Dom Other industries (w5)	-0.0250·	0.0122	-0.0605**	0.1031***	-0.0242	-0.0098	0.0006	0.0863***	-0.0239·	-0.0588
Im Pharmaceuticals (w6)	0.0049	0.0087	0.0266***	-0.0230**	-0.0098	0.0138*	-0.0044	-0.0061	0.0090*	-0.0196*
Im Food etc. (w7)	-0.0027	-0.0000	-0.0260***	0.0067	0.0006	-0.0044	0.0040	0.0114·	-0.0064·	0.0168*
Im Transportation (w8)	-0.0110	0.0040	0.0502***	-0.0231*	0.0863***	-0.0061	0.0114·	-0.0699***	0.0126	-0.0544**
Im IT Electronics (w9)	0.0065	0.0093·	-0.0391***	0.0394***	-0.0239·	0.0090*	-0.0064·	0.0126	-0.0292***	0.0216·
Im Other industries (w10)	-0.0724***	0.0207*	-0.1517***	0.0099	-0.0588	-0.0196*	0.0168*	-0.0544**	0.0216·	0.2879***

11.4.4 IT & Electronics

	Dom Pharmaceuticals log(py1)	Dom Foods etc. log(py2)	Dom Transportation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharmaceuticals log(pim1)	Im Food etc. log(pim2)	Im Transportation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	0.0215*	0.0052	-0.0111·	-0.0491*	-0.0011	-0.0104·	-0.0006	0.0028	0.0261**	0.0168
Dom Food etc. (w2)	0.0052	0.0011	-0.0031	0.0245*	-0.0190*	-0.0079*	-0.0027	-0.0022	-0.0036	0.0078
Dom Transportation (w3)	-0.0111·	-0.0031	-0.0282***	0.0003	-0.0089	0.0193***	-0.0012	0.0063·	0.0026	0.0241·
Dom IT Electronics (w4)	-0.0491*	0.0245*	0.0003	-0.0766	0.2331***	-0.0151	0.0211·	-0.0478**	-0.0524	-0.0378
Dom Other industries (w5)	-0.0011	-0.0190*	-0.0089	0.2331***	-0.1559**	0.0204	-0.0145	0.0493***	-0.0139	-0.0895*
Im Pharmaceuticals (w6)	-0.0104·	-0.0079*	0.0193***	-0.0151	0.0204	0.0113·	0.0002	-0.0023	0.0019	-0.0173·
Im Food etc. (w7)	-0.0006	-0.0027	-0.0012	0.0211·	-0.0145	0.0002	-0.0022	0.0022	-0.0040	0.0018
Im Transportation (w8)	0.0028	-0.0022	0.0063·	-0.0478**	0.0493***	-0.0023	0.0022	-0.0156**	0.0136*	-0.0061
Im IT Electronics (w9)	0.0261**	-0.0036	0.0026	-0.0524	-0.0139	0.0019	-0.0040	0.0136*	-0.0026	0.0323
Im Other industries (w10)	0.0168	0.0078	0.0241·	-0.0378	-0.0895*	-0.0173·	0.0018	-0.0061	0.0323	0.0680

11.4.5 Other industries

	Dom Pharmaceuticals log(py1)	Dom Foods etc. log(py2)	Dom Transportation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharmaceuticals log(pim1)	Im Food etc. log(pim2)	Im Transportation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0075**	-0.0056·	0.0120***	-0.0144***	0.0411***	-0.0023	0.0127***	-0.0089*	0.0024	-0.0295***
Dom Food etc. (w2)	-0.0056·	0.0243*	-0.0064·	-0.0001	-0.0309*	0.0073	-0.0031	0.0035	0.0059	0.0050
Dom Transportation (w3)	0.0120***	-0.0064·	-0.0046	0.0033	-0.0269**	0.0232***	-0.0073·	0.0182***	-0.0071*	-0.0043
Dom IT Electronics (w4)	-0.0144***	-0.0001	0.0033	0.0282·	0.0173	-0.0005	-0.0036	0.0004	-0.0102·	-0.0205**
Dom Other industries (w5)	0.0411***	-0.0309*	-0.0269**	0.0173	0.0646*	0.0720***	-0.0703***	0.0419**	-0.0029	-0.1059***
Im Pharmaceuticals (w6)	-0.0023	0.0073	0.0232***	-0.0005	0.0720***	-0.0298***	-0.0040	-0.0188***	-0.0028	-0.0442***
Im Food etc. (w7)	0.0127***	-0.0031	-0.0073·	-0.0036	-0.0703***	-0.0040	0.0208**	0.0224***	-0.0017	0.0340***
Im Transportation (w8)	-0.0089*	0.0035	0.0182***	0.0004	0.0419**	-0.0188***	0.0224***	-0.0169*	-0.0053	-0.0364***
Im IT Electronics (w9)	0.0024	0.0059	-0.0071*	-0.0102·	-0.0029	-0.0028	-0.0017	-0.0053	0.0087*	0.0131*
Im Other industries (w10)	-0.0295***	0.0050	-0.0043	-0.0205**	-0.1059***	-0.0442***	0.0340***	-0.0364***	0.0131*	0.1886***

11.5 Diagnostics test

The purpose of this section is to present the diagnostic test performed on the estimated AIDS models. These tests investigate the theoretical conditions of symmetry and homogeneity. The diagnostic test results for the original sample (1966-2023) are presented first, followed by those for the shorter sample (1973-2023).

11.5.1 The Pharmaceutical industry (1966-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for the Pharmaceutical industry must be investigated:

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0674·	0.0198	-0.0794***	-0.0383*	-0.0241	0.2039***	-0.0410	0.0700*	-0.0620**	0.0185
Dom Food etc. (w2)	0.0198	0.2586**	-0.0239	-0.0580*	-0.3917***	0.0279	-0.1889***	0.0278	0.0391	0.2895***
Dom Transportation (w3)	-0.0794***	-0.0239	-0.0457	-0.0363**	-0.1891***	0.3341***	-0.0806**	-0.0235	-0.0257	0.1702**
Dom IT Electronics (w4)	-0.0383*	-0.0580*	-0.0363**	0.0312	0.0433	0.0049	0.0228	0.0329	-0.0462*	0.0438
Dom Other industries (w5)	-0.0241	-0.3917***	-0.1891***	0.0433	0.3406*	-0.0008	-0.4216***	0.2385***	-0.0051	0.4099**
Im Pharmaceuticals (w6)	0.2039***	0.0279	0.3341***	0.0049	-0.0008	-0.1158	0.0663	-0.4192***	0.1642***	-0.2654*
Im Food etc. (w7)	-0.0410	-0.1889***	-0.0806**	0.0228	-0.4216***	0.0663	-0.1099**	0.0515	-0.0078	0.7093***
Im Transportation (w8)	0.0700*	0.0278	-0.0235	0.0329	0.2385***	-0.4192***	0.0515	0.1448**	0.0086	-0.1315·
Im IT Electronics (w9)	-0.0620**	0.0391	-0.0257	-0.0462*	-0.0051	0.1642***	-0.0078	0.0086	-0.0347·	-0.0304
Im Other industries (w10)	0.0185	0.2895***	0.1702**	0.0438	0.4099**	-0.2654*	0.7093***	-0.1315·	-0.0304	-1.2140***

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is 0.0198 and the effect of $\ln(py_1)$ on ω_2 is also 0.0198.
- The effect of $ln(py_3)$ on ω_1 is -0.0794 and the effect of $ln(py_1)$ on ω_3 is also -0.0794.
- The effect of $\ln(py_3)$ on ω_2 is -0.0239 and the effect of $\ln(py_2)$ on ω_3 is also -0.0239.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for the Pharmaceutical industry.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0, for\ each\ i$$

By summing across each row, the following is retrieved:

$$w_1: \quad (-0.0674) + (0.0198) + (-0.0794) + (-0.0383) + (-0.0241) + (0.2039) + (-0.0410) + (0.0700) + (-0.0620) + (0.0185) = 0$$

$$w_2: \quad (0.0198) + (0.2586) + (-0.0239) + (-0.0580) + (-0.3917) + (0.0279) + (-0.1889) + (0.0278) + (0.0391) + (0.2895) = 0$$

$$w_3: \quad (-0.0794) + (-0.0239) + (-0.0457) + (-0.0363) + (-0.1891) + (0.3341) + (-0.0806) + (-0.0235) + (-0.0257) + (0.1702) = 0$$

$$w_4: \quad (-0.0383) + (-0.0580) + (-0.0363) + (0.0312) + (0.0433) + (0.0049) + (0.0228) + (0.0330) + (-0.0462) + (0.0438) = 0$$

$$w_5: \quad (-0.0241) + (-0.3917) + (-0.1891) + (0.0433) + (0.3405) + (-0.0008) + (-0.4216) + (0.2385) + (-0.0051) + (0.4099) = 0$$

$$w_6: \quad (0.2039) + (0.0279) + (0.3341) + (0.0049) + (-0.0008) + (-0.1158) + (0.0663) + (-0.4192) + (0.1642) + (-0.2654) = 0$$

$$w_7: \quad (-0.0410) + (-0.1889) + (-0.0806) + (0.0228) + (-0.4216) + (0.0663) + (-0.1099) + (0.0515) + (-0.0078) + (0.7093) = 0$$

$$w_8: \quad (0.0700) + (0.0278) + (-0.0235) + (0.0330) + (0.2385) + (-0.4192) + (0.0515) + (0.1445) + (0.0086) + (-0.1315) = 0$$

$$w_9: \quad (-0.0620) + (0.0391) + (-0.0257) + (-0.0462) + (-0.0051) + (0.1642) + (-0.0078) + (0.0086) + (-0.0347) + (-0.0304) = 0$$

$$w_{10}: \quad (0.0185) + (0.2895) + (0.1702) + (0.0438) + (0.4099) + (-0.2654) + (0.7093) + (-0.1315) + (-0.0304) + (-1.2140) = 0$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for the Pharmaceutical industry over the sample period 1966-2023 fulfills the symmetry and homogeneity restrictions.

11.5.2 The Food products, beverages, and tobacco industry (1966-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for the Food products, beverages, and tobacco industry must be investigated:

	Dom Pharmaceuticals log(py1)	Dom Foods etc. log(py2)	Dom Transportation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharmaceuticals log(pim1)	Im Food etc. log(pim2)	Im Transportation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0033	-0.0180·	-0.0031	0.0026	0.0407***	-0.0043	0.0021	-0.0164**	0.0032	-0.0036
Dom Food etc. (w2)	-0.0180·	-0.0167	-0.0191	0.0305**	0.0902·	0.0171*	-0.0430·	-0.1231***	0.0520***	0.0301
Dom Transportation (w3)	-0.0031	-0.0191	-0.0015	0.0012	0.0240·	0.0055*	-0.0018	-0.0069	-0.0040·	0.0058
Dom IT Electronics (w4)	0.0026	0.0305**	0.0012	0.0003	-0.0247	-0.0016	-0.0133*	0.0169*	-0.0018	-0.0101
Dom Other industries (w5)	0.0407***	0.0902·	0.0240·	-0.0247	-0.2504***	0.0187*	-0.0015	0.1138***	0.0136	-0.0244
Im Pharmaceuticals (w6)	-0.0043	0.0171*	0.0055*	-0.0016	0.0187*	0.0020	-0.0174***	-0.0102*	0.0010	-0.0108*
Im Food etc. (w7)	0.0021	-0.0430·	-0.0018	-0.0133*	-0.0015	-0.0174***	0.0598**	0.0663***	-0.0443***	-0.0069
Im Transportation (w8)	-0.0164**	-0.1231***	-0.0069	0.0169*	0.1138***	-0.0102*	0.0663***	-0.0634***	-0.0034	0.0264·
Im IT Electronics (w9)	0.0032	0.0520***	-0.0040·	-0.0018	0.0136	0.0010	-0.0443***	-0.0034	0.0022	-0.0184***
Im Other industries (w10)	-0.0036	0.0301	0.0058	-0.0101	-0.0244	-0.0108*	-0.0069	0.0264·	-0.0184***	0.0121

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is -0.0180 and the effect of $\ln(py_1)$ on ω_2 is also -0.0180.
- The effect of $ln(py_3)$ on ω_1 is -0.0031 and the effect of $ln(py_1)$ on ω_3 is also -0.0031.
- The effect of $\ln(py_3)$ on ω_2 is -0.0191 and the effect of $\ln(py_2)$ on ω_3 is also -0.0191.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for the Food products, beverages, and tobacco industry.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i$$

By summing across each row, the following is retrieved:

$$\begin{aligned}
w_1:\ & (-0.0033) + (-0.0180) + (-0.0031) + (0.0026) + (0.0407) + (-0.0043) \\
& + (0.0021) + (-0.0164) + (0.0032) + (-0.0036) = 0 \\
w_2:\ & (-0.0180) + (-0.0167) + (-0.0191) + (0.0305) + (0.0902) + (0.0171) \\
& + (-0.0430) + (-0.1231) + (0.0520) + (0.0301) = 0 \\
w_3:\ & (-0.0031) + (-0.0191) + (-0.0015) + (0.0012) + (0.0240) + (0.0055) \\
& + (-0.0018) + (-0.0069) + (-0.0040) + (0.0058) = 0 \\
w_4:\ & (0.0026) + (0.0305) + (0.0012) + (0.0003) + (-0.0247) + (-0.0016) \\
& + (-0.0133) + (0.0169) + (-0.0018) + (-0.0101) = 0 \\
w_5:\ & (0.0407) + (0.0902) + (0.0240) + (-0.0247) + (-0.2504) + (0.0187) \\
& + (-0.0015) + (0.1138) + (0.0136) + (-0.0244) = 0 \\
w_6:\ & (-0.0043) + (0.0171) + (0.0055) + (-0.0016) + (0.0187) + (0.0020) \\
& + (-0.0174) + (-0.0102) + (0.0010) + (-0.0108) = 0 \\
w_7:\ & (0.0021) + (-0.0430) + (-0.0018) + (-0.0133) + (-0.0015) + (-0.0174) \\
& + (0.0598) + (0.0663) + (-0.0443) + (-0.0069) = 0 \\
w_8:\ & (-0.0164) + (-0.1231) + (-0.0069) + (0.0169) + (0.1138) + (-0.0102) \\
& + (0.0663) + (-0.0634) + (-0.0034) + (0.0264) = 0 \\
w_9:\ & (0.0032) + (0.0520) + (-0.0040) + (-0.0018) + (0.0136) + (0.0010) \\
& + (-0.0443) + (-0.0034) + (0.0022) + (-0.0184) = 0 \\
w_{10}:\ & (-0.0036) + (0.0301) + (0.0058) + (-0.0101) + (-0.0244) + (-0.0108) \\
& + (-0.0069) + (0.0264) + (-0.0184) + (0.0121) = 0
\end{aligned}$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for the Food products, beverages, and tobacco industry over the sample period 1966-2023 fulfills the symmetry and homogeneity restrictions.

11.5.3 The Transportation industry (1966-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for the Transportation industry must be investigated:

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0101	-0.0004	0.0754***	0.0233***	-0.0343*	0.0067	0.0051	-0.0069	0.0062	-0.0649***
Dom Food etc. (w2)	-0.0004	-0.0013	-0.0187***	-0.0238*	0.0178	0.0054	0.0041	-0.0010	0.0034	0.0144
Dom Transportation (w3)	0.0754***	-0.0187***	0.1579***	-0.0131·	-0.0567**	0.0262***	-0.0282***	0.0499***	-0.0374***	-0.1552***
Dom IT Electronics (w4)	0.0233***	-0.0238*	-0.0131·	-0.1053***	0.0766**	-0.0044	0.0128·	-0.0153	0.0345***	0.0146
Dom Other industries (w5)	-0.0343*	0.0178	-0.0567**	0.0766**	0.0335	-0.0343***	-0.0556***	0.0662**	0.0010	-0.0143
Im Pharmaceuticals (w6)	0.0067	0.0054	0.0262***	-0.0044	-0.0343***	0.0082*	-0.0001	0.0062	0.0053	-0.0192*
Im Food etc. (w7)	0.0051	0.0041	-0.0282***	0.0128·	-0.0556***	-0.0001	0.0117	0.0414***	-0.0050	0.0139
Im Transportation (w8)	-0.0069	-0.0010	0.0499***	-0.0153	0.0662**	0.0062	0.0414***	-0.0675***	-0.0003	-0.0726***
Im IT Electronics (w9)	0.0062	0.0034	-0.0374***	0.0345***	0.0010	0.0053	-0.0050	-0.0003	-0.0262***	0.0185
Im Other industries (w10)	-0.0649***	0.0144	-0.1552***	0.0146	-0.0143	-0.0192*	0.0139	-0.0726***	0.0185	0.2649***

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is -0.0004 and the effect of $\ln(py_1)$ on ω_2 is also -0.0004.
- The effect of $ln(py_3)$ on ω_1 is 0.0754 and the effect of $ln(py_1)$ on ω_3 is also 0.0754.
- The effect of $\ln(py_3)$ on ω_2 is -0.0187 and the effect of $\ln(py_2)$ on ω_3 is also -0.0187.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for the Transportation industry.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i$$

By summing across each row, the following is retrieved

$$
\begin{aligned}
w_1: \quad & (-0.0101) + (-0.0004) + (0.0754) + (0.0233) + (-0.0343) + (0.0067) \\
& + (0.0051) + (-0.0069) + (0.0062) + (-0.0649) = 0 \\
w_2: \quad & (-0.0004) + (-0.0013) + (-0.0187) + (-0.0238) + (0.0178) + (0.0054) \\
& + (0.0041) + (-0.0010) + (0.0034) + (0.0144) = 0 \\
w_3: \quad & (0.0754) + (-0.0187) + (0.1579) + (-0.0131) + (-0.0567) + (0.0262) \\
& + (-0.0282) + (0.0499) + (-0.0374) + (-0.1552) = 0 \\
w_4: \quad & (0.0233) + (-0.0238) + (-0.0131) + (-0.1053) + (0.0766) + (-0.0044) \\
& + (0.0128) + (-0.0153) + (0.0345) + (0.0146) = 0 \\
w_5: \quad & (-0.0343) + (0.0178) + (-0.0567) + (0.0766) + (0.0335) + (-0.0343) \\
& + (-0.0556) + (0.0662) + (0.0010) + (-0.0143) = 0 \\
w_6: \quad & (0.0067) + (0.0054) + (0.0262) + (-0.0044) + (-0.0343) + (0.0082) \\
& + (-0.0001) + (0.0062) + (0.0053) + (-0.0192) = 0 \\
w_7: \quad & (0.0051) + (0.0041) + (-0.0282) + (0.0128) + (-0.0556) + (-0.0001) \\
& + (0.0117) + (0.0414) + (-0.0050) + (0.0139) = 0 \\
w_8: \quad & (-0.0069) + (-0.0010) + (0.0499) + (-0.0153) + (0.0662) + (0.0062) \\
& + (0.0414) + (-0.0675) + (-0.0003) + (-0.0726) = 0 \\
w_9: \quad & (0.0062) + (0.0034) + (-0.0374) + (0.0345) + (0.0010) + (0.0053) \\
& + (-0.0050) + (-0.0003) + (-0.0262) + (0.0185) = 0 \\
w_{10}: \quad & (-0.0649) + (0.0144) + (-0.1552) + (0.0146) + (-0.0143) + (-0.0192) \\
& + (0.0139) + (-0.0726) + (0.0185) + (0.2649) = 0
\end{aligned}
$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for the Transportation industry over the sample period 1966-2023 fulfills the symmetry and homogeneity restrictions.

11.5.4 The IT & Electronics industry (1966-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for the IT & Electronics industry must be investigated:

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	0.0248*	0.0152**	-0.0080	-0.0639**	0.0152	-0.0172**	-0.0179**	0.0038	0.0365***	0.0114
Dom Food etc. (w2)	0.0152**	0.0134*	-0.0030	-0.0191	-0.0084	-0.0112**	-0.0116**	-0.0008	0.0138*	0.0118
Dom Transportation (w3)	-0.0080	-0.0030	-0.0261***	-0.0203	-0.0036	0.0142***	-0.0065	0.0089*	0.0073	0.0371**
Dom IT Electronics (w4)	-0.0639**	-0.0191	-0.0203	-0.1031	0.2260***	0.0340*	0.0979***	-0.0419**	-0.0721*	-0.0376
Dom Other industries (w5)	0.0152	-0.0084	-0.0036	0.2260***	-0.1628**	0.0070	-0.0247·	0.0424***	-0.0011	-0.0901**
Im Pharmaceuticals (w6)	-0.0172**	-0.0112**	0.0142***	0.0340*	0.0070	0.0092·	0.0017	-0.0003	-0.0152*	-0.0223*
Im Food etc. (w7)	-0.0179**	-0.0116**	-0.0065	0.0979***	-0.0247·	0.0017	-0.0027	0.0003	-0.0326***	-0.0041
Im Transportation (w8)	0.0038	-0.0008	0.0089*	-0.0419**	0.0424***	-0.0003	0.0003	-0.0165**	0.0134*	-0.0092
Im IT Electronics (w9)	0.0365***	0.0138*	0.0073	-0.0721*	-0.0011	-0.0152*	-0.0326***	0.0134*	0.0041	0.0459*
Im Other industries (w10)	0.0114	0.0118	0.0371**	-0.0376	-0.0901**	-0.0223*	-0.0041	-0.0092	0.0459*	0.0572

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is 0.0152 and the effect of $\ln(py_1)$ on ω_2 is also 0.0152.
- The effect of $ln(py_3)$ on ω_1 is -0.0080 and the effect of $ln(py_1)$ on ω_3 is also -0.0080.
- The effect of $\ln(py_3)$ on ω_2 is -0.0030 and the effect of $\ln\ (py_2)$ on ω_3 is also -0.0030.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for the IT & Electronics industry.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i$$

By summing across each row, the following is retrieved:

$$\begin{aligned}
w_1: \quad & (0.0248) + (0.0152) + (-0.0080) + (-0.0639) + (0.0152) + (-0.0172) \\
& + (-0.0179) + (0.0038) + (0.0365) + (0.0114) = 0 \\
w_2: \quad & (0.0152) + (0.0134) + (-0.0030) + (-0.0191) + (-0.0084) + (-0.0112) \\
& + (-0.0116) + (-0.0008) + (0.0138) + (0.0118) = 0 \\
w_3: \quad & (-0.0080) + (-0.0030) + (-0.0261) + (-0.0203) + (-0.0036) + (0.0142) \\
& + (-0.0065) + (0.0089) + (0.0073) + (0.0371) = 0 \\
w_4: \quad & (-0.0639) + (-0.0191) + (-0.0203) + (-0.1031) + (0.2260) + (0.0340) \\
& + (0.0979) + (-0.0419) + (-0.0721) + (-0.0376) = 0 \\
w_5: \quad & (0.0152) + (-0.0084) + (-0.0036) + (0.2260) + (-0.1628) + (0.0070) \\
& + (-0.0247) + (0.0424) + (-0.0011) + (-0.0901) = 0 \\
w_6: \quad & (-0.0172) + (-0.0112) + (0.0142) + (0.0340) + (0.0070) + (0.0092) \\
& + (0.0017) + (-0.0003) + (-0.0152) + (-0.0223) = 0 \\
w_7: \quad & (-0.0179) + (-0.0116) + (-0.0065) + (0.0979) + (-0.0247) + (0.0017) \\
& + (-0.0027) + (0.0003) + (-0.0326) + (-0.0041) = 0 \\
w_8: \quad & (0.0038) + (-0.0008) + (0.0089) + (-0.0419) + (0.0424) + (-0.0003) \\
& + (0.0003) + (-0.0165) + (0.0134) + (-0.0092) = 0 \\
w_9: \quad & (0.0365) + (0.0138) + (0.0073) + (-0.0721) + (-0.0011) + (-0.0152) \\
& + (-0.0326) + (0.0134) + (0.0041) + (0.0459) = 0 \\
w_{10}: \quad & (0.0114) + (0.0118) + (0.0371) + (-0.0376) + (-0.0901) + (-0.0223) \\
& + (-0.0041) + (-0.0092) + (0.0459) + (0.0572) = 0
\end{aligned}$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for the IT & Electronics industry over the sample period 1966-2023 fulfills the symmetry and homogeneity restrictions.

11.5.5 'Other industries' (1966-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for 'Other industries' must be investigated:

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0073**	-0.0017	0.0110***	-0.0119***	0.0385***	-0.0047*	0.0056*	-0.0068*	0.0046*	-0.0272***
Dom Food etc. (w2)	-0.0017	0.0211*	-0.0049	-0.0068	-0.0251*	0.0029	0.0056	0.0043	0.0042	0.0003
Dom Transportation (w3)	0.0110***	-0.0049	-0.0087	0.0033	-0.0290***	0.0213***	-0.0158***	0.0194***	-0.0002	0.0037
Dom IT Electronics (w4)	-0.0119***	-0.0068	0.0033	0.0198	0.0170	0.0005	0.0076*	0.0012	-0.0088·	-0.0219**
Dom Other industries (w5)	0.0385***	-0.0251*	-0.0290***	0.0170	0.0655*	0.0697***	-0.0860***	0.0424***	0.0014	-0.0944***
Im Pharmaceuticals (w6)	-0.0047*	0.0029	0.0213***	0.0005	0.0697***	-0.0196***	0.0025	-0.0213***	-0.0063*	-0.0449***
Im Food etc. (w7)	0.0056*	0.0056	-0.0158***	0.0076*	-0.0860***	0.0025	0.0003	0.0241***	0.0052·	0.0508***
Im Transportation (w8)	-0.0068*	0.0043	0.0194***	0.0012	0.0424***	-0.0213***	0.0241***	-0.0156·	-0.0072*	-0.0405***
Im IT Electronics (w9)	0.0046*	0.0042	-0.0002	-0.0088·	0.0014	-0.0063*	0.0052·	-0.0072*	0.0071*	-0.0000
Im Other industries (w10)	-0.0272***	0.0003	0.0037	-0.0219**	-0.0944***	-0.0449***	0.0508***	-0.0405***	-0.0000	0.1743***

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is -0.0017 and the effect of $\ln(py_1)$ on ω_2 is also -0.0017.
- The effect of $ln(py_3)$ on ω_1 is 0.0110 and the effect of $ln(py_1)$ on ω_3 is also 0.0110.
- The effect of $\ln(py_3)$ on ω_2 is -0.0049 and the effect of $\ln(py_2)$ on ω_3 is also -0.0049.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for 'Other industries'.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i$$

By summing across each row, the following is retrieved:

$$
\begin{aligned}
w_1: \quad & (-0.0073) + (-0.0017) + (0.0110) + (-0.0119) + (0.0385) + (-0.0047) \\
& + (0.0056) + (-0.0068) + (0.0046) + (-0.0272) = 0 \\
w_2: \quad & (-0.0017) + (0.0211) + (-0.0049) + (-0.0068) + (-0.0251) + (0.0029) \\
& + (0.0056) + (0.0043) + (0.0042) + (0.0003) = 0 \\
w_3: \quad & (0.0110) + (-0.0049) + (-0.0087) + (0.0033) + (-0.0290) + (0.0213) \\
& + (-0.0158) + (0.0194) + (-0.0002) + (0.0037) = 0 \\
w_4: \quad & (-0.0119) + (-0.0068) + (0.0033) + (0.0198) + (0.0170) + (0.0005) \\
& + (0.0076) + (0.0012) + (-0.0088) + (-0.0219) = 0 \\
w_5: \quad & (0.0385) + (-0.0251) + (-0.0290) + (0.0170) + (0.0655) + (0.0697) \\
& + (-0.0860) + (0.0424) + (0.0014) + (-0.0944) = 0 \\
w_6: \quad & (-0.0047) + (0.0029) + (0.0213) + (0.0005) + (0.0697) + (-0.0196) \\
& + (0.0025) + (-0.0213) + (-0.0063) + (-0.0449) = 0 \\
w_7: \quad & (0.0056) + (0.0056) + (-0.0158) + (0.0076) + (-0.0860) + (0.0025) \\
& + (0.0003) + (0.0241) + (0.0052) + (0.0508) = 0 \\
w_8: \quad & (-0.0068) + (0.0043) + (0.0194) + (0.0012) + (0.0424) + (-0.0213) \\
& + (0.0241) + (-0.0156) + (-0.0072) + (-0.0405) = 0 \\
w_9: \quad & (0.0046) + (0.0042) + (-0.0002) + (-0.0088) + (0.0014) + (-0.0063) \\
& + (0.0052) + (-0.0072) + (0.0071) + (-0.0000) = 0 \\
w_{10}: \quad & (-0.0272) + (0.0003) + (0.0037) + (-0.0219) + (-0.0944) + (-0.0449) \\
& + (0.0508) + (-0.0405) + (-0.0000) + (0.1743) = 0
\end{aligned}
$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for ‘Other industries’ over the sample period 1966-2023 fulfills the symmetry and homogeneity restrictions.

11.5.6 The Pharmaceutical industry (1973-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for the Pharmaceutical industry must be investigated:

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0688	0.0671*	-0.0931***	-0.0512**	-0.0772	0.2481***	0.0204	0.0763*	-0.0904***	-0.0313
Dom Food etc. (w2)	0.0671*	-0.0792	0.0107	-0.0028	-0.1590$^{\cdot}$	0.0151	0.0010	-0.1158*	0.0823**	0.1806***
Dom Transportation (w3)	-0.0931***	0.0107	-0.0659$^{\cdot}$	-0.0424**	-0.2328***	0.4180***	-0.0172	-0.0262	-0.0547*	0.1038$^{\cdot}$
Dom IT Electronics (w4)	-0.0512**	-0.0028	-0.0424**	0.1172*	-0.0598	0.0361	0.0235	0.0687**	-0.0904***	0.0011
Dom Other industries (w5)	-0.0772	-0.1590$^{\cdot}$	-0.2328***	-0.0598	0.1946	0.2002$^{\cdot}$	-0.4457***	0.2911***	-0.0379	0.3265*
Im Pharmaceuticals (w6)	0.2481***	0.0151	0.4180***	0.0361	0.2002$^{\cdot}$	-0.3519*	-0.0288	-0.4537***	0.2538***	-0.3369*
Im Food etc. (w7)	0.0204	0.0010	-0.0172	0.0235	-0.4457***	-0.0288	-0.0973	0.0884*	0.0001	0.4558***
Im Transportation (w8)	0.0763*	-0.1158*	-0.0262	0.0687**	0.2911***	-0.4537***	0.0884*	0.1215*	0.0216	-0.0718
Im IT Electronics (w9)	-0.0904***	0.0823**	-0.0547*	-0.0904***	-0.0379	0.2538***	0.0001	0.0216	-0.0512$^{\cdot}$	-0.0333
Im Other industries (w10)	-0.0313	0.1806***	0.1038$^{\cdot}$	0.0011	0.3265*	-0.3369*	0.4558***	-0.0718	-0.0333	-0.5946*

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is 0.0671 and the effect of $\ln(py_1)$ on ω_2 is also 0.0671.
- The effect of $ln(py_3)$ on ω_1 is -0.0931 and the effect of $ln(py_1)$ on ω_3 is also -0.0931.
- The effect of $\ln(py_3)$ on ω_2 is 0.0107 and the effect of $\ln(py_2)$ on ω_3 is also 0.0107.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for the Pharmaceutical industry.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i$$

By summing across each row, the following is retrieved:

$$\begin{aligned}
w_1:&\quad (-0.0688)+(0.0671)+(-0.0931)+(-0.0512)+(-0.0772)+(0.2481)\\
&\quad +(0.0204)+(0.0763)+(-0.0904)+(-0.0313)=0\\
w_2:&\quad (0.0671)+(-0.0792)+(0.0107)+(-0.0028)+(-0.1590)+(0.0151)\\
&\quad +(0.0010)+(-0.1158)+(0.0823)+(0.1806)=0\\
w_3:&\quad (-0.0931)+(0.0107)+(-0.0659)+(-0.0424)+(-0.2328)+(0.4180)\\
&\quad +(-0.0172)+(-0.0262)+(-0.0547)+(0.1038)=0\\
w_4:&\quad (-0.0512)+(-0.0028)+(-0.0424)+(0.1172)+(-0.0598)+(0.0361)\\
&\quad +(0.0235)+(0.0687)+(-0.0904)+(0.0011)=0\\
w_5:&\quad (-0.0772)+(-0.1590)+(-0.2328)+(-0.0598)+(0.1946)+(0.2002)\\
&\quad +(-0.4457)+(0.2911)+(-0.0379)+(0.3265)=0\\
w_6:&\quad (0.2481)+(0.0151)+(0.4180)+(0.0361)+(0.2002)+(-0.3519)\\
&\quad +(-0.0288)+(-0.4537)+(0.2538)+(-0.3369)=0\\
w_7:&\quad (0.0204)+(0.0010)+(-0.0172)+(0.0235)+(-0.4457)+(-0.0288)\\
&\quad +(-0.0973)+(0.0884)+(0.0001)+(0.4558)=0\\
w_8:&\quad (0.0763)+(-0.1158)+(-0.0262)+(0.0687)+(0.2911)+(-0.4537)\\
&\quad +(0.0884)+(0.1215)+(0.0216)+(-0.0718)=0\\
w_9:&\quad (-0.0904)+(0.0823)+(-0.0547)+(-0.0904)+(-0.0379)+(0.2538)\\
&\quad +(0.0001)+(0.0216)+(-0.0512)+(-0.0333)=0\\
w_{10}:&\quad (-0.0313)+(0.1806)+(0.1038)+(0.0011)+(0.3265)+(-0.3369)\\
&\quad +(0.4558)+(-0.0718)+(-0.0333)+(-0.5946)=0
\end{aligned}$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for the Pharmaceutical industry over the sample period 1973-2023 fulfills the symmetry and homogeneity restrictions.

11.5.7 The Food products, beverages, and tobacco industry (1973-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for the Food products, beverages, and tobacco industry must be investigated:

	Dom Pharmaceuticals log(py1)	Dom Foods etc. log(py2)	Dom Transportation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharmaceuticals log(pim1)	Im Food etc. log(pim2)	Im Transportation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0059	-0.0200	-0.0023	0.0031	0.0524**	-0.0066*	0.0041	-0.0199*	0.0051	-0.0100
Dom Food etc. (w2)	-0.0200	-0.0347	-0.0124	0.0516***	0.0998·	0.0143	-0.0426	-0.1319***	0.0515***	0.0245
Dom Transportation (w3)	-0.0023	-0.0124	-0.0011	0.0032	0.0230	0.0040	-0.0082	-0.0063	-0.0043	0.0042
Dom IT Electronics (w4)	0.0031	0.0516***	0.0032	0.0117	-0.0384*	-0.0019	-0.0290**	0.0212*	-0.0062	-0.0152*
Dom Other industries (w5)	0.0524**	0.0998·	0.0230	-0.0384*	-0.2898**	0.0222·	-0.0036	0.1268**	0.0125	-0.0051
Im Pharmaceuticals (w6)	-0.0066*	0.0143	0.0040	-0.0019	0.0222·	0.0018	-0.0103	-0.0107·	-0.0003	-0.0126*
Im Food etc. (w7)	0.0041	-0.0426	-0.0082	-0.0290**	-0.0036	-0.0103	0.0781**	0.0697***	-0.0449***	-0.0134
Im Transportation (w8)	-0.0199*	-0.1319***	-0.0063	0.0212*	0.1268**	-0.0107·	0.0697***	-0.0692**	-0.0019	0.0223
Im IT Electronics (w9)	0.0051	0.0515***	-0.0043	-0.0062	0.0125	-0.0003	-0.0449***	-0.0019	0.0025	-0.0140*
Im Other industries (w10)	-0.0100	0.0245	0.0042	-0.0152*	-0.0051	-0.0126*	-0.0134	0.0223	-0.0140*	0.0192

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is -0.0200 and the effect of $\ln(py_1)$ on ω_2 is also -0.0200.
- The effect of $ln(py_3)$ on ω_1 is -0.0023 and the effect of $ln(py_1)$ on ω_3 is also -0.0023.
- The effect of $\ln(py_3)$ on ω_2 is -0.0124 and the effect of $\ln(py_2)$ on ω_3 is also -0.0124.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for the Food products, beverages, and tobacco industry.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i$$

By summing across each row, the following is retrieved:

$$
\begin{aligned}
w_1: &\quad (-0.0059) + (-0.0200) + (-0.0023) + (0.0031) + (0.0524) + (-0.0066) \\
&\quad + (0.0041) + (-0.0199) + (0.0051) + (-0.0100) = 0 \\
w_2: &\quad (-0.0200) + (-0.0347) + (-0.0124) + (0.0516) + (0.0998) + (0.0143) \\
&\quad + (-0.0426) + (-0.1319) + (0.0515) + (0.0245) = 0 \\
w_3: &\quad (-0.0023) + (-0.0124) + (-0.0011) + (0.0032) + (0.0230) + (0.0040) \\
&\quad + (-0.0082) + (-0.0063) + (-0.0043) + (0.0042) = 0 \\
w_4: &\quad (0.0031) + (0.0516) + (0.0032) + (0.0117) + (-0.0384) + (-0.0019) \\
&\quad + (-0.0290) + (0.0212) + (-0.0062) + (-0.0152) = 0 \\
w_5: &\quad (0.0524) + (0.0998) + (0.0230) + (-0.0384) + (-0.2898) + (0.0222) \\
&\quad + (-0.0036) + (0.1268) + (0.0125) + (-0.0051) = 0 \\
w_6: &\quad (-0.0066) + (0.0143) + (0.0040) + (-0.0019) + (0.0222) + (0.0018) \\
&\quad + (-0.0103) + (-0.0107) + (-0.0003) + (-0.0126) = 0 \\
w_7: &\quad (0.0041) + (-0.0426) + (-0.0082) + (-0.0290) + (-0.0036) + (-0.0103) \\
&\quad + (0.0781) + (0.0697) + (-0.0449) + (-0.0134) = 0 \\
w_8: &\quad (-0.0199) + (-0.1319) + (-0.0063) + (0.0212) + (0.1268) + (-0.0107) \\
&\quad + (0.0697) + (-0.0692) + (-0.0019) + (0.0223) = 0 \\
w_9: &\quad (0.0051) + (0.0515) + (-0.0043) + (-0.0062) + (0.0125) + (-0.0003) \\
&\quad + (-0.0449) + (-0.0019) + (0.0025) + (-0.0140) = 0 \\
w_{10}: &\quad (-0.0100) + (0.0245) + (0.0042) + (-0.0152) + (-0.0051) + (-0.0126) \\
&\quad + (-0.0134) + (0.0223) + (-0.0140) + (0.0192) = 0
\end{aligned}
$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for the Food products, beverages, and tobacco industry over the sample period 1973-2023 fulfills the symmetry and homogeneity restrictions.

11.5.8 The Transportation industry (1973-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for the Transportation industry must be investigated:

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0120	0.0073	0.0778***	0.0265***	-0.0250$^{\cdot}$	0.0049	-0.0027	-0.0110	0.0065	-0.0724***
Dom Food etc. (w2)	0.0073	0.0037	-0.0228***	-0.0430***	0.0122	0.0087	-0.0000	0.0040	0.0093$^{\cdot}$	0.0207*
Dom Transportation (w3)	0.0778***	-0.0228***	0.1568***	-0.0112	-0.0605**	0.0266***	-0.0260***	0.0502***	-0.0391***	-0.1517***
Dom IT Electronics (w4)	0.0265***	-0.0430***	-0.0112	-0.0854**	0.1031***	-0.0230**	0.0067	-0.0231*	0.0394***	0.0099
Dom Other industries (w5)	-0.0250$^{\cdot}$	0.0122	-0.0605**	0.1031***	-0.0242	-0.0098	0.0006	0.0863***	-0.0239$^{\cdot}$	-0.0588
Im Pharmaceuticals (w6)	0.0049	0.0087	0.0266***	-0.0230**	-0.0098	0.0138*	-0.0044	-0.0061	0.0090*	-0.0196*
Im Food etc. (w7)	-0.0027	-0.0000	-0.0260***	0.0067	0.0006	-0.0044	0.0040	0.0114$^{\cdot}$	-0.0064$^{\cdot}$	0.0168*
Im Transportation (w8)	-0.0110	0.0040	0.0502***	-0.0231*	0.0863***	-0.0061	0.0114$^{\cdot}$	-0.0699***	0.0126	-0.0544**
Im IT Electronics (w9)	0.0065	0.0093$^{\cdot}$	-0.0391***	0.0394***	-0.0239$^{\cdot}$	0.0090*	-0.0064$^{\cdot}$	0.0126	-0.0292***	0.0216$^{\cdot}$
Im Other industries (w10)	-0.0724***	0.0207*	-0.1517***	0.0099	-0.0588	-0.0196*	0.0168*	-0.0544**	0.0216$^{\cdot}$	0.2879***

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is 0.0073 and the effect of $\ln(py_1)$ on ω_2 is also 0.0073.
- The effect of $ln(py_3)$ on ω_1 is 0.0778 and the effect of $ln(py_1)$ on ω_3 is also 0.0778.
- The effect of $\ln(py_3)$ on ω_2 is -0.0228 and the effect of $\ln\,(py_2)$ on ω_3 is also -0.0228.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for the Transportation industry.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i$$

By summing across each row, the following is retrieved:

$$\begin{aligned}
w_1 :\ & (-0.0120) + (0.0073) + (0.0778) + (0.0265) + (-0.0250) + (0.0049) \\
& + (-0.0027) + (-0.0110) + (0.0065) + (-0.0724) = 0 \\
w_2 :\ & (0.0073) + (0.0037) + (-0.0228) + (-0.0430) + (0.0122) + (0.0087) \\
& + (-0.0000) + (0.0040) + (0.0093) + (0.0207) = 0 \\
w_3 :\ & (0.0778) + (-0.0228) + (0.1568) + (-0.0112) + (-0.0605) + (0.0266) \\
& + (-0.0260) + (0.0502) + (-0.0391) + (-0.1517) = 0 \\
w_4 :\ & (0.0265) + (-0.0430) + (-0.0112) + (-0.0854) + (0.1031) + (-0.0230) \\
& + (0.0067) + (-0.0231) + (0.0394) + (0.0099) = 0 \\
w_5 :\ & (-0.0250) + (0.0122) + (-0.0605) + (0.1031) + (-0.0242) + (-0.0098) \\
& + (0.0006) + (0.0863) + (-0.0239) + (-0.0588) = 0 \\
w_6 :\ & (0.0049) + (0.0087) + (0.0266) + (-0.0230) + (-0.0098) + (0.0138) \\
& + (-0.0044) + (-0.0061) + (0.0090) + (-0.0196) = 0 \\
w_7 :\ & (-0.0027) + (-0.0000) + (-0.0260) + (0.0067) + (0.0006) + (-0.0044) \\
& + (0.0040) + (0.0114) + (-0.0064) + (0.0168) = 0 \\
w_8 :\ & (-0.0110) + (0.0040) + (0.0502) + (-0.0231) + (0.0863) + (-0.0061) \\
& + (0.0114) + (-0.0699) + (0.0126) + (-0.0544) = 0 \\
w_9 :\ & (0.0065) + (0.0093) + (-0.0391) + (0.0394) + (-0.0239) + (0.0090) \\
& + (-0.0064) + (0.0126) + (-0.0292) + (0.0216) = 0 \\
w_{10} :\ & (-0.0724) + (0.0207) + (-0.1517) + (0.0099) + (-0.0588) + (-0.0196) \\
& + (0.0168) + (-0.0544) + (0.0216) + (0.2879) = 0
\end{aligned}$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for the Transportation industry over the sample period 1973-2023 fulfills the symmetry and homogeneity restrictions.

11.5.9 The IT & Electronics industry (1973-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for the IT & Electronics industry must be investigated:

	Dom Pharma-ceuticals log(py1)	Dom Foods etc. log(py2)	Dom Trans-portation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharma-ceuticals log(pim1)	Im Food etc. log(pim2)	Im Trans-portation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	0.0215*	0.0052	-0.0111$^{\cdot}$	-0.0491*	-0.0011	-0.0104$^{\cdot}$	-0.0006	0.0028	0.0261**	0.0168
Dom Food etc. (w2)	0.0052	0.0011	-0.0031	0.0245*	-0.0190*	-0.0079*	-0.0027	-0.0022	-0.0036	0.0078
Dom Transportation (w3)	-0.0111$^{\cdot}$	-0.0031	-0.0282***	0.0003	-0.0089	0.0193***	-0.0012	0.0063$^{\cdot}$	0.0026	0.0241$^{\cdot}$
Dom IT Electronics (w4)	-0.0491*	0.0245*	0.0003	-0.0766	0.2331***	-0.0151	0.0211$^{\cdot}$	-0.0478**	-0.0524	-0.0378
Dom Other industries (w5)	-0.0011	-0.0190*	-0.0089	0.2331***	-0.1559**	0.0204	-0.0145	0.0493***	-0.0139	-0.0895*
Im Pharmaceuticals (w6)	-0.0104$^{\cdot}$	-0.0079*	0.0193***	-0.0151	0.0204	0.0113$^{\cdot}$	0.0002	-0.0023	0.0019	-0.0173$^{\cdot}$
Im Food etc. (w7)	-0.0006	-0.0027	-0.0012	0.0211$^{\cdot}$	-0.0145	0.0002	-0.0022	0.0022	-0.0040	0.0018
Im Transportation (w8)	0.0028	-0.0022	0.0063$^{\cdot}$	-0.0478**	0.0493***	-0.0023	0.0022	-0.0156**	0.0136*	-0.0061
Im IT Electronics (w9)	0.0261**	-0.0036	0.0026	-0.0524	-0.0139	0.0019	-0.0040	0.0136*	-0.0026	0.0323
Im Other industries (w10)	0.0168	0.0078	0.0241$^{\cdot}$	-0.0378	-0.0895*	-0.0173$^{\cdot}$	0.0018	-0.0061	0.0323	0.0680

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is 0.0052 and the effect of $\ln(py_1)$ on ω_2 is also 0.0052.
- The effect of $ln(py_3)$ on ω_1 is -0.0111 and the effect of $ln(py_1)$ on ω_3 is also -0.0111.
- The effect of $\ln(py_3)$ on ω_2 is -0.0031 and the effect of $\ln\,(py_2)$ on ω_3 is also -0.0031.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for the IT & Electronics industry.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i$$

By summing across each row, the following is retrieved:

$$w_1: \quad (0.0215) + (0.0052) + (-0.0111) + (-0.0491) + (-0.0011) + (-0.0104)$$
$$+ (-0.0006) + (0.0028) + (0.0261) + (0.0168) = 0$$
$$w_2: \quad (0.0052) + (0.0011) + (-0.0031) + (0.0245) + (-0.0190) + (-0.0079)$$
$$+ (-0.0027) + (-0.0022) + (-0.0036) + (0.0078) = 0$$
$$w_3: \quad (-0.0111) + (-0.0031) + (-0.0282) + (0.0003) + (-0.0089) + (0.0193)$$
$$+ (-0.0012) + (0.0063) + (0.0026) + (0.0241) = 0$$
$$w_4: \quad (-0.0491) + (0.0245) + (0.0003) + (-0.0766) + (0.2331) + (-0.0151)$$
$$+ (0.0211) + (-0.0478) + (-0.0524) + (-0.0378) = 0$$
$$w_5: \quad (-0.0011) + (-0.0190) + (-0.0089) + (0.2331) + (-0.1559) + (0.0204)$$
$$+ (-0.0145) + (0.0493) + (-0.0139) + (-0.0895) = 0$$
$$w_6: \quad (-0.0104) + (-0.0079) + (0.0193) + (-0.0151) + (0.0204) + (0.0113)$$
$$+ (0.0002) + (-0.0023) + (0.0019) + (-0.0173) = 0$$
$$w_7: \quad (-0.0006) + (-0.0027) + (-0.0012) + (0.0211) + (-0.0145) + (0.0002)$$
$$+ (-0.0022) + (0.0022) + (-0.0040) + (0.0018) = 0$$
$$w_8: \quad (0.0028) + (-0.0022) + (0.0063) + (-0.0478) + (0.0493) + (-0.0023)$$
$$+ (0.0022) + (-0.0156) + (0.0136) + (-0.0061) = 0$$
$$w_9: \quad (0.0261) + (-0.0036) + (0.0026) + (-0.0524) + (-0.0139) + (0.0019)$$
$$+ (-0.0040) + (0.0136) + (-0.0026) + (0.0323) = 0$$
$$w_{10}: \quad (0.0168) + (0.0078) + (0.0241) + (-0.0378) + (-0.0895) + (-0.0173)$$
$$+ (0.0018) + (-0.0061) + (0.0323) + (0.0680) = 0$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for the IT & Electronics industry over the sample period 1973-2023 fulfills the symmetry and homogeneity restrictions.

11.5.10 'Other industries' (1973-2023)

To test for symmetry, the estimated 10-by-10 matrix of the price effects for 'Other industries' must be investigated:

	Dom Pharmaceuticals log(py1)	Dom Foods etc. log(py2)	Dom Transportation log(py3)	Dom IT Electronics log(py4)	Dom Other industries log(py5)	Im Pharmaceuticals log(pim1)	Im Food etc. log(pim2)	Im Transportation log(pim3)	Im IT Electronics log(pim4)	Im Other industries log(pim5)
Dom Pharmaceuticals (w1)	-0.0075**	-0.0056$^{\cdot}$	0.0120***	-0.0144***	0.0411***	-0.0023	0.0127***	-0.0089*	0.0024	-0.0295***
Dom Food etc. (w2)	-0.0056$^{\cdot}$	0.0243*	-0.0064$^{\cdot}$	-0.0001	-0.0309*	0.0073	-0.0031	0.0035	0.0059	0.0050
Dom Transportation (w3)	0.0120***	-0.0064$^{\cdot}$	-0.0046	0.0033	-0.0269**	0.0232***	-0.0073$^{\cdot}$	0.0182***	-0.0071*	-0.0043
Dom IT Electronics (w4)	-0.0144***	-0.0001	0.0033	0.0282$^{\cdot}$	0.0173	-0.0005	-0.0036	0.0004	-0.0102$^{\cdot}$	-0.0205**
Dom Other industries (w5)	0.0411***	-0.0309*	-0.0269**	0.0173	0.0646*	0.0720***	-0.0703***	0.0419**	-0.0029	-0.1059***
Im Pharmaceuticals (w6)	-0.0023	0.0073	0.0232***	-0.0005	0.0720***	-0.0298***	-0.0040	-0.0188***	-0.0028	-0.0442***
Im Food etc. (w7)	0.0127***	-0.0031	-0.0073$^{\cdot}$	-0.0036	-0.0703***	-0.0040	0.0208**	0.0224***	-0.0017	0.0340***
Im Transportation (w8)	-0.0089*	0.0035	0.0182***	0.0004	0.0419**	-0.0188***	0.0224***	-0.0169*	-0.0053	-0.0364***
Im IT Electronics (w9)	0.0024	0.0059	-0.0071*	-0.0102$^{\cdot}$	-0.0029	-0.0028	-0.0017	-0.0053	0.0087*	0.0131*
Im Other industries (w10)	-0.0295***	0.0050	-0.0043	-0.0205**	-0.1059***	-0.0442***	0.0340***	-0.0364***	0.0131*	0.1886***

Symmetry: The matrix satisfies the symmetry condition, which requires that:

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i \neq j.$$

Thus:

- The effect of $ln(py_2)$ on ω_1 is -0.0056 and the effect of $\ln(py_1)$ on ω_2 is also -0.0056.
- The effect of $ln(py_3)$ on ω_1 is 0.0120 and the effect of $ln(py_1)$ on ω_3 is also 0.0120.
- The effect of $\ln(py_3)$ on ω_2 is -0.0064 and the effect of $\ln\ (py_2)$ on ω_3 is also -0.0064.
- Similarly, the symmetry holds for the derived rows ω_4 through ω_{10} as well.

These matching off-diagonal elements confirm that the symmetry restriction has been successfully imposed in the estimation of the AIDS model for 'Other industries'.

Homogeneity: The matrix satisfies the homogeneity condition, which requires that for each share equation, the sum of the coefficients on all price terms equal zero:

$$\sum_{j=1}^{n=10} \gamma_{ij} = 0\,, for\ each\ i$$

By summing across each row, the following is retrieved:

$$\begin{aligned}
w_1 :\quad & (-0.0075) + (-0.0056) + (0.0120) + (-0.0144) + (0.0411) + (-0.0023) \\
& + (0.0127) + (-0.0089) + (0.0024) + (-0.0295) = 0 \\
w_2 :\quad & (-0.0056) + (0.0243) + (-0.0064) + (-0.0001) + (-0.0309) + (0.0073) \\
& + (-0.0031) + (0.0035) + (0.0059) + (0.0050) = 0 \\
w_3 :\quad & (0.0120) + (-0.0064) + (-0.0046) + (0.0033) + (-0.0269) + (0.0232) \\
& + (-0.0073) + (0.0182) + (-0.0071) + (-0.0043) = 0 \\
w_4 :\quad & (-0.0144) + (-0.0001) + (0.0033) + (0.0282) + (0.0173) + (-0.0005) \\
& + (-0.0036) + (0.0004) + (-0.0102) + (-0.0205) = 0 \\
w_5 :\quad & (0.0411) + (-0.0309) + (-0.0269) + (0.0173) + (0.0646) + (0.0720) \\
& + (-0.0703) + (0.0419) + (-0.0029) + (-0.1059) = 0 \\
w_6 :\quad & (-0.0023) + (0.0073) + (0.0232) + (-0.0005) + (0.0720) + (-0.0298) \\
& + (-0.0040) + (-0.0188) + (-0.0028) + (-0.0442) = 0 \\
w_7 :\quad & (0.0127) + (-0.0031) + (-0.0073) + (-0.0036) + (-0.0703) + (-0.0040) \\
& + (0.0208) + (0.0224) + (-0.0017) + (0.0340) = 0 \\
w_8 :\quad & (-0.0089) + (0.0035) + (0.0182) + (0.0004) + (0.0419) + (-0.0188) \\
& + (0.0224) + (-0.0169) + (-0.0053) + (-0.0364) = 0 \\
w_9 :\quad & (0.0024) + (0.0059) + (-0.0071) + (-0.0102) + (-0.0029) + (-0.0028) \\
& + (-0.0017) + (-0.0053) + (0.0087) + (0.0131) = 0 \\
w_{10} :\quad & (-0.0295) + (0.0050) + (-0.0043) + (-0.0205) + (-0.1059) + (-0.0442) \\
& + (0.0340) + (-0.0364) + (0.0131) + (0.1886) = 0
\end{aligned}$$

The sum of each row is approximately zero, which confirms that the homogeneity condition is also satisfied.

Therefore, the AIDS model for 'Other industries' over the sample period 1973-2023 fulfills the symmetry and homogeneity restrictions.

11.6 Mean value of input demand shares

11.6.1 Pharmaceuticals

	Original sample (1966-2023)	**Shorter sample (1973-2023)**
Dom Pharmaceuticals (w1)	0.042	0.047
Dom Food etc. (w2)	0.072	0.072
Dom Transportation (w3)	0.025	0.027
Dom IT & Electronics (w4)	0.017	0.019
Dom Other industries (w5)	0.325	0.341
Im Pharmaceuticals (w6)	0.136	0.146
Im Food etc. (w7)	0.059	0.063
Im Transportation (w8)	0.007	0.007
Im IT & Electronics (w9)	0.010	0.010
Im Other industries (w10)	0.306	0.267

11.6.2 Food products, beverages, and tobacco

	Original sample (1966-2023)	**Shorter sample (1973-2023)**
Dom Pharmaceuticals (w1)	0.002	0.002
Dom Food etc. (w2)	0.187	0.181
Dom Transportation (w3)	0.027	0.028
Dom IT & Electronics (w4)	0.004	0.004
Dom Other industries (w5)	0.597	0.591
Im Pharmaceuticals (w6)	0.003	0.003
Im Food etc. (w7)	0.079	0.086
Im Transportation (w8)	0.007	0.007
Im IT & Electronics (w9)	0.002	0.002

Im Other industries (w10)	0.094	0.096

11.6.3 Transportation

	Original sample (1966-2023)	**Shorter sample (1973-2023)**
Dom Pharmaceuticals (w1)	0.000	0.000
Dom Food etc. (w2)	0.001	0.000
Dom Transportation (w3)	0.313	0.319
Dom IT & Electronics (w4)	0.022	0.025
Dom Other industries (w5)	0.489	0.483
Im Pharmaceuticals (w6)	0.000	0.000
Im Food etc. (w7)	0.000	0.000
Im Transportation (w8)	0.028	0.030
Im IT & Electronics (w9)	0.011	0.012
Im Other industries (w10)	0.136	0.130

11.6.4 IT & Electronics

	Original sample (1966-2023)	**Shorter sample (1973-2023)**
Dom Pharmaceuticals (w1)	0.000	0.000
Dom Food etc. (w2)	0.002	0.002
Dom Transportation (w3)	0.027	0.028
Dom IT & Electronics (w4)	0.128	0.133
Dom Other industries (w5)	0.493	0.489
Im Pharmaceuticals (w6)	0.002	0.002
Im Food etc. (w7)	0.002	0.002
Im Transportation (w8)	0.005	0.005
Im IT & Electronics (w9)	0.125	0.132
Im Other industries (w10)	0.217	0.207

11.6.5 Other industries

	Original sample (1966-2023)	**Shorter sample (1973-2023)**
Dom Pharmaceuticals (w1)	0.002	0.002
Dom Food etc. (w2)	0.024	0.022
Dom Transportation (w3)	0.066	0.065
Dom IT & Electronics (w4)	0.027	0.029
Dom Other industries (w5)	0.631	0.633
Im Pharmaceuticals (w6)	0.005	0.005
Im Food etc. (w7)	0.014	0.014
Im Transportation (w8)	0.012	0.013
Im IT & Electronics (w9)	0.017	0.018
Im Other industries (w10)	0.202	0.199

11.7 Aggregate price deflator

This section provides a detailed aggregate price deflator formula for the compactly written equation in section 5.6.

$$P_i I_1 = (py_1)^{w_1^{dom}} \cdot (pm_1)^{w_6^{im}} \cdot (py_2)^{w_2^{dom}} \cdot (pm_2)^{w_7^{im}} \cdot (py_3)^{w_3^{dom}} \cdot (pm_3)^{w_8^{im}} \cdot (py_4)^{w_4^{dom}} \cdot (pm_4)^{w_9^{im}} \cdot (py_5)^{w_5^{dom}} \cdot (pm_5)^{w_{10}^{im}}$$