

# The Economics of Diaper Smuggling in Norway

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# Abstract

Diapers are sold at much lower prices in Norway than in the rest of Europe. The large price difference has led to smuggling of diapers, mainly to Eastern-European countries. The diaper smuggler gain both from the price difference and by evading taxes on the trade. In this thesis, I analyze the economics of diaper smuggling, both theoretically and empirically. First, I give an overview of the diaper market and try to explain why diapers are so cheap in Norway compared to other countries. Second, I discuss the literature on tax evasion and smuggling, and derive a framework for the optimal decision of diaper smugglers. Finally, I calculate the costs and gains of smuggling, and use the theoretical framework to calculate the profitability of this trade (i) compared to trading legally and (ii) compared to regular employment. I also calculate the tax loss to the importing country. The calculations are made for various assumptions about the unknown factors, such as the probability of detection.



# Preface

This thesis is submitted as part of the Master's degree program in Economics at the University of Oslo.

Writing this thesis has been a fun but demanding process. I have enjoyed analyzing this rather unconventional thesis topic, which has allowed me to model a real-life phenomenon and investigate a large variety of economic topics.

Thank you to my supervisor Tone Ognedal for valuable input and feedback throughout the writing process. I would also especially like to thank my boyfriend Jakob Lenz for all your help throughout my entire Master's degree as well as this thesis.

All remaining errors are my own.

Heidi Buø Åmot

8 May 2017



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# 1 Introduction

## 1.1 Background and motivation

### 1.1.1 Price competition on diapers

In the year 2000 the grocery chain Kiwi became the first Norwegian retailer to introduce a specific pricing strategy on baby diapers. Previously diapers had been a rather expensive, yet necessary commodity for all families with young children. The goal of Kiwi's marketing strategy was to use diaper discounts to increase their share in the grocery store market. They targeted families with young children, in order to ensure that this segment of consumers would favor Kiwi over otherwise similarly priced grocery chains.

Instead of lowering the diaper price directly, Kiwi introduced what they called *the diaper agreement*. This was a system where every 5<sup>th</sup> package bought was given to the consumer for free. Customers received a 'diaper membership card' to use every time they visited the store. Thus it was not necessary to buy all five packages at once, but instead it created strong incentives for consumers to return to Kiwi for their daily grocery shopping.

This was the start of a general price reduction on diapers in Norway. Kiwi's pricing strategy was quickly followed up by other grocery chains, which also started to introduce direct and indirect price reductions through similar diaper agreements. A very strong price competition between chains continued throughout the 2000's, which the media popularly referred to as *the diaper war*. During fall 2010 the price war escalated. Due to their first mover advantage, Kiwi had an established reputation as the best grocery store for families with young children. Rema 1000 challenged Kiwi's reputation, and cut the price of all their diapers by 50%. Other chains quickly followed course, and in the following months consumers observed increasingly larger price cuts on a weekly basis. Both Norwegian and international media showed great interest in the matter, as the otherwise rather expensive country of Norway now sold the cheapest diapers in all of Europe.

While consumers who bought diapers greatly benefited from the price reductions, the grocery chains experienced large losses on the sale of diapers (NTB, 2010). The 2010 *diaper war* increased diaper sales in Norway by 27.8%, however the grocery chains had a combined loss

of 44 million NOK (Aamodt-Hansen, 2011) and declared the price war over in January 2011. Diaper prices in Norway have since increased some compared to their bottom levels of the price war in fall 2010, yet they quickly reached an equilibrium level that is significantly lower than the prices before the 2000's. Fueled by diaper agreements and a continued focus among the grocery chains to win families as a consumer group, diaper prices have stabilized at a low level. Table 1 illustrates the price development in Norway since 2004.

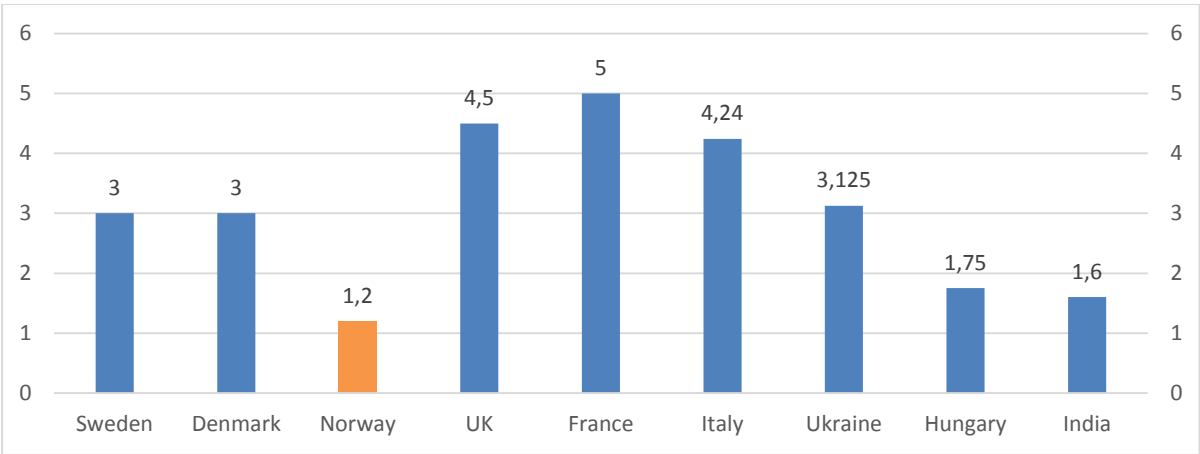
**Table 1: Price comparisons of Norwegian diapers at different times**

	<i>Libero</i>	<i>Pampers</i>	<i>Store brand<sup>1</sup></i>
<b>13.07.2004</b>	2,06kr	1,95kr	-
<b>27.01.2010</b>	1,2kr	1kr	0,55kr
<b>15.09.2010</b> <i>(time of the price war)</i>	0,4kr	0,4kr	0,09kr
<b>25.11.2011</b>	1,21kr	1,16kr	0,49kr
<b>29.10.2014</b>	1,1kr	1,15kr	0,34kr
<b>11.02.2016</b>	1,5kr	1,4kr	0,6kr

Categorized by brand. The table represents the lowest prices available on the given date.<sup>2</sup>

The general price level of diapers is still significantly lower in Norway than in other European countries. According to a price index study of world diaper prices from 2015 (see Figure 1), Norwegian diapers are among cheapest in the world.

**Figure 1: Diaper price index Norway and abroad**



Cost of one diaper in NOK in 2015. Source: Norgesgruppen (2015)

<sup>1</sup> Rema 1000 or First price (Kiwi).

<sup>2</sup> Based on price tests done by various newspapers and online magazines.

As a result of the decreasing diaper prices, a number of foreign consumers started to do cross border diaper shopping in Norway in the 2000's. Families from areas near the Norwegian border in Sweden and Russia came to Norway to stock up on diapers for personal use. However the large and long lasting price differences between countries have also encouraged smuggling.

### 1.1.2 The “*diaper mafia*”

The first news articles about smuggling of large volumes of diapers out of Norway surfaced in the media in 2009. This activity continued to grow in popularity the following years. The height of the price war in fall 2010 increased awareness of the price differences between countries, and by 2012 the word *diaper mafia* was an established term in the Norwegian media. *Diaper mafia* is a reference to small semi-organized groups coming to Norway with the sole intention to buy cheap diapers and sell them in their home country at a profit. Most of these groups come from Lithuania and Poland; countries where diaper prices are significantly higher than in Norway. Due to the negative stigma of the term *mafia*, I will in this thesis instead refer to this consumer group as diaper traders or smugglers. The groups typically consist of 1-4 people who make their way to Norway with large vehicles, which they fill to the brim with diapers. The total values of the purchases are significant, and vehicles containing diapers worth up to 75 000NOK have been stopped in custom controls. It is important to specify that the diapers in question are legally bought in grocery stores, and not stolen goods. However, to evade taxes the traders usually sell the diapers on the black market in their home country. In this respect, trade is illegal and the traders are smugglers.

### 1.1.3 Legal aspects of bringing diapers out of Norway

In contrast to tobacco and alcohol, diapers are a legal good without specific quota restrictions for import and export. Nevertheless, according to Norwegian law all goods with a total value of more than 5000NOK shall be declared to the customs when exiting Norway (Customs Act, § 3-1-15). One of the main pillars of the customs authority is the individual's obligations to declare and disclosure all goods that cross the border. A breach of this obligation is referred to as smuggling (Customs Law, § 3-1). The declaration duty is published in § 4-11 of the Norwegian Customs Act, which states that “Any person wishing to export goods has an obligation to obtain the permission of the customs authorities prior to exporting the goods. An

application for such permission is submitted by declaring the goods. (...) The declaration shall be made early enough for the goods to be inspected before they are loaded into the means of transport.” Specifically, when exporting by vehicle one must give notice to the customs at least 1 hour before arriving at the border crossing, and the prior notice is done by electronically filling out customs forms (Customs Act, § 3-1). When declared according to these rules, goods without specific restrictions can be transported out of Norway free of charge. In conclusion, when transporting goods worth more than 5000NOK out of Norway, this must be declared to the customs but the declaration does not involve direct monetary costs for the exporter.

Relating this to the activities performed by foreign diaper traders, it is not illegal to purchase a large amount of diapers in Norway. However not declaring goods with a total value exceeding 5000NOK is equivalent to smuggling. According to the Norwegian Customs Law § 16-2, violations of this paragraph is punishable with fines and/or a maximum jail sentence of 6 months. Furthermore § 16-8 states that if the person in question does not have a permanent residence in Norway, the goods will be confiscated.

Despite export declaration being free of charge, the bulk shopping done by the diaper traders is generally not declared to the Norwegian customs. According to the customs, diaper smuggling is likely an intentional action to avoid creating paper trails (Torheim, 2015). When goods are declared Norwegian export papers are created, and the transaction and cash flow becomes public information for foreign governments. This would make it harder to sell the diapers on the black market to evade taxes.

#### **1.1.4 Custom duties and evasion of taxes in the home country**

Since Norway is not a member of the European Union, import declarations must be made for products imported from Norway to an EU country. This includes filing a customs declaration, provide documentation of purchase and export of goods, and paying customs duties on the goods. Customs duty is a tariff or tax imposed on goods when transported across international borders. The final duty value is determined by customs value, tariff classification and origin of the goods (European Commission, 2017a). When payments are made, goods can circulate freely within the EU (Romaniec, 2014). As most of the diaper smugglers originate from Lithuania and Poland, the thesis will focus on regulations in these two countries.

In both Poland and Lithuania customs duties on land transport (car, train, foot) are enforced on imported goods from outside of the EU with a total value higher than EUR 300 (Migrant, n.d.). The duty must be paid within 10 days after receiving an approved customs declaration from the customs authorities, and the goods will be kept in the customs authorities' possession until payment has been made (Romaniec, 2014). Table 2 shows an overview of import duties in Poland and Lithuania. Baby diapers fall under the EU nomenclature code 9619.00.8100, and there are no additional fees on imported diapers from Norway (European Commission, 2017b).

**Table 2: Import duties and taxes on diapers in Poland and Lithuania**

<i>Poland</i>	<i>Lithuania</i>
<ul style="list-style-type: none"> <li>• Customs duties on non-commercial imported goods from non-EU country with total value higher than EUR 300</li> <li>• Imported goods are subject to VAT (23%)</li> </ul>	<ul style="list-style-type: none"> <li>• Customs duties on non-commercial imported goods from non-EU country with total value higher than EUR 300</li> <li>• Imported goods are subject to VAT (18%)</li> </ul>

Sources: Customs of the Republic of Lithuania (2016), Migrant (n.d.) and Romaniec (2014)

By not declaring, the foreign diaper smugglers can avoid import taxation, as well as fees, taxation and regulations regarding re-selling in their home country. Legally re-selling diapers in Lithuania requires individuals to buy a business license or to register their individual activities to the tax office. They must then pay a fixed income tax, value added tax (VAT), compulsory health insurance and social insurance to the state. If a person fails to do this it is regarded as illegal, and if the smuggler is detected the trader must pay penalty taxes. According to the Lithuanian State Tax Inspectorate (STI) there are some cases of legal Norwegian diaper businesses in Lithuania, however most diaper sellers are not operating legally (Samoskaite, 2012). Table 3 shows an overview of the taxes that must be paid when operating as a legal business in Lithuania. Observe that income tax evasion and not paying health and social insurance are the biggest monetary advantages of operating illegally. In combination these taxes makes up approximately 50% of gross income. Furthermore, in order to incorporate and register a new firm in Lithuania, there is a minimum capital requirement of 23 210kr.

**Table 3: Costs of operating and starting a legal firm in Lithuania**

Business license / start-up costs	630kr (World Bank, 2017)
Corporate profit tax	15% of gross income, 5% if the average number of employees do not exceed 10 and firm do not make more than 300 000kr per year (TaxGuide Lithuania, 2017)
Personal income tax	15% of gross income (TaxGuide Lithuania, 2017)
Value added tax (VAT)	Must only be paid when a firm makes more than approximately 400 000kr per year (Samoskaite, 2012)
Health and social insurance	30,98% of gross income (KPMG, 2017)
Minimum paid-in capital requirement	23 210kr (World Bank, 2017)

Sources: World Bank (2017), TaxGuide Lithuania (2017), KPMG (2017) and Samoskaite (2012)

### 1.1.5 Diaper confiscation

Since 2012 both Norwegian and Swedish customs have stopped several diaper smuggling attempts. The attempts are widespread throughout Norway, and smugglers have been stopped in various locations along the borders to Sweden, Finland and Russia, as well as the ports in Bergen and Kristiansand on ferries with destination Denmark.

The total value of the attempted smuggled goods is between 10 000NOK - 75 000NOK. All diapers found by the customs are confiscated, and either destroyed or donated to local kindergartens or child welfare institutions. Depending on the total value of the smuggling attempt, the smugglers also must to pay fines and are prosecuted for not declaring the goods.

Smuggling attempts are caught for different reasons. Some of the vehicles are stopped due to suspicion of overweight, and upon investigation large amounts of diapers were found. Other vehicles are stopped in random customs inspections at the border, some of which have even been rebuilt with secret compartments to better hide the diapers. In other cases, owners of grocery stores have directly contacted the customs regarding particularly large quantities recently bought in their stores. When crossing the border, the customs were then ready to make inspections and catch the smuggling attempt. However far from all smuggling attempts

are caught, and many Norwegian diapers have made their way to Eastern Europe. Table 4 shows an overview of most diaper smuggling attempts caught by the Swedish and Norwegian customs during the years 2012 - 2016.<sup>3</sup>

**Table 4: Diaper smuggling detections made in Norway and Sweden 2011-2016**

<i>Total value</i>	<i>Quantity</i>	<i>When</i>	<i>Where</i>	<i>Who</i>	<i>How caught?</i>	<i>Punishment in addition to confiscation</i>	<i>Source</i>
75 000NOK	301 packages	22.05.16	Helligskogen tollsted (Troms, Norway)	n/a	Outbound control	n/a	Tollvesenet (personal communication 2017)
75 000NOK	744 packages	20.11.15	Junkerdal tollsted (Nordland, Norway)	Three Lithuanian citizens (age 20's, 40's and 40's), two Mercedes vans	Outbound control	Prosecuted + 5000NOK fee	Tollvesenet (personal communication 2017) and Robertsen (2015)
n/a	1 ton of diapers	10.03.15	Lillehammer (Oppland, Norway)	One Lithuanian citizen	Traffic police: suspicion of overweight	Prosecuted for overweight + fee	Midtbø (2015)
n/a	25 000 diapers	27.09.14	Åsarna tullsted (Jämtland, Sweden)	Two Lithuanian citizens (age 25 and 40's), van	n/a	Prosecuted for smuggling attempt	NTB (2014)
n/a	1350 packages, 27 000 diapers	18.07.14	Bergen port (Hordaland, Norway)	One German citizen, van	Routine control ferry to Denmark	Prosecuted for not declaring	Jetmundsen and Nilsen (2014)
18 000NOK	22 430 diapers	22.01.14	Helligskogen tollsted (Troms, Norway)	Headed to Lithuania, Mercedes van	n/a	Fee	Bye and Berg (2014)
n/a	26 210 diapers	31.08.12	Hån (Värmland, Sweden)	Headed to eastern Europe	Routine control	n/a	Torgersen (2012)

<sup>3</sup> It has proved difficult to get an extensive overview, as neither the Norwegian nor the Swedish customs record detailed overviews of confiscated good. This overview is assimilated based on extensive research of Norwegian and Swedish newspapers.

13 000NOK	600 packages	19.05.12	Lierne (Nord-Trøndelag, Norway)	One Lithuanian citizen	Suspicion of heavy load	Fee	Granlund (2012) and Egge and Ness (2012)
44 000NOK	n/a	24.04.12	Storlien tollsted (Nord-Trøndelag, Norway)	Two Lithuanian citizens, Fiat van	Routine control	Fee	Granlund (2012)
45 000NOK	n/a	2012	Kristiansand port (Vest-Agder, Norway)	One Polish citizen, ferry to Denmark	n/a	n/a	Eie (2013)
24 000NOK	n/a	April 2012	Kristiansand port (Vest-Agder, Norway)	Headed to Lithuania	n/a	n/a	Stavanger Aftenblad (2012)
n/a	n/a	07.10.11	Lyngdal (Vest-Agder, Norway)	Two Lithuanian citizens (age 19 and 22), van	Suspicion of heavy load	Detained, interrogation	NTB (2011)
n/a	n/a	07.10.11	Larvik (Vestfold, Norway)	Two Lithuanian citizens (age 19 and 20), van	Suspicion of heavy load	Detained, interrogation	NTB (2011)

Sources: personal communication with Tollvesenet and various newspaper sources

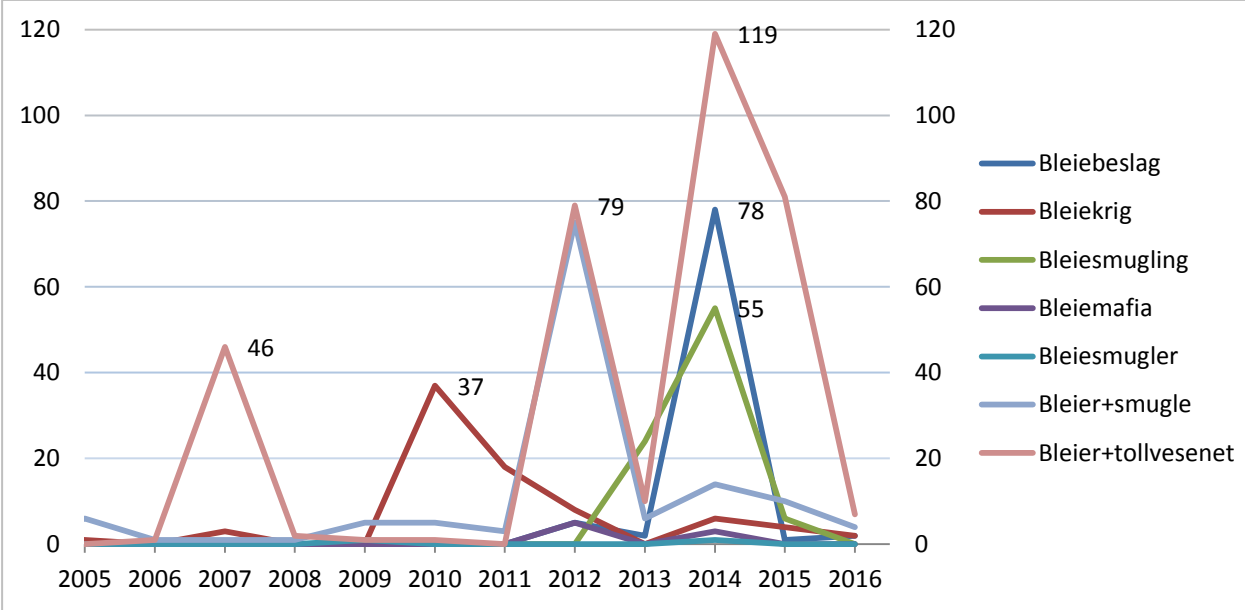
### 1.1.6 The size of the diaper smuggling phenomenon

Estimating the size of the diaper smuggling phenomenon has proved difficult. The Norwegian customs authorities can only share information from internal reports, of which only two have been made regarding diaper smuggling (Tollvesenet, personal communication, 2017). Diapers are not a separate category for the customs, as their main objective is to confiscate drugs and alcohol. Neither the Norwegian Police Directorate can provide statistics that contains information about the type of goods illegally smuggled out of Norway (Politidirektoratet, personal communication, 2017). A non-extensive overview of diaper smuggle attempts gathered from Norwegian and Swedish newspapers can be found in Table 4, which shows 13 separate cases of diaper smuggle attempts caught by the customs in the years 2012-2016. Similarly we get indications of the size of the phenomenon by investigating Norwegian



newspaper articles in the years 2005-2016 for key words related to diaper smuggling (see Figure 2). The figure illustrates that there seems to be a cyclical development, where 2012 and 2014 stands out as the years with most media coverage regarding the topic. The articles emphasize that the people caught have usually performed several similar diaper smuggling operations in Norway before. This is indication that the phenomenon is of a certain scale.

**Figure 2: Number of Norwegian paper and digital newspaper articles published in years 2005-2016 that contain key words related to diaper smuggling**



Key words: ‘diaper confiscation’, ‘diaper war’, ‘diaper smuggling’, ‘diaper mafia’, ‘diaper smuggler’, ‘diapers + smuggling’, ‘diapers + customs authorities’.<sup>4</sup>

Another aspect that give valuable indication of the size of the phenomenon is looking at the supply of the foreign diaper businesses. Investigating online Lithuanian diaper selling pages<sup>5</sup>, new posts regarding Norwegian diapers for sale are still published several times a week, implying that the diaper selling business is continuing. Consequently, the sellers do not seem to run out of supply, indicating that new diaper visits to Norway are still occurring. In chapter 3.5 I make calculations on the scope of diaper smuggling.

<sup>4</sup> Assimilated using <https://www.retriever-info.com/>.

<sup>5</sup> See pages like <https://www.skelbiu.lt/> and <http://www.alio.lt/>, searching for the keyword “sauskelnes norvegijos” (translation: Norwegian diapers).

### 1.1.7 Why is the “*diaper mafia*” a problem?

Diaper smuggling is a type of tax evasion as the diaper receiving countries do not receive income-, import- and business taxes when the individual sells the goods at the black market. Consequently, it is preferable that the diaper traders legally declare the goods in the exiting and entering countries. This will reduce the possibility of tax evasion in the entering country and allow the authorities to track the movement of the goods. Chapter 0 discuss the economic theory of tax evasion and smuggling, while the theoretical model in chapter 2 intends to answer questions regarding what would make the current diaper smuggling scheme unprofitable for smugglers.

The presence of diaper traders affects the Norwegian grocery store markets and Norwegian consumers. Since diapers are a bulky good, stores can only store a limited amount of them at the time. Many stores do not have daily supply delivery, and run out of stock as a result of diaper bulk shopping. Due to this excessive demand, Norwegian stores have experienced diaper shortages. To reduce this problem many stores instated a maximum limit on diaper sales per customer, which had a preventive effect. This was especially prevalent in the years 2012 - 2015, however per December 2016 there were still Norwegian stores enforcing limitations on diaper purchases, especially along the borders to Russia (Lorch-Falch, 2016).

In conclusion, the bulk shopping of foreign diaper traders has from time to time resulted in empty stores for regular Norwegian diaper consumers. At the same time, the presence of diaper traders may reduce retailers’ overall profit due to the diapers role as a loss leader. However who appears to be the winner is the diaper supplier, as the increased demand from consumers increases their revenues.

## 1.2 Pricing strategies and the diaper market

### 1.2.1 Diapers as a loss leader

According to Statistics Norway (2016) approximately 60 000 children are born in Norway every year, and families with young children is an important consumer group for grocery chains. This consumer segment is usually comprised of younger couples who are in a phase where they establish consumer routines for their new life as a family. This includes establishing loyalty towards specific products, labels and chains. Targeting this audience can thus potentially yield long run results for a grocery chain. Diapers are a necessary good for young families, which does not have a close substitute good. While fabric diapers have increased in popularity within recent years, store bought disposable baby diapers are still the dominant choice. According to SIFO (National Institute for Consumer Research), a child will use approximately 4000 diapers throughout their first 0-4 years (Gjørven, 2010).

Since diapers are an inelastic good, reducing their price will in theory have a limited effect on sales. It is the diapers role as a *bate good* or *loss leader* that increases profit for the grocery chain. A loss leader is priced such that it provides incentives for customers to shop in a store, and is often sold for a price equal to or lower than the cost price (Lal and Matutes, 1994). However due to the economics of scale in shopping, a larger customer share and increased prices of other goods, the store may increase its overall profit. The pricing strategy itself is called loss leading, and is a type of cross subsidizing (Nese, 2010).

**Table 5: Characteristics of a loss leader**

<i>Trait</i>	<i>Reason</i>
Product that consumers purchase frequently	Ensures consumer is aware of the low price
Scarce supply in stores	Discourages consumer stockpiling
Placed in inconvenient part of the store	Consumers more likely to buy other goods as well
Limitations on quantity a customer can purchase, or systems where good number x is free of charge	Ensures consumer come back often

Based on information in Didriksen (2012)

Imperfect price information and advertisement play important roles in the success of loss leading. Bate goods are most efficient for consumers who make shopping decisions based on prices of a limited amount of goods. Families with young children generally have high costs of acquiring perfect price information, as they do not have the time or willingness to compare all options. Targeting this consumer segment through advertisements and bate goods is thus a strategic choice by the stores to increase consumer share. Due to imperfect price information, consumers may overvalue the importance of diaper purchases, and the low diaper prices have a psychological higher importance than the markups on other goods.

The loss leading of diapers in Norwegian stores has proved very efficient for grocery stores, and at the height of the diaper war Kiwi could boast of a growth in sales of 30-50% on other goods (Andersen, 2015). If loss leaders are priced far below the cost price, it is sometimes criticized for hurting competition. However as grocery stores sell thousands of goods, selling some of these at a loss does not force competitors to leave the market. Thus diaper loss leading is not harmful for competition (Nese, 2010).

### 1.2.2 Models with gains from loss-leading

#### Model A

One simple explanation for cutting prices of diapers is that it is a form of price discrimination: it may be that families with small children, the diaper consumers, have a higher elasticity than other consumers, in the sense that the price difference that make them change store is lower than for other consumers. If this is the case, the store may want to lower prices for this group, without lowering them for the more price inelastic groups. This can be accomplished by lowering the prices on a good that is bought by the price elastic group, but not for the others, such as diapers. In that way, shopping in the store is in sum cheaper for families with children than for other groups.

#### Model B

Loss leading may also be profitable for the store if diaper customers are myopic in the sense that they overvalue the budget effect of diaper prices. Assume that every consumer buys one unit of goods other than diapers and some of them buy  $b$  diapers. Consumers chose to do their

grocery shopping in the store where the sum of the price of the bundle and price of diapers is lowest. Assume that there are three types of consumers:

Type I: families with young children, purchase both diapers and other goods

Type II: consumers without young children, purchase only other goods

Type III: diaper traders, purchase only diapers

Assume that there are two stores available, A and B. Consumer  $i$  has a subjective cost  $k_i$  from shopping in store A.  $k_i$  has expectation 0 and is symmetrically distributed from  $K$  to  $-K$  with expectation 0. This subjective cost includes factors such as individual preferences for a specific store and distance to the store. Let  $P_A$  and  $P_B$  be the total price of one unit of the consumption bundle without diapers in stores A and B, respectively.  $q_A$  and  $q_B$  are the prices of diapers, and assume that all prices are positive.

A rational consumer of type I, family with small children, will buy in store A if and only if  $P_A + bq_A + k_i \leq P_B + bq_B$ . However, if they value the importance of diaper prices too high they will shop in store A if  $P_A + (b + \Delta)q_A + k_i \leq P_B + (b + \Delta)q_B$ , where  $\Delta$  is the “overvaluing” of the importance of cheap diapers. As  $\Delta$  increases, the more the price difference of diapers between stores matter to the consumer when making the shopping decision.

Let  $F(k)$  be the cumulative distribution function for  $k$ . The fraction of type I consumers that shop in store A is then given by

$$S_i = F(P_B - P_A - (q_B - q_A)(b + \Delta))$$

Let  $C$  be the cost price for a bundle of goods, and  $c$  the cost price of one diaper. Thus store A’s profit of from the irrational customers ( $\pi_i$ ) is

$$\pi_i = (P_A - C + (q_A - c)b)F(P_B - P_A - (q_B - q_A)(b + \Delta))$$

If all consumers are affected by loss leading and have high  $\Delta$ , stores maximize profit by lowering price of diapers and raising the price of the bundle of other goods.

Type II-consumers do not purchase diapers, so  $b=0$ . As they are acting rationally, they will consume in the store with the lowest overall prices. Thus for this consumer group stores maximize profit in the traditional way.

Combining both types of consumers into one model, let  $\alpha$  be the fraction of type I-consumers and  $\beta$  the fraction of type II-consumers, i.e.  $\alpha + \beta = 1$ . Store A's overall profit is then:

$$\pi = \alpha(P_A - C + (q_A - c)b)F(P_B - P_A - (q_B - q_A)(b + \Delta)) + \beta(P_A - C)F(P_B - P_A)$$

The larger  $\alpha$ , the larger is the gain from lowering diaper prices. The store must consider the tradeoff between lowering  $q$  and raising  $P$ , as raising price of the bundle of other goods will make rational consumers shop in the other store.

The diaper traders only purchase diapers for resale and shop where they find the lowest diaper prices. Thus, the share of diaper trader consumption in store A is decided by the price difference of diapers between the stores. However even more important for the diaper traders is the price difference between Norwegian and foreign diapers. The diaper traders' demand for diapers in store A is a function of the price in store A itself, as well as the price difference between stores.

$$D_t = D(q_A, q_A - q_B)$$

Demand is obviously decreasing in both arguments. If the store sells diapers at a price lower than cost price, they lose from the diaper traders.

When diaper traders are not present, it can in both models be beneficial for stores to set diaper prices below cost price if families with small children makes up a large share of the consumers. This means that the store loses money on the diapers, but increase overall profit as consumers purchase other goods as well. However, if diaper prices are set too low, stores also attract the diaper traders. As diaper prices decrease, diaper traders increase diaper consumption and take advantage of the low prices. This has unwanted effects for the stores, as stores take a loss on these consumers when diaper prices are below cost price.

Thus, in both models, the presence of diaper traders limits the store's possibility to earn money on diaper as a loss leader.

### 1.2.3 Diaper markets and price discrimination in Norway

While loss leading is a common pricing strategy in many countries, Norway appears to be the only country to use diapers as a lure good. Families make up a large share of the population in all countries, however Norwegian society and welfare is specially known for the emphasis on equality and egalitarianism. Norway is also characterized by having homogenous consumers, a high density of grocery stores and a high preference for low-price chains. In combination, these factors indicate that Norwegian consumers are an especially good target market for diaper pricing strategies. In contrast, in many other European countries there are larger consumer segmentations for grocery chains. Preferences vary more across the population due to more heterogeneous consumers, which may make the same diaper pricing strategy less effective. Furthermore, it is difficult to say whether overall Norwegian grocery store profit would be different if no diaper war had taken place. While Kiwi benefited from first-mover advantages, there exists a prisoner's dilemma of setting low diaper prices. Stores choose the same pricing strategy in order to not fall behind their competitors. However if all stores chose to increase the price of diapers, their long-run profits should be similar to current levels.

The presence of foreign diaper shoppers in Norway limits the possibility of price discrimination on diapers between Norway and other countries. The diaper traders purchase more the larger the price difference between countries. This is because much of their profit based on purchasing where prices are low and selling where they are high. Thus the law of one price does not hold, and arbitrage is possible.

## 1.3 Tax evasion and smuggling

The economics of diaper smuggling in Norway can be seen in the light of two theoretical economic topics – smuggling and tax evasion. Traditionally these topics have been analyzed separately. Tax evasion is generally investigated from a public economics view, with focus on the individual choice of the evader. In contrast smuggling is traditionally analyzed in an international trade-setting. However, smuggling can also be seen as a special case of indirect tax evasion, by being an attempt to evade import duties and quota regulations (Sandmo, 2012).

### 1.3.1 Tax evasion

Tax evasion is defined as hiding income to avoid paying taxes. Tax evasion must be clearly differentiated from tax avoidance, which is to exploit tax loopholes and work within the legal framework of the tax law to avoid paying taxes. Consequently, a tax avoider will report his transactions as accurately and openly as possible in order to receive tax reductions, while a tax evader worries about the possibility of being detected. Tax evasion can occur in a multitude of ways, through income tax evasion, capital tax evasion, tax havens, use of multinational enterprises and profit shifting, and indirect tax evasion. The scope of tax evasion can be investigated directly through amount of detections, as well as indirect methods such as interviews and third party reporting.

Allingham and Sandmo (1972) were the first to formalize a study of income tax evasion, as they modelled tax evasion as a decision under uncertainty. The A-S model focuses on the *intensive margin* – how much individuals engage in tax evasion, and the *extensive margin* – what factors determine if an individual evades taxes at all. The model is an adaptation of a model of portfolio choice with one safe and one risky asset. The risky asset is the amount of income not reported to the tax officials, and the safe asset the amount reported correctly.

There is some probability that the evasion will be discovered, causing the individual to pay a penalty rate on the evaded income which is higher than the tax rate. Thus the individual must maximize his expected utility under uncertainty, and is influenced by possible legal penalties just like other costs. The individual decides how much income to report and not report. The optimal quantity of tax evasion depends on the probability of being caught, the penalty rate and the individual's degree of risk aversion.

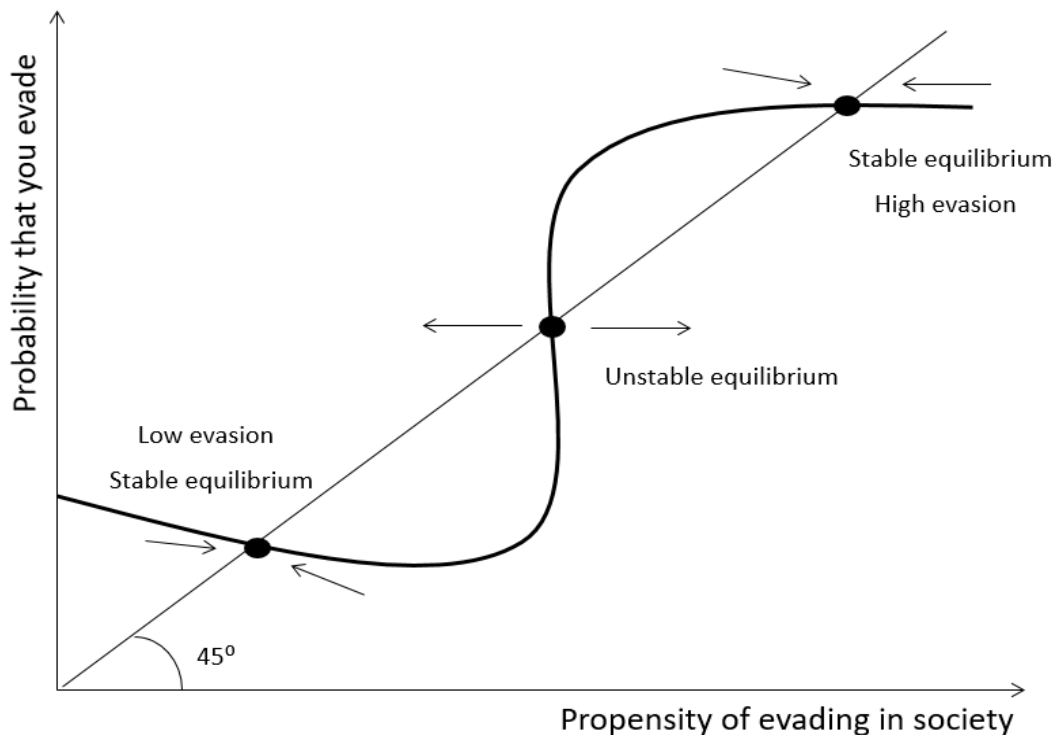


The results show that increases in probability and detection penalty rate reduce tax evasion, while an increase in income increases evasion. In the A-S model an individual will evade income if the statutory tax rate is greater than the expected penalty tax rate. This result gets little support from empirical studies, as the extensive margin would imply much more evasion than what empirical data shows. Some extensions of the Allingham-Sandmo model try to explain this discrepancy by including psychological costs of evasion and concealment cost. Sandmo (1981) also presents an extension of the model where labor supply is endogenous, and the individual can choose between working in the regular economy or the hidden economy.

More recent studies emphasize the importance of the differences in opportunity to evade. The pioneer model of Allingham and Sandmo fits best for self-employed people who declare their own income, and therefore have opportunity to evade. However, most employees do not have this opportunity, as their incomes are reported by their employer (so-called third party reporting of wages). The importance of these differences in opportunities is supported by empirical studies such as Kleven et al (2010), who find that tax evasion rate is close to zero for income subject to third party reporting, but substantial for self-reported income.

Finally, moral costs may effect an individual's decision to evade. These costs are comprised of various factors and may vary between individuals. Barth, Cappelen and Ognedal (2006) discuss the concept of fair tax evasion, and emphasize that the presence of unjust tax systems can make people justify evasion. In particular, they find that individuals with low wages and long working hours are more likely to justify income tax evasion. The Allingham-Sandmo portfolio models assume that the individual tax evader is isolated from the rest of the community. However, the degree to which the tax evader feels stigmatized by detection is likely dependent on whether others have been detected for similar violations (Sandmo, 2005). Andvig and Moene (1990) look at the general equilibrium effects of tax evasion, and find that the individual cost of being honest in a corrupt society is higher than in a society where most individuals are honest. Figure 3 shows how individual decisions about tax compliance affect the performance of the whole economic system, creating equilibriums with high and low evasion. As more people evade, an individual's disutility of breaking the law is likely lower. Similarly, it might be less risky to evade in a country where evasion is widespread.

**Figure 3: General equilibrium effects of tax evasion**



Based on Andvig and Moene (1990)

Most work in the field of tax evasion considers direct taxation such as income and capital tax evasion. While the literature of direct tax evasion focus on the choice of the individual, indirect tax evasion is generally considered a decision made by firms. This shifts the analysis from utility maximization to profit maximization, challenging certain assumptions such as risk aversion. Marrelli (1984) was the first to extend the Allingham-Sandmo model to a risk averse firm. He examines a monopolistic firm's decision under uncertainty, investigating whether and to what extent the firm should avoid indirect taxes by under-reporting. Sandmo (2002) extends the theory to risk neutral firms, by investigating the commodity tax evasion decisions of a non-compliant polluting company.

Research in the field of indirect tax evasion focus on the issues of separability between output and evasion decisions, and policy tools to reduce evasion (Arias, 2005). If the output and evasion decisions made by firms are separable, the tax rate is set to achieve a specific policy objective to get the desired consumer price. Evasion should instead be controlled by the intuitive and traditional ways of increasing detection fines and the probability of detection. However, if the evasion decision of the individual or firm is dependent on output, one may also alter the tax rate to deter evasion. This challenges the traditional way of setting tax rates,

which focus on efficiency and equity concerns (Sandmo, 2005). Optimal tax analysis does not offer a clear conclusion to whether the existence of tax evasion is an argument for a lower marginal tax rate.

### 1.3.2 Smuggling

While the word smuggling often is associated with trade of illegal goods such as drugs and weapons, smuggling of highly taxed or otherwise regulated legal goods is also of great economic interest. Smuggling takes place when full prices differ for legal or illegal goods between different jurisdictions, and this price difference minus the costs makes the net returns from smuggling positive (Saba et al, 1995).

The theoretical literature of smuggling started in the 1970s, and the main focus at the time was the welfare impacts of smuggling. Bhagwati and Hansen (1971) investigate whether it holds true that a small country in an open economy can experience welfare improvements from smuggling. Smuggling implies evasion of taxes (or other quantitative restrictions) on trade. These restrictions make the trade sub-optimal, and their hypothesis is that avoiding such restrictions may remove distortions and therefore be welfare improving. Focusing on the general equilibrium effects of smuggling, Bhagwati and Hansen conclude that smuggling is only welfare improving if it eliminates legal trade. This is because smuggling results in a loss of tariff revenue, without a corresponding improvement in the efficiency of production or consumption patterns (Martin and Panagariya, 1984).

The Bhagwati-Hansen models have become the theoretical basis for further studies in economics of smuggling. Pitt (1981) extends on this work, by allowing for simultaneous existence of smuggling, legal trade and price disparity. Price disparity is defined as the difference between the domestic market price and tax-inclusive world price of a commodity. This means that the domestic price of an exportable is greater than its return from legal export. Pitt finds that when smuggling and legal trade coexist, smuggling has no effect on the domestic price.

Coexistence of smuggling and legal trade characterizes real world smuggling situations, and smuggling activity can occur in various ways. Bhagwati (1981) categorizes different models of illegal trade (see Table 6), all of which are triggered by tariffs or quantitative restrictions in

either pure quantity or value terms. We distinguish between smuggling through legal and illegal checkpoints, as they have different implications and costs.

**Table 6: Types of tariff evasion**

<i>Legal checkpoints</i>	<i>Illegal checkpoints</i>
<ul style="list-style-type: none"> <li>a) Bribing customs officer</li> <li>b) Concealing import               <ul style="list-style-type: none"> <li>i) Underestimate unit value of correctly invoiced quantity</li> <li>ii) Underestimate invoiced quantity, but with correct unit value</li> <li>iii) Misclassifying high tariff products as a lower tariff variety</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a) Smuggling of untaxed commodities by firms engaging in illegal trade</li> <li>b) Smuggling of untaxed commodities by firms engaging simultaneously in legal and illegal trade</li> </ul>

Based on Bhagwati (1981) and Javorcik and Narciso (2008)

In general, there is a tradeoff between cost and detectability. Conducting illegal trade through illegal checkpoints often involve higher real costs, as it generally requires higher levels of secrecy. Illegal trade through legal checkpoints may occur without cost. Underestimating unit value can take place at almost negligible real costs for the smuggler, and is hard to detect. Underestimating invoiced quantity generally involves higher risks, as it is more detectable. This type of under invoicing is also likely to involve special packaging to hide the goods, which again yields increasing costs for the smuggler. However, inspections are likely to only occur randomly, as customs monitoring is imperfect and costly.

Tariff evasion is the concealment of dutiable imports, and can be performed by individuals and firms alike. Based on empirical data from ten Eastern European countries, Javorcik and Narciso (2008) find that tariff evasion is more prevalent for differentiated products. This is because compared to homogeneous goods, it is more difficult for the customs to detect an invoice stating incorrect price of differentiated goods. Furthermore, they find that tariff evasion mostly occurs through misrepresentation of the import price rather than underreporting quantity.

Martin and Panagariya (1984) were the first to focus on the microeconomic foundations in the theory of smuggling. Modeling a firm that engages in both legal and illegal trade, there are similarities between their work and the original Allingham-Sandmo model of income tax

evasion. The firm must take into account the possibility of being caught, and the associated costs of fines and confiscation. The firm seeks to maximize expected profits, and choose the optimal composition of legal and illegal trade. A simplified version of this model adjusted to the case of diaper smuggling can be found in the appendix. Norton (1988) continues this study by specifically looking at smuggling of agricultural goods, while Jensen, Thorsby and Thorsby (1988) assume a model where smuggling is camouflaged by legal sales. While the Bhagwati-Hansen model allows each firm to either trade legally or smuggle (but not both), one of the shortcomings the Martin-Panagariya model is that pure legal traders are driven out of the market when smuggling occurs. Jensen, Thorsby and Thorsby (1998) expand on this by showing that if firms have some market power, legal traders and firms that camouflage smuggling by also operating legal can coexist.

Cross border smuggling generally occurs when there is a large price difference between two countries or jurisdictions. Often this is due to significant differences in tax levels, like in the classic example of cross border cigarette smuggling between US states. Since the 1970's, states with high cigarette taxes have experienced high levels of cigarette smuggling from neighboring low-tax states. This results in large revenue losses for the high tax-state governments. Several empirical studies have investigated cross border smuggling of specific items between certain countries. Nielsen (2001) presents a simple model of cross-border shopping due to tax differentials on commodities between two countries. With an interesting extension that focuses on illegal cross-border shopping, he shows that border inspections tend to increase commodity taxes in both countries. Through this coordination, both countries experience higher tax revenues.

## 1.4 Motivation and organization of the smugglers

The typical diaper trader in Norway operates in small groups of 2-3 people, and with origins from Lithuania or Poland. Their main motivation is to make profit through arbitrage, as diaper prices in these countries are significantly higher than in Norway. Furthermore most diaper traders sell their goods in the black market, and evade import, income and business taxation.

While the media often refers to the foreign diaper traders as *mafia*, there is no evidence that the diaper smugglers are organized like mafia groups. Mafias are traditionally built up around strong hierarchal structures and have strong inner norms. These are not know characteristics for the diaper smugglers. However, the Norwegian police suspect that a large share of the diaper smuggling is organized crime. They believe that the drivers acts as couriers while the main profit is acquired by someone higher up in the organization (Granlund, 2012).

Nevertheless, this has not been proven, and in the theoretical part of this thesis I will treat the diaper traders as individuals.

### 1.4.1 Prevalent shadow economies in the home country

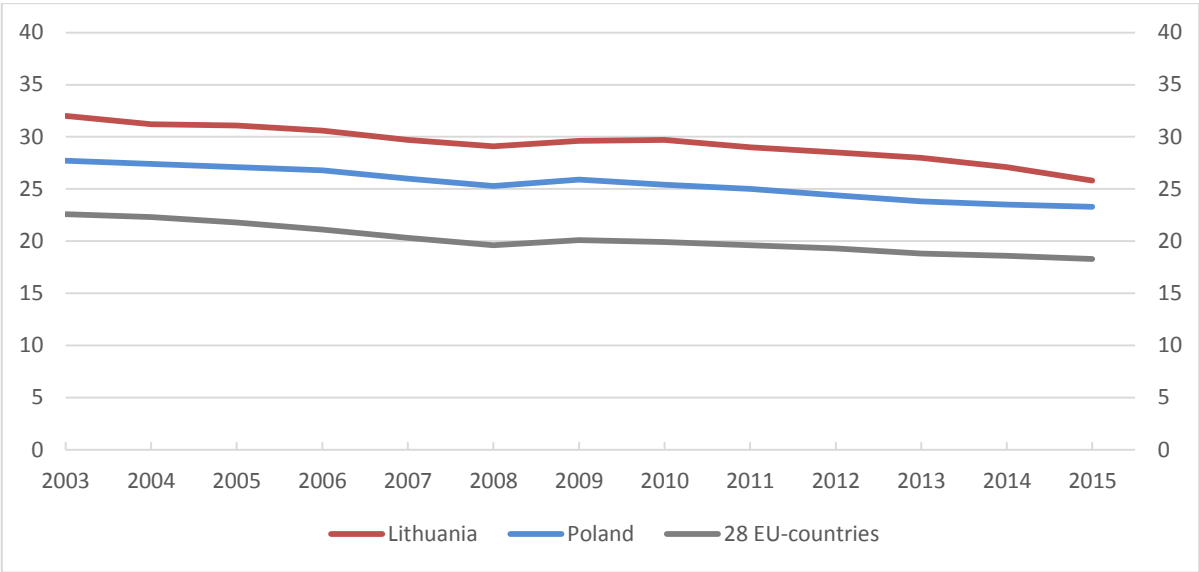
Schneider, Buehn and Montenegro (2010) define a shadow economy as follows: economic activity that is deliberately concealed from public authorities for any of the following reasons:

- 1) to avoid payment of income, value added or other taxes
- 2) to avoid payment of social security contributions
- 3) to avoid having to meet certain legal labor market standards, such as minimum wages and maximum working hours
- 4) to avoid complying with certain administrative procedures

In the case of diaper smuggling, the first two reasons are the most relevant.

The size of the shadow economies in Lithuania and Poland are well above the European average. Schneider (2015) finds that the Lithuanian and Polish shadow economy in 2015 equaled 25,4% and 23,5% of GDP respectably. This was significantly higher than the same year's EU average of 18,3%. As shown in Figure 4 the trend of high shadow economies in these countries has been consistent throughout the 2000's. The figure illustrates that despite shrinking in recent years, Lithuania's shadow economy is one of the largest in Europe.

**Figure 4: Size of the shadow economy in Lithuania, Poland and EU in percent of official GDP**



Unweighted average of 28 EU-countries. Based on Schneider (2015).

In other words the smuggler’s countries of origin can be categorized as high evasion countries. Javorik and Narcico (2008) emphasize that weak institutions including customs service makes Eastern Europe more prone to tariff evasion. To illustrate they refer to a survey by the World Bank from 1999 where 45% of Lithuanians believed that there was a “need to make additional payments” when dealing with the customs. Relating this back to Figure 3 of high and low equilibrium evasion, the costs of operating illegally are lower when living in a high evasion equilibrium country such as Lithuania. Furthermore the probability of detection is likely lower, as illegal behavior is more widespread.

**1.4.2 Operation of diaper businesses in the home country**

Most of the illegally imported diapers are sold online, and there are various Lithuanian and Polish websites advertising Norwegian diapers for sale. Based on research of the Lithuanian market, I find that most imported diapers are sold in two different online categories; through traditional buy-and-sell pages where anyone can insert their own ad<sup>6</sup>, or through more professional looking web sites and online diaper stores.

On the buy-and-sell pages diapers are sold relatively anonymously, and the ads contains little information beyond the current city location of the goods. The goods are delivered to the

<sup>6</sup> See pages like <https://www.skelbiu.lt/> and <http://www.alio.lt/>, searching for the keyword “sauskelnes norvegijos” (translation: Norwegian diapers).

consumer's home, which in itself is illegal without a business license in Lithuania (Samoskaite, 2012). Based on contact with the people behind some of the more proper web sites<sup>7</sup>, they imply that diapers sold on buy-and-sell pages are illegally imported and sold by the diaper smugglers themselves. They further claim that web sites like their own buy legally imported goods from suppliers in Lithuania. However even if this is correct, according to the Lithuanian State Tax Inspectorate (STI) most of the online diaper websites are also illegal activity, as few are registered with a business license or pay taxes.

The diaper sellers offer a large selection of diapers in all sizes, ranging from store brands like Rema 1000, Coop, Lille Go' and First Price to the established brands Pampers and Libero. Table 9 compares the current sales prices of Norwegian diapers in Norwegian stores and Lithuanian online sales, and I find that the Norwegian diapers are sold for 1,-6-2,5 times the price in Lithuania. The "western" diapers are advertised for its high quality, as most diapers sold in Lithuanian stores are manufactured in third world countries (Samoskaite, 2012).

Through these sales pages it also becomes evident that diapers are not only imported from Norway, but also from Germany, Belgium and England. Notice that between EU countries there are no limitations on private diaper import. According to Lithuanian media some of the first diaper traders caught on the Lithuanian border with large amounts of Norwegian diapers were unaware of the extra import/export laws from non-EU countries (Delfi Verslas, 2014), however since 2014 there have been several Lithuanian news articles informing about these laws.

### 1.4.3 Disadvantages of operating in the shadow economy

The obvious benefit of smuggling rather than declaring diapers is that it easily allows the smuggler to operate in the black market. As previously discussed, this allows the smuggler to evade income taxes and regulations required from legal businesses.

Nevertheless, there are also negative consequences of operating illegally. Firstly, it prohibits the smuggler from taking up personal or business loans to purchase and increase their stock of goods. As illustrated in Table 4, the total value of smuggled diapers in Norway is typically between 10 000NOK - 75 000NOK. Thus the diaper smuggler needs high liquidity when

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<sup>7</sup> Personal communication with <http://www.pigioussauskelnes.lt/> and <https://www.facebook.com/Sauskeln%C4%97s-i%C5%A1-Norvegijos-Panev%C4%97%C5%BEyje-1718846248371847/>



shopping in Norway. Smugglers also experience the traditional disadvantages of operating in the shadow economy, such as no accumulation pension benefits, sick leave and other social benefits.

According to a spokesperson in the Norwegian customs, some of the diaper smugglers also illegally import goods such as windows into Norway (Nilsen, 2015). The windows are sold in Norway for a profit, and the money is used to buy diapers in Norway for resale in Poland or Lithuania. This creates a cycle of cross-border arbitrage. Lastly another important negative aspect is the always lurking chance of getting caught.

## 2 Smuggling as a choice under uncertainty

The aim of this section is to create a microeconomic model of the decisions of a foreign diaper trader in Norway. The trader's main objective is to maximize profit. This is achieved through arbitrage, by purchasing large quantities of cheap diapers in Norway and selling them at a higher price in the trader's home country. The individual can choose between legally declaring goods, or importing and exporting illegally. When smuggling the purchaser face uncertainty, as the operation could be either successful or detected by the customs.

The main goal of the model is to estimate profits of smuggling, determine how diaper smuggling can be reduced and determine what would make the current diaper smuggling scheme unprofitable. The model analyzes the trader's incentive to smuggle, and compares legal and illegal operations. The starting point of the model is the Allingham-Sandmo model of income tax evasion, with focus on a single diaper trader's decision under uncertainty. The model differs from the one in Allingham-Sandmo (1972) in that I assume that the smugglers maximize expected profit, i.e. they are risk neutral. This may be defended by the fact that diaper smuggling is performed by individuals making several trips.

### 2.1 Fundamentals of the model

Assume that diapers are a homogeneous good, and that the diaper trader sells all the Norwegian diapers in the foreign market. The quantity  $q$  purchased is fixed at the maximum amount of goods that can fit in a vehicle. The market price of diapers in Norway ( $P_n$ ) is lower than the market price in the foreign country ( $P_a$ ), so  $P_n \neq P_a$  and  $P_n < P_a$ . Illegally imported goods are transacted in the domestic market at prices similar to those of legally imported goods, so assume for simplicity that the price of foreign diapers is the same regardless of import method. This makes the diaper trader a price taker. Notice that in reality illegally imported goods are likely sold at a lower cost (Bhagwati, 1981). Lastly I assume that the amount of diapers exported from Norway is not enough to significantly change the market prices, so  $P_n$  and  $P_a$  are constant.

The individual must choose to either legally declare all goods or to transport them illegally. The customs cannot perfectly monitor all traffic passing through the borders, and instead have

to rely on random inspections. Thus when smuggling, the individual is subject to the probability  $\Theta$  of being caught. If caught, all diapers are confiscated and the smuggler lose her revenue. I only consider the case where the trader exports goods for more than the legal value out of Norway, and for simplicity assume that the individual only faces border control once while driving from Norway to the foreign country.

The endogenous variable in the model is amount of diaper trips  $x$ , as the diaper trader choses the amount of trips to maximize profit. In the first model I assume that diaper shopping is an activity performed by individuals as a side job in addition to regular employment.  $c(x)$  is the opportunity cost of spending time on diaper trips, which I assume is increasing at an increasing rate. Transportation costs  $K$  are equal in the legal and illegal case. These costs include fuel and other direct travel costs per trip.

$T$  is a simplification of various taxes and fees that incurs to the individual if she chooses to declare the goods. While declaring goods for export from Norway is free of charge, declaration means that customs papers are created and the transaction is trackable for foreign governments. In other words, I assume that when legally exporting and importing goods, these goods cannot be sold in the black market. Thus the individual must pay income tax, health insurance, social insurance and business taxes in the home country. Taxes are paid based on gross profit. Furthermore the individual faces startup costs  $m$  if operating legally, such as purchasing a business license and fulfilling requirements of minimum paid-in capital. To illustrate, Table 3 gives an overview of numerical values of costs of operating legally in Lithuania.

**Table 7: Notation used in the model**

$P_n$	consumer price of diapers in Norway
$P_a$	consumer price of diapers in country abroad
$q$	quantity of diapers exported per trip
$K$	transportation costs per trip
$x$	amount of trips
$c(x)$	opportunity cost of trips, $c'(x)>0$ , $c''(x)>0$ , $c'(0)=0$
$\Theta$	probability of being caught smuggling, $0<\Theta<1$
$T$	taxes and fees when operating legally, $0<T<1$
$m$	start-up costs of registering and incorporating a legal firm

First consider the legal case, which will serve as a benchmark.

Legal case:

The individual's profit is determined by the exogenous variables  $P_a$ ,  $P_n$ ,  $q$ ,  $K$  and  $T$ , and the endogenous variable  $x$ . Equation (1) shows the individual's total profit per trip when legally declaring the goods.

$$g_L = (1 - T)((P_a - P_n)q - K) \quad (1)$$

The first term is the after-tax income from buying  $q$  diapers in Norway at price  $P_n$  and selling abroad at the higher price  $P_a$ . Let  $\Delta P$  be the price difference  $P_a - P_n$ . The individual chooses the number of trips  $x$  that maximizes profit. As the number of trips increase, so does the opportunity cost  $c(x)$  of diaper trips. I have assumed that  $c(x)$  is increasing and convex, i.e.  $c'(x) > 0$  and  $c''(x) > 0$ . I have also assumed that when operating legally, the individual must pay constant startup costs,  $m > 0$ . If legal trips are profitable, i.e. if there is an interior solution to the maximization problem, the optimal number of trips is determined by the first order condition:

$$\frac{d\pi_L}{dx} = (1 - T)(\Delta Pq - K) - c'(x) = 0 \quad (2)$$

(2) can also be written as

$$g_L = c'(x) \quad (3)$$

The gains per trip,  $g_L$ , should be equal to the marginal opportunity cost of the time used on the trips.

Illegal case:

If the individual does not declare the goods, this makes her a smuggler. The smuggling operation has two possible outcomes: i) the smuggling is not detected by the customs, and ii) the smuggling is detected by the customs.

i) No detection

This is a success from smuggler's point of view. She now evades taxation, which reduces the overall outlays. Compared to the legal case in (1), profits are increased. The equation below shows the gain from a successful diaper trip, i.e. a trip where smuggling is not detected.

$$g_{IN} = (P_a - P_n)q - K \quad (4)$$

ii) Detection

In case of detection, there are no revenues from a smuggling operation. All goods are confiscated, and the smuggler yields

$$g_{ID} = -P_nq - K \quad (5)$$

Let  $\Theta$  be the probability of detection. Assume that the probability is independent of how many trips the individual makes. The expected gain per illegal trip  $g_I$  is then

$$(1 - \Theta)g_{IN} + \Theta g_{ID} = g_I \quad (6)$$

Let the expected gain per illegal trip be positive, as the individual is acting rationally.

Subtracting the cost of making  $x$  trips, the expected profit as a function of the number of trips is then

$$\begin{aligned} E\pi_I &= g_I x - c(x) \quad (7) \\ &= (1 - \Theta)P_a q x - P_n q x - K x - c(x) \end{aligned}$$

Maximizing expected profit with respect to the number of trips  $x$  gives the following first order condition:

$$\frac{d E(\pi_I)}{dx} = (1 - \Theta)P_a q - P_n q - K - c'(x) = 0 \quad (8)$$

The smuggler pays the cost of buying diapers whether or not the smuggling is detected, but she only gets the gain from selling them if she is not detected.

When does the foreign diaper smuggler have an incentive to make diaper trips at all? For an interior solution to be optimal, expected profit must increase in  $x$  at  $x=0$ , as shown in (9).

$$\frac{d E(\pi_I)}{dx} \Big|_{x=0} = (1 - \Theta)P_a q - P_n q - K - c'(0) > 0 \quad (9)$$

Observe from Table 7 that  $c'(0)=0$ , thus (9) implies that

$$(1 - \Theta)P_a q > P_n q + K \quad (10)$$

This means that the individual will make diaper trips if expected sales revenue abroad is larger than the cost price of Norwegian diapers and transportation costs. In other words, the price difference between Norwegian and foreign diapers and the probability of detection plays major parts in making smuggling profitable. In order to reduce smuggling, these variables must be targeted. Further notice that the effect of  $P_n$  varies in the legal and illegal case. In the legal case an increase in  $P_n$  will have smaller influence on the profit, since taxes are enforced on profit. Thus smuggling is more sensitive to an increase in Norwegian diaper prices.

To see the empirical implications of the model I differentiate the first order condition with respect to the exogenous variables  $\Theta$ ,  $P_a$ ,  $P_n$  and  $q$ .

- $\frac{d E(\pi_I)}{d\Theta} = -P_a q < 0$ . A higher probability of detection reduces the optimal number of diaper trips.
- $\frac{d E(\pi_I)}{dP_a} = (1 - \Theta)q > 0$ . An increase in foreign diaper prices increases the optimal number of diaper trips.
- $\frac{d E(\pi_I)}{dP_n} = -q < 0$ . An increase in Norwegian diaper prices decreases the optimal number of diaper trips.
- $\frac{d E(\pi_I)}{dq} = (1 - \Theta)P_a - P_n$ . If it is profitable to smuggle, an increase in quantity will increase the optimal number of diaper trips. If it is not profitable, then a higher  $q$  will lead to a lower optimal number of trips, in order to reduce losses.

A lower price difference between countries will reduce the overall profitability of arbitrage, legal as well as illegal. Furthermore increases in the Norwegian price will influence the profitability of smuggling more than legal operation. According to classical economic theory, prices rise when there is a shortage or excess demand for a good. Norwegian stores have

experienced diaper shortages due to the bulk shopping. However due to the success of diapers as a loss leader, Norwegian stores are not likely to significantly increase the prices in the near future.

Assuming that the prices will not change, the main questions of interest becomes how to make the diaper traders legally declare goods instead of smuggling. Next I investigate when the individual chooses legal diaper export rather than illegal.

Comparing (1) and (6), it follows that it is more profitable to legally bring diapers than to smuggle when:

$$\Theta P_a q \geq T(\Delta P q - K) \quad (11)$$

Since the opportunity costs  $c(x)$  are the same when operating legally and illegally, it will be profitable to operate legally if the profits per trip is higher than in the illegal case.

Consequently, the individuals will operate legally if and only if  $g_L \geq g_I$ , as defined in (1) and (6). Simplifying this expression yields the result in (11), which shows that it is profitable to operate legally if the expected punishment of smuggling (lost revenue) is higher than the taxes that must be paid when operating legally.

Looking at the effect of changes in the variables, we see that as probability of detection increases, it becomes relatively less profitable to smuggle. Reductions in  $T$  also makes the individual favor legal operation. The prices also play an important part, and a higher  $P_n$  reduces the relative profitability of smuggling.

## 2.2 Discussion of the probability of detection

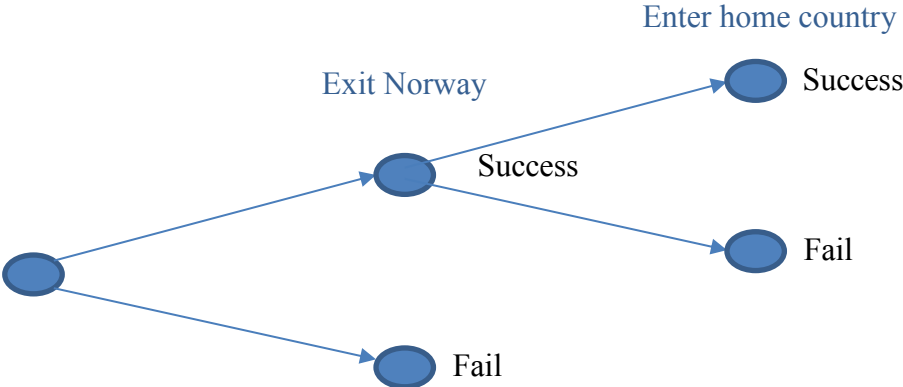
The potential smuggler does not have perfect information. Thus it is not the true value of  $\Theta$  that matters when she decides whether or not to smuggle and how many trips to make, but what the individual believe  $\Theta$  is. People may make different smuggling decisions based on different beliefs about the probability of detection. This subjective probability is likely influenced by own and acquaintances' previous experiences with diaper smuggling, as well as the frequency of media attention relating to the issue. An individual's subjective probability can thus be interpreted as a function of her own smuggling experience and her perceived amount of evasion done by others.

Andreoni, Erard and Feinstein (1998) discuss several empirical studies of income tax evasion which show the disparity between the subjective perception of detection probability and actual probability. In general individuals make poor predictions of detection probability, and in most cases there are no significant correlation between subjective and true probability. They furthermore point out that subjective perception is in most cases substantially higher than the true probability, and that moral and social considerations increase subjective probability. While these studies focus on income tax evasion, the general attitudes of overvaluing subjective probability can be applied to the case of diaper smuggling as well. It should however be noted that smugglers likely have a better perception of detection probability than that in the traditional Andreoni, Erard and Feinstein case, as most of them have performed several similar trips and likely know many other diaper smugglers.

In the model above  $\theta$  was assumed to be exogenous, independent of the number of trips. However if the customs monitor cars that enter and exit Norway, the probability of being stopped may increase with the number of trips, i.e  $\theta'(x) > 0$  and  $\theta''(x) > 0$ . The individual would then need to consider this effect when maximizing profit.

Previously I assumed that the individual faces border control only once. In reality the individual must avoid being detected multiple times, as she passes through several countries when driving from Norway to the home country. A smuggler may face border control both when exiting Norway and when entering the home country. The smuggle operation now has three possible outcomes, as illustrated in Figure 5. It is natural to assume that the probability of detection varies in the different countries, due to varying degrees of border control.

**Figure 5: Possible outcomes of smuggling**





Consequently the marginal revenue of smuggling becomes a function of overall detection probability, and  $\Theta$  will increase the more customs checks the individual must pass through. We can internalize the discussed effect in this section into the original model by redefining  $\Theta$  to represent the individuals *perceived overall probability* of detection on the diaper trip.

## 2.3 Increased costs of smuggling reduce profitability

In the basic model, the real costs related to smuggling are transportation costs, purchase cost and confiscation of the goods in case of detection. Realistically the smuggler will face other potential costs, which I will investigate further. Changes in costs influence the extensive margin of the diaper trader's decision-making. Nevertheless, it should be noted that neither of these extensions change the comparative statics predictions of the model, provided interior solution is assumed.

### 1. Fees if caught smuggling

In many discovered diaper smuggle attempts, the smuggler must pay a fine if detected (see Table 4). This is in addition to confiscation of all goods. Thus the total outlays in case of a failed smuggling attempt increase compared to the original case in (7). I introduce the constant  $F \geq 0$ , which reduces the expected profit of one smuggle attempt as illustrated below.

$$g_I' = (1 - \Theta)P_a q - P_n q - K - F\Theta \quad (12)$$

The introduction of the extra punishment makes the expected marginal costs higher, forcing a higher  $P_a$  or lower  $\Theta$  in order for the operation to be profitable.

$$\frac{d E(\pi_I)}{dx} = -\Theta < 0 \quad (13)$$

Looking at the marginal effect, observe that an increase in detection fees reduce the amount of diaper trips. Thus the introduction of fees makes diaper smuggling less profitable.

## 2. Psychological costs of illegal behavior

In an extension of their main model, Allingham and Sandmo (1972) discuss the existence of psychological costs of engaging in illegal activities. This includes personal disutility of breaking the law, as well as social stigma. This extension illustrates that there can be other factors than just monetary maximization that plays a role in the individual's smuggling decision.

Let the variable  $s$  represent all psychological factors the individual experiences related to smuggling.  $s$  is bigger if detected, due to social stigma. Nevertheless,  $s$  is also present if the smuggling operation is successful, as the individual experiences personal disutility from breaking the law. Thus let  $s > 0$  take on different values according to what state of the world occurs, and assume that  $s_N < s_D$  where  $N$  is no detection and  $D$  is detection. We revise the expected profit from one illegal diaper trip in (6) as following:

$$(1 - \Theta)(g_{IN} - s_N) + \Theta(g_{ID} - s_D) = g_I'' \quad (14)$$

We must further revise our expected utility function to include the psychological factors, so the new maximization function is:

$$EU(\pi_I) = g_I''x - c(x) \quad (15)$$

Assuming inner solution, this yields:

$$(1 - \Theta) * P_a * q = P_n * q + K + c'(x) + \Theta * (s_B - s_A) + s_A \quad (16)$$

There is uncertainty attached to both the marginal revenue and marginal cost. Furthermore, the expected marginal costs are larger than in the original case: the term  $s$  acts as a “conscience tax” on illegal smuggling, and makes the condition for profitable smuggling stricter.

## 3. Increased difficulty of buying diapers

Due to the increase of foreign diaper traders operating in Norway, many Norwegian grocery stores have introduced limitations on sales. By enforcing a maximum of 2-4 diaper packages per consumer, stores reduce their likelihood of running out of supply. However, for the diaper trader this means that she must travel from store to store to buy enough diapers to make the

trip profitable. This increases transportation costs due to increased fuel and accommodation expenses, as well as rising opportunity costs since the diaper purchasing becomes more time consuming. Anecdotal evidence shows that diaper traders generally travel through large parts of Norway to acquire as many diapers as possible. Similarly a larger presence of diaper traders would also increase the difficulty of buying diapers. The more people buy in bulk, the harder it is to find the amounts required to make the diaper trip profitable, as searching costs increases.

We now further specify the transportation costs of the diaper trader. Let transportation costs  $K(t)$  be defined as following:

$$K(t) = f * d(t) + k \quad (17)$$

Let  $d(t)$  be the kilometers driven, dependent on time  $t$  it takes to purchase sufficient amount of diapers to fill up the car. Let  $d'(t) > 0$ .  $t$  increases with the presence of other diaper traders and store limitations.  $f$  is the exogenous and constant fuel cost per kilometer, and  $k > 0$  the fixed costs of acquiring and/or maintaining a vehicle.

$$EU(\pi_L) = (1 - \Theta) * P_a * q * x - P_n * q * x - f * d(t) * x - k * x - c(x) \quad (18)$$

The additions discussed in this section shapes a more realistic picture of the smuggler's decision, and leads to more restrictive conditions for smuggling to be optimal.

#### 4. VAT refunds

According to the Norwegian customs (2015), foreign residents of other countries than Sweden, Denmark and Finland can receive refunds for individual invoices that exceed 250NOK. Accordingly, the foreign consumers are entitled to receive VAT refunds if they legally declare the goods. Norwegian diapers have a value-added tax of 25% - money that the diaper trader can get back. This will shift the margins of operating legally.

Let  $i$  be the import tax in the home country,  $r$  the Norwegian VAT refund and  $0 < i < 1$  and  $0 < r < 1$ . The import tax and VAT refunds are based on the value of export. Furthermore based on empirical evidence in Table 2 I assume that  $r > i$ , and redefine the gains from one legal diaper trip  $g_L'$  as follows:

$$g_L' = (1 - T)(\Delta Pq - K) + P_n q(r - i) \quad (19)$$

Observe that the marginal revenue is larger than in the previous setup, as it is made up by the sales revenue abroad and the VAT refund. The margins have now shifted such that it is more profitable to declare legally in this VAT case than the original case. In chapter 3 I use this extension to calculate profit.

## 2.4 Introducing alternative wages

In the previous model the implicit assumption was that smuggling was an extra job, and profit from diaper smuggling was considered an extra income. The cost of smuggling was then the opportunity cost of time and effort, which reduced time spent on regular employment.

An alternative assumption is that smuggling is a full-time project, in particular if the activity becomes very profitable, which means that the income from the optimal number of trips is sufficiently high. Long distance smuggling may also be difficult to combine with regular employment, which means that the individual must choose between them. In this model I assume that the individual chooses between a regular job and smuggling, and determine the fraction of people who chose to smuggle. Every individual  $i$  has an alternative wage  $w_i$ . Individual  $i$  will smuggle if expected profits from smuggling exceeds  $w_i$ .

The expected profit from smuggling is expressed in (20). Now I assume that each individual can drive a fixed amount of trips per year  $\dot{x}$ . There are no longer increasing opportunity costs of smuggling, so the expected profit is a constant.

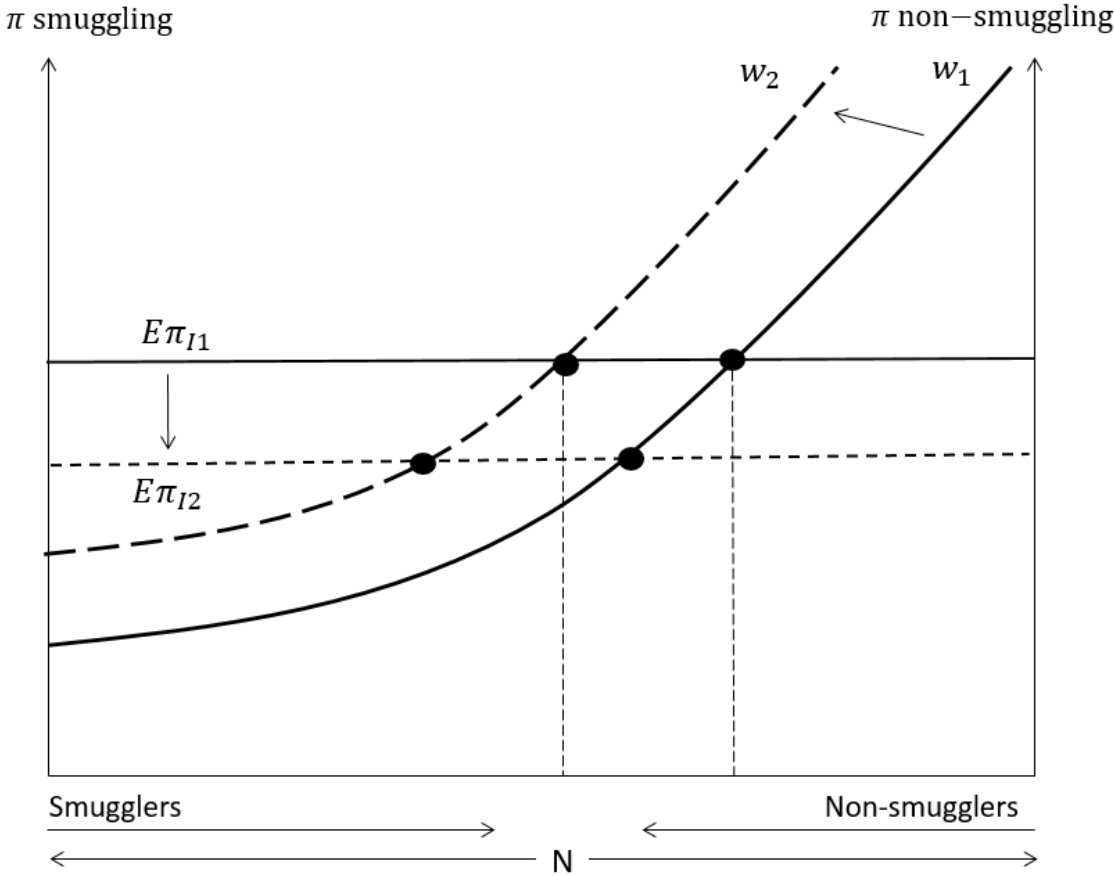
$$E\pi_I = g_I \dot{x} \quad (20)$$

An individual will smuggle if expected profit from diaper smuggling exceeds her alternative wage  $w_i$ .

$$w_i < g_I \dot{x} = ((1 - \theta)P_a q - P_n q - K) \dot{x} \quad (21)$$

Let  $F(w)$  be the cumulative distribution function of  $w$ . The fraction of smugglers is then defined as a function of expected profit of smuggling  $F(E\pi_I)$ .

Figure 6: Share of population N who choose to smuggle

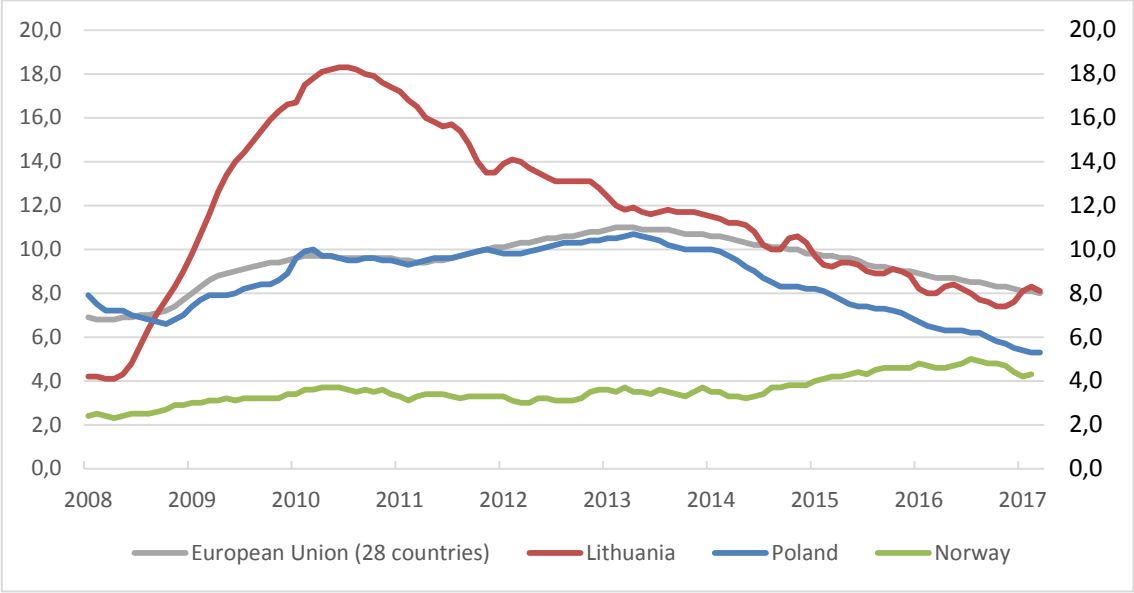


The wage distribution gives a supply curve for smuggling, marked by  $w$  in Figure 6 above. For every level of smuggling profit  $E\pi_I$  the figure tells the fraction of population  $N$  who have lower alternative wages in a regular job, and thus choose to smuggle. If the wage levels in the home countries increase from  $w_1$  to  $w_2$ , the share of smugglers will decrease. The equilibrium will shift to the left, making regular employment more profitable than smuggling for more individuals.

Shifts in the distribution of wages are dependent on economic booms and busts in the smuggler’s country of origin. If unemployment is high, the distribution of wages shifts down making smuggling profitable for more people. Figure 7 shows that unemployment in Lithuania and Poland has decreased in recent years. While the unemployment rate in Poland has been stable and close to the European average, the Lithuanian unemployment in the years 2010-2012 was substantially higher than the rest of the EU. As wages have increased and

unemployment decreased in Lithuania since the diaper smuggling phenomena started in 2010-2011, the share of smugglers is likely to have declined since then.

**Figure 7: Seasonal unemployment in Lithuania, Poland, Norway and the European Union. In percentage of active population. January 2008 – March 2017**



Source: Eurostat

Figure 6 can be used to show how changes in different variables can change the overall share of smuggling. Below I look at the marginal effects on expected profit of smuggling (see Table 8) from changes in probability of detection, foreign diaper prices and Norwegian diaper prices. Everything else constant, increased probability of detection, decreased foreign diaper prices and increased Norwegian prices will shift the expected profit curve downwards. This would reduce the total share of smugglers, as more individuals would experience that  $w_i > E\pi_i$  and choose regular employment.

**Table 8: Marginal effects on expected profit of smuggling**

$\frac{dE\pi_I}{d\theta} < 0$	$\frac{dE\pi_I}{dP_a} > 0$	$\frac{dE\pi_I}{dP_n} < 0$
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As defined in (20), ceteris paribus.

## 2.5 Legally imported goods can be sold in the black market

In the previous model, I assumed that legally imported goods must be sold legally and that only smuggled goods can be sold in the black market. Below I discuss a model where also legally imported goods can be sold in the black market.

In this model the only cost of operating legally is to pay tariff taxes when goods are imported. Consequently we move away from the income taxation and social security contributions discussed in the first model, which made up the largest argument of the outlays of legal operation. The model is a simplified version of Martin and Panagariya (1984)'s model of a risk neutral import firm. As discussed in Bhagwati (1981) and Javorcik and Narciso (2008), tariff evasion can occur through concealed importation. Thus the firm in the model seeks to maximize profit, and does so by under invoicing import quantity to evade tariff taxes.

In contrast to the main model above, this model assumes that the probability of detection depends on the ratio of illegal to legal trade made by the firm. Consequently it allows for partial evasion, as the firm undervalues the quantity. As the scope of this type of partial evasion is unknown in the case of Norwegian diaper smuggling<sup>8</sup>, I have chosen not to use this as the basis for my main model, as the Allingham-Sandmo based model better illustrates a diaper smuggler's decision. However the main contribution of this model is that it provides an industry equilibrium of legal and illegal quantities and allows legally imported goods to be sold in the shadow economy. While a single diaper firm is not likely to transport both legally and illegally, it is interesting to study the overall ratio of declaration versus smuggling. A formal discussion of this model can be found in the appendix.

The models in this chapter focus on various assumptions regarding the diaper smuggler and her choices, however an interesting extension would be to create a dynamic model where the individual experiences a higher probability of detection if she has been caught previously. When detected, the customs and police have personal information and license plate information on file, making them more likely to catch the individual in a proceeding smuggling attempt. Thus the probability of detection would vary through time as a function of

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<sup>8</sup> Lithuanian newspapers emphasize that not all Norwegian diapers are smuggled into the country, but that some are also declared to the customs. It is however unknown if the same people transport legally and illegally.

recent smuggling outcomes. While this is beyond the scope of this thesis, it would allow for more complex analysis of the individual's smuggling decision.



### 3 Numerical estimations

This section will present simple numerical calculations based on the theoretical model presented in chapter 2. I will calculate the expected profit of diaper smugglers based on different assumptions about the probability of detection. Further I also make calculations for the size of the diaper smuggling phenomena.

Lithuania appears to be the most prevalent country of origin for the diaper smugglers, so I narrow down my focus to diaper smuggling between Norway and Lithuania in order to make more accurate calculations. As discussed in 1.1.5, it has proved difficult to perform a proper survey of all diaper smuggling attempts in Norway, as neither the Norwegian nor the Swedish customs have detailed accounts. Table 4 presents an overview of 13 cases of diaper smuggling attempts caught by the Swedish and Norwegian customs during the years 2012 – 2016, which will be used as a basis for the assumptions in this chapter. As a consequence of limited data available, it must be stressed that the results in this section are highly uncertain.

#### 3.1 Diaper prices

I first compare the current price of Norwegian diapers in Norway and Lithuania. Table 9 compares the prices of a representative selection of store brands, non-store brands and different sizes. The Norwegian prices are marked in blue, and the Lithuanian in white. For the selected diapers in the table, calculations show that imported diapers are sold for 1,6-2,5 times the Norwegian price, averaging at 2,1. Store brands are sold for 2-2,5 times the price, while Pampers for 1,6-2,3 times the price.

The Norwegian prices recorded do not include reductions from diaper agreements. To account for this, I choose  $P_n = 0,60kr$  as the representative price of one Norwegian diaper. This is slightly less than the average price in Table 9, which is 0,65kr. I assume that diapers are sold in Lithuania for 2,2 times the Norwegian price. Consequently I assume that one Norwegian diaper is sold for  $0,60kr * 2,2 = 1,32kr$  in Lithuania. Thus  $P_a = 1,32kr$  and  $\Delta P = P_a - P_n = 0,72kr$ .

**Table 9: Comparison of prices for diapers in Norway and Norwegian diapers sold in Lithuania**

	Pampers New Baby (Norway)	Pampers New Baby (Seuskelnes norvegijos)	Lev Vel Rema 1000 (Norway)	Lev Vel Rema 1000 (alio.lt)	Lille Go Kiwi (Norway)	Lille Go (alio.lt)
Size 1 (2-5kg)	16,10kr (0,70kr/pcs) 23pcs	36,5kr (1,59kr/pcs) 23pcs	n/a	n/a	n/a	n/a
Size 2 (3-6kg)	22,40kr (0,72kr/pcs) 31pcs	36,5kr (1,18kr/pcs) 31pcs	18,50kr (0,66kr/pcs) 28pcs	45,65kr (1,63kr/pcs) 28pcs	22,70kr (0,63kr/pcs) 36pcs	45,65kr (0,14€/pcs) 36pcs
Size 3 (5-9kg)	24,70kr (0,85kr/pcs) 29pcs	36,5kr (1,26kr/pcs) 29pcs	29,70kr (0,53kr/pcs) 56pcs	63,90kr (1,14kr/pcs) 56pcs	29,50kr (0,53kr/pcs) 56pcs	68,47kr (1,22kr/pcs) 56pcs
Size 4 (7-16kg)	n/a	n/a	31,60kr (0,63kr/pcs) 50pcs	63,90kr (1,28kr/pcs) 50pcs	29,50kr (0,59kr/pcs) 50pcs	68,47kr (1,37kr/pcs) 50pcs
Size 5 (12-25kg)	n/a	n/a	29,50kr (0,67kr/pcs) 44pcs	68,47kr (1,56kr/pcs) 44pcs	29,50kr (0,67kr/pcs) 44pcs	68,47kr (1,56kr/pcs) 44pcs

The Lithuanian prices are converted into NOK using the exchange rate per 18/4/17. The Norwegian prices for *Pampers New Baby* and *Lev Vel Rema 1000* are from the online shop kolonial.no per 18/4/17 and the prices for *Lille Go* from Kiwi Oslo per 8/3/17. These prices do not take into consideration diaper agreements or other special sales in the store. The Lithuanian prices for *Pampers New Baby* and *Lev Vel Rema 1000* are from the “buy and sell” page alio.it, while *Lille Go* is from the facebook store “Sauskelnes is Norvegijos Panevezyje”. After a comparison of several ads, these sites present representative prices, and specifically advertise that the goods are imported from Norway.

## 3.2 Transportation costs

I assume that the foreign diaper trader already has a vehicle, which is likely the case if she has previously made similar diaper trips. If there are no store-imposed limitations on diaper sales, the smuggler can buy the necessary diapers right across the Norwegian border. The round trip to Norway is split into three parts: a) drive between city of origin and Klaipeda, Lithuania b) ferry trip from Klaipeda to Karlshamn, Sweden c) drive between Karlshamn and the Norwegian border, for example to Halden. I realistically assume that the city of origin is Kaunas<sup>9</sup>, and that the smuggler drives a large van. Table 10 below sums up the different costs of a round trip from Kaunas to Halden.

<sup>9</sup> Kaunas is the second biggest city in Lithuania, and is geographically closer to Norway than the capital Vilnius. Online ads show large amounts of Norwegian diapers stored in Kaunas.

**Table 10: Transportation costs for a round trip from Kaunas to Halden**

<i>A</i>	Liters per 100kms of a Mercedes Sprinter Van 2010 (fuelly.com)	15,7L
<i>B</i>	Distance Kaunas – Klaipeda, round trip	430km
<i>C</i>	DFDS Seaways round trip ferry (cheapest option selected, price per 21/4/17)	3490kr (313,80GBP)
<i>D</i>	Distance Karlshamn – Halden, round trip	962km
<i>E</i>	Gas price per liter in Sweden (price per 10/4/17)	13,684kr (14,38 SEK)
<i>F</i>	Toll roads (entering Norway, rush traffic toll road near Gothenburg)	60kr

Thus total transportation costs  $K$  are as follows:

$$K = \frac{(B + D)}{100}AE + C + F \quad (22)$$

Based on the numbers in Table 10, total transportation costs equal 6541kr.

### 3.3 Estimations of profits when operating legally

I use equation (19) to calculate the estimated legal profit of one trip, given by

$$g_L' = (1 - T)(\Delta Pq - K) + P_n q(r - i) \quad (19)$$

$T$  are the tax payments the individual must make in Lithuania when operating legally. This includes fixed income taxes, corporate profit tax and compulsory health insurance and social insurance to the state, as shown in Table 3. I assume that the diaper firm is small and makes less than 300 000kr per year. As a result the tax payments equals 50,98% of gross profit (5% corporate profit tax, 15% income tax, 30,98% health and social insurance), so  $T=0,5098$ . As discussed in 2.3, when legally declaring goods in Norway, foreign individuals can file forms to get a VAT refund of 25%. Furthermore, Table 2 shows that the import VAT tax in Lithuania is 18%. Thus  $r=0,25$  and  $i=0,18$ .

$K$  are the total transportation costs as calculated in (22),  $P_n = 0,60kr$  the Norwegian price and  $\Delta P = 0,72kr$  the price difference between Norwegian and Lithuanian diapers from 3.1.

Inserting our known values into (19) gives the following expression for profit of one trip:

$$g_L' = 0,395q - 3206 \quad (23)$$

Profit is now a linear function increasing in  $q$ . Based on the information in Table 4, let  $q = 40\ 000$ . While the table provides few data points regarding quantity, it provides more information regarding total value of diapers smuggled per trip. When quantity is 40 000, the total value of diapers smuggled is 24 000kr in this example. This corresponds well with the data, and seems representative for the quantities that can fit in one van. Thus  $g_L(q = 40\ 000) = 12\ 591$ kr, so operating legally the individual will make approximately 12 600kr per diaper trip.

### 3.4 Calculating the profit of smuggling under different assumptions

Next I look at the case where the individual decides to smuggle. I estimate expected profit of one trip using (12), as shown below.

$$g_I' = (1 - \Theta)P_a q - P_n q - K - F\Theta \quad (12)$$

In case of detection, all diapers are confiscated. Plugging in the same values for  $P_a, P_n, q$  and  $K$  as in 3.3 gives the following expression:

$$g_I' = 22\ 319 - \Theta(52\ 800 + F) \quad (24)$$

The profit of one smuggling trip is now defined as a function of subjective probability of detection  $\Theta$  and a fee  $F$ , which must be paid if the smuggling operation is detected.

I investigate two cases of the fee  $F$ ,  $F_I$  and  $F_0$ . According to Customs Law § 16-17, the Norwegian customs authorities can fine an individual who exports for more than the legal value. This infringement fee varies between 1049kr - 52 450kr (Act on Court Fees, § 1-1). Based on Table 4 and assumptions about the seriousness of diaper smuggling versus other smuggle goods, let  $F_I=5000$ kr. However as also illustrated in Table 4 not all smuggling attempts are fined, so let  $F_0=0$ kr.

Table 11 shows the expected profit of one diaper smuggling trip for different assumptions of probabilities and fees.

**Table 11: Expected profit of one smuggling trip given different probabilities of detection and fees**

	$\theta = 0,05$	$\theta = 0,1$	$\theta = 0,15$	$\theta = 0,2$	$\theta = 0,3$	$\theta = 0,4$
5000kr fee	19 369kr	16 489kr	13 589kr	10 699kr	4919kr	-861kr
No fee	19 619kr	16 979kr	14 339kr	11 699kr	6419kr	1139kr

We observe that when the subjective probability of detection is low (5-15%), the expected profits is high, and significantly higher than the legal profit of 12 600kr. Furthermore the table shows that smuggling becomes unprofitable when the subjective probability approaches 40%.

Further comparisons of legal and illegal profit are made in Table 12, which looks at the expected illegal profit minus legal profit. The table illustrates that legal declaration becomes increasingly more profitable than smuggling as the probability of detection increase. A rational individual is indifferent between smuggling and legal declaration when the overall perceived probability of detection is approximately 18%.

**Table 12: Expected illegal profit of one trip minus legal profit of one trip given different probabilities of detection and fees**

	$\theta = 0,05$	$\theta = 0,1$	$\theta = 0,15$	$\theta = 0,18$	$\theta = 0,2$	$\theta = 0,3$
5000kr fee	6778kr	3888kr	998kr	-736kr	-1892kr	-7672kr
No fee	7028kr	4388kr	1748kr	164kr	-892kr	-6172kr

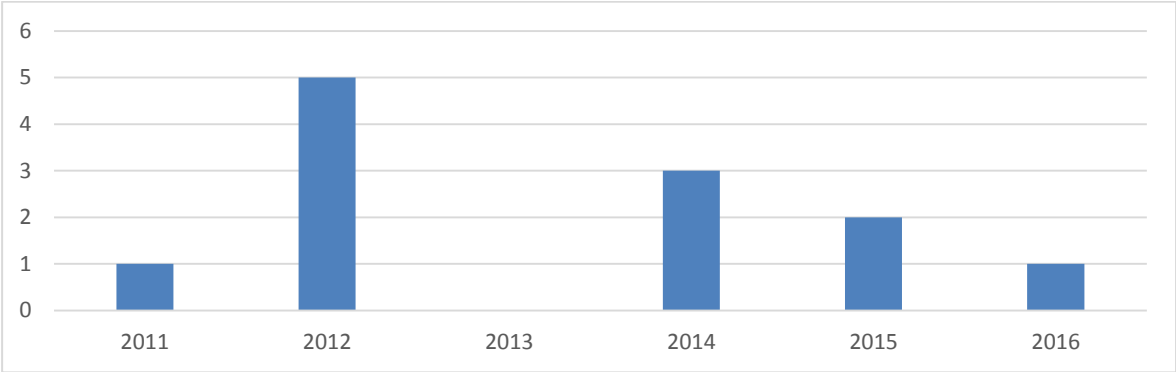
### 3.5 Probability of detection and size of the diaper smuggling phenomenon

We distinguish between perceived probability of detection, which is the individual's subjective probability of detection, and true probability of detection. Since most diaper traders are operating illegally rather than legally, the expected profit of smuggling must be higher than legal profit. Consequently, this indicates that the perceived overall probability of detection is lower than 18%. Furthermore the true probability of detection is significantly lower than 18%, as an individual is likely to overvalue subjective probability of detection (see discussion in 2.2).

In the proposed travel route the smuggler passes through two potential check points; border crossing between Norway and Sweden and at the ferry terminal in Lithuania. Table 4 gives indicators for the frequency of the first, while I have had no success gathering data for the

second case. To calculate the possible size of diaper smuggling I look at different values of detection probabilities at the Norwegian border. The discussion above indicates that the true overall probability of detection is in the range 5-10%. Since Lithuania is a high evasion country with a large shadow economy (see discussions in 0), the probability of detection is higher on the border crossing between Norway and Sweden than in Lithuania. Consequently I choose to look at the cases of probability of detection at the Norwegian border ranging from 2-6%.

**Figure 8: Detected diaper smuggling attempts in Norway and Sweden 2011-2016 by year**



Source: Table 4.

Next I investigate annual total diaper smuggling attempts, quantity of goods attempted smuggled, value of the goods and total profit made by smugglers.

Table 13 contains calculations of the size of diaper smuggling for the year 2012 for different values of detection, using the values of  $q, P_n, P_a, T, K$  and  $i$  from above. As shown in Figure 8, in that year there were 5 detected cases of diaper smuggling, which I set equal to different values of detection probability at the Norwegian border. Thus, the attempted number of smuggling trips is calculated as follows: given that the probability of detection  $x\%$ , how many smuggling trips were made in total that year when 5 of them were detected. I calculate this for different values of  $x$ , given by  $a$  in Table 13.  $b$  is the total diaper smuggling trips (i.e. attempted smuggling) in that year, given the probability in  $a$ . I calculate total attempted diapers smuggled,  $c$ , which is the number of trips times diapers per trip, i.e. it is given by  $c = bq$ . Based on the calculations of  $c$  I calculate the total value of attempted smuggled diapers  $d = cP_n$ . Furthermore, total profit made by diaper smugglers is given by the equation  $g_{IN} * x'$ , where  $x'$  are the successful diaper attempts. Thus  $x' = b - 5$  and  $g_{IN}$  is defined as in (4). Consequently, total profit made by diaper smugglers is:

$$e = g_{IN}x' = (\Delta Pq - K)(b - 5) \quad (25)$$

Finally, I calculate the total lost revenue of the Lithuanian government as a consequence of tax evasion related to diaper smuggling. This includes revenue from taxes on profit  $T$  and import taxes  $i$ , as shown below.

$$h = (T(\Delta Pq - K) + P_n qi)x' \quad (26)$$

**Table 13: Estimations of size of diaper smuggling in Norway in year 2012**

<i>a</i>	True probability of detection at Norwegian border	2%	3%	4%	5%	6%
<i>b</i>	Total diaper smuggling attempts	250	167	125	100	83
<i>c</i>	Total diapers attempted smuggled	10 million	6,67 million	5 million	4 million	3,33 million
<i>d</i>	Total value of attempted smuggled diapers (in kr)	6 million	4 million	3 million	2,4 million	2 million
<i>e</i>	Total profit made by diaper smugglers (in kr)	5,45 million	3,7 million	2,78 million	2,23 million	1,89 million
<i>h</i>	Total lost revenue in terms of tax evasion for the Lithuanian Government (in kr)	3,84 million	2,53 million	1,88 million	1,49 million	1,22 million

The table shows 80-250 diaper smuggling attempts in one year, depending on the probability of detection. This yields a total value of smuggled diapers of 2-6 million kr and a total quantity of 3-10 million attempted smuggled diapers. The yearly total profit of diaper smuggling is then in the interval of 1,9-5,5 million kr. Note that this number does not take into account the fixed costs or other expenses related to having and operating a car, such as repairs and insurance. Lastly I find that the total tax evasion in Lithuania as a result of diaper smuggling is in the interval 1,2-3,8 million kr.

As observed in Figure 2 and Figure 8, diaper smuggling has declined after 2014, so the numbers above illustrate the size of the smuggling phenomenon at its height.

### **3.6 Comparing legal and illegal diaper operation**

Lithuania is a country with substantially lower costs of living and wages than Norway. According to Trading Economics (2017), the average monthly wage in Lithuania was approximately 7600kr in 2016 Q4. Furthermore, a large share of the population has even lower incomes. As calculated in Table 11, the expected illegal profits from one trip is between 13-19 000kr. Consequently, the profit from one illegal diaper trip alone greatly exceeds the average monthly wage in Lithuania. If a diaper shopper makes weekly trips to Norway, we are looking at monthly revenues more than eight times the average monthly Lithuanian wage. The numerical examples illustrate how lucrative diaper arbitrage is for Lithuanians. Facing high unemployment rates<sup>10</sup> and low wage levels, choosing to import Norwegian diapers is strikingly profitable.

Nevertheless, calculations in 3.3 also shows that the profit per legally diaper trip is approximately 12 600kr, and thus higher than the average Lithuanian monthly wage. However, this does not include the startup costs of operating legally. As shown in Table 3, startup costs equals approximately 24 000kr and includes acquiring a mandatory business license and a minimum paid-in capital requirement. In a country with low wages this is a significant amount of money, which may deter Lithuanian diaper traders from choosing to operate legally. Furthermore, establishing a legal business requires an individual to continue a diaper import business over a longer period of time. In contrast a smuggler has fewer obligations, and can easily stop smuggling if the price difference between Norway and Lithuania is reduced. In addition anecdotal evidence shows that smugglers are generally not aware of the possibility of Norwegian VAT refunds, which increase the profitability of legal declaration. In combination these factors help explain why foreign diaper traders do not legally declare the goods.

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<sup>10</sup> Unemployment rate 8.1% and youth unemployment rate 15.3%, March 2017. Source: Eurostat.



## 4 Concluding remarks

Norwegian diaper prices are the cheapest in Europe as a result of price wars between grocery chains. Due to the low prices diaper arbitrage between Norway and especially Lithuania and Poland has become a very profitable business. News articles on the topic emphasize the negative effects this have on the Norwegian market and for Norwegian consumer. I find that the negative effects are found in the diaper receiving countries: their governments experience missing tax revenues as the diapers are typically sold in the shadow market.

I first discuss why stores use diapers as a loss leader. It may be a type of price discrimination, since it allows them to make shopping in the store cheaper for the highly elastic customers (families with kids) without reducing prices for other less price-elastic customers.

Alternatively, stores may rely on “myopic” customers, for whom diaper prices are so salient that they overlook the mark-up of other prices. Loss leading is an established pricing strategy used by all Norwegian grocery chains. If one chain was to alter their pricing strategy and mark up the price of diapers, the chain will likely experience a decline in consumer share and a reduction in profit. This helps explain why Norwegian diaper prices have remained so low for a long period of time.

The main part of the thesis is dedicated to analyzing the behavior and choices of diaper smugglers. I model the behavior of a diaper smuggler as a decision under uncertainty, and compare the profitability of legal and illegal diaper operation. When operating illegally, the diaper smuggler evades import taxes, income taxes, corporate profit taxes and mandatory health and social insurances to maximize profit.

Using the model of a smuggler’s decision making, I calculate expected profit of a smuggling trip for different assumptions of probability and detection fees. I show that profits from a legal diaper trip is approximately 12 600kr, and that profits from an illegal trip is in the interval 13-19 000kr. Both these values are significantly higher than the average monthly wage in Lithuania, and illustrates the profitability of diaper arbitrage. I argue that most diaper traders operate illegally due to high start-up costs of operating legally as well as higher expected profit.

Further I investigate the size of the diaper smuggling phenomenon. A weakness of this thesis is the lack of reliable data. It has proved difficult to gather data about diaper smuggling

attempts in Norway and Lithuania, the regularity of diaper trips and the difference between Norwegian supplier prices and store prices. I use newspaper data of detected diaper smuggling in Norway and Sweden to calculate that at the height of the diaper smuggling period, there were 80-250 annual diaper smuggling attempts in Norway. I also find that the total value of diaper smuggled in one year was 2-6 million kr and that the overall yearly profit made by diaper smugglers was in the range of 1,9-5,5 million kr, illustrating that diaper smuggling is of a significant size. I find that even though the scope of diaper smuggling has likely decreased since 2014, Norwegian diapers are still regularly being sold in the diaper receiving countries and the phenomenon is still present.

Diaper smuggling can be deterred by enforcing a high probability of detection and increasing detection fees. In order for smuggling to have negative expected profits, I find that the subjective probability of detection must increase to approximately 40%. Increasing the probability of detection occurs through increased border controls, which is costly. Increasing fees of detection is another way to reduce the expected profit of smuggling. However at the low current probability levels, fees must increase significantly from today's level of 5000kr to the maximum infringement fee of 52 000kr in order to have the desired effect. Thus a combination of increased detection probability and fees will be a more efficient solution.

Obviously, a reduction in the price difference between Norwegian and foreign diaper prices reduce overall profitability of arbitrage, reducing legal as well as illegal diaper operation. I also show that an increase in Norwegian prices has a larger deterring effect on smuggling than on legal diaper operation, as taxes are enforced on profit. Finally I investigate alternative wages and opportunity costs of smuggling, and find that the share of diaper smugglers will decrease if wages in the home country increase.

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# Appendix

## Alternative model: legally imported goods can be sold in the black market

Assume that a risk neutral import firm in a small economy imports Norwegian diapers. Imports are subject to an ad valorem tariff rate  $t$ . The firm can choose to evade tariffs on some or all of its imports, thus under invoicing quantity. The model analyzes the economic decisions of a single diaper trip, and finds optimal values for declaration.

We denote the quantities of legal and smuggled import as  $q_L$  and  $q_S$  respectively.  $\theta$  is the probability of being detected, and in case of detection all smuggled goods are confiscated. The probability of detection depends on two decisions made by the firm: the ratio of smuggled to legal imports  $q = \frac{q_S}{q_L}$ , and the concealment costs  $\beta$  of hiding the illegal activity. Thus concealment cost is a direct cost of evasion, and we define  $\theta = \theta(q, \beta)$ . Further assume that the probability of detection increases with the ratio of smuggled to legal imports, such that  $\frac{d\theta}{dq} > 0$ . For simplicity we also assume that  $\theta$  is separable in  $q$  and  $\beta$ .

The concealment costs includes special packaging costs and rebuilding of cars to hide the diapers better. Assume that the firm itself selects the parameter  $\beta$ . For every unit smuggled, the firm must pay  $\frac{1}{\beta}$  in concealment costs, and  $0 < \beta \leq 1$ . Note that a high  $\beta$  implies reduced concealment costs, thus  $\theta$  is increasing in  $\beta$ ,  $\frac{d\theta}{d\beta} > 0$ . Since diapers are a bulky good that is difficult to conceal, we assume that  $\beta$  is high. Furthermore, observe that if it is optimal for the firm to purchase some concealment, it has similar effects on the outcome as if the firm was risk averse as it generates increasing costs of evasion.

Let  $p_a$  denote the sales price in the home country and  $p_n$  the Norwegian price.  $\pi_A$  denotes profits when the smuggling is successful, and  $\pi_B$  when detected. Let transportation costs be a constant  $K$ , which is equal in both the legal and illegal case.

i) No detection

$$\pi_A = p_a(q_L + q_S) - p_n \left( q_L + \frac{q_S}{\beta} \right) - t p_n q_L - K \quad (27)$$



The first term shows revenues from sales in the home country: in case of success, both the legally and illegally imported goods are sold to create revenues. The remaining terms express the outlays of the firm. The second term is total cost of diaper purchased in Norway plus the concealment cost. The third term is taxes incurred on the legally imported goods, while the last term is the transportation costs of the import.

ii) Detection

$$\pi_B = p_a q_L - p_n \left( q_L + \frac{q_S}{\beta} \right) - t p_n q_L - K \quad (28)$$

In case of detection, the quantity of smuggled goods is confiscated. Consequently the revenues are significantly reduced, while the expenses stay the same as in the case of no detection.

The firm is risk neutral and maximizes expected profits with respect to  $q_L$ ,  $q_S$  and  $\beta$ :

$$\max E\pi = \max(1 - \Theta(q, \beta))\pi_A + \Theta(q, \beta)\pi_B \quad (29)$$

The first-order conditions for maximization are as follows:

$$\begin{aligned} \frac{dE\pi}{dq_L} &= p_a - p_n - t p_n - \frac{d\Theta}{dq_L} p_a q_S = 0 \\ p_a - (1 + t)p_n - \frac{d\Theta}{dq} (-1) \frac{q_S}{q_L^2} p_a q_S &= 0 \\ p_a + \frac{d\Theta}{dq} q^2 p_a &= (1 + t)p_n \end{aligned} \quad (30)$$

The left-hand side in (30) shows the marginal revenue from legal trade of diapers.  $p_a$  is the direct revenue from sales of one extra unit, while the second term is the increase in expected revenue caused by the decline in probability. This occurs due to an expansion of legal trade. The right-hand side is the marginal costs of legal imports.

$$\frac{dE\pi}{dq_S} = (1 - \Theta)p_a - \frac{d\Theta}{dq_S} q_S p_a = 0$$

$$(1 - \Theta)p_a - \frac{d\Theta}{dq} \frac{1}{q_L} q_s p_a = \frac{p_n}{\beta}$$

$$(1 - \Theta)p_a - \frac{d\Theta}{dq} q p_a = \frac{p_n}{\beta} \quad (31)$$

$(1 - \Theta)p_a$  is the expected revenue from selling one more unit of diapers illegally, while  $-\frac{d\Theta}{dq} q_s p_a$  is the indirect negative effect when selling one more unit illegally. This is because probability of detection rises as quantity of illegal goods increase. The right-hand side is the marginal cost of acquiring one more unit of diapers illegally.

$$\frac{dE\pi}{d\beta} = p_n \frac{q_s}{\beta^2} - \frac{d\Theta}{d\beta} p_a q_s = 0$$

Assuming that  $q_s \neq 0$ , this simplifies to:

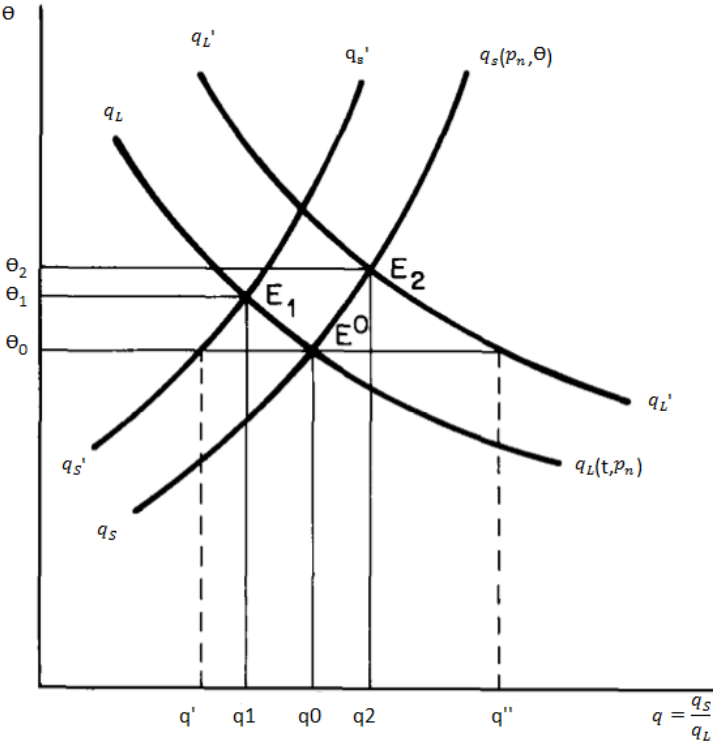
$$\frac{d\Theta}{d\beta} p_a = \frac{p_n}{\beta^2} \quad (32)$$

The right-hand side represents the lost revenue per unit of illegal imports when smuggling is more likely to be detected. The left-hand-side shows the direct savings from lower concealment costs.

Interestingly the first order conditions above are valid for all diaper-exporting firms from the same country. Since all diaper exporters face the same choices of  $q$  and  $\beta$ , and are subject to identical  $p_a$ ,  $p_n$  and  $t$ , they will choose identical solution values of  $q$  and  $\beta$ . Note that due to the assumptions on  $\Theta$ , we do not consider subjective probabilities and thus  $\Theta$  is also the same for all firms. Consequently, the first order conditions also represent the industry equilibrium.

As previously discussed, diapers are large and bulky goods that are difficult to conceal. If we assume that the firm spends no money on concealment, then  $\beta=1$ . In that case the probability of detection depends purely on the ratio of illegal and legally imported diapers.  $\Theta$  and  $q = \frac{q_s}{q_L}$  can then be represented graphically (see Figure 9).

**Figure 9: Illustration of optimal values of  $q$  and  $\theta$**



Source: Martin and Panagariya (1984)

The  $q_s$  curves show the different combinations of  $\theta$  and  $q$  that yield zero expected marginal profits from illegal trade. The curves slope upwards because a rise in  $q$  makes the marginal expected profits from illegal trade negative. Thus the price must rise in order to bring the expected marginal profits to zero.

The  $q_L$  curves slopes downwards because a rise in  $q$  makes the expected marginal profits from legal trade positive. Consequently the price must fall in order to bring expected marginal profits from legal trade zero. In equilibrium, the expected marginal profits from both legal and illegal imports must be zero.