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Special studies

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The importance of fuel prices for companies' costs





Special study

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Preface

The government has tasked the Norwegian Economic Institute with analyzing fuel prices, see the Norwegian Economic Institute's regulation letter for 2024, dnr Fi/2023/03284 (in part). This report forms part of this assignment and aims to analyze how the costs for companies in the various sectors of the business world change when fuel prices rise see.

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Stockholm in January 2024

Albin Kainelainen Director General

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1 Summary

This report analyzes how changes in fuel prices affect costs in business sectors. The analysis is included as part of the task that the Institute of Economics has been given by the government to analyze fuel prices.1 More specifically, how the industries' costs are affected indirectly, via effects on other industries' increased costs, is examined. In addition, it examines how consumer prices in total are affected both directly and indirectly by changes in fuel prices. The analysis is limited to studying price increases that only take place in Sweden. The price increase could thus be due to changes in the reduction obligation or the introduction of a national trading system for fuel, i.e. changes that are specific to the Swedish market.

The model analysis shows that the cost increase that occurs when fuel becomes more expensive is small for most industries in Swedish business life. This is a consequence of the fact that fuel constitutes a relatively small proportion of the total cost mass for the companies. Truck transport, fisheries, public transport, buses and taxis experience greater cost increases from higher fuel prices relative to other industries. Also forestry, agriculture, post and other transport services such as sea transport are affected more than others. The indirect effect on consumer prices is somewhat greater than the direct effect.

In the model calculation, the effect of a 35 percent price increase on fuel (gasoline and diesel) excluding tax is calculated. For household consumers, this corresponds to a ten percent increase in the price of fuel at the pump.2 This leads to an increase in consumer prices in total by approx. 0.2 percentage points as a direct effect, since household expenses for fuel make up approx. 2 percent of total consumption . In addition, there is an indirect effect of higher prices on other goods and services from the higher production costs, which amount to just under 0.3 percentage points. In total, the effect on consumer prices is thus barely 0.5 percentage points of an increase in fuel prices of 35 percent at the producer level, corresponding to 10 percent at the consumer level.3

It should be borne in mind that these effects on consumer prices are calculated under a number of simplifying assumptions. It is assumed that there is no substitution or changed behavior due to the price changes. It is also assumed that domestic producers manage to raise the prices of their own products even though import prices do not rise to the same extent. In that respect, the model-calculated price effect is an upper limit of the real effect. If companies and households substitute away from more expensive fuels, the price effect is likely to be smaller. On the other hand, it is also assumed that no adjustment of demand, exchange rate or wage level takes place. If, for example, wage demands become higher due to more expensive fuel, then increased wage costs can lead to a greater effect on prices in the end.

¹ See Regulation letter for the budget year 2024 regarding the Norwegian Economic Institute, dnr. Fi/2023/03284 (in part).

² The figures apply to 2021 as the data for the calculation refer to that year. The fact that the price at the pump increases less in percentage terms than the price excluding tax is due to the excise duties on fuel being set in kroner and ören. The relationship between percentage price changes including and excluding tax varies from year to year as excise taxes and prices change.

³ The model is completely linear, which means that an increase in fuel prices at the consumer level by 20 percent has twice the effect on prices and costs. An increase of 5 percent gives half as much effect, and so on further.

2 Background and purpose

This report analyzes how changes in fuel prices affect costs in business sectors. The purpose of the analysis is best illustrated by an example: Increased fuel prices cause transport costs to increase. This, in turn, means that the cost of producing and distributing various input goods (everything from agricultural goods, metals, concrete, plastic goods, etc.) increases. This in turn causes the prices of these products to rise, leading to further cost increases, and so on. The purpose is to calculate the size of the combined direct and indirect effect on production costs and consumer prices that arise when fuel prices increase.

3 Use of fuel and road transport in business sectors

How an industry is affected by increased fuel prices depends both on how much fuel the companies use in their own operations and how much fuel used by companies earlier in the production chain. An important cost impulse comes from road freight transport, which uses a lot of fuel. Freight transport can either be carried out under the auspices of the company that needs to transport goods, or the company purchases freight transport services from a company that belongs to the road transport industry and that produces these services. The majority of freight transport on Swedish roads is carried out by professional traffic that, for payment, performs transport services for others. This share, expressed as the amount of goods loaded, made up 91 percent of all domestic transport in 2022.4 The remaining amount of goods was transported by companies that distribute goods to their customers on their own account. Most industries are thus not directly affected by fuel price increases, but the industry's cost increase is indirectly affected by the purchase of road transport services and by other price changes resulting from the change in the fuel price.

Below is presented the use of fuel and freight transport in the business sectors in relation to the production value in 2021. 5 How the use looks like in different sectors has a large impact on the effect on consumption costs and is the basis for the results shown in sections 5 and 5.

3.1 Use of fuel

Table 1 shows the use of fuel in 2021 measured as a share of total production for various industries. Fuel is defined here as petrol or diesel. The transport industry is presented both as an aggregate for the entire industry and disaggregated to make clear which part of the transport sector uses the most fuel (on the left and right in table 1). Industries that have the largest share of direct use of fuel are transport, agriculture and fishing, as well as water, sanitation and waste. The purchase of fuel

⁴ The proportion is calculated based on road traffic statistics from Trafikanalys, see https://www.trafa.se/vagtrafik/last-bilstrafik/.

⁵ Appendix 1 describes the industry classification used in this chapter.

including tax in these industries accounted for 7.6 percent, 4.5 percent and 2.7 percent respectively of the respective industry's total production in 2021. Within the transport industry, road transport of goods uses the largest share of fuel, corresponding to 22.2 percent of total production. In passenger traffic, 8.1 percent of the production value is fuel, while the same figure for sea transport and rail transport is 5.2 and 3.2 percent respectively. Air transport uses aviation fuel and therefore has no use of

either petrol or diesel.

Table 1 Direct use of fuel in 2021

Share of total production within each industry (%)

Industries	Proportion of fuel	Proportion of fuel Transport industry Proportion of fuel		
Transport	7.6	Road transport goods	22.2	
Agriculture and fishing	4.5	Passenger traffic	8.1	
Water, sanitation and waste	2.7	Sea transport	5.2	
Forestry	1.5	Rail transport	3.2	
Construction services	1.1	Post and others transport services	0.8	
Extraction of minerals	1.0	Flight	0.0	
Leisure services	0.6			
Trade	0.5			
Property management	0.4			
Manufacturing	0.4			
Business services	0.2			
Care and education	0.2			
Hotel and restaurant	0.1			
Heat	0.1			
Finance and insurance	0.1			
EI	0.1			
Information and				
communication services	0.1			

Note The table shows the value of purchased fuel including tax as a percentage of the total production value in various industries. Fuel refers to petrol and diesel.

Sources: Statistics Norway and the Norwegian Economic Institute

The statistics above measure usage in kroner and describe total usage. That is, diesel and petrol can be used both for a work machine (for example a tractor) and for a vehicle. Work machines are mainly used in agriculture and fishing, forestry, extraction of minerals and construction services.

3.2 Use of freight transport services

Many companies do not arrange freight transport within the company, but buy a freight transport service from a freight or logistics company that exists in the transport industry. Table 2 shows the share of freight transport services of total production that each industry bought in 2021. The two industries with the highest use are the transport industry (17.9 percent) and forestry (15.6 percent). The transport industry is disaggregated and displayed

to the right of the table. The postal and other transport services sub-industry, which includes mail and freight and logistics services, used 38.5 percent of its output on road transport services in 2021. This industry includes forwarding companies. Since they are mainly resellers of transport services to other companies, the value share of purchased transport services is very high for the industry.

01.

Table 2 Use of freight transport services in 2021

Share of total production within each industry (%)

			Share
Industries	Share of use Trans	sport industry	use
		Post and other	
Transport	17.9	transport services	38.5
Forestry	15.6	Rail transport	2.0
Water, sanitation and waste	1.8	Sea transport	0.4
Construction services	1.8	Passenger traffic	0.0
Heat	1.4	Road transport goods	0.0
Manufacturing	0.7	Flight	0.0
Extraction of minerals	0.5		
EI	0.5		
Trade	0.3		
Business services	0.2		
Agriculture and fishing	0.2		
Leisure services	0.1		
Informational and			
communication services	0.1		
Hotel and restaurant	0.1		
Care and education	0.0		
Property management	0.0		
Finance and insurance	0.0		

Note The table shows the value of purchased road transport including tax as a percentage of total production in various industries.

Sources: Statistics Norway and the Norwegian Economic Institute

Use of freight transport services has not changed significantly over time among the industries that use relatively much freight transport services compared to other industries. Chart 1 shows that use of freight transport services has been between 15–18 percent for the transport industry since 2011. The heating industry's use of freight transport as a share of total production has fallen from 2.3 percent 2017 to 1.4 percent in 2021.



Chart 1 Use of freight transport services for selected industries 2011-2021

Share of total production within each industry (%)

Note The diagram shows the value of purchased road transport including tax as a percentage of the total production value in selected industries over time

Sources: Statistics Norway and the Norwegian Economic Institute

4 An input-output based price model is used to calculate the effect on consumer prices

A common way to calculate price effects is with a so-called input-output model. Input-output models are based on data on which products different industries use in their production, and collect this information in an equation system that can be used to calculate the entire chain of price pass-through, i.e. also indirect effects.

This type of model has previously been used by the Norwegian Economic Institute in a similar context. 6

The models are based on a number of basic assumptions that should be kept in mind when interpreting the results (see the box below).

6 See for example Konjunkturinstitutet (2023c) and Konjunkturinstitutet (2022).

Input-output models and central assumptions

Input-output models consist of equation systems that show the mutual dependence between different branches of the economy. The industries use each other's products to varying degrees as input consumption in their production. With the help of information from the national accounts, the cost shares of the various products in the production of various goods and services are calculated. Together with data on labor costs, an equation system can be set up that describes how the cost structure for different products looks like. The model can, for example, be used to calculate the impact of import price increases on total production costs. When the model is supplemented with information on the weight of the products in consumption and other use, as well as taxes and subsidies, etc., the price pass-through at the consumer level can also be calculated. In the model calculations, it is central to distinguish between so-called endogenous, cost-determined product prices, and exogenous, predetermined prices. The exogenous prices are set by the model user, and the endogenous prices are then calculated with the system of equations, based on the assumption of full cost pass-through. It is thus the costs that completely determine what the endogenous prices will be. Input-output models have several limitations that are important to bear in mind when interpreting the results. The model assumes that there are no behavioral changes, that is, consumers are assumed to demand the same amount of all individual products regardless of how the prices for different products develop. It is also assumed that there is no substitution from more expensive to cheaper inputs in the event of price changes. Furthermore, the data material is uncertain and is based on values in current prices from previous years (in this case 2021). Depending on the degree of aggregation in the model, the results can be misleading.

The exogenous assumptions, which are to some extent subjective, are decisive for the results the tat. The profitability assumption (fixed profit share, profit margin or return on capital) affects the calculated cost impact. Even some model technical assumptions (for example the choice between so-called industry or product technology) have some significance. For a detailed description of input-output models, see Miller and Blair (2009).

The model used in this analysis is based on the production costs of individual products, rather than industries. The results reported refer to the cost increase that occurs in the production of various products. The industries in business often produce more than just one product, so the overlap from product to industry is not 1:1.

But the results for products correspond approximately to the cost increase for the corresponding industry. The model is based on data from 2021. The results are not exactly applicable to other years because the model results are dependent on prices and tax rates in the initial state. For example, higher fuel prices in the initial situation mean that the expenditure on fuel as a share of total household expenditure is higher, and the effect of relative price changes on consumer prices overall is therefore greater.

The profitability assumption is that all industries have a fixed profit share.7 This means that increased consumption costs are passed on to the end customer, kroner for kroner.

⁷ However, the petroleum refining industry, which is the industry with an exogenously set price, is not assumed to have a fixed profit share. In the model, one can choose to set the price exogenously or the profitability exogenously in each industry. You cannot set both profitability and price exogenously at the same time.

Import prices are kept exogenous, so the change in fuel prices is assumed to take place only in Sweden. It could, for example, be due to a change in the requirements for the mixing of (more expensive) biofuels that apply only in Sweden or the introduction of a national trading system emission rights for fuels.

The calculation assumes an exogenous increase in the fuel price (gasoline and diesel) for consumers at the pump by 10 percent. Since a large part of the price at the pump consists of excise duty, the fuel price excluding tax must increase more than that in percentage terms for the pump price to increase by 10 percent. The price increase for fuel excluding tax is just over 35 percent, which with base year data from 2021 gives a price increase for consumers at the pump of 10 percent. Note that this relationship between the percentage change in product price relative to consumer price depends on the level of the product price relative to the level of excise taxes, and the figure applies to the year 2021. The relationship between the price including and excluding tax for different industries is also affected by the proportion of diesel/ gasoline the various industries use. This is because the excise duty on petrol is higher than on diesel (in 2021). For an industry that uses a lot of diesel, changes in the price excluding tax result in a larger price increase in relative terms including tax than the corresponding impact is for consumers, who buy a larger proportion of petrol. A 35 percent increase in the price of gasoline and diesel combined in 2021 would have meant an increased purchase price of fuel in total of over 20 percent for truck companies (which mainly use diesel). Industries that have reduced tax on the use of fuel, for example in agriculture and forestry, also face greater price increases for fuel in relative terms than household customers. It is also because the excise tax for those companies is lower, so a proportional change in the fuel price set excluding tax has a greater impact on those companies' purchasing costs.

5 Effect on consumer prices

The total effect on consumer prices of a 10 percent increase in the consumer price of fuel is an increase in the price level of just under 0.5 percentage points. The indirect effect is slightly greater than the direct effect. The effect is calculated for the so-called consumption deflator.8 The effect on the CPI is similar, but may be somewhat different due to differences in the degree of coverage and the weights of the various products in the consumption basket. The direct effect comes from the fact that the weight of fuel in consumption according to the national accounts was about 2 percent in 2021. Since the price increase at the consumer level is 10 percent, the direct effect is just 0.2 percentage points. In addition to this, there are also price increases for other goods and services which are due to increased production costs. All in all, these price increases result in a consumer price increase of just under 0.3 percentage points. Note that it is not assumed that there will be any change in the import prices of goods other than fuel in this calculation because the price increase for fuel is assumed to be limited to Sweden. The indirect effect thus comes solely from increases in production costs in Sweden. If fuel prices were to rise throughout the world, the effect on consumer prices in Sweden would be higher. The calculation also assumes that all companies succeed in raising their prices even though the prices of competing imported products do not rise.

⁸ The consumption deflator is an implicit price index for total household consumption in the national accounts.

6 Effect on production costs in various industries

Table 3 and Table 4 show the increase in purchasing costs per unit produced that occurs due to fuel prices increasing by 35 percent excluding tax in the calculation. A simple calculation example illustrates this. Assume that a company sells machines for SEK 100,000 during one year. To be able to produce and sell the machines, transport services are purchased as well as some consumables. In the initial situation, the total purchase costs are SEK 20,000. The increase in the price of fuel causes consumption costs to rise by SEK 5,000 to SEK 25,000. The table shows this cost increase as a percentage of the production value, which in the calculation example would therefore be 5 percent.9. If the company wants to maintain the same profit per machine produced, calculated in kroner and ören, they must raise their selling price by 5 percent. Table 3 thus shows how much the companies need to raise their sales prices in percentage if they want to maintain the same profit calculated in kroner.

The table is divided into a direct and an indirect effect. The direct effect stems from the industry's own consumption of fuel. Suppose that the machine-producing company in the example above had its own truck that it used to transport goods between production units. The direct effect then comes from the increased cost of the fuels used in the own transport. The indirect effect comes from other purchased goods and services (eg steel, electronics, etc.) also becoming more expensive as a result of other companies' increased costs. The last column shows the total effect on the production cost. So that is the sum of it

direct and the indirect effect.

The direct effect (column 2 in the tables) for agriculture shows that the production cost for that industry increases by 1.0 percent because the industry's purchase of fuel becomes more expensive. The indirect effect is 0.4 percentage points for agriculture. The production cost in agriculture thus rises by a total of 1.4 percent due to the increase in fuel prices. This means that farmers need to raise their selling prices by exactly 1.4 percent if they want to maintain their profit calculated in kroner and ören. Truck transport is most affected by the direct effect. Refined petroleum products as well as fisheries also experience a relatively large increase in costs because, according to the statistics, the industries use a lot of diesel as an input in the product ion.10 Public transport, forestry as well as mail and other transport services suffer relatively much from the indirect effect.

The fact that the postal and other transport services sector is greatly affected by the indirect effect is due to the fact that companies buy in transport services to a large extent. The industry includes freight brokerage and similar logistics services. These are companies that buy transport services from other companies. As the price increase for transport services increases, a large indirect cost increase occurs for the logistics companies. That the indirect effect for

^{9 5,000/100,000 = 5%.}

¹⁰ It is a little unclear why the refineries use so much diesel, but it could be because they mix different types of diesel (e.g. biodiesel and fossil diesel) into a finished product, and that the components involved are counted as input consumption in the national accounts. The diesel that the refineries use can be imported or domestically produced.

public transport is large is probably due to local transport companies such as SL buying bus services and other transport services from subcontractors.

Table 3 Increase in production costs in commodity industries

Percentage units

Product	Immediately	Indirectly	Total
Fish	2.4	0.7	3.1
Refined petroleum products	1.6	0.0	1.6
Forestry	0.3	1.2	1.4
Agricultural products	1.0	0.4	1.3
water, sewage, sanitation, recycling	0.6	0.3	0.8
Food	0.1	0.5	0.6
Paper and wood	0.1	0.5	0.6
Construction services	0.2	0.2	0.5
Beverages	0.1	0.3	0.4
Mining products	0.3	0.1	0.4
Non-metallic mineral products	0.1	0.3	0.4
gas, district heating and district cooling	0.0	0.2	0.3
Steel and metals	0.0	0.2	0.2
Clothing and textiles	0.1	0.1	0.2
Electricity production and distribution	0.0	0.1	0.2
Rubber and plastic goods	0.0	0.1	0.2
Chemistry and pharmaceuticals	0.0	0.1	0.2
Furniture, toys and other manufacturing	0.0	0.1	0.1
Transport	0.0	0.1	0.1
Machined metal goods	0.0	0.1	0.1
Machines	0.0	0.1	0.1
Electronics and electrical appliances	0.0	0.1	0.1
Tobacco	0.0	0.1	0.1

Note The table shows the increase in total consumption costs per unit produced expressed in percentages. The table shows the cost of the production of goods, which is not exactly the same as the production cost in the corresponding industries because an industry can produce several different products. The increase in production costs refers to the effect that the price of both petrol and diesel excluding tax rises by 35 percent.

Source: Konkunkturinstitutet.

Table 4 Increase in production costs in service industries

Percentage units

Product	Immediately	Indirectly	Total
Road transport of goods (Truck transport)	4.0	0.3	4.4
Public transport, bus and taxi	1.7	0.8	2.5
Post and other transport services	0.4	1.4	1.8
Sea transport	1.0	0.5	1.5
Rail transport	0.7	0.4	1.1
Air transport	0.0	0.4	0.4
Trade	0.1	0.2	0.3
Property management	0.1	0.2	0.3
Hotel and restaurant	0.0	0.2	0.2
Culture, fun, leisure and service	0.1	0.1	0.2
Small and holiday homes	0.0	0.2	0.2
Business services	0.1	0.1	0.2
Care and education	0.0	0.1	0.1
Information and communication services	0.0	0.1	0.1
Finance and insurance	0.0	0.1	0.1

Note The table shows the increase in total consumption costs per unit produced expressed in percentages. The table shows the cost of the production of services, which is not exactly the same as the production cost in corresponding industries because an industry can produce several different products. The product/industry Truck transport also includes pipe transport (pipelines). The increase in production costs refers to the effect that the price of both petrol and diesel excluding tax rises by 35 percent.

Source: Konkunkturinstitutet.

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Appendix 1

Table 5 Industry classification in section 3			
Industry code SNI 2007	Description		
A01, A03	Agriculture and fishing		
A02	Forestry		
B07–09	Extraction of minerals		
с	Manufacturing		
D351	EI		
D352-353	Heat		
E	Water, sanitation and waste		
F	Construction services		
G	Trade		
hrs	Transport		
H491-492	Rail transport		
H493	Passenger transport (public transport, bus and taxi)		
H494-495	Road transport goods		
H50	Sea transport		
H51	Flight		
H52-53	Post and other transport services		
N	Hotel and restaurant		
J	Information and communication services		
к	Finance and insurance		
L excluding L68A	Property management		
M, N	Business services		
Q	Care and education		
R, S, T	Leisure services		

SPIN-2015/SNI 2007 code	Product/Industry
A01	Agricultural products
A02	Forestry
A03	Fish
B05–06	Energy minerals
B, excl. B05–06	Mining products
C10	Food
C11	Beverages
C12	Tobacco
C13–15	Clothing and textiles
C16–18	Paper and wood
C19	Refined petroleum products
C20–21	Chemistry and pharmaceuticals
C22	Rubber and plastic goods
C23	Non-metallic mineral products
C24	Steel and metals
C25	Machined metal goods
C26–27	Electronics and electrical appliances
C28	Machines
C29–30	Transport
C31–33	Furniture, toys and other manufacturing
D351	Electricity production and distribution
D352-D353	gas, district heating and district cooling
E	water, sewage, sanitation, recycling
F	Construction services

Table 6 Products/industries regarding goods in the price model

Note Domestic production of energy minerals does not occur. Therefore, energy minerals are not included in all tables. See sni2007.scb.se for a detailed description of what is included in the various industries.

Source: Statistics Sweden

SPIN-2015/SNI 2007 code	Product/Industry	
G	Trade	
H491-H492	Rail transport	
H493	Public transport, bus and taxi	
H494-H495	Road transport of goods (Truck transport)	
H50	Sea transport	
H51	Air transport	
H52-H53	Post and other transport services	
EN	Hotel and restaurant	
J	Information and communication services	
к	Finance and insurance	
L68201A, L68201B, L68A	Small and holiday homes	
L, excl. L68201A, L68201B, L68A	Property management	
M, N	Business services	
Q	Care and education	
R, S, T	Culture, fun, leisure and service	

Table 7 Products/sectors regarding services in the price model

Note Small and holiday homes are an industry whose production value and prices are imputed. See sni2007.scb.se for a detailed description of what is included in the various industries.

Source: Statistics Sweden.