

# State and Industrial Actions to Influence Consumer Behavior

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*To caffeine, music, and comfort food,  
my friends by my side during many evenings spent writing.*



# Abstract

This thesis consists of an introductory part and four papers.

**Paper [I]** examines how taxes affect consumption of commodities that are detrimental to health and the environment: tobacco, alcoholic beverages, household energy, and petroleum fuel (petrol) for transportation. Specifically, this paper examines if a tax increase leads to a significantly larger change in consumption than a producer price change, which is referred to as the signaling effect from taxation. Through an empirical analysis using the Linear Almost Ideal Demand System, the analysis uses aggregated cross-sectional time series data and information on major legislation introductions in Sweden, Denmark and the United Kingdom from 1970 to 2009. We find the main result to be that the signaling effect is significant for “Electricity” in Sweden and Denmark and significant for “Electricity” and “Petrol” in the United Kingdom. This implies that tax policy is more effective in tackling consumption of commodities which produce negative public effects (negative externalities affecting the social good such as pollution) than those for negative private effects (negative externalities affecting the private good such as health).

**Paper [II]** examines how sin taxation changes long-term consumer behavior regarding commodities which are deemed harmful for both health and the environment. These include tobacco, alcoholic beverages, sugar and confectionary, household energy, and motor fuel. Specifically, we examine the signaling effect from taxation which is seen if a tax increase leads to a significantly larger change in consumption than a producer price change. The empirical analysis is conducted by a US panel data study, during the period 1988-2012 for the four US census regions, using the Almost Ideal Demand System (AIDS). We find the main result to be that the signaling effect from taxation is significant for tobacco (at the 10% significance level) as well as for electricity and motor fuel (at the 5% significance level).

**Paper [III]** examines the empirical effect of state and industry responses on consumption of cigarettes and petroleum in the United States from 1998-2012. Upon facing consumption choices, the consumer faces two competing sets of messages, one from the government and another from the industry. The objective of the state is to steer consumption in the right direction due to the harmful effects from consumption and asymmetric information among consumers. This is done mainly via taxation and state media expenditures. The industry, on the other hand, seeks to incentivize the public to ignore or reject state research and signals as well as maximizing net economic returns. This is mainly done via industry media and lobbying expenditures. We find that the main results indicate, for cigarettes, industrial media and lobbying expenditure is statistically significant on consumption. For petroleum, we find that producer prices, state media expenditure, and industrial lobbying expenditure are statistically significant on consumption. While significant results are mainly seen for media and lobbying expenditures, no significant results are seen for taxation.

**Keywords:** Taxation; legislation; regulation; health; environment; tobacco; alcohol; petroleum; electricity; gas; sugar; consumption; prices; signaling effect; almost ideal demand system; public policy; panel data; media expenditure; lobbying; vector error correction model



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*“It is good to have an end to journey toward; but it is the journey that matters, in the end.” – Ernest Hemingway*

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Erik Brockwell  
Umeå University, 2014

**This thesis consists of an introduction and three papers:**

- [I] Brockwell, Erik (2014) “The Signaling Effect of Environmental and Health-Based Taxation and Legislation for Public Policy: An Empirical Analysis”, CERE Working Paper #2013-3
- [II] Brockwell, Erik (2014) “Signaling through Taxing America’s Sin”, CERE Working Paper #2014-4
- [III] Brockwell, Erik (2014) “The War for Consumers’ Minds and Wallets: State vs. Industry Responses on Cigarette and Petroleum Consumption”, CERE Working Paper #2014-5



## **1. Introduction**

This thesis contains three self-written papers that address certain key questions on the topic of how consumer behavior is affected by taxation, legislation, public policy, and industry responses. These research questions address the fields of environmental and health economics as well as the political economy. These questions are: (1) does a tax increase of commodities, which produce negative externalities or internalities, lead to a significantly larger change in consumption than a producer price change through a signaling effect? (2) Is the aforementioned signaling effect greater for taxation on commodities that produce negative private internalities as opposed to public externalities? (3) From a panel data study, is the signaling effect significant for a given commodity in the United States? (4) Are legislative and gender interaction effects on taxation significant in any direction? (5) What are the effects of state and industry responses on consumption of cigarettes and petroleum in the United States?

The above questions are the focus of the thesis where we will discuss their importance and the need to undertake research to answer them. Broadly, this thesis considers consumption of tobacco, alcohol, and sugar (primarily affecting consumers' private wellbeing) as well as consumption of residential electricity, natural gas, and petroleum (primarily affecting the public wellbeing). Thus it is quite clear as to the specific importance of these questions with the amount of vast research regarding the negative impacts of these commodities on health care and the environment as well as the way to which the state looks to intervene to solve these negative effects.

## **2. Taxation and the Signaling Effect**

Taxes have long been considered an essential tool and policy lever to change consumption patterns among individuals and society. Commodities like tobacco and alcohol are seen to cause negative health defects. Other commodities such as electricity and petroleum, through pollution, cause negative public effects. Thus there may exist a market failure in sense that the market cost of that harmful good does not fully cover the social cost. By internalizing the external cost with a tax, the individual will adjust its consumption behavior in the desired direction.

Paper [I] and [II] expand upon previous literature through estimating an additional effect from taxation known as the signaling effect. Specifically this is done through investigating whether the effects of a change in consumer prices differ depending on whether the consumer price change is due to a tax change or a change in producer price. If there is a statistically significant difference in the sense that a tax increase leads to a larger change in consumption than a producer price change, this is referred to as the signaling effect from taxation. Here the consumer would cut back on consumption of a commodity more than the effect from the added cost of the tax. This signaling effect would signal properties of that good which enter the consumers' information set.

The notion of signaling expands upon work by previous authors who have supplied arguments questioning the simple mechanism from basic consumer theory. Through signaling, taxation departs from the traditional Pigovian theory as stated by Sandmo (1975). This subject, which has its roots in contract theory and asymmetric information, is covered by Spence (1973, 2002) who states that the consumer may be less informed about the properties of a good than the supplier of that good and the government. The state, which is considered better informed through possession of statistics agencies and specialized research groups, then finds the need to signal properties of the good through taxation to lessen these market failures. However, an issue arises, as pointed out by Truys (2012), if consumers cannot distinguish the taxed from the untaxed goods this might then impair the informational value of the commodity tax. That is

why, along with the financial disincentive, the government passes along information about its policies to the targets of the regulation (Schneider and Ingram, 1993).

Truyts (2012), furthermore, addresses criticism from certain studies (Ireland, 2001, p. 194) that signaling cannot be observed or accomplished via taxation. Here, Truyts (2012) states, commodities in the same aggregate are assumed similar in essential signaling qualities. Where a commodity without a luxury label or design has just as much of a signal as the most exclusive item, consumers are not easily affected from efforts by the state to signal further properties.

This thesis also brings in discussion on norms within taxation. Leslie *et al.* (1973) defines social norms as “*rules developed by a group that specify how people must, should, may, should not and must not behave in various situations*”. As stated by a collection of authors (Lindbeck *et al.*, 1999; Benabou and Tirole, 2003; Glaeser, 2006), through understanding the justification for and the legitimacy of taxation, public acceptance and tax norm support is more likely. This thesis expands upon these views where tax norm support makes it more likely for the signaling effect to be significant among consumers. If the disutility of deviating from the social norm is high, this would indicate that consumers take into account extra information beyond a simple price effect. Here, for example, a heavy smoker or polluter would risk disutility from health or environmental damage and also may potentially face social disapproval. These are views to which Paper [I] and [II] in the thesis justifies the use of the signaling effect.

Overall, only two papers, to the author’s knowledge, have considered the signaling effect empirically: Licari and Meier (2000) and Ghalwash (2007). Licari and Meier (2000) focus on US cigarette consumption from 1955 to 1996 through pooled-time series OLS estimation where the main hypothesis was that, “*when the tax on cigarettes increases, there is an additional signaling effect besides the price increase*”. Licari and Meier’s justification for the public being able to perceive signals from taxation is that the negative health effects of smoking are so well known. Media coverage of legislative debates, along with government transmission of research emphasizes these health risks and sends signals of the specific goals and usefulness of tax policy. Analysis was done by modeling addictive phenomena via habit persistence. To do this, a lagged value of the dependent variable is included in a demand model as an independent variable. Overall, results show that the statistically significant signaling effect is seen at 0.15% above a general price increase. Overall, we expand upon Licari and Meier’s analysis where no studies have considered the signaling effect of tobacco and related commodities from a European perspective. Through also looking at alcohol (Paper [I] and [II]) as well as sugar and confectionary (Paper [II]), this also provides an extended analysis. Through a stylized model of demand incorporating the prices and consumption for other commodities, we are better able to estimate the specific effect on consumption regarding a change in consumer prices and taxes, compared to Licari and Meier (2000).

Ghalwash (2007) estimates the signaling effect through household demand in Sweden concerning the introduction of, or change in, environmental taxation. The same premise regarding signaling is used here as from Licari and Meier (2000), i.e. that a change in taxation may send a different signal to the consumer compared to one from producer price changes. Referencing Berkhout *et al.* (2004), a difference between the two papers, and one that Paper [I] and [II] employs, is that signaling effect may also differ and change between and when compared to different commodities in a given commodity group. Ghalwash accomplishes this through a system of household demand equations and a three-stage budgeting process<sup>1</sup>, using time series data<sup>2</sup> for different commodity groups<sup>3</sup> from 1980 to 2002. The three-stage budgeting process is one that is also employed in Papers [I] and [II] where the first stage assumes that the cost-minimizing household determines how much to spend on leisure consumption, savings, and consumer goods. Second, given a total consumption budget, the household allocates its

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<sup>1</sup> Evolving from the two-stage budgeting process for household demand (Gorman, 1959; Berkhout *et al.*, 2004)

<sup>2</sup> Data includes taxation, household expenditures, consumer price, and producer price index levels

<sup>3</sup> Split into four main groups: “Foodstuff”, “Transport”, “Heating”, and “Other goods”

expenditure on commodity groups, i.e. foodstuff, transport, etc. In the third stage, the household allocates expenditure on specific commodities within each group, given its budget for the commodity group.

The main hypothesis put forward by Ghalwash (2007) is that changes in taxation send a different signal than pure price changes. Appropriate demand function estimates are done via the AIDS (Almost Ideal Demand System) model, and subsequent Linear Almost Ideal Demand System (LAIDS) model, first derived by Deaton and Muellbauer (1980). The overall outcome is that changes in environmental taxes had a significant signaling effect on the demand for residential heating where consumers are more sensitive to a tax change than a producer price change. For petrol within transports, the opposite is seen where no significant difference is observed. Furthermore, petrol consumption seems less sensitive to a tax change than from a producer price change.

Papers [I] and [II] deviate upon work by Ghalwash through incorporating a longer timeline for European and American demand and environmental taxes, as well as considering taxes for commodities producing negative public health effects. Paper [I] expands the timeline to cover the period 1970-2012 in order to incorporate the decade as to when research and legislative policies on health and environmental taxes became a major issue. Ghalwash (2007) states that the consistency of the signaling effect may be further affected, due its non-linear nature, where the signaling effect is stronger when taxes are introduced than for subsequent tax changes. Furthermore, by adding more countries to the analysis (Denmark and the United Kingdom), a country-to-country comparison can be done as a point of interest. For Paper [II], a US perspective is given for health and environmental taxes where the signaling effect may have a different outcome. Due to data restrictions regarding consumption data, a shorter timeline is used for this study from 1988-2012.

Given estimates of the parameters in the econometric model in Papers [I] and [II], we can evaluate consumers' sensitivity to a tax change compared to a pure price change, i.e. the price and tax elasticities, as well as the income (or expenditure) elasticities. Here, a significant difference between taxation and producer price would indicate the presence of a statistically significant signaling effect. For the commodities considered, certain articles have found estimated values for the price elasticity of demand to which Papers [I] and [II] compare to for taxation in the conclusion sections. For tobacco, a review from Wilson *et al.* (2012) finds a price elasticity ranging from -0.1 to -1.41 among youths, and 0.1 to -0.45 for adults. This was done through a collection on 84 studies, across 88 publications in various countries, in order to gather the price elasticities of increasing taxes on tobacco products. Paper [II] specifically focuses on American data. Focusing on the US, Wasserman *et al.* (1991) and Chaloupka *et al.* (2002) estimate since 1970 that results have varied greatly from -0.25 to -1.3.

Concerning alcohol, a study by Wagenaar *et al.* (2009) is given where they conduct a review across 1,033 estimates from 112 different studies. Here they find the mean price elasticity ranging between -0.46 (beer) and -0.80 (spirits). Wagenaar *et al.* (2009) finds overall that there is a large variation between the results. Paper [II] expands upon commodities that affect the public health of the consumer by including sugar and confectionary into the analysis. Andreyeva *et al.* (2010), to gather the price elasticity of demand, conducted a review across 160 studies for major food categories. Here, a mean long-run price elasticity of -0.34 is found for sugar and confectionary.

For residential electricity, through a comprehensive literature review, Espey and Espey (2004) give short-run and long-run price elasticities for US residential electricity to be -0.35 and -0.85, respectively. For residential natural gas, Dahl (1993) states that from a review across many studies that price elasticity is around -0.27. However these results from Dahl (1993) have been shown to be quite varied where a clear consensus is not clearly seen. We also see that from these two studies that for natural gas is often more price inelastic than electricity. Finally, considering petroleum (or gasoline) demand, Brons *et al.* (2008), through a dataset of 312 elasticity

observations for gasoline demand, finds that the price elasticity of demand is quite inelastic for short-run and long-run elasticities of  $-0.36$  and  $-0.81$ , respectively. An interesting note from the study by Brons *et al.* (2008) is that a pricing policy based only on gasoline taxes may not be a very effective instrument to decrease the demand for gasoline. None of the other studies considered have come to such a conclusion, and so it is a hypothesis that this thesis will examine.

Paper [III] does not directly consider taxation in terms of the signaling effect, but rather taxation on whole as a policy tool along with other state media expenditure against industry responses (industrial media and lobbying expenditure)<sup>4</sup>. The same thinking, as with the signaling effect, is used regarding social norms. Along with the price effect of taxation, the message of taxation that consumption of tobacco and petroleum produces negative effects is reinforced via changes in social norms. Social norms are changed through generating public support for control policies (e.g. tax initiatives and restrictions) as well as changing attitudes and beliefs towards consumption. As stated by Jacobson *et al.* (1997), the government can validate or justify regulating a legal good, sustain decreasing consumption, and counter industry responses. Without these efforts, taxation may not have such a large effect where political backlash may result without generating public support. Licari and Meier (2000) and Friend and Levy (2002) state this is done through paid-for state media campaigns and research where the better informed government, through possession of statistics agencies along with specialized research groups, disseminates this information through mutual communication streams<sup>5</sup>.

### 3. Legislation

Papers [I] and [II] expand beyond considering purely the signaling effect from taxation through analyzing the effects of legislative introductions through specific laws and policies. As motivated by Licari and Meier (2000), realistically taxation cannot effectively transmit signals in isolation. The government has a key function to disseminate this through mutual communication streams (through, e.g. legislation, public information campaigns, etc.) to persuade the consumer to alter beliefs. Here, it is believed that the price/tax effect may be reinforced or crowded out if a change in taxation is combined with a non-price signal, through changes in legislation, such as an informational campaign. This deviates from the assertion by Ghalwash (2007) that the effects of legislation are implicitly included in the tax function.

To model legislative introductions, Licari and Meier (2000) adds an interaction term as a dummy variable that takes a value of 0 prior to 1966, 1 from 1966 to 1996, and 2 from 1971 to 1996 to take into account introductions of warning labels and advertising bans. These two events are deemed “key events” in government policy. Legislation is hypothesized to, firstly, have a direct impact on smoking to quit or reduce consumption. Secondly, legislation should have an indirect impact on efficacy of tax increases on smoking. These reasons for the second hypothesis is that consumers have other reasons besides economic ones to reduce consumption and thus may be less influenced by economic factors; secondly, remaining smokers may be more resistant to incentives to quit and thus are more price inelastic.

Paper [I] and [II] further expands upon previous literature as it is assumed that legislation directly interacts with the ability of taxation according to how households perceive changes in the tax level. These changes in legislation are included within the aforementioned final stage of the household budgeting process. From this it is shown that each legislative increase is collected, added, and reflected within the consumption behavior of the household as an index of regulatory pressure. It is also assumed that coefficients for legislation are not equal across time

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<sup>4</sup> Media and lobbying expenditure is defined in Section 4.

<sup>5</sup> Such communication streams include public service announcements through various forms of media, discussions regarding research on consumption, and announced descriptions of legislative introductions.

but instead is an individual effect from each law passed. Whilst logically it may be the case that the effects of legislation on consumer behavior may decay over time as it loses its impact or relevance, for simplicity, we assume long term memory across households having zero decay over time concerning legislative effects.

Another addition to the study is an expanded list of legislative introductions where by research from Swedish, Danish, British, European Union (EU), and US law databases<sup>6</sup>, there has been multiple legislative introductions and revisions to previous commodity legislation including media restrictions, warning and educational labels, and subsidies to households to list a few. An advantage of Paper [I] considering numerous countries is that for certain commodities, some governments relied mostly on industry self-regulation. For the US, in Paper [II], the list of legislative introductions also includes executive orders signed by the president. Each legislative introduction, in Paper [I] and [II] is included once passed and signed as law.

#### **4. Media and Lobbying Expenditure**

Before explaining the overview of media and lobbying expenditure, it is important to set up the premise as to why this is important. This is the main topic presented in Paper [III] where we consider consumption of harmful commodities which create negative health and environmental effects; in this case, these commodities are tobacco and petroleum. When the consumer makes their choices, they are often faced with two competing sets of messages, one from the government and another from the industry producing the harmful commodity. The objective of the government is to steer consumption in the right direction, i.e. to reduce consumption of these commodities, to minimize the cost to the consumer and the public.

The rationale for this is that, as stated by Mathewson (1972) and Hu *et al.* (1995a), consumption of commodities that are bad for the individual or for the public is irrational and may be based on imperfect information. This is as consumers hold only partial knowledge on the characteristics or consequences of goods consumption as well as the state of the world and nature. Thus there is a case, as with taxation, to correct these market failures of asymmetric information and negative internalities/externalities. Through similar logic as with legislation, to reinforce the reasons for taxation, and to potentially enhance the effect from taxation, the better informed government uses media expenditure in order to validate or justify regulating a legal good and educate the public as to the effects from consumption (Jacobson *et al.*, 1997; Licari and Meier, 2000; Friend and Levy, 2002). Such media expenditure is communicated through various media outlets (e.g. print and TV advertisements), government broadcasts, and via educational material.

Considering tobacco state media expenditure, many authors claim that well-funded and implemented mass media campaigns, joined with comprehensive control programs are associated with sustained reduced consumption (Friend and Levy, 2002; CDC, 2004; Ibrahim and Glantz, 2007). However, despite the evidence that state media expenditure is effective, tobacco control media campaigns have proven difficult to sustain due to industrial counter-advertisements and a lack of state funding.

State media expenditure on petroleum, however, is conducted slightly differently than that for tobacco. Whereas tobacco media expenditure is done in order to get consumers to quit smoking, media communication on the effects of petroleum consumption does not ask consumers to simply stop buying fuel or stop driving. Instead the goal is to show the long term effects from pollution and climate change from consuming great amounts of fuel. As stated by Colman (2012), the government seeks to counter messages by the oil and gas industry who aim to downplay the severity of climate change. This being where the oil industry who has spent

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<sup>6</sup> Law databases used are, for: Sweden (<http://www.notisum.se>), Denmark (<https://www.retsinformation.dk/>), UK (<http://www.legislation.gov.uk/>), EU ([http://ec.europa.eu/health/tobacco/law/index\\_en.htm](http://ec.europa.eu/health/tobacco/law/index_en.htm)), and the US (THOMAS database from the Library of Congress).

millions of dollars on ad campaigns belittling government research and attacking U.S. energy policies as being against economic growth and ‘anti-jobs’. The need for such communication is clear, where unlike smoking where its cancerous effects are clear, only 63% of Americans believe climate change is happening while the rest are unsure or deny its existence (Leiserowitz *et al.*, 2013). All this is despite a large consensus from the scientific community that climate change poses serious risks to human societies and ecosystems, which have already begun to happen<sup>7</sup> (Hmielowski *et al.*, 2013).

On the other hand, the objective of the industry is to maximize profits by encouraging consumers to consume more. This is done through messages to incentivize the public to ignore or reject state research and signals through various motivations, e.g. through arguing against research, political support, and making the product seem more attractive or enticing. This is especially true if messages sent by the state are uncomfortable to believe or where there exists skepticism.

Considering industry media advertising, there are certain key aims, as stated by Warner (1985) and Van den Hove *et al.* (2002), for the industry. Firstly, the industry seeks to have consumers focus on the external attributes of consumption. For smoking, this is to divert attention from health concerns to promote attributes such as flavor, satisfaction, sex appeal, and individuality. Secondly, given scientific evidence regarding the health effects of smoking and the environmental damage from petroleum consumption, the industry seeks to label such research as “junk science” or to say such reactions are exaggerated. Brownell and Warner (2009) stated, for tobacco, this is commonly done denying the addictive and destructive nature of smoking. For petroleum, discrediting scientific evidence of climate change has been an important aim due to the aforementioned increase in scientific reports regarding the severity of climate change. Thirdly, the industry may try and promote themselves better through public relations and image-restoration. The tobacco industry, stating that they are concerned about the public health may instead promote “less-hazardous products”. For the petroleum industry this has been a major aim since the 2010 BP oil spill in the Gulf of Mexico where massive fines were levied and sweeping regulation was called to prevent another incident. Lastly, as stated by Sutter (2002), advertising from industries also seeks to label state messages and actions as anti-business or holding political bias. The industry would try and increase support for the domestic economies and feed opposition to alleged “government interference” and to defend the “free-market system”.

Few studies have directly considered the effects on consumption of state vs. industry media expenditure empirically. Motivation for considering media expenditures in Paper [III] was through a study by Hu *et al.* (1995a) who studied California’s antismoking media campaigns against industry media campaigns on cigarette consumption from 1980 to 1993. The authors also took into account tax, measured per pack of cigarettes; consumption was given in quarterly values as well. California’s antismoking media campaign is measured in terms of media placement expenditures by the Tobacco Control Section in the California Department of Human Services. On the other side, industrial media expenditure is obtained through quantifying total pages of cigarette advertising in Life magazine distributed in California.

To gather the effects on consumption, Hu *et al.* (1995a) employed a time series model with explanatory variables including a time trend, quarterly dummy variables, California’s state tax, the federal tax rate, retail price (minus state tax) as well as state and industrial media variables. Overall, results show that the state media campaign has a statistically significant negative effect on cigarette consumption and the industry media campaign has a statistically significant positive effect on consumption. Both the federal and state tax rate as well as the time trend show statistically significant and negative impacts on cigarette consumption as well.

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<sup>7</sup> As reported by the IPCC (2014), such examples include: 1) Changing precipitation rates and melting of the polar regions have led to sea level rises as well as changes of the quality and quantity of water resources; 2) Many terrestrial, freshwater, and marine species have shifted their geographic ranges, migration patterns, abundances, and species interactions; 3) Net crop yields have been negatively impacted; and 4) Pollution levels have caused a decrease in the air quality in many urban locations.

Paper [III] expands upon Hu *et al.* (1995a) through not only examining the effects of state and industry action on consumption of cigarettes (tobacco) but also to consider petroleum where there has been no such study to the author's knowledge. We also do not look at the state level, but instead the federal level where there has been no other studies covering this to the author's knowledge. As with Hu *et al.* (1995a), Paper [III] includes taxation as part of the government's response to consumption along with media expenditures. However, for the industrial counterbalancing response, we deviate from Hu *et al.* (1995a) through also incorporating implicit communication to the consumer in the form of lobbying. This is due to a subsequent paper by Hu *et al.* (1995b) as well as recommendations from Begay *et al.* (1993) that for the example of California, lobbying efforts may have been cost-effective for the tobacco industry compared to countering the state's media campaign. This would be an interesting point to explore if the same effect is found on the federal level and also through lobbying by petroleum action groups.

Another of the main industrial reactions to the state is through lobbying. This serves as a form of indirect communication where the industry would work through policymakers to persuade them on what is good policy and what statements should be given. As discussed by certain authors (Brock and Magee, 1978; Kollman, 1998), lobbying is defined as activities by special interests and industries to argue for specific legislation in the government. Here, such methods are done through transparent contributions to a politician or political committee. The public is hence made aware of these messages through rules requiring extensive disclosure and through politicians' statements and decisions (e.g. campaign speeches, statements on laws passes/defeated, and organized messages to the public).

Brock and Magee (1978) and Kollman (1998) refer to lobbying as a traditional rent seeking method where a straightforward *quid-pro-quo* exchange of money is given for political decisions. If the interests of the policymaker and the industry conflict, a strictly positive contribution is required to enhance the credibility of industry reports on the reasons they require support (Lohmann, 1995). A key dynamic effect of industrial lobbying is that such expenditures can be a long-term investment which may not bear fruit right away (Kang, 2011).

A great deal of literature has debated the effectiveness of lobbying for the tobacco and petroleum lobbies. The tobacco lobby has seen a great number of challenges where it is argued that the power of the tobacco industry to sway politicians has decreased over the years where a growing number of people view tobacco lobbying efforts very negatively and as public health programs have become more successful. Furthermore, literature on this subject has stated that in spite of their contributions, declining political persuasion is due to the unfavorable association with the lobby and the social costs of increased consumption on negative externality producing commodities (Brock and Magee, 1978; Givel and Glantz, 2001; Kolk and Levy, 2001).

For petroleum lobbying, many authors (Kolk and Levy, 2001; Gelspan, 2004; Kolk and Pinkse, 2007) have said unlike for the tobacco lobby, the effectiveness of petroleum lobbying has increased over the years in persuading the politicians and the public alike through claims that climate change science is exaggerated and that green policies will only hurt the economy. Thus we have seen a declining number of passed legislation and new taxes while high levels of consumption have persisted. From a study of lobbying in the energy sector, Kang (2011) states that environmental regulations also directly impacts the competitive advantage based on the current level of cleaner production technologies. Thus many companies in the energy industry seek to lobby the government. Here, the petroleum lobby forms the largest lobbyist spending group in Washington.

Overall, the public may accept lobbying as benefiting the policymakers' work and a potential help in avoiding bureaucratic errors. However, lobbying may instead have the opposite effect than intended due to the negative perception held by the public where these forms of contributions may be seen as another form of manipulation, corruption, or bribery. However, it is not easy to predict the impacts of lobbying as it depends on how the politician reacts to

lobbying efforts. As quoted by Kollman (1998), “sometimes these campaigns have their effects – just as rain sometimes follows the rainmakers’ dance”.

## 5. Data Considerations

In this thesis, a wide variety of data is used from many sources. A core contribution of each paper is that the datasets used are unique to the study. Paper [I] uses publicly available data from Sweden, Denmark, and the United Kingdom. Data considered include indices on prices (consumer and producer prices), household consumer expenditure, and population figures. As these indices have a different base year depending on the timeline of the dataset used, these indices are rebased (2005 = 100) in order to have a consistent timeline. Data from Sweden is collected from Statistiska Centralbyrån (Statistics Sweden, SCB); data from Denmark is collected from Danmarks Statistik (Statistics Denmark); and data for the United Kingdom is collected from the Office of National Statistics (ONS). Consumption data is given per capita to account for changes in the population where population figures are also provided through these statistics agencies.

Furthermore, to consider the aforementioned effects of legislation, individual legislative introductions are collected from country law databases. This is done through searching domestic and EU-wide laws which specifically affect the population as a whole as opposed to a specific section of the population (e.g. laws targeting under-21 students). The legislative introductions are referred in Paper [1] as “major legislative introductions”. Furthermore, this study ignores “voluntary agreements” (or self-regulation<sup>8</sup>) which are considered non-binding agreements between the state and the commodity producing industry. These are ignored as the industry may circumvent these agreements as no penalty is imposed for violating these agreements.

We can see from the legislative introductions recorded, that all three countries have varying levels of legislation introduced where some prefer relying on voluntary agreements or self-regulation. For example, we see that tobacco legislation has been quite extensive across all three countries. Alcohol legislation, on the other hand, is generally favored in Sweden, where Denmark and the UK have a system preferring self-regulation. For household energy and petrol, for all three countries, legislative introductions are more often imposed on the suppliers and producers rather than the consumers (OECD, 2008). Swedish legislation data is collected via Notisum AB (Swedish Legislation Archive, [www.notisum.se](http://www.notisum.se)); Danish legislation data is collected via Retsinformation (Danish Legal Information Archive, [www.retsinformation.dk](http://www.retsinformation.dk)); legislation data for the United Kingdom is collected via The National Archives ([www.legislation.gov.uk](http://www.legislation.gov.uk)); and EU-wide legislation data collected via Europa<sup>9</sup>.

For Paper [II], a panel data study is conducted for the United States by region of residence across the four census regions (East, Midwest, South, and West). To accomplish this, specific data for the Consumer Price Index (CPI) and the Consumer Expenditure Survey is gathered across these regions. Here, the CPI is measured through monthly reported indices representing changes in prices of goods and services purchased for consumption, user fees (such as for utilities), as well as sales and excise taxes.

Data for producer prices is collected via the Producer Price Index (PPI). These indices are reported on a national level as they are constant throughout each census (or panel) region. These PPI values measure the average change over time in the selling prices received by domestic producers for their output, i.e. the first commercial transaction for many products and services.

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<sup>8</sup> Self-regulation is defined as control of policies or restrictions exercised independently of government supervision, laws, or the like.

<sup>9</sup> Europa - [http://europa.eu/legislation\\_summaries/consumers/index\\_en.htm](http://europa.eu/legislation_summaries/consumers/index_en.htm)

The Consumer Expenditure Survey consists of two national surveys: the Quarterly Interview Survey and Diary Survey. This is done to collect information on household and families' buying habits (expenditures) as well as income and household characteristics. Unlike the CPI datasets, Consumer Expenditure Survey is reported annually. This means that we are unable to conduct a quarterly study across the timeline (1988-2012). The timeline goes back as far as 1988 due to the Consumer Expenditure Survey being incomplete before this year. Furthermore, this panel data study is not conducted by a state-by-state basis due to unavailability of Consumer Expenditure Survey data. To calculate CPI values yearly, we take the average across the year to give yearly values. Another unique aim of Paper [II] is to consider if there has been any effects from changes in the gender share over time. This being as through the U.S. Consumer Expenditure Survey<sup>10</sup>, the sampling of men and women has changed over time quite dramatically. For example, on average across the four regions considered, in 1988 within the sample there were 68.75% men and 31.25% women within the survey. In 2012 this changed to 46.75% men and 53.25% women. This shows the sample has potentially been biased towards men<sup>11</sup>. Data on gender shares is also collected from the Consumer Expenditure Survey given in percentages across each year.

Data for the Consumer Price Index, Producer Price Index, and the Consumer Expenditure Survey are collected via the Bureau of Labor Statistics (BLS). Data from the Consumer Expenditure Survey is given per capita to account for changes in the population where population figures are also provided via the U.S. Census Bureau.

To gather the interaction effects on taxation from legislative introductions, Paper [II] only considers federal legislation (not state-specific as to fit with our national analysis) that affects the household's consumption decision directly covering the population as a whole, not a select group (e.g. children, veterans, etc.). We do not consider state-specific legislation here as, for example, a state law passed on tobacco in Massachusetts would not have an effect in New York or any other state in the East census region. Furthermore, we do not consider legislation that has not been signed by the president during the stage in the legislative process. This includes legislation passed by only the House and Senate as each state is not under any obligation to implement these laws. Legislation data is collected through the THOMAS database from the Library of Congress, through searching the bill summary and status<sup>12</sup>, the National Archives database of Executive Orders signed by the President<sup>13</sup>, and the U.S. Food and Drug Administration (FDA) "Guidance, Compliance, and Regulatory Information"<sup>14</sup>.

Lastly, for Paper [III], this paper uses readily available quarterly time series data covering the years 1998-2012 from various data sources for the United States. An advantage of conducting analysis for the United States is that certain data on lobbying and media expenditures is easier to obtain for the United States than for Europe. Analysis for this paper is conducted on the national (federal) level as much of the data is incomplete or unobtainable on the state-by-state level. Lastly, we begin from the year 1998 as this is the first year that data on lobbying is available on the public record.

Data on consumption refers, in Paper [III], to that for cigarettes and petroleum. Here, cigarette consumption is calculated as cigarettes consumed per capita whilst petroleum products are consumed in barrels (thousands) per capita. These represent real values consumed and not indices values. An advantage of this is that we may avoid a possible 'index-number problem' which refers to the difficulty of combining relative changes in the prices and quantities of various commodities into a single measure of the relative change of the overall price or quantity

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<sup>10</sup> The Consumer Expenditure Survey is detailed in Chapter 3.2 for the description of data.

<sup>11</sup> See the description of Paper [II] for more details.

<sup>12</sup> THOMAS database – Search Bill Summary and Status: <http://thomas.loc.gov/home/LegislativeData.php?n=BSS>

<sup>13</sup> National Archives Executive Orders: <http://www.archives.gov/federal-register/executive-orders/>

<sup>14</sup> FDA Guidance, Compliance and Regulatory Information: <http://www.fda.gov/drugs/guidancecomplianceregulatoryinformation/default.htm>

level (ILO *et al.*, 2004). We count cigarettes instead of tobacco as a whole as other forms of tobacco units consumed (e.g. snuff, chewing tobacco, etc.) are not readily available to the author's knowledge. As other forms of tobacco form a small fraction of the total tobacco consumption, this should not lead to any severe estimation errors. Petroleum consumption refers specifically to distillate fuel oil and liquefied petroleum gases. Consumption data is collected via the Alcohol and Tobacco Tax and Trade Bureau (within the Department of the Treasury) and the U.S. Department of US Energy Information Administration (EIA) for cigarettes and petroleum, respectively.

Quarterly data for producer prices are given for cigarettes and petroleum excluding federal taxes in current prices. As with Paper [II], producer price data is given as indices taken at the national or federal level where producer prices do not vary state by state. This data is obtained from the United States Department of Labor Bureau of Labor Statistics (BLS). For quarterly taxation values we consider excise taxation cigarettes and petroleum, which is defined as indirect taxes on the use or consumption on listed items. These excise taxes are taken on the federal level and come as part of the overall consumer price that the consumer pays for a given commodity. For tobacco, these taxes are measured in cents per pack of 20 cigarettes and are obtained quarterly from the average across all fifty states. The same principle is applied for petroleum but measured in cents per gallon. Excise tax data is obtained via the Department of Health and Human Services Centers for Disease Control and Prevention (CDC) and the U.S. Department of Transportation Federal Highway Administration (FHWA) for cigarettes and petroleum, respectively.

GDP measures, controlling for income are also included to detail how the income of a country may affect consumption. Data for GDP levels (measures in billions US\$) was provided by the U.S. Bureau of Economic Analysis.

A key variable in the analysis for Paper [III] is state advertising spending on tobacco and petroleum. However, two separate measures are given between the two. Tobacco industry state advertising spending is provided annually by the Campaign for Tobacco-Free Kids database on state spending vs. tobacco industry marketing. This provides quarterly expenditure by the state for specific advertising and media outreach regarding the harmful effects of cigarettes. However, state ad spending concerning petroleum operates in a different nature than that of tobacco where advertisements do not directly ask consumers to simply stop driving or to stop buying fuel. However, research campaigns showing negative effects on the public good are communicated through various media outlets, government broadcasts, and via educational material. To this point, we use data provided for the U.S. Global Climate Change Research Program (USGCRP) on research and transmission of results through various outlets as a measure of the state response. Data for the financial reports of the U.S. Global Climate Change Research Program<sup>15</sup> are released annually. As monetary variables it is appropriate to deflate these variables based on the current level of consumer prices and thus we use the quarterly U.S. Consumer Price Index (CPI) (1997 = 100) given by the Bureau of Labor Statistics (BLS). This is to take into account the effects of inflation over the timeline.

Considering industry media expenditures, tobacco industry ad spending is provided annually by the Campaign for Tobacco-Free Kids database on state spending vs. tobacco industry marketing. This refers to specific ad spending by the industry to promote increased consumption amongst consumers, as detailed in Section 3. Comprehensive and consistent quarterly data on petroleum industry media expenditures is, however, particularly difficult to obtain and not readily available. Thus, a measure for media expenditures is done via proxy. As suggested by the Union for Concerned Scientists, on average the petroleum industry spends 8% of its total profits on advertising and marketing. Using this benchmark, may not be a fully accurate representation of advertising spending but holds as an approximate figure for this study. Data on profits is given annually by the IEA (International Energy Agency). As with state media expenditures, these

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<sup>15</sup> U.S. Global Climate Change Research Program - <http://www.globalchange.gov/home>

datasets are deflated based on the current level of consumer prices from the quarterly U.S. Consumer Price Index (CPI) (1997 = 100) given by the BLS.

Lastly, quarterly data on lobbying is collected via The Center for Responsive Politics from 1998 to present date. To ensure accuracy, these values are checked against records provided by the U.S. Federal Commission. Due to data restrictions, lobbying data from 1998 to 2007 was reported on a mid-year and year-end basis before quarterly reports were published. From 2007 onwards, data is given on a quarterly basis. Here, this data refers to lobbying expenditure from a specific company, lobbying firm, or individual lobbyist. These amounts are filed with the Secretary of the Senate's Office of Public Records (SOPR) where lobbyists are required to provide a 'good-faith' estimate rounded to the nearest \$10,000 in each quarter.

## 6. Summary of the Papers

### ***Paper [1]: The Signaling Effect of Environmental and Health-Based Taxation and Legislation for Public Policy: An Empirical Analysis***

This paper examines how taxes affect consumption behavior of tobacco and alcohol<sup>16</sup>, which are detrimental for public health, as well as electricity, natural gas, and petroleum which are detrimental for the environment. Specifically, this paper investigates whether the change in consumer prices differs depending on whether the price change is due to a tax change or a change in producer price. A statistically significant difference in the sense that a tax increase leads to a larger change in consumption than a producer price change is referred to as the signaling effect. Additionally, this article estimates how legislative introductions may interact with taxes. For the empirical analysis, this article uses aggregated time series data for Sweden, Denmark, and the United Kingdom, covering the period 1970-2009.

The logic behind the signaling effect is that the consumer may be less informed about the properties of a good than the supplier of that good and the government. The regulator or policymaker, who is considered better informed through possession of statistics agencies along with specialized research groups, may deem consumption to be too high or low from both the individual and social point of view (Spence 1973, 2002). As asymmetric information presents a market failure, the government is validated to correct this.

However, realistically taxation cannot effectively transmit signals in isolation. The government has a key function to disseminate this through mutual communication streams to persuade the consumer to alter beliefs. The price and/or tax may have a signaling effect, and therefore such an effect may be reinforced if a change in taxation is combined with a non-price signal, for example changes in legislation such as an informational campaign.

To empirically model consumer behavior, this paper implicitly adapts a three-stage budgeting model as recommended by Ghalwash (2007). Here, the first stage assumes that the cost-minimizing household determines how much to spend on leisure consumption, savings and consumer goods. Second, given a total budget, the household allocates its total expenditure for commodity groups, i.e. foodstuff, transport, etc. Third, the household allocates expenditure on specific commodities within each group, given its budget for the commodity group.

The econometric method used expands upon the basic form of the AIDS (Almost Ideal Demand System) model first developed by Deaton and Muellbauer (1980b) and used, among others, by Ghalwash (2007). Through partitioning producer prices and taxation from the overall consumer price, the parameters gathered help separate the effects between these prices. Estimates are gathered both on the commodity group level (e.g. Foodstuff) and for the individual commodity

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<sup>16</sup> As well as alcoholic beverages in aggregate, analysis is also done splitting alcohol up for Spirits and Wine and Beer

level, which represents the second and third stage of the three-stage budgeting model, respectively.

Considering the third stage, possible effects from legislation and information is introduced via a set of dummy variables representing major legislative reforms or information campaigns upon the point of implementation. These dummies are assumed as interacting with the tax variable as legislation and information may reinforce the tax effect. This is done via interaction terms that are included with the parameter for taxation.

The results show that the “Foodstuff” and “Household energy and utilities” commodity groups have a significant signaling effect both at the 1% level. For individual commodities, we see a significant signaling effect from taxation for Electricity at the 5% significance level. For Denmark, as with Sweden, we have a significant signaling effect through only Electricity taxation but at the 1% significance level. Finally for the United Kingdom, both Electricity and Petrol possess a statistically significant signaling effect at the 1% and 5% significance level, respectively.

### ***Paper [II]: Signaling Through Taxing America’s Sin: A Panel Data Study***

This paper conducts a panel data study to examine how ‘sin taxation’, via the signaling effect, changes long-term consumer behavior regarding commodities which are deemed harmful for both health and the environment. Specifically, we use US panel data from 1988-2012 for the four census regions: 1) Northwest; 2) Midwest; 3) South; and 4) West. Commodities considered here are Tobacco, Alcoholic Beverages, Sugar and Confectionary, Electricity, Utility Natural Gas, and Motor Fuel (Petroleum).

The signaling effect refers to when taxation leads to a larger change in consumption than the producer price due to an added informational effect regarding the properties of a given commodity on top of the price effect. Here, taxation signals to the consumer the properties of the good consumed on how consumption affects negatively the public good via, e.g. pollution, or the private good via, e.g. health effects. The government seeks to disseminate this through mutual communication streams through, e.g. legislation, public information campaigns, etc., to persuade the consumer to alter beliefs (Licari and Meier, 2000).

Also included in the model is the effect of changes in gender shares within the U.S. Consumer Expenditure Survey where the sampling of men and women has changed over time quite dramatically. This shift in gender shares over time shows there may be a selection problem in the Consumer Expenditure Survey where the sample may not be representative of the population.

For use in the econometric model, this paper adopts, as in Paper I, the three-stage budgeting model assuming in the first stage, the cost-minimizing household determines how much to spend in total. Second, given a total budget for consumer goods, the household allocates its expenditure for commodity groups, i.e. foodstuff, household energy, etc. Third, the household allocates expenditure on specific commodities within each group.

The model employed expands a fixed effects panel data approach upon the basic form of the AIDS (Almost Ideal Demand System) model first developed by Deaton and Muellbauer (1980), and expanded by Ghalwash (2007). To estimate the individual parameters within the total consumer price, commodity prices are partitioned into a producer price component and a tax component. To account for the aforementioned gender share changes, the model is appended with an interaction between gender shares and the tax effect. To model the effects of legislative introductions, this is done through a set of dummy variables, representing major legislative reforms or information campaigns upon the point of implementation. Interaction terms are added to the econometric model which also comes as part of the tax effect.

Overall we see from the results that, for the “Foodstuff” commodity group, there exists a significant signaling effect from tobacco taxation at the 10% level. No statistically significant effect, however, is observed for Alcoholic Beverages or Sugar and Confectionary. Considering the “Fuels and Related Products and Power” commodity group, we find a significant signaling effect from taxation for electricity and motor fuel at the 5% level. However, no such effect is observed for Natural Gas.

Considering legislation, for the “Foodstuff” commodity group, we find two significant interaction effects from 1990 referring to the “Nutrition Labeling and Education Act” and in 2006 referring to the FDA revision for labelling of trans-fat and fatty acid amounts. Considering the “Fuels and Related Products and Power” commodity group, we find no significant interaction effects from legislation for any commodity. Considering the interaction effects from gender shares, from the “Foodstuff” and “Fuels and Related Products and Power” commodity groups, no statistically significant interaction effects were found. One possible interpretation to this is that consumption behavior does not differ significantly between men and women.

### ***Paper [III]: The War for Consumers’ Minds and Wallets: State vs. Industry Responses on Cigarette and Petroleum Consumption***

The objective of this paper is to examine the effect of state and industry responses, or measures, on consumption of Tobacco (cigarettes) and Petroleum in the United States. Specifically, the government seeks to discourage consumption of these harmful goods through taxation and state media expenditures. We then examine the industry’s response, which seeks to increase consumption, via industry media and lobbying expenditures. Through time-series expenditure data, this article will conduct analysis from the years 1998 to 2012.

Upon facing consumption choices, the consumer faces two competing sets of messages, one from the government and another from the industry producing the harmful commodity. Given the well-documented effects of cigarette and petroleum fuel consumption, the objective of the government is to steer consumption in the right direction to minimize cost to the consumer and the public.

Consumption of commodities which produce these negative effects are deemed irrational where it is hypothesized that the decision to consume, knowing these effects, may be based on imperfect information as consumers hold only partial knowledge on the characteristics or consequences of commodity consumption (Mathewson, 1972; Hu *et al.*, 1995a). There is then a case for the government to intervene to correct these market failures of asymmetric information and negative internalities/externalities. This is mainly done via taxation and media expenditures.

On the other hand, the industry’s objective is to maximize net economic returns, which in turn motivates marketing and communication campaigns as well as lobbying expenditures (working through the politicians). The main aim of industrial communication is to incentivize the public to ignore or reject state research and signals through various motivations. In this paper, these aims are done via industrial media and lobbying expenditures.

The model employed is a Vector Error Correction Model (VECM), where short-run coefficients are given across each variable and for each variable. However, to get long term coefficients for consumption, which is set as the dependent variable, separate equations form the variables in the system of equations are normalized on consumption to get the cointegrating vector. This follows tests for unit roots for the time series variables and determination the number of cointegrating equations using the Johansen test for cointegration.

In our results, we see for cigarettes a statistically significant result is seen for industrial media expenditure (IM) and industrial lobbying expenditure (LOB), both at the 1% level. A unique result of this study is that industrial media expenditure is not of the expected sign. Here an

increase in industrial media expenditure is associated with a fall in consumption. Lobbying is, on the other hand, of the expected sign where an increase in lobbying expenditure is associated with a rise in consumption. No statistically significant result is observed, however, for producer price, taxation, government media expenditure, and income.

For petroleum, we see that producer price, government media expenditure, and industrial lobbying expenditure are significant at the 1% significance level. Producer prices (P) is also significant but at the 10% level. Here, all coefficient values seem to be of expected sign where an increase in producer prices and government media expenditure is associated with a fall in petroleum consumption. However, an increase in industrial lobbying expenditure would likely be followed by an increase in consumption.

## **7. Policy Implications and Future Research**

Considering taxation in Sweden, Denmark, and the United Kingdom (as seen in Paper I), a significant signaling effect is seen for electricity (in all three countries) and petroleum (in the UK). However, no significant results are seen for tobacco, alcoholic beverages, or natural gas. From the results given we can conclude that environmental taxes seem more effective than that for health taxation (for tobacco and alcoholic beverages) regarding the signaling effect. Specifically this indicates that environmental taxation seems more effective in signaling the properties and negative impacts of electricity and petroleum consumption. Here, consumers may be much more aware of the negative effects from consumption, which then means that additional 'signals' will have very few additional effects. Direct policy implications may be that the policymakers be advised to maintain, or even increase, the level of taxation on such products.

Although no statistically significant outcome is seen for health taxation on tobacco and alcoholic beverages, this does not mean that policymakers should abandon or decrease current taxation. Taxation is still effective in the sense that it still works to lower consumption via the normal 'price effect'. Taxation in this case still holds a signaling effect at least to a small degree and is furthermore a key policy lever to decrease consumption and provide funding to the state and further legislation. Direct policy implications may be to focus and expand upon current legislation on these products as well as implementing additional legislation introductions.

However from the US perspective (as seen in Paper [II]), we see a statistically significant signaling effect for tobacco, electricity, and motor fuel. Here, this signals to the policymaker that taxation is an effective method to signal the negative properties from consumption, e.g. health defects or pollution, to the consumer and to incentivize reduced consumption. Policymakers here would be advised to consider taxation as the most useful policy tool for signaling informational properties of the commodity and to reduce consumption. Furthermore, for electricity and petrol, in the face of political resistance from the public regarding energy and fuel prices, this signals a good result that the public may be more receptive to a price increase than previously thought.

Considering consumption of alcoholic beverages, sugar and confectionary, and natural gas, no significant results are seen for the signaling effect. From these results, policymakers would be ill advised to simply consider taxation as an ineffective policy tool. Simply, the signaling effect is not as large as for tobacco, electricity, and motor fuel in significant terms but still is a vital policy lever for reducing consumption via the price effect. As with the European perspective, the US government may look to increase and expand upon existing legislation or look to introduce new more comprehensive forms of legislative introductions.

For legislation of these harmful commodities, we see a wide range of results as to which legislative introductions have been effective in interacting with taxation to reduce consumption.

For tobacco, such successful policies include smoking bans in public places as well, restrictions on advertising for tobacco products, requirements of health warning labels, and increased penalties of sales to underage persons. For alcohol, statistically significant legislation includes the labeling of a beverage's alcoholic strength, tighter regulation of media advertising, and educational messages warning consumers on the consequences of excessive consumption. However, these significant results are only seen in Sweden where no significant results are seen (for alcohol) in Denmark, UK, or the USA. For these countries, policymakers may be advised to revise existing legislation or consider new effective legislation to implement. For the US (as seen in Paper [II]), statistically significant results are seen for sugar and confectionary legislation. Such successful laws that policymakers would be advised to continue, and even expand upon, include nutrition labelling and education regarding the impact of consumption as well as the FDA revision for labelling of trans-fat and fatty acid amounts.

For household energy (electricity and natural gas), examples of successful (statistically significant) legislative introductions, which the policymaker would be advised to continue and expand upon, include the labelling of appliances and light bulbs<sup>17</sup> as well as price transparency from household energy used. For motor fuel (petrol), successful legislative introductions include the requirement of car dealers to include in each vehicle and petrol selling location the fuel consumption and CO<sub>2</sub> emission figures of that vehicle as well as educational material on how to minimize fuel consumption and the impact of CO<sub>2</sub> emissions. These results are consistent for Sweden, Denmark, the United Kingdom, and the United States (Papers [I] and [II]), with statistically significant results in the negative direction, implying to the policymaker that such legislation has been useful in reinforcing the tax effect to reduce consumption. However, for motor fuel, no significant legislative results are seen for the US (Paper [II]).

From the results given regarding state and industry actions to affect consumption of tobacco and petroleum (Paper [III]), we are hence able to see clear policy recommendations for the state in order to counter the tobacco and petroleum industries for incentivizing sustained decreases in consumption. For tobacco and petroleum, with no statistically significant effects, taxation has not been as effective, as hoped for, as a policy lever to affect consumption decisions of the consumer. Whilst we still achieve a negative effect from price and tax effects in our model for petroleum, a slight positive result is achieved on cigarette consumption. This may indicate that the consumers may be more responsive to price changes on petroleum products. Overall, these results may indicate to us that taxation may not be as effective as the other variables in influencing consumption behavior. Despite these results, this does not mean that decision makers should abandon or decrease the level of taxation as taxation still has an effect on consumption as a vital policy lever.

Considering state media expenditures, this type of direct communication to the consumer seems to have different results for cigarettes and petroleum. Government media campaigns on cigarettes are not significant in result and hold a slight positive value on consumption, which contradicts the results from Hu *et al.* (2005a). This shows us that governmental media campaigns have not led to a decreased level of consumption where instead a positive effect is seen. Through statistically insignificant results, however, government media campaigns are less effective to incentivize changing consumption levels. However, as stated by the CDC (2004), industry media spending has outnumbered state spending and as such the government's message may not have been fully received. Thus, it is still vital for the state to increase media advertisements. For government media campaigns on petroleum, however, we do find significant results in the expected negative direction on consumption. With a long term elasticity of -0.523%, this is highest among the variables considered which implies that this indicates to the policymaker that the research campaign, the U.S. Global Climate Change Research Program (USGCRP), has been a valuable policy tool in communicating the effects of overconsumption of petroleum on the environment. Hence, a policy recommendation would be a sustained

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<sup>17</sup> This labelling aims to provide information to households regarding their energy consumption, the scale of their environmental impact, and the commodity's energy capacity.

continuation of funding into the program and an expansion of the program across the country. An extension in funding to the USGCRP and an expansion of the program across the country would be another economically viable policy recommendation if the cost of the campaigns is less than the value of lower levels of climate change.

Considering industrial media expenditures, contrasting results are found for tobacco and petroleum. A statistically significant result is found for tobacco, but of a negative sign. This is not the expected result as the goal of industrial media expenditure would be to increase consumption. This would indicate to us that the public may be resistant to messages from the tobacco industry where such reasons may be an increased knowledge of the effects of smoking or that such advertisements may be read by children. This would be an encouraging result to the policymaker, especially as no statistically significant result was found for state media expenditure.

For petroleum, a positive result on consumption was seen but at an insignificant level which shows that the industry's attempt to display themselves in a socially responsible light (i.e. through "greener methods" and with greater safety controls to prevent oil spills) has not appeared to resonate with the public. This may indicate to the policymaker that, along with a significant result for state media expenditure in the expected direction, state policy measures have been effective.

Finally, considering industrial lobbying expenditure, for tobacco and petroleum we see a consistent statistically significant positive effect on consumption. This is of the expected sign where the industry lobbies the government with the aim to increase consumption. This is a worrying outcome as this indicates that lobbying has resonated largely with the public. For tobacco, this contradicts earlier assertions (Givel and Glantz, 2001; Ahrens *et al.*, 2011) on the scope of the tobacco lobby's influence where because of the poor public image the lobby holds, tobacco lobbying was not expected to be largely effective. For petroleum, however, this is not a surprising result where this confirms literature that petroleum lobbying has positive effects on consumption (see, e.g., Kolk and Levy, 2001; Gelbspan, 2004; Kolk and Pinkse, 2007). Through record levels of spending by the petroleum industry, lobbyists may be argued to have successfully tapped into the rampant problem of climate change denialism<sup>18</sup>. These implications stress the importance of maintaining the stock of information to the public on the effects of climate change through media spending. Additionally, the government may consider stricter legislation on lobbyists to curb their influence, e.g. spending limits.

For future research, a further improvement to this study may be a study on the psychological element behind how consumers perceive and react to taxation. It is argued that within the field of consumer behavior from taxation, "what is needed is a comprehensive model on how tax attitudes come about" (Furnham, 1984, pg. 545). Such studies may be comprehensive psychological mapping of consumer behavior as well as how a person's own beliefs may impact their decision. Explicitly, it may also be worthwhile and interesting to conduct a survey analysis for future studies based on values as to how certain 'values groups' may react to the signaling effect. Such values groups may be those who consider themselves religious or not (i.e. Christian, Muslim, Atheist, etc.) or those of a particular political persuasion (i.e. liberal, conservative, etc.).

In Papers [I] and [II], only regulation made by the government is considered. However, producers of harmful commodities also produce their own advertisements and campaigns to boost consumption. As stated by the ASPECT Consortium (2004), tobacco companies are a prime example where despite existing legislation, tobacco companies have launched their own promotion and campaigns to undermine and influence anti-tobacco legislation and to satisfy the "psycho-social needs" for current smokers. Likewise, the tobacco industry "is increasingly

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<sup>18</sup> Where 161 elected officials from the 113<sup>th</sup> Congress (Jan-June 2013) have taken in over \$54 million from the fossil fuel industry to vote against 'green policies' despite an overwhelming scientific consensus on the environmental and financial impacts of climate change<sup>18</sup> (Germain *et al.*, 2013; Spross, 2013)

*aware of the need to target children and young adults to assure its future market*". Another improvement to the study of the signaling effect from taxation may be inclusion of variables regarding marketing campaigns by the not only the tobacco industry, but for the alcohol or energy industry as well.

The objective of Paper [II] is to provide analysis on the federal level. However, a point of analysis for future research would be a state-by-state study regarding the signaling effect and legislation. A state-by-state analysis would also be able to utilize individual state legislation where such legislation differs state to state. This study assumes that information is held over time in constant terms. However, information held by the consumer may decay over time. Incorporating a decay function within the methodology may take into account such factors. As consumers also import the commodities considered from a state with a lower state tax rate, assessing the impact on such actions would also be interesting to a future study.

Paper [III] is conducted using data on the national level; however, state-by-state differences play a major role on where the federal government should concentrate its policy to ensure decreased consumption. However, in this study, due to data restrictions, data on consumer expenditure and lobbying was not readily available.

An area this paper has not addressed is the divide between political ideologies regarding whether action should be taken by the state to try and influence consumer expenditure of cigarettes and petroleum. As said in the paper, many see government interventions as anti-business or holding potential political bias. This is typically divided amongst Republicans and Democrats where the conservative ideology is argued to try and increase support for the domestic economy feeding opposition to alleged 'government interference' and defending the 'free-enterprise system' (Sutter, 2002). Looking at lobbying, from the Center for Responsive Politics, the party split is quite partisan in nature. For example, in 2012 from the tobacco industry, of \$26.7 million spent, \$3 million went specifically to Republican lawmakers (79.4%)<sup>19</sup> whilst \$779.2 thousand (20.6%) went to Democratic lawmakers. For the oil and gas industry, the divide was even more pronounced where, out of \$143.6 million spent, \$50.8 million went to Republicans (89.6%) whilst \$5.9 million (10.4%) went to the Democrats. A future study may try and look closely at the differences in consumer behavior and reactions to state and industry communication between Republicans, Democrats, and Independents.

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<sup>19</sup> Percentages are given as a total of contributions to specific political parties. Contributions not given to specific political parties are given to independent candidates (non-affiliated or belonging to an alternative party) or non-partisan political action committees and organizations.

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