SUBMITTED ARTICLE

AAEA Agricultural & Applied Economics Association   WILEY

A multiple-standards framework to address externalities resulting from meat production

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Editor in charge: Daniel Petrolia.

Abstract

This article develops a framework for assessing the implementation of standards in a context of multiple negative externalities resulting from meat production. The framework is applied to the introduction of the New Dutch Retail Standard in the Dutch broiler market, a standard on animal welfare initiated by the private sector with national coverage. The results show that this standard did not lower producer, retailer, and consumer welfare; rather, social welfare increased by approximately 300 million euros. The framework provides a sound scientific basis for an ex ante analysis on the market potential of multiple standards.

KEYWORDS

externalities, market effects, meat supply chain, partial equilibrium model, standards

JEL CLASSIFICATION

D62; Q13; Q18

Intensive broiler and pig production systems have been under increased public scrutiny in the Netherlands, because of their negative side effects—defined as negative externalities—on Animal Welfare (AW), the environment, and public health (Eurobarometer, 2016, 2017, 2019). For instance, the NGO Wakker Dier introduced the term "plofkip" ("exploding chicken") to decry the leg problems that fast-growing broilers may develop when reared in intensive production

systems. Although the EU has passed legislation to improve food safety, environmental footprints and AW (European Council Directive, 2001, 2003, 2008), societal criticism persists. This criticism implies that further improvements should be implemented, beyond the prevailing legal minimum, in order to attain public acceptance both in the short and long term. To address the critique on AW, more extensive pig and broiler production systems have been developed in the Netherlands that exceed the minimum legal AW requirements (Gocsik et al., 2016). However, farmers are reluctant to implement these systems (Gocsik et al., 2015), as they entail a higher cost of production relative to intensive production systems, while at the same time the price premium is uncertain. Therefore, the Dutch meat market faces a multiple externality problem: on the one hand society and specific consumer groups demand additional measures, and on the other hand financial insecurity withholds farmers from adopting such measures. Out of dissatisfaction with the current situation, some actors (partly) left the market. Certain consumers switched to a (semi)vegetarian diet and some farmers adopted specific production systems with distribution channels to restaurants or online outlets (Reinders et al., 2013).

More stringent standards are required to address the externality problem but is it unclear how they should be introduced. Should these standards, for example, replace the minimum legal requirements and would government intervention be required? Standards are defined as requirements relating to inputs, production processes, or final products that can solve market failure related to production or consumption externalities (Swinnen et al., 2015). As Dutch broiler and pig farmers operate in a market that is characterized by tight profit margins (Reinders et al., 2013), it is essential to understand the price incentive compatibility of chain actors for a successful introduction of more stringent standards. However, a comprehensive theoretical economic understanding that supports value chain decision-making is still lacking. Earlier attempts to address this problem, such as the conceptual framework of Swinnen et al. (2015), analyze the welfare effects of standards in value chains. Plastina and Giannakas (2007) developed a framework to analyze welfare effects under consumer aversion to genetically modified products. Neither framework elaborates on the price incentive compatibility of chain actors, or accounts for multiple externalities or their potential interaction. Research has shown, however, that externalities related to on-farm animal management such as AW, animal health, and environmental impact, are interlinked. For example, a slower-growing breed results in improved AW and animal health (Gocsik et al., 2016), but also has a larger carbon footprint compared to a fast-growing breed (Bokkers & De Boer, 2009). While improved animal health may lead to reduced costs and therefore enhanced profits (Lusk & Norwood, 2011), a higher carbon footprint may (partly) offset the added value for consumers.

The previous example illustrates that the interaction between externalities might affect production costs and consumer's Willingness-To-Pay (WTP). In the context of the externality problem, the existing frameworks cannot provide insight into the commercial feasibility of more stringent standards. This study contributes to the existing literature by developing an extended framework to analyze the implementation of multiple standards that aim to address negative externalities of meat production. This framework can be used to assess the socioeconomic potential of new production systems, relying on private, public, or public-private arrangements, as it allows for a quantitative analysis of the commercial feasibility of standards and the impact of government intervention on producer and consumer welfare. As such, the article contributes to a more accurate assessment on the costs and prices of policies aimed at implementing production systems with more stringent standards.

The remainder of this article is structured as follows. The next section develops the conceptual framework, which describes the economic effects of introducing a more stringent

standard in a multiple standards-context followed by a theoretical underpinning of the framework. Section three applies the framework to the New Dutch Retail Standard, which includes the introduction of a more stringent standard on AW in the Dutch broiler market. Section four discusses the results and the policy implications, and the article ends with the conclusions.

CONCEPTUAL FRAMEWORK

Description of standards in the meat supply chain

The meat supply chain consists of input suppliers, farmers, processors, retailers, and consumers. Farmers buy inputs from breeders and feed producers to produce livestock. As a joint product from this activity, (negative) externalities are generated. Animals are then slaughtered and processed, and consequently sold by the retailer to consumers. The externalities at farm level can be addressed by introducing a more stringent standard (Swinnen et al., 2015). The standard is assumed to be voluntary for farmers, i.e., the farmers can freely decide to adopt this standard or to adopt the less stringent, public mandatory standard. Furthermore, the standard is assumed to be exogenous, imposed only at farm level, and to affect only production-related traits (externalities). Hence, product-related traits (e.g. meat texture or taste) are unaffected. When imposing a more stringent standard at farm level, a negative externality would be reduced, but this standard would also involve higher production costs due to higher input prices and a decrease in the production efficiency (e.g. requiring higher input volumes). In order to guarantee the farmer's income, a higher producer price would be required. This means that processors, in turn, would face higher resource costs and both a higher processor and consumer price are required to guarantee the profit of processors and retailers. A higher valuation of the product traits, via the reduction of the externalities, may offset the higher consumer price.

A successful introduction of a more stringent standard requires that each player in the chain is willing to adopt the standard. For simplicity, further analysis includes only the three main players in the chain: the producer, the retailer, and the consumer. It is assumed that producers and retailers aim to maximize profits and consumers aim to maximize utility. Therefore, for a more stringent standard to be commercially feasible, it is assumed that the following three conditions have to be satisfied:

i. producer's profits are not decreasing
ii. retailer's profits are not decreasing

iii. the increase in WTP equals or exceeds the increase in consumer price needed to cover all additional costs of the more stringent standard.

When introducing the more stringent standard, this standard may interact with another standard, thereby causing cost savings and/or an additional increase in consumer's WTP, or adversely, an additional increase in production costs. In this paper, we defined a synergy as an interaction effect resulting in cost savings or an additional increase in consumer's WTP, whereas we defined conflicting effects as an interaction effect leading to an additional increase in production costs or a mitigation of the increase in consumer's WTP.

Economic effect of standards per actor

To model the economic effect of a more stringent standard, the producer and retailer profit function from Swinnen et al. (2015) and the consumer utility function from Plastina and Giannakas (2007) were used as a starting point in the theoretical framework. In the framework we considered the economic effects only from a national perspective. Throughout it is assumed that producers are risk neutral and maximize short-run profits, with the latter implying that quasi-fixed inputs are unaffected by production and standards.

Producer

The producer's objective is to maximize profits, given the selected standard, by setting output. The producer's profit is calculated by subtracting variable costs and fixed costs from the revenues. A mathematical substantiation of the producer's profit relationship and the economic effect of a more stringent standard on producer profits is provided in Appendix A. It is assumed that the producer price is either unaffected by the standard or increased with the intensity of the standard. Per unit variable costs are assumed to be increasing and strictly convex in the intensity of the standard. An increase in a standard decreases production (ceteris paribus). When increasing the intensity of a standard, the interaction of the standard with a different standard, can have a positive, negative, or no effect on variable costs. For independent standards, the interaction does not affect variable costs. In case of conflicting standards, the interaction causes an additional increase in variable costs, relative to separate standard implementation. In contrast, synergy between standards implies that the cost increase associated with an increase in a specific standard is partly offset by cost savings from a different standard. For example, slower-growing breeds can be introduced to satisfy a relatively high AW standard. As slower-growing breeds are less susceptible to diseases than fast-growing breeds they require less antibiotics (Van Geijlswijk et al., 2019), thereby resulting in cost savings on animal health. Appendix A provides a mathematical substantiation of these interaction effects.

Retailer

Based on the selected standard, the retailer's objective is to maximize profits by choosing the optimal quantity of output. The retailer's profits are equal to revenues minus handling costs. The handling costs consist of activities such as wholesaling, labelling, and marketing. A more stringent standard at farm level would result in an increase of the producer price, and therefore an increase in the retailer's marginal costs. To prevent a decrease in the retailer's profits, the consumer price needs to increase to cover the additional costs. A mathematical notation of the profit function and the economic effect of a more stringent standard on retailer profits is provided in Appendix A.
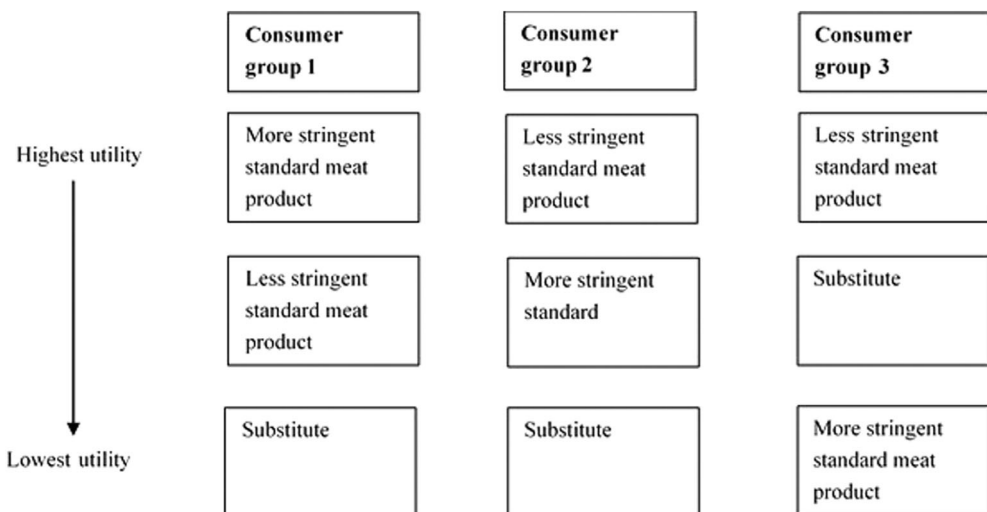
Consumer

When making purchase decisions, consumers make a trade-off between the product's traits and the consumer price (De Jonge & Van Trijp, 2013). In this purchase decision, the following three

products are considered: a meat product (e.g., broiler meat) containing a less stringent standard, the same meat product containing a more stringent standard, and a substitute (e.g., pork). It is assumed that all products are labeled. A mathematical description of the effect of a more stringent standard on consumer utility is shown in Appendix A. It is assumed that a consumer experiences a base level of utility derived from the product related traits (such as texture and taste), which is unaffected by standards. Furthermore, a consumer experiences disutility from the consumer price and from the negative externalities of the meat product. It is assumed that the disutility from the consumer price and the negative externalities are both affected by the standard. Because of consumer heterogeneity, it is assumed that the disutility from the negative externalities differs among consumers. A consumer experiences two opposite effects when consuming a more stringent standard meat product relative to consuming a less stringent standard meat product, namely (1) a (possible) increase in utility from the decrease in the negative externalities and (2) a decrease in utility from the increase in consumer price.

The more stringent standard can be introduced in the market in two ways, namely as a voluntary standard or as a pseudomandatory standard. A pseudomandatory standard is defined as a standard that is initiated by the private sector with national coverage and that operates as such in a similar way as a mandatory public standard. Hence, the less stringent standard meat product is no longer on offer in the case of a pseudomandatory standard, while it still is in the case of a voluntary standard. When introducing the more stringent standard as a voluntary standard, both meat products are on offer, and consumers may prefer one over the other. In Figure 1, these preferences are depicted for three consumer groups:

1. Consumers for which the increase in utility from the standard (caused by decrease in the negative externalities) exceeds the decrease in utility from the increase in consumer price will prefer the more stringent standard meat product (consumers from group 1 in Figure 1).
2. Consumers for which the decrease in utility from the increase in consumer price exceeds the increase in utility from the standard will prefer the less stringent standard meat product (consumers from group 2 and 3).

FIGURE 1 Ranking of consumer preferences for the meat products based on the utility derived from the products, differentiated for three types of consumer groups

Whereas consumers from group 1 are net beneficiaries from the increased standard, consumers from group 2 and 3 face a welfare loss from this standard. When introducing the more stringent standard as a pseudomandatory standard, consumers preferring the less stringent standard meat product (consumers from group 2 and 3) experience a negative trade-off as this product is no longer offered. Such consumers will switch towards the more stringent standard meat product when the utility derived from the more stringent standard meat product exceeds the utility derived from the substitute product (consumers from group 2). Consumers experiencing a negative trade-off such that the utility derived from the meat product entailing a more stringent standard is below the utility derived from the substitute, will switch towards the substitute (consumer group 3). Consequently, the retailer condition (no decrease in profits) may not be satisfied when imposing a more stringent standard.

The more stringent standard may interact with another standard, thereby affecting the disutility associated with the negative externalities of the meat product. In case of independent standards, the interaction between two standards does not affect the disutility associated with the other externalities when changing one of these standards. A conflict between two standards implies that the increase in a standard (e.g., AW) enhances the disutility associated with the other externalities of another standard (e.g., greenhouse gas emissions). Therefore, the number of consumers preferring the higher standard meat product over the lower-standard meat product and the substitute decreases, relative to the case of independent standards. In contrast, synergy between the standards implies that an increase in a standard generates a decrease in the disutility associated with the other externalities, relative to separate standard assessment, when increasing a standard. As a result, the number of consumers preferring the higher standard meat product over the lower-standard meat product and the substitute increases, relative to the case of independent standards. Appendix A provides a mathematical substantiation of these effects.

EMPIRICAL APPLICATION

New Dutch retail standard

The conceptual framework presented in the previous section was applied to the introduction of the New Dutch Retail Standard (NDRS) in 2014–2015, a pseudomandatory standard on AW. Prior to its introduction in 2014, Dutch retailers supplied meat from broilers in conventional production systems that met the minimum legal EU requirements on AW (Saatkamp et al., 2019). Under pressure of AW organizations, Dutch retailers replaced the conventional system by the NDRS system in 2014–2015. The main changes of the NDRS system vis-à-vis the conventional system are a slower-growing breed and a lower stocking density. Broiler farmers can still use the conventional system for export markets. Since the NDRS system does not include investments affecting total annual fixed costs, farmers are flexible in adopting either the conventional or NDRS system.

The changes of the NDRS system affect not only AW, but also antibiotic use, greenhouse gas emissions, ammonia emissions and particulate matter emissions. These effects may affect consumer valuation. A slower-growing breed has a higher feed intake than a fast-growing breed, and thus the greenhouse gas emissions per broiler increase (Bokkers & De Boer, 2009). However, a slower-growing breed is less susceptible to disease, leading to a lower use of antibiotics in the NDRS system relative to the conventional system (Van Geijlswijk et al., 2019).

The NDRS system extends the production period of the broiler and stimulates the activity of the broiler (Vissers et al., 2020), elevating ammonia and particulate matter emissions. All these externalities are included in the model to calculate the societal costs and benefits associated with Dutch broiler production before and after the introduction of the NDRS system.

Model

A partial equilibrium model has been developed to simulate the short-run effects of the introduction of the NDRS. Only the NDRS and conventional production system were considered, since these are the two dominant systems in the Netherlands (Saatkamp et al., 2019). Other production systems, such as organic or those from broiler meat substitutes, are ignored. To reflect the situation of the Netherlands as a net exporter of broiler meat, the model includes a rest of the world import demand function (Agrimatie, 2015). Producers are assumed to operate in a perfectly competitive market. Based on the theory of contestable markets (Baumol et al., 1983), retailers are assumed to operate in a competitive manner. Inputs were expressed in annual poultry housing capacity in kg. A market share parameter has been added to the domestic demand functions to simulate the introduction of the NDRS. The partial equilibrium model includes constant elasticity demand and supply functions. The model solves for the optimal allocation of inputs to conventional and NDRS broiler meat production by maximizing aggregated producer surplus minus aggregated consumer expenditure, subject to available production capacity (defined as annual poultry housing capacity in kg), and market clearing conditions. Appendix B gives a detailed description of the empirical model.

Data

The partial equilibrium model was calibrated for the base year 2013, which depicts the situation before the introduction of the NDRS. Information on the broiler market balance (production, consumption, net exports) was gathered from Agrimatie (2015). The producer price of conventional broilers was obtained from Agrimatie (2018). The price premium for broilers produced in the NDRS system was obtained from Blanken et al. (2019). Consumer price of conventional and NDRS broiler meat were derived from Gocsik et al. (2013) and Albert Heijn (2018), respectively, and were both corrected for inflation using the meat price index (CBS, 2018). All prices and quantities were expressed per kg carcass weight, which is 70% of the broiler's live weight as delivered from the farm (Van Horne, 2017). As no data was found on slaughter and handling costs, they were excluded from the model. This exclusion implies that retailer profits are most likely overestimated, although relative differences remain unaffected. The greenhouse gas, ammonia and particulate matter emission originating from the conventional and NDRS system were obtained from Rougoor and Van der Schans (2019) and Vissers et al. (2020). The societal costs associated with these emissions were obtained from the Dutch Ministry of Instrastructure and Water Management (2020). To our knowledge, no study assessed the consumer valuation of reduced antibiotic use in the Netherlands.[1] To illustrate the potential societal benefits that might arise from reduced antibiotic use in the NDRS system, a consumer WTP of €0.10/kg carcass weight for reduced antibiotic use is assumed. Price elasticities of demand and supply were obtained from Gallet (2010) and FAPRI (2019). The price elasticity of demand and supply is assumed to be equal for both systems. No data

was found on the price elasticity of demand from rest of the world for broiler meat. As the EU broiler market is highly competitive (Van Horne, 2017), a price elasticity of export supply of −10 is assumed. Appendix C provides an overview of the data that has been used for calibration of the model.

Results

Table 1 shows the short-run effects of the introduction of the NDRS. The base year solution represents the situation before the introduction of the NDRS: approximately 38% of total production went to the domestic market while the remaining 62% was exported. Following the introduction of the NDRS system, approximately 38% of broiler production shifted from conventional to NDRS. As a result, the supply of conventional broilers to the export market decreased by 69.6 million kg (−12.9%). Although the consumer price for broiler meat increased by €0.94/kg, domestic demand (and thus domestic supply) for broiler meat increased by 0.2 million kg (+0.1%).

The introduction of the NDRS led to increased welfare for all supply chain actors (producer, retailer, and consumer). Hence, all three incentive compatibility conditions were satisfied.

TABLE 1 Summary of model results before and after the introduction of the NDRS (in kg carcass weight)

Variable	Unit	Before	After
Production	Million kg	888.0	476.4
Conventional	Million kg	-	342.2
NDRS			
Total	Million kg	888.0	818.6
Consumption	Million kg	342.0	-
Conventional	Million kg	-	342.2
NDRS			
Total	Million kg	342.0	342.2
Net exports		546.0	476.4
Producer price	€/kg	1.31	1.33
Conventional	€/kg	-	1.56
NDRS	€/kg	3.93	-
Consumer price	€/kg	-	4.87
Conventional			
NDRS			
Producer surplus	Million euro	1147.6	1150.4
Retailer gross profits	Million euro	894.6	1132.4
Consumer surplus	Million euro	9386.1	9420.3
Potential societal benefits[1]	Million euro	0	34.2
Antibiotic residues			
Societal costs	Million euro	129.4	124.3
Greenhouse gas emissions			
Ammonia emissions	Million euro	104.0	105.6
Particulate matter emissions	Million euro	49.2	55.2
Social welfare	Million euro	11,145.6	11,452.3

Retailers had the largest gain in welfare (+237.8 million euro), followed by consumers (+34.2 million euro) and producers (+2.9 million euro). The relatively large welfare increase for retailers can be explained by the higher absolute gross profit margin (€3.31/kg) earned over NDRS broiler meat compared to conventional broiler meat (€2.62/kg). The increase in consumer surplus can be explained by the increase in consumer valuation from the NDRS system exceeding the increase in consumer price (+€0.94/kg), therefore incrementing consumer surplus. Producer surplus increased as the price effect (higher profit per animal) outweighed the quantity effect (lower annual output per m^2) in the NDRS system. Potential societal benefits from reduced antibiotic use were small (+34.2 million euro). The societal costs associated with greenhouse gas emission decreased marginally (−5.1 million euro), while the societal costs associated with ammonia and particulate matter emission increased marginally (+1.6 million euro and + 6.0 million euro respectively). Social welfare reflects the sum of producer surplus, retailer profits, consumer surplus, and societal benefits minus societal costs. When attaching equal weights to the welfare of each group, social welfare increased by approximately 300 million euro after introduction of the NDRS.

DISCUSSION AND POLICY IMPLICATIONS

Discussion

This paper developed a framework for analyzing the effects of multiple standards that address negative externalities resulting from meat production. The framework considers three incentive compatibility conditions that need to be satisfied for a more stringent standard to be commercially feasible. It has been demonstrated that standards may interact with one another, thereby causing synergistic or conflicting effects. These interaction effects evoke interesting questions associated with standards. For instance, what is the rationale of making a standard stricter? What impact will this standard have on direct and indirect costs and benefits, of some of which may be marketable and others may not? The framework has been applied to the case of the Dutch broiler sector, where a pseudomandatory standard was introduced based on a broad stakeholder consensus, over and above the existing minimum legal standard. The framework helps to understand under which conditions such a standard could be commercially feasible.

Earlier studies on the introduction of more stringent standards, such as Saitone et al. (2015) and Segerson (2013) analyzed the welfare effects and requirements for success in a voluntary setting. Segerson (2013) states that an effective voluntary standard must provide strong participation incentives, clearly identify standards, and monitor outcomes. The market potential of a voluntary standard may be limited by free-riding of consumers, i.e. consumers benefiting from the purchases of others without paying the associated cost themselves. Our framework demonstrates that a pseudomandatory standard, which limits consumer choice, can be used to overcome this issue. In line with our framework, Saitone et al. (2015) demonstrates that a limitation of consumer choice will cause distributional effects among consumers. Producers gain welfare only in case most consumers prefer the product entailing a more stringent standard or in case their WTP is large. However, Saitone et al. (2015) consider the limiting consumer choice phenomena only in mandatory standard setting, thus ignoring the case of a pseudomandatory standard. As such, the pseudomandatory setting is similar to a mandatory one, but requires commercial feasibility, i.e., compatible incentives for all chain actors, including consumers. This is not relevant in a mandatory setting since there is legal enforcement of the standard. To our

knowledge, this is the first study that analyzes the commercial feasibility of standards in a pseudomandatory setting. It also is the first study that demonstrates how synergistic and conflicting effects at producer and consumer level are relevant in evaluating the pros and cons of such standards. The framework provides a better understanding of private initiatives that make consumers contribute to improved sustainability, which is considered as key priority in food policy research (Lusk & McCluskey, 2018).

The empirical application of our multiple-standards framework concerns the NDRS, a pseudomandatory standard on AW introduced in the Dutch domestic poultry market. Our results of showed that, although broiler meat became more expensive for consumers, domestic demand was virtually not affected (+0.1%). As the NDRS system requires more square meter poultry housing surface per animal, relative to the conventional production system, total broiler volume decreased. The decrease in supply mainly occurred at the export market (−12.9%), leaving supply at the domestic market practically unaffected (+0.1%). These model simulation findings are supported by data, which showed a slight increase in domestic production and consumption (+0.3% and + 0.3%) in the period 2013–2016 (Agrimatie, 2015). In contrast to our simulation results, there was an increase in the net exports of broiler meat (+28.1%), which can be explained by the strong increase in net imports of broilers (+59.6%). The results of the empirical application also showed that all three incentive compatibility conditions (producer, retailer, consumer) were satisfied as additional benefits occurred for producers (+2.9 million euro), retailers (+237.8 million euro), as well as consumers (+34.2 million euro). The findings show that market failure related to production externalities can be successfully addressed by pseudomandatory standards, provided that all three incentive compatibility conditions are satisfied.

Our empirical application abstracted from reality in ways that we discuss next. Firstly, it is assumed that producers are willing to adopt a more stringent standard on the condition that it does not lower their profits. Other factors of influence, such as the non-use value, are not considered. The non-use value refers to the "intrinsic" value that producers derive from adhering to specific farming practices (Lagerkvist et al., 2011), so that a farmer may adopt a more stringent standard even when it is economically burdensome. Our study is restricted to standard adoption purely from an economic perspective.

Secondly, while Dutch consumers prefer to purchase cut-up chicken meat, such as breasts, wings, and legs (Bokkers & De Boer, 2009), the empirical application focused only on chicken meat as a whole. Shortly after the introduction of the NDRS system, chicken breast originating from this system was sold by retailers, whereas other cut-up parts were processed by the food industry or exported. Accordingly, the increase in production costs due to higher standards had to be transferred primarily to the price of chicken breast. However, the NDRS system has developed in the past years such that nearly all parts (95%–100%) of the broiler are sold at a price premium (P.L.M. Van Horne, personal communication, November 12, 2019).

Thirdly, the framework did not consider the impact of more stringent standards on the profitability of other chain actors such as input suppliers and processors. In case of the introduction of the NDRS, two opposite forces occurred: a higher feed conversion rate of the broilers (more feed required per animal produced) and a lower stocking density (less feed required per m^2) relative to the conventional system. Depending on the impact of both forces, farmers switching towards the NDRS system may require less feed, thereby negatively affecting feed supplier's turnover (assuming poultry housing capacity to be fixed). Since expansion of production capacity in the Netherlands is constrained by institutional factors (such as environmental regulations), the introduction of the NDRS resulted in a reduction of Dutch broilers in the period 2015–2016 (Agrimatie, 2015). As a result, slaughterhouses and processors had an overcapacity in

the short term. The slaughterhouses and processors offered conventional producers a higher price to attract more broilers. As a result, more broilers were imported (and exported thereafter) to ensure full use of production capacity (Agrimatie, 2015). These imports increased transportation and transaction costs for slaughterhouses, which were covered by instating a higher processor price. However, this price effect is expected to be only temporary, as production abroad may expand to fill up the gap in supply caused by the lower production volume in the Netherlands. Future research should include the welfare effects on input suppliers and processors to obtain better insight in the willingness of all chain actors to implement more stringent standards.

Policy implications

The multiple-standards framework can aid research for policy support by analyzing the welfare effects of voluntary and pseudomandatory standards in a multiple actor supply chain-context. This insight is particularly relevant when the public standard is considered too low from a social welfare point of view. This so-called "understandardization" may result from successful lobbying by interest groups (Swinnen et al., 2015), and/or national standards that are following international standards (e.g. EU standards) that "lag behind" national preferences. Voluntary or pseudomandatory standards, which go beyond the public legal standard, can enhance social welfare in case of understandardization. Standard antitrust reasoning, however, would be critical to such collective private sector "agreements," since they could lead to an abuse of economic power at the costs of consumer interests and consumer freedom. We show that such collective private sector agreements do not necessarily contradict the interests of consumers and may even contribute to solving the problem of "understandardization." We show that when taking into account the aggregate net benefits arising from potential interaction effects on externalities, there could even be an argument for governments to, under specific conditions, facilitate and/or support a pseudomandatory standard going beyond what is required from a legal minimum perspective.

Figure 2 shows a differentiated picture of the various cases that should be distinguished. The cases vary based on the commercial feasibility of the pseudomandatory standard and the different net benefits arising from interaction with other standards and their effects on (other) externalities. If the pseudomandatory standard is commercially feasible (i) (i.e., the standard does not lower both aggregated producer profits, retailer profits and consumer surplus), no state support is required to introduce this standard. In case the pseudomandatory standard (e.g., on AW) causes synergy on another standard (e.g., on antibiotic use) (ia), multiple externalities are addressed simultaneously. Such synergistic effects would provide an argument for the government to facilitate the pseudomandatory standard. In case the standard conflicts with one or more other standards (ib), one externality is addressed while no indirect "benefits" result with respect to these other externalities. Because of these conflicting effects, the government could decide to facilitate or forbid this standard, depending on the outcome of a critical weighing of all (direct and indirect) benefits and losses. If there is no interaction with another standard (ic), the government should be careful with the facilitation of the new standard. Although the pseudomandatory standard enhances welfare (on aggregate) in its own right, the government will have to account for the distributional impact of the standard on consumers and consumer freedom. If the pseudomandatory standard is not commercially feasible (ii), the newly proposed pseudomandatory standard is evaluated as "a bridge too far" in terms of the private sector benefit/cost trade-off. Therefore, government support would be required for its introduction. In case the pseudomandatory standard causes synergy on one or more other standards (iia), the indirect
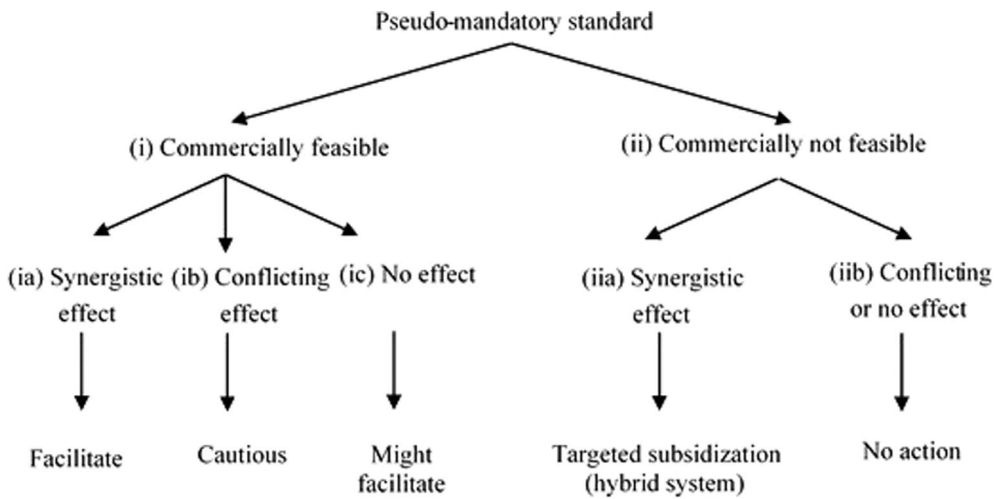
FIGURE 2 Decision tree on the justification of government facilitation and support of the pseudo-mandatory standard

"side benefits" of the synergistic effect could justify targeted support of the pseudomandatory standard. However, in case the pseudomandatory standard conflicts with other standards or has negative trade-offs with respect to other externalities (iib), there is no case for governmental support of its introduction. Moreover, without government support, the pseudomandatory standard will clearly be a nonstarter in this case.

CONCLUDING REMARKS

The framework developed in this paper provides a scientific basis for an ex ante analysis of the market potential of pseudomandatory standards in the context of multiple standards or externalities context. The framework accounts for welfare effects and the relevant incentive compatibility conditions. The empirical application of the framework to the New Dutch Retail Standard in the Dutch broiler market demonstrated that for this case all three incentive compatibility conditions were satisfied to support a successful introduction. The side benefits from related externalities also turned out to be positive. This case demonstrates that a pseudomandatory standard that goes beyond a legal or public minimum standard can be welfare enhancing in a context of "understandardization." Depending on the specific conditions, governments should consider a differentiated response to such standards (facilitate, support, caution), which goes beyond the classical antitrust response of prohibiting private sector "agreements" affecting market conditions. Future research should focus on the development of more elaborated quantitative value chain models that include interaction effects and allow an ex ante analysis of price incentive compatibility issues. These interaction effects can provide better insight into how the introduction of a pseudomandatory standard can potentially erode the impact and investments in voluntary standards.

Economic Affairs and Climate Change, the Ministry of Economic Affairs, Innovation, Digitalization and Energy of North Rhine-Westphalia and the provinces of Gelderland, Limburg, and North Brabant. It is accompanied by the program management at the Euregio Rhein-Waal.

ENDNOTES

[1] Some studies, such as Lusk et al. (2006), assessed consumer WTP for antibiotic free meat in the United States. Lusk et al. (2006) found that the average WTP for antibiotic free pork over regular pork was $1.86 per choice. As growth promotors are banned in the EU, and antibiotics are still used in the NDRS system, consumer WTP associated with reduced antibiotic use in the NDRS system is most likely lower than the WTP found by Lusk et al. (2006).

[2] Note that although improved animal welfare can be perceived as a societal benefit, it is already included in the consumer surplus. To prevent double counting, this benefit has not been included in the societal benefits.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.