Essays on Credence Goods with Applications to Health Care and News Markets

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I dedicate this thesis to my daughter, who showed me what really matters in life.

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1 Introduction

The economic performance of a market depends crucially on the level of information that market players possess about the traded goods or services. While in some markets the relevant knowledge about the quality or characteristics of goods and services is straightforward to discover for consumers, it is less transparent in others. Such informational asymmetries become particularly tricky if the goods or services are provided by qualified experts who enjoy superior information about their quality, which, however, remains concealed to consumers. As a consequence, consumers have to trust experts which may create strong incentives for opportunistic behavior by the latter. Thus, in economic research, such goods and services are referred to as credence goods (see Darby and Karni (1973), Dulleck and Kerschbamer (2006)).

Studying credence goods and services through the economic lens is important for several reasons. A large and vital part of the economy features credence goods and services, such as car repair services (Schneider (2012)), taxi rides (Balafoutas, Beck, Kerschbamer and Sutter (2013)), legal and financial advice, or medical service provision (Gottschalk, Mimra and Waibel (2018)). At the same time, in various industries, there is abundant empirical evidence for inefficiencies linked to the behavior of the providers of credence goods and services (see Balafoutas and Kerschbamer (2020) for a recent survey). Moreover, another specialty of credence goods markets relates to the economic policy design in these industries; typically these markets are subject to various regulations, ranging from price guidelines to occupation-level entry requirements and advertising restrictions. Hence, understanding the behavior, functionality,

and market outcomes of credence goods industries is socially highly relevant.

1.1 Overview of the thesis

This thesis focuses on selected aspects of credence goods markets. The insights from this thesis contribute to a more rigorous understanding of the economics of health care and news markets. Despite fundamental differences in purpose and nature, health care and media markets share – from an economic theory perspective – certain commonalities. In both markets, highly qualified experts provide a service (treatment, news content) to their consumers (patients, audience), who are unable to verify the service quality on their own and therefore have to rely largely on their experts' behavior. This informational asymmetry may harm consumers and society if experts provide a suboptimal level of service quality (overprovision, biased news).

The thesis builds on three separate research papers. The first paper develops a novel rationale for the use of price and entry regulations in the markets for expert services. The two other papers introduce novel approaches to measure biases and polarization in the market for news.

Chapter 2 Access to health services is a basic need for human beings. Health services are provided by highly qualified experts. Consumers themselves, however, typically lack the expertise to assess the quality of the service provided to them. This constellation creates incentives for experts to behave opportunistically, resulting, for example, in over- or underprovision, or overcharging of health services.

Perhaps as a response to these inefficiencies, the provision of health services is highly regulated in most countries. Common regulations include restrictions of market entry for experts and price controls. Our analysis provides a new, efficiency-based justification for the wide-spread use of such regulatory policies.

In Chapter 2, "Inefficiency and Regulation of Credence Goods Markets with Altruistic

Experts", we analyze a credence goods problem where altruistic experts care about their income and utility of consumers: experts' marginal rate of substitution between income and consumer utility declines in income, such that experts care less for consumers when their financial situation is bad. In a credence goods market with multiple consumers per expert, a cross-consumer externality arises: one consumer's payment raises the expert's income which makes the non-selfish part of preferences more important, thereby inducing the expert to provide higher quality services to all consumers. That externality renders the market outcome inefficient. We show that price regulation partially overcomes this inefficiency and Pareto improves upon the market outcome. Prices above competitive level, however, attract new experts to enter the market, which counteracts the intended effect through price regulation. Thus, if market entry of experts is endogenous, price regulation should be accompanied by entry restrictions to realize efficiency gains.

Chapter 3 News media is a key source of information and news for citizens. Its content crucially shapes peoples' opinions and attitudes, thereby affecting economic and political outcomes (DellaVigna and Ferrara (2015)). Thus, having access to an unbiased and diverse news media landscape is pivotal for the functionality of democratic societies.

Analogous to health care markets, informational asymmetries make the market for news an interesting real-world application of credence goods. A piece of news is typically provided by news outlets, who are assumed to be better informed about the true state of an event. At the same time, consumers can neither ex-ante nor ex-post reliably evaluate the quality of their news. Opportunistic experts may exploit this by providing slanted news. In fact, news outlets are frequently accused of being ideologically or politically biased and thereby contributing to polarization around important social and political events (Groeling (2013), Puglisi and Snyder (2015)). The 2015-16 migration crisis in Europe constitutes a prime example of such an event in which the role – and, specifically, coverage behavior – of news media was critically challenged.

Chapter 3, "Measuring Attitudes towards Migration and Polarization in the Market for News: The Case of the 2015-16 Migration Crisis", proposes a novel approach to measuring attitudes of news outlets towards migration and polarization in a news market. I collect and code all news pictures that the large German news outlets published in their news stories on migration during the 2015-16 migration crisis. To put these news pictures into a natural perspective, however, I also collect pictures from ideological campaigns that are strongly engaged in favor of or against immigration. By comparing the difference in pictures of news outlets relative to the difference in pictures of ideological campaigns, I determine the degree of polarization in the market for news. As the main metrics to identify attitudes of news outlets towards migration, I use gender composition, group size, and news topics portrayed in the pictures. I find that news outlets exploit less than 50 percent of the differentiation that is used by ideological campaigns. When the reach of news outlets is taken into account, the degree of polarization is less than 30 percent. Finally, with one notable exception, news outlets largely maintain their attitude towards migration over time as public opinion shifts against migration.

Chapter 4 While the metrics in Chapter 3 build on specific measures (gender composition, group size, news topics) that are likely not to reflect all aspects of news pictures, Chapter 4, "Polarization and the Markets for News", introduces a more holistic measure of a news outlet's attitude to migration. To this end, we evaluate a sample of pictures by asking human coders from a large-scale, representative survey the question "How does this picture influence an observer's attitude towards economic migrants?"; answers are provided on a scale from -5 (very negative, against acceptance of economic migrants) to +5 (very positive, in favor of acceptance of economic migrants). For each picture, we obtain an average rating that can be interpreted as to its level of negativity or positivity; for each news outlet, we then compile the mean average rating of its pictures and use this measure as the news outlet's attitude to migration. To evaluate the degree of polarization, we conduct the same procedure on a large

sample of pictures from ideological campaigns. We find that news outlets use approximately 62 percent of the differentiation of ideological campaigns. Taking the reach of news outlets into account, polarization drops to 33 percent, mainly driven by the fact that the most negative news outlet has only a little reach. We also study how polarization changes over time. Apart from one tabloid news outlet, we find that news outlets maintain their relative position over time even when public sentiment about migration shifted strongly.

1.2 Contribution to the co-authored chapters

Subsequent to the PhD Regulations of the Faculty of Economics, Management, and Social Sciences at the University of Cologne (published on 17 February 2015), I describe how I contributed to the co-authored chapters of this thesis.

Chapter 2 "Inefficiency and Regulation of Credence Goods Markets with Altruistic Experts" is joint work with Anna Kerkhof and Jonas Löbbing. The research idea was developed in collaboration by Jonas Löbbing and me. The model and its proofs were formalized by Jonas Löbbing. Anna Kerkhof conducted the empirical analyses. Anna Kerkhof and I wrote the first draft of the research paper, which Jonas Löbbing revised.

Chapter 3 "Measuring Attitudes towards Migration and Polarization in the Market for News: The Case of the 2015-16 Migration Crisis" is single-authored.

Chapter 4 "Polarization and the Markets for News" is joint work with Matthias Heinz and Heiner Schumacher. The research idea, survey design, and hypotheses resulted from joint discussions. I collected and analyzed the datasets. Matthias Heinz and Heiner Schumacher contributed to the conceptual framework and empirical approach. I wrote the first draft which Matthias Heinz and Heiner Schumacher revised. All of us contributed to the current version of the paper.

2 Inefficiency and Regulation of Credence Goods Markets with Altruistic Experts

With Anna Kerkhof and Jonas Löbbing

2.1 Introduction

Market regulation is a pervasive feature of the economy in virtually all countries. In general, it appears to be more prevalent in developing countries and has consequently been associated with poor economic performance (e.g. Djankov, La Porta, de Silanes and Shleifer, 2002).

Yet, even in highly developed countries, a certain set of service sector industries exhibits a particularly high degree of regulation. In these industries, often highly qualified experts provide specialized services to consumers, who are unable to reliably assess the quality of the service provided. In its purest form, the resulting information asymmetry requires that the consumer trusts the expert to provide an appropriate service. Hence, such services have been termed credence goods (e.g. Darby and Karni, 1973; Dulleck and Kerschbamer, 2006). Existing regulation of credence goods markets often entails a combination of price controls and entry restrictions.[1] Given their potentially detrimental effect on efficiency, it is important

[1] The European Economic and Social Committee (2014) provides a comprehensive description of the various types of regulations imposed on credence goods markets in the European Union. For a detailed overview of the regulation of health care markets (arguably one of the most important credence goods markets) in OECD countries, see Paris, Devaux and Wei (2010).

to understand whether such regulations can be justified by the specific features of credence goods markets.[2]

Addressing this issue, we provide a novel rationale for price and entry regulation on markets for credence goods, based on considerations of economic efficiency.

In particular, we consider a setting where consumers demand a good of variable quality and cannot write contracts contingent on quality or on a signal thereof. Producers (experts, henceforth) are altruistic in the sense that they value both their own monetary income and their consumers' well-being.

We impose two key assumptions. First, experts' preferences are convex in a way that makes their marginal rate of substitution between income and consumer utility decline in income. Put differently, experts' valuation of additional money relative to their consumers' utility decreases in the amount of income already earned. Second, there is a common agency structure, whereby many consumers (the principals) are served by a single expert (the agent).

In combination, these two assumptions give rise to an externality across consumers: the payment of a given consumer raises the expert's income, which in turn increases the relative importance of the other-regarding part of the expert's preferences. This improves the service quality received by all consumers served by the expert.

We study the implications of this externality in the setting that allows to expose our main results in the most transparent way. In particular, we assume that consumers are matched randomly to experts (in a many-to-one fashion) and make a take-it-or-leave-it price offer to the matched expert. Experts then decide whether to accept the offers and, in case of acceptance,

[2] The professions related to credence goods markets, such as physicians or lawyers, consistently rank among the top-earning occupations in most advanced economies. Arguably, their high incomes partly reflect the regulations imposed on their markets. See, for example, Kleiner and Krueger (2013) for evidence supporting that occupational-level entry restrictions substantially increase earnings of incumbent workers. The question for justification of these regulations is therefore also relevant from a distributional perspective.

covertly choose the quality of the good supplied to the respective consumer.[3]

Our first set of results shows that consumers' equilibrium price offers are inefficiently low. When making offers, consumers do not internalize the positive effect of their payment on the quality received by other consumers. Consequently, raising prices above the (unregulated) equilibrium level can make all consumers better off. Since experts are trivially better off when prices increase, introducing a fixed price or a price floor above the equilibrium price can achieve a Pareto improvement. We also show that there is no need to consider policies other than the regulation of prices in our baseline setting. Price regulation can implement all allocations that are constrained efficient in an appropriate sense.

Next, we endogenize the entry decisions of experts. We introduce a fixed cost of entry and decreasing returns in experts' technology, such that entry costs are financed out of inframarginal rents. The unregulated equilibrium is still (constrained) inefficient. With endogenous entry, however, price regulation alone does not suffice to overcome this inefficiency. Indeed, price regulation alone can lead to a Pareto deterioration: Elevated prices draw additional experts into the market until profits (net of the cost of entry) are close to zero again. Thus, the desirable effect of a price floor on profits, and thereby on experts' social behavior, vanishes. This leaves the increase in price and a congruent increase in total entry costs as the only essential allocation changes. Yet, when price regulation is combined with entry restrictions, its efficiency-enhancing effect is re-established. A cap on the number of active experts prevents the dilution of profits through entry after prices have been raised, such that profits and the extent of experts' prosociality increase as desired.

Key to our results is the assumption that experts' preferences give rise to income effects on social behavior. We discuss evidence for this assumption in Section 2.8 at length. In a nutshell, we describe three types of evidence from existing work that support our assumption.

[3] In Appendix A.2, we show that our main results are unchanged in a setting where experts post prices and consumers subsequently choose between experts.

First, results from numerous dictator games show that the level of giving strongly increases in the overall amount of money to be distributed (e.g. Engel, 2011). Second, Bartling, Valero and Weber (2019) present results from a more focused experiment, showing that increases in (experimental) income raise participants' willingness to forgo additional income to the benefit of others. Finally, various forms of correlational evidence on real-world giving behavior support the notion that giving increases with income (e.g. List, 2011).

In addition to that, we provide an empirical analysis that demonstrates the causal effect of income on prosocial behavior. Arguing that financial donations indicate prosocial behavior, we use data from the German Socio-Economic Panel (SOEP) to show that income has a positive effect on financial donations on the extensive and on the intensive margin. To isolate the causal channel, we use intertemporal changes in average net income within occupation groups to instrument for individual net income. The idea is that income changes within occupation groups are strongly correlated to the individuals' income, but otherwise exogenous to any of their decisions; in particular, they have no effect on individual financial donations except through individual income. The results strongly support the plausibility of our key theoretical assumption: A 100 Euro increase in net income leads to a 2.4 percentage point increase in the probability to donate and a 13 Euro increase in the amount donated; moreover, a one standard deviation increase in net income leads to a 40% standard deviation increase on the extensive and a 30% standard deviation increase on the intensive margin of financial donations.

We contribute to the existing literature by providing a novel rationale for price and entry regulation in credence goods markets. This complements Pesendorfer and Wolinsky (2003) who provide an alternative argument for price (but not entry) regulation in markets for credence goods. Other theoretical analyses of quality-related entry or price regulation, such as Atkeson, Hellwig and Ordonez (2015), deviate more strongly from the pure credence goods case and thus have different applications. Existing studies of credence goods markets with

socially motivated experts (e.g. Kerschbamer, Sutter and Dulleck, 2017) and, more generally, in behavioral contract theory have not discovered the cross-consumer externality central to our results, because they either lack the common agency structure or the non-linear structure of (social) preferences.

The relation of our work to the existing literature is discussed in more detail in the next section. Section 2.3 introduces our model. In Section 2.4, we discuss a benchmark without common agency to clearly lay out the key mechanism in the model. Section 2.5 analyzes a market setting with common agency and Section 2.6 analyzes regulatory intervention. In Section 2.7, we extend the analysis to include endogenous market entry of experts and, correspondingly, study the effects of entry regulation. In Section 2.8, we describe evidence from existing work that supports our assumption that social behavior depends on income. Finally, Section 2.9 concludes.

2.2 Related Literature

In studying the regulation of credence goods markets, our work is closely related to Pesendorfer and Wolinsky (2003). They also provide a rationale for the introduction of price floors on credence goods markets. Their argument is based on a setting where consumers can consult multiple experts sequentially to learn about the service most appropriate to their needs. In this setting, an externality arises from experts' efforts to identify the need of a consumer: if other experts identify the consumer's need with high probability, the consumer can verify any given expert's recommendation with high precision by consulting a second expert. Price competition then leads any given expert to reduce price and effort, which erodes effort incentives for all other experts. A price floor stops this process and sustains high diagnostic effort by all. Our rationale for regulation is different, building on experts' social preferences. It is complementary to Pesendorfer and Wolinsky (2003) in the sense that, incorporating non-linear

social preferences into their setup would give rise to the same considerations as in our analysis. In particular, this would arguably strengthen the case for a price floor and introduce benefits from entry restrictions.[4]

Other theoretical work on market regulation with the goal to promote quality deviates more strongly from the pure credence goods case analyzed here. Atkeson et al. (2015), for example, assume that consumers receive an imperfect signal of quality after their purchase, which allows for reputation building by suppliers. They also find a rationale for joint entry and price regulation, as this incentivizes sellers to undertake ex-ante investments into their quality. But again, if experts had social preferences as in our analysis, the cross-consumer externality from our setting would also arise in theirs and our implications for regulation would complement their results.

More generally, whenever the monitoring of quality is imperfect and experts have non-linear social preferences, our reasoning applies and creates a rationale for regulation. Yet, it is arguably most relevant in the pure credence goods case, where social behavior of suppliers becomes crucial because other mechanisms, such as reputation building or explicit monetary incentives, are not available.[5]

The theoretical literature on credence goods mainly focuses on relaxing the informational restrictions of the pure credence goods case in various ways and studies how this affects the ability of private contracts to overcome the remaining informational problems. Dulleck

[4]Note that the reason for price regulation identified by Pesendorfer and Wolinsky (2003) critically depends on consumers being able to consult multiple experts. This excludes a variety of settings, in which our analysis remains applicable. These are (i) settings with a need for immediate service delivery, such as medical emergencies; (ii) situations where recommendation and execution of the service cannot be well separated; and (iii) situations where separation is feasible but the execution cannot be monitored.

[5]It is, however, important for our results that consumers have a restricted set of contracts at their disposal. Prescott and Townsend (1984) show that unrestricted private contracts achieve a constrained efficient outcome in a wide range of moral hazard settings. Their results do not apply in our case because we do not allow consumers to propose contracts contingent on experts' interaction with other consumers. For example, consumers might overcome the inefficiency in our setting by offering prices conditional on experts not accepting lower prices by other consumers. We consider this less realistic than the analyzed regulatory interventions. See Arnott, Greenwald and Stiglitz (1994) for a similar view.

and Kerschbamer (2006) provide a useful taxonomy of informational assumptions and the associated results, giving a comprehensive overview of the corresponding studies.[6] With the exception of Pesendorfer and Wolinsky (2003) (see above), these studies do not analyze the scope for public regulation. In contrast, Mimra, Rasch and Waibel (2016) study the effects of price regulation on quality in an experiment on credence goods provision. They find that fixed prices lead to higher quality than price competition, but do not offer a theoretical explanation for their results.

Kerschbamer et al. (2017) propose social preferences as an explanation for deviations from theoretical predictions identified in experimental work by Dulleck, Kerschbamer and Sutter (2011). Yet, neither these authors nor subsequent work studies (non-linear) social preferences in a market setting with common agency. Hence, they do not discover the externality that is at the core of our results.

The same holds, more generally, for the entire literature on behavioral contract theory (see Kőszegi (2014) for a survey). Englmaier and Wambach (2010), for example, study moral hazard with inequity-averse agents, but they do not embed their analysis in a common agency framework. Therefore, they do not obtain externalities across principals.

Studies of common agency, in contrast, have identified externalities across principals in various settings (e.g. Dixit, Grossman and Helpman, 1997). Yet, these papers do not consider non-linear social preferences. Hence, their externalities are different from the one in our analysis.

[6] For examples, see Pitchik and Schotter (1987), Wolinsky (1993), and Emons (1997). An important more recent contribution to this line of research is Bester and Dahm (2018).

2.3 Setup

We set up a model with many consumers who need a service and many experts who can provide this service. Experts covertly choose the quality of the service, which creates moral hazard. Moreover, consumer utility is not contractible, which makes the service a credence good (e.g., Dulleck and Kerschbamer, 2006).

2.3.1 Consumers

There is a continuum of consumers (or, buyers) indexed by $b \in B$. The mass of consumers $|B|$ is denoted M. Consumer b's utility is

$$u_b = v(a_b) - p_b \tag{2.1}$$

if the consumer receives a service of quality a_b and pays p_b in return. If the consumer receives no service, he gets outside utility $\underline{v}$.[7]

We assume that v is C^2, with $v' > 0$ and $v'' < 0$ everywhere. For interior solutions, let $v'(a) \to 0$ as $a \to \infty$.

2.3.2 Experts

There is a finite set of experts indexed by $e \in E \coloneqq \{1, 2, ..., N\}$. To reduce notation, let the number of experts equal the mass of consumers, $N = M$. Expert e earns an income of

$$y_e = \int_{B_e} [p_b - c(a_b)] \, db \, ,$$

where $B_e \subset B$ is the set of consumers served by expert e and $c(a_b)$ denotes the cost of providing a service of quality a_b. The cost function is C^2 with $c > 0$, $c' > 0$, and $c'' > 0$

[7] We use 'he' when we speak of a consumer and 'she' when we speak of an expert.

everywhere. We restrict the quality variable to take positive values, such that 0 is the minimum quality an expert can provide.[8]

Note that we do not explicitly model the expert's opportunity cost of service provision. Hence, the cost function c is best thought of as including this opportunity cost. Income is then measured net of opportunity costs. If $y_e = 0$, the expert does therefore not literally earn nothing, but she earns the same amount she could earn from alternative uses of her time.

Expert e's utility is given by

$$u_e = W(y_e) + \int_{B_e} [v(a_b) - p_b] \; db \; . \tag{2.2}$$

Hence, experts care about their material payoff y_e but also about the utility of their clients. The function W is C^2 with $W' > 1$. This ensures that the expert always values her own income more than her clients' incomes at the margin. Crucially, we also assume that the marginal utility from income is decreasing, that is, $W'' < 0$ everywhere. This makes the expert's degree of selfishness contingent on her income level. If the expert earns little, she will focus on increasing her income with little regard to consumers' utility. If in contrast the expert is financially well situated, she will pay more attention to her clients' needs.

We impose two further sensible assumptions on preferences to simplify the analysis. Our main results do not depend on these assumptions. First, we transform consumers' utility function such that $v(0) - c(0) = 0$. This implies that experts do not derive moral satisfaction (i.e., utility through the non-selfish part of their preferences) by serving consumers the minimum quality 0 at the price of its cost. Second, let consumers' outside utility be small, $\underline{v} \leq 0$. This excludes uninteresting cases where consumers refuse to participate in the market.

[8] We interpret 0 as a quality threshold such that consumers can observe whether the quality they receive exceeds 0 or not. Consumers can then condition payments on this, making experts always provide at least 0 quality. Alternatively, take 0 as a minimum service that is costless to the expert, such that she is always willing to provide this minimum.

2.3.3 Information

We assume throughout the paper that only experts themselves observe the quality of their services. Thus, consumers cannot enforce contracts that make payments contingent on quality. Moreover, we assume that consumer utility is not contractible either.[9] This precludes standard approaches to moral hazard problems.

With purely selfish preferences, these assumptions would make the case for consumers hopeless. Experts would never have an incentive to provide more than the minimum level of quality. Non-selfish experts, however, may provide higher quality services because they care for their clients. This makes our setup well-suited to study the impact of non-selfish preferences on credence goods provision in isolation from other considerations.

Note at this point that, in contrast to standard moral hazard and credence goods problems, our setting does not include a stochastic, potentially unobservable state. We can easily incorporate such a state in the analysis, but this does not add any relevant insights.

2.4 Bilateral Trade

To prepare the analysis of trading mechanisms for many consumers and many experts, consider first a bilateral setting with a single expert e and a single consumer b. The consumer is as described above. The expert, however, does not perceive the consumer as atomistic, because he is her only client. Hence the expert's utility is

$$\tilde{u}_e = W(p_b - c(a_b)) + v(a_b) - p_b$$

[9] In the jargon of the credence goods literature, we consider a setting without verifiability (of treatments) and liability (e.g., Dulleck and Kerschbamer, 2006).

if she provides her service to the consumer, and $W(0)$ otherwise. In relation to the common agency setting studied in the remainder of the paper, this may best be thought of as a situation where all consumers perfectly cooperate and are replaced by a representative consumer who follows their jointly optimal strategy.

Suppose now the consumer offers a payment p_b to the expert, who can then accept or reject the offer. If the expert accepts the offer, she chooses the quality a_b and provides the service.

If the expert accepts an offer p_b, she will choose the quality a_b of her service to maximize utility. Expert utility is strictly concave in a_b and a_b must be non-negative by assumption, so the following Kuhn-Tucker conditions uniquely determine the optimal quality $\tilde{a}^{IC}(p_b)$:

$$\begin{aligned} \left[W'(p_b - c(\tilde{a}_b^{IC}))c'(\tilde{a}_b^{IC}) - v'(\tilde{a}_b^{IC})\right]\tilde{a}_b^{IC} &= 0 \\ W'(p_b - c(\tilde{a}_b^{IC}))c'(\tilde{a}_b^{IC}) - v'(\tilde{a}_b^{IC}) &\geq 0 \\ \tilde{a}_b^{IC} &\geq 0\ . \end{aligned} \tag{2.3}$$

For concreteness, assume now that

$$W'(0)c'(0) \geq v'(0)\ . \tag{2.4}$$

This implies that the expert chooses the minimum quality of 0 if her income is zero. In particular, she will not incur monetary losses (relative to her outside option) to provide a quality higher than necessary.

Consider now the expert's acceptance decision. Suppose the offer is $p_b = c(0)$. If accepting this offer, the expert will choose a quality of 0 and obtain utility $W(0)$, equal to her outside option. For simplicity we assume throughout the paper that, when indifferent between two actions one of which leads to the outside option, all individuals decide against the outside option. Hence, the expert accepts the payment $c(0)$. Moreover, her utility strictly increases in

p_b (recall that $W' > 1$), so she accepts all offers above $c(0)$ and rejects all offers below.

Anticipating these decisions of the expert, the consumer chooses his payment offer. In particular, he takes into account the effect of his payment on service quality. By condition (2.3), this effect is positive: a higher payment raises the expert's income, which reduces the marginal utility of income and makes the expert pay more attention to consumer utility. Thus, the consumer's offer choice is non-trivial; he may well choose a payment above $c(0)$ to receive a service of higher quality.

Let p^* denote the optimal offer for the consumer, that is,

$$p^* \in \underset{p_b \geq c(0)}{\operatorname{argmax}} \left\{ v\left(\tilde{a}_b^{IC}(p_b)\right) - p_b \right\} . \tag{2.5}$$

To focus on the most interesting case, we assume henceforth that v, W, and c indeed leave some scope for mutually beneficial exchange above the minimum quality 0. Formally, the minimum offer $c(0)$ (and the resulting minimum quality service) shall not maximize consumer utility:

$$c(0) \notin \underset{p_b \geq c(0)}{\operatorname{argmax}} \left\{ v\left(\tilde{a}_b^{IC}(p_b)\right) - p_b \right\} . \tag{2.6}$$

In Appendix A.1.1, we provide an exact condition showing that assumption (2.6) holds if the expert's marginal cost does not increase too quickly in quality at $a_b = 0$.

Figure 2.1 illustrates the results of the bilateral setting. The curve $\tilde{a}_b^{IC}$ marks the set of feasible allocations from the consumer's perspective. The consumer chooses the point $\left(p^*, \tilde{a}_b^{IC}(p^*)\right)$ on the curve, where his indifference curve I_b is tangent to the graph of $\tilde{a}_b^{IC}$. The expert's indifference curves I_e are such that expert utility is maximized at $\tilde{a}_b^{IC}(p_b)$ for any p_b. Hence they have slope infinity at any point $\left(p_b, \tilde{a}_b^{IC}\right)$.

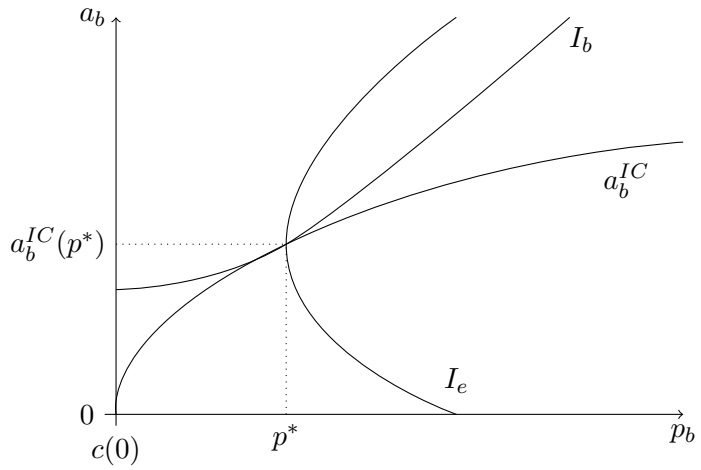

Figure 2.1. Graphical illustration of the bilateral setting.

Notes: The figure displays indifference curves of the expert, I_e, and of the consumer, I_b, together with the graph of expert's quality choices $\tilde{a}_b^{IC}$. The point $(p^*, \tilde{a}_b^{IC}(p^*))$ maximizes consumer utility on the curve $\tilde{a}_b^{IC}$.

2.5 Market Trade

Consider now again the setup with a finite number of experts and a continuum of consumers. As in the bilateral setting we study a trading mechanism in which consumers offer payments in exchange for the expert service and experts accept or reject.

In Appendix A.2 we analyze a mechanism where experts offer prices and consumers decide which offer to accept. This mechanism yields essentially the same outcome as the consumer-proposing mechanism studied here. The only difference is that the expert-proposing mechanism gives rise to additional equilibria (with different outcomes), which heavily rely on coordination across consumers. We argue in the appendix that these equilibria are not very plausible and provide two selection criteria, restricting consumers' ability to coordinate. Both criteria leave only the equilibrium that replicates the outcome of the consumer-proposing mechanism. To avoid these complications here, we focus directly on the consumer-proposing mechanism.

In particular, consider the following mechanism.

Stage 1 Each consumer b is matched randomly to an expert e and offers a payment p_b to the expert.[10]

Stage 2 Experts accept or reject the payments offered to them. If a consumer b's offer is rejected, he obtains outside utility $\underline{v}$. If b's offer is accepted, the accepting expert chooses a quality level a_b, and consumer b receives utility (2.1). Each expert e receives utility (2.2), where B_e is the set of consumers whose offers the expert accepted.[11]

Stages 1 and 2 describe a sequential game with complete information. We study its subgame perfect equilibria by backward induction. For that, suppose payments $\{p_b\}_{b\in B}$ and acceptance sets B_e are given. Then, experts choose quality levels a_b to maximize utility subject to the non-negativity constraint $a_b \geq 0$ for all b. Let a_b^{IC} denote the optimal quality choice of expert e for consumer $b \in B_e$. As in the bilateral setting, this quality is uniquely determined by the following Kuhn-Tucker conditions:[12]

$$\begin{aligned} \left[W'(y_e)c'(a_b^{IC}) - v'(a_b^{IC})\right] a_b^{IC} &= 0 \\ W'(y_e)c'(a_b^{IC}) - v'(a_b^{IC}) &\geq 0 \\ a_b^{IC} &\geq 0\,. \end{aligned} \tag{2.7}$$

Before choosing quality, experts decide which offers to accept. Formally, each expert e assesses for each of her offers the marginal utility of adding the offer to her acceptance set B_e.

[10] We assume that for each consumer the matching probability is uniform across experts. Thus, each expert will be matched to a mass M/N of consumers.

[11] Note that consumers cannot condition their payments on the service quality they receive. This follows from our assumption that quality is hidden to consumers and final outcomes are not contractible.

[12] Expert utility is strictly concave in $\{a_b\}_{b\in B_e}$, such that the Kuhn-Tucker conditions identify a unique maximizer.

The set B_e must therefore satisfy the following conditions:

$$W'(y_e)\left(p_b - c(a_b^{IC})\right) + v\left(a_b^{IC}\right) - p_b \begin{cases} \geq 0 & \forall\, b \in B_e \\ < 0 & \text{for all } b \text{ whose offer } e \text{ rejects.} \end{cases} \tag{2.8}$$

Using experts' quality choices, these conditions lead to a simple characterization of acceptance decisions contingent on an expert's income.

Lemma 1. *Given payment offers $\{p_b\}_{b\in B}$, any expert e's acceptance set B_e and income y_e must satisfy, for any b matched to e on stage 1,*

$$b \in B_e \quad \Leftrightarrow \quad p_b \geq \begin{cases} c(0) & \text{if } y_e \leq 0 \\ \tilde{p}(y_e) & \text{if } y_e > 0 \end{cases}$$

with $\tilde{p} : y_e \mapsto \tilde{p}(y_e)$ decreasing in y_e and $\tilde{p}(y_e) \leq c(0)$ for all $y_e > 0$.

Proof. See Appendix A.1.2. □

Lemma 1 provides an acceptance threshold for consumers' offers. Anticipating this threshold and experts' subsequent quality choices, consumers decide about their offers.

Importantly, here the quality provided by expert e does not depend on any individual payment p_b. In particular, by condition (2.7) the quality an expert provides is fully determined by her income. But since consumers are atomistic, they perceive their contribution to the expert's income as negligible. Hence, in contrast to the bilateral setting, consumers have no incentive to raise their payment above the acceptance threshold. The following proposition shows that the relevant piece of the threshold then becomes $c(0)$.

Proposition 1. *Consider the game described by stages 1 and 2. In any subgame perfect equilibrium all consumers offer $c(0)$ and receive the minimum quality, that is, $p_b = c(0)$ and $a_b = 0$*

for all $b \in B$.[13,14]

Proof. See Appendix A.1.3. □

Proposition 1 stands in stark contrast to the result from the bilateral setting. Intuitively, this discrepancy stems from an externality across buyers. If other buyers raised their payments, experts' incomes would increase and so would the service quality that any given buyer receives.

Note that the key assumption for this result is that experts' preferences over income and consumer utility are convex in a way that makes the marginal rate of substitution between the two goods decreases in income. This induces experts to care more for their consumers and provide higher quality services when their income is high.

2.6 Regulation and Efficiency

The cross-buyer externality suggests to study regulation policy. We study price regulation that fixes consumers' payments at a prescribed level.[15]

In particular, consider the game described by stages 1 and 2 but with buyers' offers p_b fixed at the level $\overline{p}$. Since buyers then have no decisions left, the game collapses to experts' acceptance and quality decisions. These must again satisfy conditions (2.7) and (2.8).

From Lemma 1 we already know that experts accept all offers if the regulation $\overline{p}$ is greater or equal to $c(0)$. Otherwise, they reject all offers. We can therefore implement an allocation

[13] Our propositions focus on equilibrium outcomes instead of on the equilibria themselves, because there may be multiplicity in the latter. This multiplicity, however, purely arises from off-equilibrium actions.

[14] A formal complication arises from the assumption of a consumer continuum: If experts change their actions towards a measure zero of consumers, this does not affect experts' utilities. We ignore this uninteresting issue throughout the paper. Specifically, we dismiss any equilibrium in which some expert chooses a special action for a measure zero subset of consumers.

[15] If payments were restricted by a lower bound instead of fixed, consumers would set their offers at the lower bound as long as the lower bound does not fall short of the competitive level $c(0)$. Hence, a price floor yields essentially the same results as a fixed price.

$\{p_b\}_{b\in B}$, $\{B_e\}_{e\in E}$, $\{a_b\}_{b\in\cup_{e\in E}B_e}$ via price regulation if and only if it satisfies the following conditions.[16]

(i) Payments are uniform across buyers, $p_b = p_{b'}$ for all $b, b' \in B$, and $p_b \geq c(0)$ for all $b \in B$.

(ii) The sets B_e have equal size, $|B_e| = 1$ for all $e \in E$, and they are disjoint, $B_e \cap B_{e'} = \emptyset$ for all $e \neq e'$.

(iii) Service quality is uniform across buyers, $a_b = a_{b'}$ for all $b, b' \in B$, and satisfies the Kuhn-Tucker conditions (2.7).

We call such allocations implementable. In an implementable allocation, consumer utility is given by

$$v\left(\overline{a}^{IC}(\overline{p})\right) - \overline{p}\,,$$

where the quality level $\overline{a}^{IC}(\overline{p})$ follows from the Kuhn-Tucker conditions (2.7). Using the symmetry of implementable allocations implied by (i) and (ii), the Kuhn-Tucker conditions simplify to

$$\begin{aligned}\left[W'\left(\overline{p} - c(\overline{a}^{IC})\right)c'(\overline{a}^{IC}) - v'(\overline{a}^{IC})\right]\overline{a}^{IC} &= 0\\ W'\left(\overline{p} - c(\overline{a}^{IC})\right)c'(\overline{a}^{IC}) - v'(\overline{a}^{IC}) &\geq 0\\ \overline{a}^{IC} &\geq 0\,.\end{aligned}$$

The thus defined quality $\overline{a}^{IC}$ is identical to the quality $\tilde{a}^{IC}$ from the bilateral setting. Hence, consumer utility as a function of the regulated price $\overline{p}$ is identical to consumer utility as a function of the consumer's payment offer in the bilateral setting. This identity implies that the

[16] Via $\overline{p} < c(0)$ we can also implement the trivial allocation where $B_e = \emptyset$ for all $e \in E$. We ignore this allocation here.

price p^* (as defined by equation (2.5)) maximizes consumer utility among all implementable allocations.

Turning to experts' utility under regulation $\overline{p}$, we obtain

$$\max_{a \geq 0} \{W(\overline{p} - c(a)) + v(a) - \overline{p}\} \ .$$

This is strictly increasing in $\overline{p}$. Since $p^* > c(0)$ by assumption (2.6), experts prefer the regulation p^* to the competitive equilibrium outcome (described in Proposition 1).[17] We have therefore established that price regulation at p^* Pareto-improves upon the competitive outcome.[18]

Proposition 2. *The allocation implemented by price regulation p^* (defined in equation (2.5)) Pareto-dominates the competitive equilibrium outcome described in Proposition 1.*

Intuitively, price regulation forces consumers to raise their payments as if internalizing the externality they impose on other consumers. This counteracts the inefficiency that arises in the competitive equilibrium.

Note at this point that a subsidy could not achieve such efficiency gains. A subsidy would lower experts' acceptance thresholds. Anticipating this, consumers would reduce their offers, leaving producer prices at $c(0)$. The incidence of the subsidy therefore falls completely on consumers. It thereby fails to raise experts' profits such that service quality remains unchanged.

To understand the potential of price regulation more completely, consider the set of constrained efficient allocations. This is the set of implementable allocations that are not Pareto-dominated by any other implementable allocation.

[17] We use the term competitive (equilibrium) outcome for the allocation described in Proposition 1, because it is identical to the outcome obtained under (perfect) price competition between experts in Appendix A.2.

[18] We say that an allocation Pareto-dominates another allocation, if no agent is worse off and a non-zero measure of agents is strictly better off in the first allocation.

Since the regulation p^* maximizes consumer utility, the allocation induced by p^* is constrained efficient. When raising the price above p^*, experts gain and consumers lose. Hence, regulation levels $\overline{p} > p^*$ are constrained efficient as well. Any allocation implemented by $\overline{p} < p^*$ in contrast is not constrained efficient, as both consumers and experts prefer the allocation under p^*. The set of contrained efficient allocations is therefore the set of allocations implementable by a fixed price $\overline{p} \geq p^*$.[19]

Compare now the set of constrained efficient allocations to the set of fully efficient allocations. An allocation is fully efficient if and only if it is not Pareto-dominated by any other allocation. In the proof of Proposition 3 below, we show that an allocation is fully efficient if and only if $a_b = a^{**}$ for all consumers b, where the (fully) efficient quality a^{**} is given by

$$v'(a^{**}) = c'(a^{**}) \ .$$

Intuitively, fully efficient allocations maximize surplus, defined as $\int_B \left(v(a_b) - c(a_b)\right) \, db$. Starting from an allocation that does not maximize surplus, we can move to a surplus-maximizing allocation and redistribute the gains over experts and consumers to make everyone better off.

Inspecting the Kuhn-Tucker conditions for experts' quality choices, we find that expert e chooses the fully efficient quality a^{**} if and only if $W'(y_e) = 1$. In words, to provide fully efficient quality, experts must be indifferent regarding marginal redistribution of money between them and their consumers. Since we excluded this by assumption ($W' > 1$), we can never achieve fully efficient service quality without interfering with experts' quality choices directly. So, the sets of constrained efficient and fully efficient allocations are disjoint; price regulation never achieves full efficiency.

We summarize our findings on the structure of efficient allocations as follows.

[19] By the way we set up the analysis of price regulation, we ignore participation constraints of consumers. If we were to include such constraints, they would imply an upper bound on the regulation $\overline{p}$, beyond which consumers no longer participate. Otherwise, the results would remain unchanged.

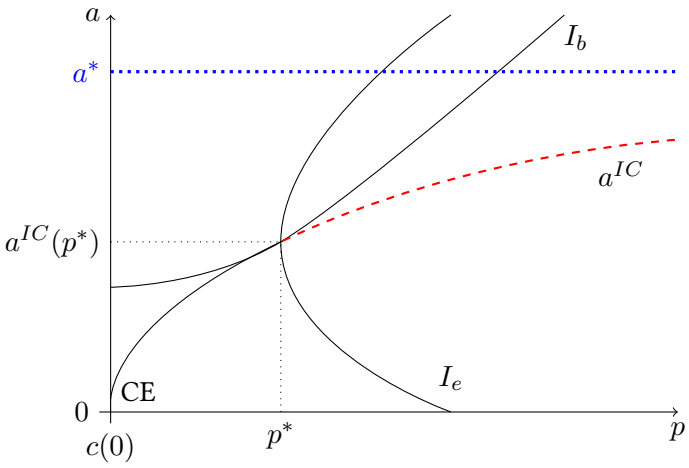

Figure 2.2. Graphical illustration of Proposition 3.

Notes: The figure displays indifference curves of experts, I_e, and of consumers, I_b, among symmetric allocations represented by a common payment p and a common service quality a. The function $\overline{a}^{IC}$ returns experts' optimal quality choice given a common payment offer p. The point CE marks the competitive equilibrium outcome from Proposition 1, the red dashed segment of $\overline{a}^{IC}$ is the set of symmetric constrained efficient allocations, and the blue dotted line is the set of symmetric fully efficient allocations

Proposition 3. *The set of constrained efficient allocations equals the set of allocations implementable by price regulation $\overline{p} \geq p^*$, where p^* is given by equation* (2.5).

The regulation p^* maximizes consumer utility. Expert utility increases strictly in the regulation $\overline{p}$.

Moreover, the sets of constrained efficient and fully efficient allocations are disjoint.

Proof. See Appendix A.1. □

Proposition 3 is illustrated by Figure 2.2. The figure focuses on symmetric allocations, represented by a common payment p and a common quality level a across consumers.

The curve $\overline{a}^{IC}$ marks all allocations implementable via price regulation. Of these, all allocations on the red (dashed) part of the curve are constrained efficient, as they have $p \geq p^*$. There is no intersection with the set of fully efficient symmetric allocations marked by the

blue (dotted) line. The competitive outcome CE at $(0, c(0))$ is neither constrained nor fully efficient.

In short, raising prices up to p^* is Pareto-improving. Raising prices further benefits experts and hurts consumers.

2.7 Endogenous Entry

When price regulation raises experts' profits it may incentivize new experts to enter the market. This may dilute profits and thereby undermine the desired consequences of regulation. To address this concern we extend the analysis to a setting with endogenous entry.

In particular, suppose now that there is a (countably) infinite set of experts who initially decide whether to enter the market at a fixed cost $F > 0$ or not. To finance the entry cost even in a situation where prices equal marginal cost, suppose that experts operate decreasing returns to scale technologies. Formally, let the income of an expert e who entered the market be

$$\hat{y}_e = \int_{B_e} [p_b - c(a_b)] \, db - k(|B_e|) - F \, , \tag{2.9}$$

where all recurrent variables have the same meaning as before. The new cost function k is C^2 and satisfies $k(0) = 0$, $k' > 0$, and $k'' > 0$. Without loss of generality we can now impose the normalization $c(0) = 0$. The function k then measures a fixed cost per consumer served that is independent of service quality. It is convex in the mass of consumers served to capture decreasing returns to scale.[20]

[20] Decreasing returns to scale may for example stem from increasing difficulties to coordinate appointments with consumers, frictional interaction with a growing number of employees, or disproportional wear and tear of equipment.

Expert e's utility becomes

$$\hat{u}_e = W(\hat{y}_e) + \int_{B_e} \left(v(a_b) - p_b - v(0) + k'(|B_e|) \right) db \, . \tag{2.10}$$

Compared to the previous sections we adjust the other-regarding part of experts' utility by $|B_e| \left(-v(0) + k'(|B_e|)\right)$. This adjustment ensures that experts do not derive immaterial benefits or losses from serving a consumer the minimal quality at marginal cost. It mirrors our assumption of $v(0) - c(0) = 0$ from the previous sections. As in the previous sections, the assumption serves to simplify the analysis without substantively changing the results.

Consumers are modeled exactly as before (see section 2.3), except for that we replace the assumption $\underline{v} \leq 0$ by

$$\underline{v} \leq v(0) - k'(M) \, .$$

This again ensures that consumers' outside utility is small enough to exclude uninteresting cases where consumers refuse to participate in the market.

2.7.1 Market Trade with Endogenous Entry

We consider now the following timing of events.

Stage 1' Experts decide whether to enter the market or not. If they do not enter, they receive utility $W(0)$.

Stage 2' Denote by $E = \{1, 2, ..., N\}$ the set of experts who enter the market. Each consumer $b \in B$ is matched randomly to an expert $e \in E$ and offers a payment p_b to the expert.[21]

Stage 3' Experts accept or reject offers. If an offer p_b is rejected, consumer b receives the outside option $\underline{v}$. If p_b is accepted, the corresponding expert chooses a_b and the consumer

[21] Let the matching probability again be uniform, such that each expert is matched to mass M/N of consumers.

receives utility (2.1). Finally, each expert $e \in E$ receives utility according to (2.10), where B_e is the set of consumers whose offers e accepts.

This defines a sequential game with complete information and we again study its subgame perfect equilibria by backward induction.

Given a set of active experts E, payment offers $\{p_b\}_{b\in B}$ and a matching $\{B_e\}_{e\in E}$, experts' quality choices $\hat{a}_b^{IC}$ are determined by the Kuhn-Tucker conditions (2.7) as in Section 2.5. The only difference is that income y_e is replaced by $\hat{y}_e$ as given by equation (2.9).

Moving backwards, the acceptance decisions of each expert $e \in E$ must satisfy

$$W'(\hat{y}_e)\left(p_b - c(\hat{a}_b^{IC}) - k'(|B_e|)\right) + v(\hat{a}_b^{IC}) - p_b - v(0) + k'(|B_e|) \begin{cases} \geq 0 & \forall\, b \in B_e \\ < 0 & \text{for all } b \text{ whose offer } e \text{ rejects.} \end{cases}$$

The condition computes the marginal benefit from expanding the set B_e by consumer b. If this marginal benefit is positive, the expert accepts b's offer, otherwise not. The condition leads to the following intermediate result.

Lemma 2. *Given payment offers $\{p_b\}_{b\in B}$, each active expert e's acceptance decisions B_e and income $\hat{y}_e$ must satisfy, for any consumer b matched to e on stage 2',*

$$b \in B_e \quad \Leftrightarrow \quad p_b \geq \begin{cases} k'(|B_e|) & \text{if } \hat{y}_e \leq 0 \\ \hat{p}(y_e, B_e) & \text{if } \hat{y}_e > 0 \end{cases}$$

with $\hat{p} : (\hat{y}_e, B_e) \mapsto \hat{p}(\hat{y}_e, B_e)$ decreasing in $\hat{y}_e$ and $\hat{p}(\hat{y}_e, B_e) \leq k'(|B_e|)$ for all $\hat{y}_e > 0$ and all B_e.

Proof. See Appendix A.1. □

Lemma 2 provides an acceptance threshold, which consumers anticipate when making their

offers on stage 2'. Determining equilibrium offers is now complicated by inframarginal rents, which may induce positive profits. We therefore proceed with a case distinction.

Lemma 3. *Take a non-empty set of active experts E and consider the subgame after E described by stages 2' and 3'. Distinguish the following cases.*

1. *If*

$$\frac{M}{N}k'\left(\frac{M}{N}\right) - k\left(\frac{M}{N}\right) - F > 0 \ ,$$

payment offers and expert utilities must satisfy

$$p_b \leq k'\left(\frac{M}{N}\right) \quad \textit{and} \quad \hat{u}_e > W(0)$$

for all $b \in B$ and $e \in E$.

2. *If*

$$\frac{M}{N}k'\left(\frac{M}{N}\right) - k\left(\frac{M}{N}\right) - F = 0 \ ,$$

payment offers and expert utilities must satisfy

$$p_b = k'\left(\frac{M}{N}\right) \quad \textit{and} \quad \hat{u}_e = W(0)$$

for all $b \in B$ and $e \in E$.

3. *If*

$$\frac{M}{N}k'\left(\frac{M}{N}\right) - k\left(\frac{M}{N}\right) - F < 0 \ ,$$

payment offers and expert utilities must satisfy

$$p_b = k'\left(\frac{M}{N}\right) \quad \textit{and} \quad \hat{u}_e < W(0)$$

for all $b \in B$ *and* $e \in E$.

Proof. See Appendix A.1. □

Case 3 is not compatible with entry decisions on stage 1', as experts' utility falls short of their outside option. Hence, the equilibrium number of experts $\hat{N}$ must satisfy the conditions of cases 1 or 2. At $\hat{N}+1$, however, we need case 3, such that expert $\hat{N}+1$ finds it unprofitable to enter:

$$\frac{M}{\hat{N}} k'\left(\frac{M}{\hat{N}}\right) - k\left(\frac{M}{\hat{N}}\right) - F \geq 0 \tag{2.11}$$

$$\frac{M}{\hat{N}+1} k'\left(\frac{M}{\hat{N}+1}\right) - k\left(\frac{M}{\hat{N}+1}\right) - F < 0\,. \tag{2.12}$$

To resolve the cumbersome case distinction, suppose now that the mass of consumers is large, $M \to \infty$. Then, conditions (2.11) and (2.12) imply $M/\hat{N} \to m$, where m satisfies

$$mk'(m) - k(m) - F = 0\,. \tag{2.13}$$

Hence,

$$\frac{M}{\hat{N}} k'\left(\frac{M}{\hat{N}}\right) - k\left(\frac{M}{\hat{N}}\right) - F \to 0$$

as $M \to 0$. In words, when we get rid of the integer problem with finite N, we approach case 2 of Lemma 3, where experts make zero profits and payments equal marginal cost.

Proposition 4. *Consider the game described by stages 1' to 3'. Suppose* $M \to \infty$. *Then, in any subgame perfect equilibrium consumers' offers approach marginal cost and quality levels approach zero, that is,* $p_b \to k'(m)$ *and* $a_b \to 0$ *for all* $b \in B$, *where* m *is defined by equation* (2.13).

Proof. See Appendix A.1. □

Proposition 4 shows that for large M the equilibrium allocation with market entry approaches the competitive outcome of minimal quality and marginal cost pricing familiar from Section 2.5. The only difference is that here marginal cost is given by $k'(m)$ instead of $c(0)$.

2.7.2 Regulation with Endogenous Entry

We consider now a joint regulation of prices and entry, represented by the tuple $(\overline{p}, \overline{N})$. Such a regulation induces a game described by stages 1' to 3' with two modifications. First, only a number of $\overline{N}$ experts decides whether to enter the market on stage 1'. This caps the number of active experts at $\overline{N}$. Second, as in Section 2.6 price regulation fixes buyers' offers at $\overline{p}$.

Hence under regulation $(\overline{p}, \overline{N})$, experts decide whether to enter the market, whether to accept the fixed payment offers, and which quality to provide. Consumers have no choices. In the following we construct a regulation that Pareto-improves upon the competitive outcome of Proposition 4.

Note first that for a given number of active experts $\tilde{N}$, experts accept all offers if $\overline{p} \geq k'(M/\tilde{N})$. In such a situation, condition (2.7) for experts' quality choices simplifies to

$$\begin{aligned}\left[W'\left(\frac{M}{\tilde{N}}\overline{p} - \frac{M}{\tilde{N}}c(\hat{\overline{a}}^{IC}) - k\left(\frac{M}{\tilde{N}}\right) - F\right)c'(\hat{\overline{a}}^{IC}) - v'(\hat{\overline{a}}^{IC})\right]\hat{\overline{a}}^{IC} &= 0\\ W'\left(\frac{M}{\tilde{N}}\overline{p} - \frac{M}{\tilde{N}}c(\hat{\overline{a}}^{IC}) - k\left(\frac{M}{\tilde{N}}\right) - F\right)c'(\hat{\overline{a}}^{IC}) - v'(\hat{\overline{a}}^{IC}) &\geq 0\\ \hat{\overline{a}}^{IC} &\geq 0\,.\end{aligned}$$

This defines the quality $\hat{\overline{a}}^{IC}(M/\tilde{N}, \overline{p})$ as a function of the consumer to expert ratio $M/\tilde{N}$ and the price level $\overline{p}$. Consumer utility then also becomes a function of $M/\tilde{N}$ and $\overline{p}$. We denote the price that maximizes consumer utility at a given consumer to expert ratio by $\hat{p}^*(M/\tilde{N})$:

$$\hat{p}^*\left(\frac{M}{\tilde{N}}\right) \in \max_{\overline{p} \geq k'\left(\frac{M}{\tilde{N}}\right)} \left\{v\left(\hat{\overline{a}}^{IC}\left(\frac{M}{\tilde{N}}, \overline{p}\right)\right) - \overline{p}\right\}\,. \tag{2.14}$$

Assume now that for large M and at the unregulated expert number $\hat{N}$ (as given by conditions (2.11) and (2.12)), there is scope for trade above the minimum quality level of zero. Formally, if the expert to consumer ratio approaches its limit value m from the unregulated case (as given by equation (2.13)), marginal cost pricing is not collectively optimal for consumers:

$$k'(m) \notin \max_{\overline{p} \geq k'(m)} \left\{ v\left(\hat{\overline{a}}^{IC}(m, \overline{p})\right) - \overline{p} \right\} . \tag{2.15}$$

This assumption is analogous to assumption (2.6) in the setting without entry.

As a consequence of assumption (2.15), if we can regulate entry such that the number of active experts remains the same as in the unregulated equilibrium, we can Pareto-improve upon the unregulated outcome by raising prices to $\hat{p}^*(m)$ when M is large. Proposition 5 shows that capping entry at the number of experts from the unregulated outcome, $\overline{N} = \hat{N}$, yields the desired result.[22] In addition, Proposition 5 shows that the entry-related component of the regulation is important.

Proposition 5. *Consider the regulation $(\hat{p}^*(m), \hat{N})$, where $\hat{p}^*$ is the consumer-optimal price given by equation (2.14) and $\hat{N}$ is the number of active experts in the unregulated equilibrium given by conditions (2.11) and (2.12). There exists a value $\overline{M}$ such that for all $M > \overline{M}$, the allocation implemented by the described regulation Pareto-dominates the unregulated equilibrium outcome described in Proposition 4.*

Consider in contrast the pure price regulation $(\hat{p}^*(m), \infty)$. There exists a value $\overline{M}'$ such that for all $M > \overline{M}'$, the allocation implemented by the pure price regulation is Pareto-dominated by the allocation implemented by the joint price and entry regulation described above.

Proof. See Appendix A.1. □

[22] Intuitively, raising prices above the marginal cost $k'(m)$ makes entry more attractive, such that the cap at $\hat{N}$ is binding and therefore equal to the actual number of active experts.

Proposition 5 shows that price regulation should be accompanied by entry regulation when entry is endogenous. Adding the entry regulation $\hat{N}$ to the pure price regulation $(\hat{p}^*(m), \infty)$ yields a Pareto-improvement.

To understand this result, note that the purpose of price regulation is to make experts behave less selfishly by raising their profits. But with endogenous entry, any attempt to raise profits via price regulation attracts new entrants, which counteracts the increase in profits. The desired effect on service quality is therefore mitigated. Entry regulation solves this problem by capping the number of active experts. Those who are still allowed to enter benefit from the increased prices and decide, non-selfishly, to provide higher quality services. Thus, entry regulation restores the effectiveness of price regulation.

Whether the price regulation alone already achieves a Pareto-improvement over the competitive outcome is unclear. For large M, experts' utility is approximately unaffected by pure price regulation, because entry drives down experts' utility to their outside option. For consumers the effect is ambiguous. On the one hand, increased prices reduce utility. On the other hand, although mitigated by entry, the pure price regulation can still have a positive effect on service quality. This is because the regulation raises prices above marginal cost, which has a negative effect on experts' utility through the non-selfish part of their preferences: experts feel bad because consumers pay "too much" for what they receive. This immaterial utility loss must be compensated by material gains to make experts enter the market. Hence, entry stops before the income level drops to zero. Since income is positive, service quality can be positive as well.

2.8 Does Social Behavior Depend on Income?

Our theory builds on the assumption that there are positive income effects on social behavior. To support the plausibility of this assumption, this section provides a broad range of experimental and empirical evidence on the relationship between income and prosocial behavior. To

this end, we first review the existing literature and, second, present the results of our own empirical analysis.

2.8.1 Evidence from the literature

In the experimental and empirical literature, there are three types of evidence that support our key assumption.

First, experimental evidence from dictator games consistently shows that individuals give more to others when their endowment increases.[23] Hence, as individuals' income in the experiment goes up, so does their willingness to forgo additional income to the benefit of others. This exactly replicates the crucial behavioral property implied by our assumption on experts' preferences. The finding that the absolute level of giving in dictator games increases in the endowment is uncontroversial in the experimental literature and therefore typically receives little attention. We view this as an indication that, at least qualitatively, our preference assumption is quite modest.

Bartling et al. (2019) question the informativeness of dictator games for whether social behavior is income-dependent or not, based on the assertion that there are strong social norms regarding the share of income to be kept in the dictator game.[24] They propose an alternative experiment, mimicking a market situation where participants decide between buying a good that inflicts externalities on others and one that does not. They find that the premium individuals are willing to pay for the externality-free good increases in their experimental income, in line with our preference assumption.

Finally, there is correlational evidence from the field. Many studies find that charitable giving significantly increases in household income (e.g. Smith, Kehoe and Cremer, 1995; List, 2011).

[23] See, for example, Carpenter, Verhoogen and Burks (2005), Chowdhury and Jeon (2014), Korenok, Millner and Razzolini (2012), and the comprehensive meta study on dictator games by Engel (2011).

[24] They argue that many individuals adhere to the norm that the money should be divided equally between dictator and recipient. Indeed, many individuals seem to follow this norm.

Wiepking and Bekkers (2012) review over 50 studies showing that income and wealth have a positive effect on the level of philantrophic donations.[25] Moreover, Andreoni, Nikiforakis and Stoop (2017) demonstrate that rich households are more likely to return misdelivered envelopes with money than poor households.

Particularly insightful in our context is a study by Rasch and Waibel (2018). Using data on car repairs – i.e., expert services – in Germany, they find that a critical financial situation of a car garage is associated with a higher amount of overcharging incidences.

2.8.2 Empirical analysis

Next, we present the results of an empirical analysis based on data from the German Socio-Economic Panel (SOEP); a detailed description of the procedure and robustness checks can be found in Appendix A.3. Following Section 2.8.1, we argue that financial donations indicate social behavior and show that net income has a positive effect on financial donations on the extensive and on the intensive margin.

A major challenge in the analysis is that a naive regression of financial donations on income is unlikely to yield a causal effect. As argued above, correlational studies typically document a positive relationship, but self-selection and reverse causality could lead to over- or underestimation of the effect. E.g., low-earning individuals could be more social per se; similarly, individuals who exhibit a strong prosocial attitude might self-select into occupations that are poorly paid, which would entail downward biased coefficients.

To eliminate endogeneity in income, we proceed in two steps. First, we exploit the panel structure of our data to erase individual fixed effects from the regression. Thus, we consider

[25] Conducting dictator games with millionaires, Smeets, Bauer and Gneezy (2015) find that the level of giving by millionaires is "much higher than in other experiments we are aware of" (p. 10641).

each individual's intertemporal *change* in income and financial donations and estimate

$$\Delta fdon_i = \beta_0 + \beta_1 \Delta netinc_i + \beta_2 \Delta \mathbf{X_i} + \varepsilon_i, \tag{2.16}$$

where $\Delta fdon_i$ corresponds to individual i's change in financial donations and $\Delta netinc_i$ refers to i's change in net income. We also consider a broad range of control variables $\Delta \mathbf{X_i}$, including i's change in bonus payments (Christmas, vacation, and annual bonus), employment circumstances (weekly working hours, side job, activity status), marital and health status, and life satisfaction. The parameter of interest is β_1: it measures the marginal effect of an absolute change in $\Delta netinc_i$ on $\Delta fdon_i$. Following our theory, we expect that an increase in $\Delta netinc_i$ has a positive effect on $\Delta fdon_i$, i.e., $\hat{\beta}_1 > 0$.

Second, we use the intertemporal *change in the average net income within occupation groups*, denoted by $\Delta avinc_i$, to instrument for $\Delta netinc_i$. We argue that $\Delta avinc_i$ meets the requirements of a valid instrument: it is strongly correlated to $\Delta netinc_i$, but otherwise exogenous to any of i's decisions. In particular, the change in the average net income within her occupation group does not affect an individual's financial donations except through $\Delta netinc_i$. Thus, we augment the model with the first stage

$$\Delta netinc_i = \pi_0 + \pi_1 \Delta avinc_i + \pi_2 \Delta \mathbf{X_i} + u_i \tag{2.17}$$

and estimate equations (2.16) and (2.17) by 2SLS.

Table 2.1 summarizes our findings; see Appendix A.3.2 for the complete set of results. Columns 1 to 4 show the OLS and the 2SLS estimates of regressing an individual's change in net income on the change in her financial donations on the extensive margin, with and without controls. To enhance readabilty of the estimates, $\Delta netinc_i$ is scaled with the factor 100. All estimates are positive, but the 2SLS estimates in columns 3 and 4 are several times larger and

more statistically significant than the OLS estimates in columns 1 and 2, which is in line with our concerns about a downward biased OLS estimation. According to the 2SLS estimates, a 100 Euro increase in $\Delta netinc_i$ leads to a 2.4 percentage point change in the probability to donate; a one standard deviation increase in $\Delta netinc_i$ leads to about a 40% increase in the dependent variable.

Analogously, columns 5 to 8 show the OLS and the 2SLS estimates of regressing an individual's change in net income on the change in her financial donations on the intensive margin, with and without controls. All estimates are positive, but the OLS estimates are not statistically significant. Moreover, the 2SLS estimates are again several times larger than their OLS counterparts. Following the 2SLS estimates, a 1 Euro increase in $\Delta netinc_i$ leads to a 0.13 Euro increase in the change in the amount donated; a one standard deviation increase in $\Delta netinc_i$ leads to about a 30% increase in the dependent variable. We conclude that income has a causal positive effect on the extensive and on the intensive margin of financial donations.

Table 2.1. The effect of net income on financial donations

	Extensive margin				Intensive margin			
	OLS		2SLS		OLS		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta netinc_i$	0.0018*	0.0015*	0.0241***	0.0222**	0.0130	0.0127	0.132**	0.134***
	(0.0009)	(0.0009)	(0.0091)	(0.0093)	(0.0205)	(0.0210)	(0.0521)	(0.0511)
ΔX_{1i}		X		X		X		X
ΔX_{2i}		X		X		X		X
ΔX_{3i}		X		X		X		X
Intercept	0.044***	0.041***	-0.008	-0.053	33.84***	31.33***	5.86	3.55
	(0.007)	(0.008)	(0.022)	(0.022)	(7.22)	(7.25)	(12.17)	(11.86)
			First Stage				First Stage	
$\Delta avinc_i$			0.021***	0.020***			2.06***	2.03***
			(0.004)	(0.003)			(0.36)	(0.35)
F-statistic			33.74	33.22			33.50	32.98
N	5,496	5,390	5,496	5,390	5,449	5,347	5,449	5,347

Notes: Robust standard errors in parentheses. The dependent variable in columns 1 to 4 is $\Delta ddonate_i$, which is the change in financial donations on the extensive margin. The dependent variable in columns 5 to 8 is $\Delta donation_i$, which is the change in financial donations on the intensive margin. The estimates in columns 1, 2, 5, and 6 are OLS estimates. The estimates in columns 3, 4, 7, and 8 are 2SLS estimates. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. To enhance readability of the estimates, $\Delta netinc_i$ is scaled with the factor 100 in columns 1 to 4. See Section A.3 for details on data and empirical strategy.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.9 Conclusion

We propose that income-dependence of social behavior creates an externality across principals in a common agency framework. This externality is most relevant in environments where the scope for monetary incentives is limited and social behavior plays a critical role. The propotypical case of such an environment is a market for credence goods.

We show that the externality creates a rationale for regulatory intervention in credence goods markets. Regulation that raises producer prices above their competitive level can achieve Pareto improvements. Examples are price floors and fixed prices. When market entry of experts is endogenous, price regulation must be accompanied by entry restrictions to seize Pareto gains.

Regarding their practical implications, our results provide a novel perspective on discussions about the dismissal of existing regulations in markets for expert services. While we believe that decisions about such deregulation must be made on a case-by-case basis, accounting for the idiosyncrasies of each market, our results should be considered as an input into these decisions.

3 Measuring Attitudes Towards Migration and Polarization in the Market for News: The Case of the 2015-16 Migration Crisis

Single-authored

3.1 Introduction

The recent immigration wave to Europe and the US has caused significant interest in citizens' perceptions and attitudes towards migrants, and the extent to which these perceptions and attitudes can be changed (e.g., Alesina, Miano and Stantcheva (2018), Tabellini (2020)). Migration often has positive effects on economic growth and social welfare (e.g., Tabellini (2020)), but many people exhibit negative attitudes towards migrants. A consequence of the 2015-16 immigration wave in several Western countries was therefore the rise of far-right parties (Halla, Wagner and Zweimüller (2017), Dustmann, Vasiljeva and Piil Damm (2018), Steinmayr (2021)). Importantly, many citizens do not directly interact with migrants on a day-to-day basis. Instead, they receive information about important events involving migrants through mass online and print media. To understand how views on migration are shaped, it is thus important to study how the media covers migration. Do they present migration in an

excessively negative tone? For example, Alesina et al. (2018) paint a bleak picture for the US (p. 35):

> *[M]uch of the political debate about immigration takes place in a world of misinformation. Citizens and voters have distorted views about the number, the origin, and the characteristics of immigrants. The amount and nature of information that citizens receive is endogenous. [...] Because information is endogenous, a vicious cycle of disinformation may arise. The more natives are misinformed, the more they become averse to immigrants and redistribution, and the more they may look for confirmation of their views in the media. As a result, the media has an incentive to offer information supporting these views. For instance, immigrants who commit crimes or who free-ride on the welfare system may receive more media coverage than non-immigrants doing the same.*

Alternatively, news outlets may be polarized in their attitudes towards migration: some media outlets may paint an overly rosy picture of migration, while others create fear by only highlighting the negative consequences of migration for society. Another alternative is that news outlets report in a balanced way which highlights both positive and negative aspects of migration equally.

In this paper, I study attitudes towards migration and polarization of large news media in Germany. Specifically, I examine the coverage of seven large daily German print newspapers on the 2015-16 migration crisis, which was the major political event of the past decade. Within a few months in this period, Germany received the largest inflow of migrants since the post-war years. It absorbed the largest absolute number of refugee migrants (mostly from Syria and the Maghreb countries) of all countries in the European Union: between 2015 and 2016, more than 2.5 million refugee migrants crossed borders to Europe and applied for asylum in states of the European Union; above 1.2 million refugee migrants arrived in Germany within a couple

of months between 2015 and 2016 (see Figure 3.1). The management of the migration inflow polarized the country and paved the way for the rise of a right-wing party (Alternative for Germany, AfD), which in 2017 became the largest opposition party in the German parliament.

To examine the media coverage of the migration crisis, I adjust and apply a method from media economics, psychology, and communication sciences that allows to evaluate media bias and polarization (see Puglisi and Snyder (2015) for an extensive overview of empirical measurement of media bias). I collect and code all news pictures that the most important news outlets published in their news stories on migration during the 2015-16 migration crisis. These news pictures represent very diverse motives: Portraits of individual migrants, large groups of migrants, migrants as victims, or migrants involved in violent or illegal actions. Some highlight positive aspects of migration, such as the provision of humanitarian aid or benefits for economic development. Others show negative aspects, such as integration problems or criminal acts by migrants.

However, to put these news pictures into a natural perspective, I also collect and code pictures from ideological campaigns that are profoundly engaged in favor of or against migration. By comparing the pictures between different news outlets and the pictures of news outlets to those of ideological campaigns, I determine the degree of polarization in the market for news. Additionally, by exploiting the high-frequency nature of my data, I can also test to what extent news media change their coverage behavior in response to a change in sentiment or drastic events linked to migration over time in 2015-16.

News pictures make up a crucial share of the news content presented (see Figure B.1). Using news pictures to analyze news presentation of a topic has a number of advantages. First, news outlets have a lot of discretion over the content of news pictures they choose. Second, news pictures can be chosen easily to highlight certain aspects of an event. There is ample evidence in the field of psychology and communication science suggesting that news pictures

are emotionally strongly appealing and persuasive, and can draw a lot of attention from news consumers and change their attitude and perception (see, e.g., Graber (1990), Huddy and Gunnthorsdottir (2000) Barrett and Barrington (2005), Veneti, Jackson and Lilleker (2019)). Finally, it is relatively easy to compare news pictures of different outlets about the same news story or event.

Pictures are multidimensional objects. The challenge is to find a way to code them that allows to identify and categorize the (relative) position of a news outlet or ideological campaign using these pictures. I focus on gender composition, group size, and news topic of the pictures as main variables to identify the attitude towards migration of news outlets and polarization. For this paper, I chose the following strategy: For each picture, I determine (i) the total number of migrants and (ii) the share of male, female, and children thereof. Additionally, I take into account the overall topic represented in the picture. The rationale for these variables is as follows: Males are generally seen as less deserving of help and thus often less welcome than females or children (see, e.g., Frey, Savage and Torgler (2010), Bansak, Hainmueller and Hangartner (2016), Cappelen, Falch and Tungodden (2019), Barrera, Guriev, Henry and Zhuravskaya (2020)) and more perceived as a threat (Becker, Kenrick, Neuberg, Blackwell and Smith (2007), Navarrete, Olsson, Ho, Mendes, Thomsen and Sidanius (2009)). Similarly, large groups of people generally evoke less altruism than individuals (Kogut and Ritov (2005)), and they appear as more threatening for security and cultural identity, which frequently is linked to the narrative of "invasions" of migrants played by right-wing politicians (see, e.g., The Guardian (2020)).

My results are as follows. First, I find that news outlets exploit less than 50 percent of the differentiation that is used by ideological and political campaigns. This result holds for both indicators of attitude towards migration – gender composition and group size – and even if including the politically and ideologically most divergent news outlets in my sample. If I take

news outlets' reach into account, the degree of differentiation is much smaller and at most 28 percent of the differentiation that is used by ideological campaigns. Second, I find that most news outlets changed their relative attitude towards migration only very little over time, even though public opinion about migration became more negative from 2015 to 2016. A notable exception is one of the most influential news outlet in Germany, the tabloid *Bild-Zeitung*, whose news pictures trend from positive to negative for both indicators of attitude towards migration. Overall, media polarization is roughly the same in 2015 and 2016, though there are some small changes.

This paper contributes to two strands of economic literatures that only had little common ground so far: the literature on media bias and the literature on attitudes towards migration. The empirical literature on media bias is concerned with measuring explicit and implicit bias in the relative positions of news outlets (see Groeling (2013) and Puglisi and Snyder (2015) for comprehensive reviews). This literature almost exclusively focuses on media bias in politics, e.g., whether news outlets in the US favor Democrats or Republicans. The closest paper to mine in this literature is Groseclose and Milyo (2005). They count the times that news outlets and members of Congress cite the output from political organizations (think tanks and policy groups), and then compare citations between news outlets and politicians. They find that the US news media exhibit a significant bias to the left. Similarly, Gentzkow and Shapiro (2010) measure media bias by comparing the use of "partisan" words in news outlets and politicians. They demonstrate that news outlets strongly follow readers' political preferences. Apart from a different object of interest – attitudes to migration – this paper deviates in one further key aspect: that is, it measures the degree of polarization by using content from ideological campaigns that support opposed ideological and political views. By exploiting this natural benchmark for the possible differentiation in the attitudes on migration, I quantify the degree of polarization in the market for news.

Further, a growing literature investigates the news content of pictures. Within economics, Ash, Durante, Grebenshchikova and Schwarz (2021) examine news pictures to study identity groups and presence of stereotypes in the *New York Times* and *Fox News*. Beyond economics, there is a small literature in communication sciences that uses pictures to describe political positions. For example, Hehman, Graber, Hoffman and Gaertner (2012) and Peng (2018) analyze how US presidents are displayed in news outlets of varying political position. Moreover, some recent papers in communication sciences describe how news outlets covered migration in Europe (see, e.g., Hovden, Mjelde and Gripsrud (2018)). However, none of these papers quantifies attitudes towards migration and polarization in the market for news.

The topic of attitudes to migration has received considerable attention since the 2015-16 migration crisis. Bansak et al. (2016) conduct a large-scale survey experiment to study which personal characteristics of refugee migrants influence respondents' willingness to grant asylum. They find that refugee migrants with higher employability or severe vulnerabilities receive the most support. Alesina et al. (2018) conduct a large-scale survey experiment to measure how natives in the United States perceive migrants. They detect a number of misperceptions; for example, the number of migrants is greatly overestimated by respondents. Overall, respondents hold pessimistic views towards migrants. Providing favorable information about migrants has no lasting effect on respondents' attitude. Alesina et al. (2018) examine the link between migration and attitudes towards redistribution. They find that support for redistribution decreases in the share of migrants within a region.

The remainder of the paper is organized as follows. In Section 3.2, I provide an overview of the 2015-16 migration crisis in Germany and how the public sentiment towards migration changed during this period. In Section 3.3, I introduce the polarization measures and describe how I infer attitude towards migration from pictorial coverage. In Section 3.4, I explain the main data sources. In Section 3.5, I present the main results on the static polarization measures,

while in Section 3.6, I discuss to what extent news outlets changed their attitude towards migration over time and study the dynamics of the polarization. Section 3.7 concludes. An appendix contains additional information.

3.2 Background

This section contains background information that motivates my research design. First, in Subsection 3.2.1, I provide a brief overview of the 2015-16 migration crisis in Europe, especially in Germany. Next, in Subsection 3.2.2, I discuss how the public attitude towards migration changed in Germany during that time. I will exploit this change in public sentiment in the dynamic analysis in Section 3.6.

3.2.1 The European and German Migration Crisis 2015/16

Between January and December 2015, more than one million refugee migrants crossed European borders and applied for asylum in states of the European Union (UNHCR (2015)). The large inflow of asylum seekers became a major topic in public debates all over Europe and was a turning point in European politics. Large conflicts between different members of the EU emerged during the crisis. For example, some EU states closed their borders to stop the inflow of asylum seekers, while others refused to do so; the question how asylum seekers should be allocated between EU countries became a significant political controversy which led to discord among EU states lasting until today.

The question on how to deal with asylum seekers and migration in general also became a major topic in domestic politics in many European countries in the following years, and arguably influenced election outcomes. For instance, the Brexit (Leave) supporters put a strong focus on the migration topic in their election campaign during the EU referendum in the United

Kingdom in June 2016.[1] In the elections for the European Parliament 2019, right-populist parties increased their number of seats from 70 in 2014 to 106 in 2019.[2] At the same time, in many national parliaments right-populist parties increased their voting shares substantially over the following years. For example, the AfD party increased their voting share in Germany from below 5 percent in 2013 to 12.6 percent in 2017 and became the first right-populist party in the German national parliament for decades.

Germany was at the center of the political debate in Europe during the 2015-16 refugee crisis and the country with the largest number of applications for asylum. More than 1.2 million asylum seekers arrived in Germany within couples of months between 2015 and 2016. Figure 3.1 shows how the number of asylum seekers varied over time; the number of asylum seekers in Germany increased in spring 2015, strongly increased in summer and fall 2015 and decreased in winter 2015/16. In March 2016, following an agreement between the EU and Turkey which effectively closed the border between Greece and Turkey for asylum seekers, the number of asylum seekers in Germany decreased to the pre-crisis level.

Most asylum seekers in Germany came from Syria (35 percent), Southeast Europe (25 percent, primary Albania and Kosovo), Afghanistan, and the Iraq (7 percent each). Around 69 percent of the refugee migrants were male adults or teenagers; 20 percent were children younger than 11 years.

[1] For example, Nigel Farage, the head of UK Independence Party (UKIP), stated after the Brexit referendum "We would not have won without the immigration argument" (see `https://www.theneweuropean.co.uk/brexit-news-nigel-farage-discusses-george-osborne-brexit-comments-on-bbc-newsnight-35832/`, accessed 29 December 2021).

[2] In 2014, the leading right-wing political group of the European Parliament was Europe of Nations and Freedom with 36 seats, which reorganized itself to Identity and Democracy in 2019. Notice that the popular right-wing populist parties UK Brexit Party (successor party of UKIP) and the then newly Spain's Vox party have not been part of Identity and Democracy alliance in 2019 (`https://www.dw.com/en/far-right-parties-form-new-group-in-european-parliament/a-49189262`, accessed 29 December 2021).

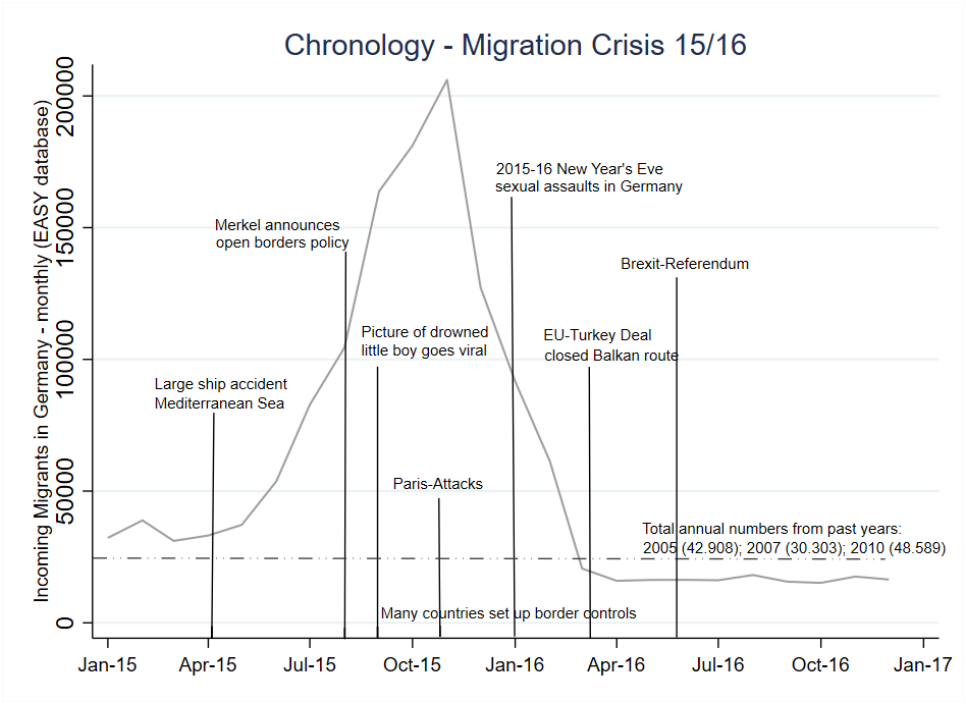

Figure 3.1. Chronology of the 2015-16 migration crisis in Europe.

3.2.2 Public opinion and policy preferences on migration in Germany in 2015/16

The large inflow of refugee migrants arguably affected on the public opinion and policy preferences on migration in Germany in 2015-16.[3] This is not only reflected in the steep rise of the AfD party in German politics, but also explicitly in various representative opinion polls in 2015 and 2016. Table B.1 provides an overview on various polls measuring public opinion and policy preferences in Germany on migration- and asylum-related topics.

Although survey questions, subject pools, the research institutes that conducted the opinion polls and the exact point in time when the polls were conducted may differ, they all document a similar change in the public sentiment towards migration: the attitudes towards refugees and migrants in general became much more negative in Germany over time in 2015-16. For example, the share of people who agreed with the statement "*It worries me that a lot of refugees are coming to us.*" raised from 38 percent in Q3/2015 to 51 percent in Q4/2015; the share of people who perceived migration in general as more disadvantageous increased from 33 percent in Q3/2015 to 44 percent in Q4/2015 (see Table B.1 for an extensive list of surveys and questions documenting the change in attitudes towards migration).

Overall, the public opinion became more negative especially from the last months of the year 2015 onwards. The negative event of the 2015-16 New Year's Eve poses probably the most salient turning point: Hundreds of women were sexually assaulted in Cologne and many other German cities by groups of mainly refugee migrants. This event became quickly one of the most relevant topics in Germany. Anti-immigration parties in Germany, other countries in Europe, and in the United States leveraged this event extensively to highlight the negative aspects of migration. This momentum in the change in attitudes to immigration in Germany from 2015 to 2016 is also captured in a YouGov survey: following the statement "*In general, do*

[3] Note that the months August, September, and October 2015 were considered as the height of the 2015-16 migration crisis, characterized by record number of newly incoming refugee migrants.

you think that Germany could welcome more asylum seekers or do you think that the number is already too high", the share of people responded "too high" increased from 43 percent in September 2015 to 53 percent in November 2015, and further increased to 62 percent in January 2016 (see Table B.1).

3.3 Conceptual Framework

Before describing my dataset, I first explain the conceptual framework for the analysis. In particular, I formally define my measure of polarization in the market for news in Subsection 3.3.1. In Subsection 3.3.2, I describe how I will use news pictures to identify the attitude of news outlets towards migration and polarization in the market for news.

3.3.1 Attitudes and polarization in the market for news

There are n news outlets $i \in \{1, ..., n\}$ in the market for news. Each news outlet i chooses an attitude towards migration $x_i \in \mathbb{R}$. This attitude can be negative in the sense that migration into the home country is portrayed as disadvantageous for society, or it can be positive in the sense that it highlights how migrants and natives can mutually benefit from migration. Let x_L be the most positive attitude towards migration and x_R the most negative attitude that can be chosen. Suppose these extreme values to be the attitudes of political or ideological campaigns towards migration, i.e. campaigns that are strongly in favor of or against migration. Then, the subscripts L, R can be interpreted as the political or ideological position of the opposing campaigns, where L denotes attitudes towards migration of the left (pro-migration) and R of the right (anti-migration). I assume that $x_L > x_R$ and $x_i \in [x_R, x_L]$ for all news outlets i.

There can be different motives for a news outlet's choice of an attitude towards migration. News outlets may choose a certain attitude in order to cater to their consumers' beliefs (Mullainathan and Shleifer (2005)), to maintain a reputation for quality reporting (Gentzkow

and Shapiro (2010)), or because journalists push their own agenda (Baron (2006)). All these motives may shape how an outlet presents news on migration. Therefore, it is an empirical question to what extent news outlets choose differentiated attitudes towards migration.

My data will allow me to find values $x_1, ..., x_n$ of the news outlets' attitudes towards migration as well as of the most positive and negative attitudes x_L and x_R, respectively. Based on these values, I define a measure for the degree of polarization in the market for news as

$$\text{polarization measure} = \Delta = \frac{\max_i\{x_i\} - \min_i\{x_i\}}{x_L - x_R}. \tag{3.1}$$

The numerator is the maximal difference in the attitude towards migration between any two news outlets in the market for news. The denominator is the maximal difference in the attitude towards migration between the opposing campaigns. The polarization measure takes on values between zero and one. A value near zero indicates that all news outlets choose roughly the same attitude towards migration. A value near one indicates that news outlets fully exploit the possible range of attitudes towards migration.

Next, I also consider an influence-weighted polarization measure, taking into account the heterogeneity that news outlets have in terms of their influence – which may reflect the circulation of news outlets – in the market for news. For this, I proceed in two steps. First, I order the set of news outlets according to their attitude x so that $x_1 > x_2 > ... > x_n$.[4] Denote by π_i the market share of news outlet i so that $\sum_{i=1}^{n} \pi_i = 1$.[5] Then, define by $\bar{x} = \sum_{i=1}^{n} \pi_i x_i$ the (influence-weighted) average attitude of the market for news, and the news outlet i^* so that $x_{i^*} > \bar{x}$ and $x_{i^*+1} \leq \bar{x}$. Second, conditional on having split news outlets based on threshold $\bar{x}$, i.e., after having assigned each news outlet to its corresponding (positive or negative) set

[4] For convenience, I assume that there are no ties.

[5] I derive these influence-weights of news outlets from a large-scale Forsa survey where, among others, a representative sample of $N = 2000$ subjects in Germany was asked to report their news consumption behavior. I provide more detail on this in the appendix and Chapter 4.

of news outlets, I determine for both sets of news outlets separately an influence-weighted attitude towards migration. That is, the influence-weighted positive attitude towards migration of news outlets is

$$x_L^{news} = \frac{\sum_{i=1}^{i^*} \pi_i x_i}{\sum_{i=1}^{i^*} \pi_i} \tag{3.2}$$

and the influence-weighted negative attitude towards migration of news outlets equals

$$x_R^{news} = \frac{\sum_{i=i^*+1}^{n} \pi_i x_i}{\sum_{i=i^*+1}^{n} \pi_i}. \tag{3.3}$$

The influence-weighted measure of polarization is then defined by

$$\text{influence weighted polarization measure} = \Delta_{weight} = \frac{x_L^{news} - x_R^{news}}{x_L - x_R}. \tag{3.4}$$

My data will also allow me to test whether a news outlet changes its attitude towards migration over time, in particular, when exogenous events make certain aspects of migration salient. Let $t \in \{1, 2\}$ denote two periods, and x_i^t the attitude towards migration of news outlet i in period t. I will consider a case where criminal acts were presented prominently in the news and significantly altered the public debate about migration. A news outlet i may react by becoming more critical about migration, $x_i^1 > x_i^2$, in order to react to its consumers' changed beliefs. Alternatively, it may react by becoming more positive towards migration, $x_i^1 < x_i^2$, if it follows a supportive agenda and wishes to counter the change in sentiment in the population. Accordingly, I can then test to what extent exogenous events affect the degree of polarization in the market for news.

3.3.2 Measuring attitudes towards migration in news outlets

In this subsection, I present two measures for a news outlet's attitude towards migration x_i as well as for the extreme values of attitudes x_L and x_R. Both measures are derived from the

pictures in the datasets collected.

Gender Composition I propose that a news outlet's attitude towards migration is partially captured in the share of *non-male adult* migrants presented on its news stories' pictures: a higher share of female and children reflect a more positive attitude (higher x_i). Conversely, a higher share of male migrants mirrors a more negative attitude (lower x_i). To justify this claim, I argue that, on the one hand, males, and, on the other hand, females and children, differ in the way their population characteristics are perceived in various circumstances; the latter two are perceived as more deserving of (humanitarian) help than males, eliciting less controversy about their immigration motives, and are associated as less aggressive and thus perpetrating less criminal activities.[6]

Several studies in economics and psychology document that females and children are perceived as more deserving of help than males. Frey et al. (2010) find this in the context of the RMS Titanic disaster in 1912, in which 1,501 people were killed. Females (and children) were more likely to get access to the lifeboats and therefore were at least 23 percent more likely to survive. Thus, even in a life-threatening situation, people tend to adhere to the social norm "Women and children first!" Cappelen et al. (2019) conduct an experiment in which impartial spectators can make transfers from a more productive to a less productive individual. They find that the level of spectators' transfer depend substantially on the recipient's gender, both at the extensive and intensive margin. That is, the share of zero-transfers increases by 7.3

[6] Furthermore, research in the field of (social) psychology establishes evidence showing how gender-specific stimuli affect various affect measures, belief, and behavioral responses. For example, Becker et al. (2007) uncover in a series of studies the relationship on the gender choice of a face and emotional expressions of angry and happiness. Overall, anger is on average significantly more often linked and correctly matched to a male's face, whereas happiness was easier to identify on a female's face. Notably, however, they also find that pictures of neutral male faces were misclassified significantly more often as angry than neutral female pictures. Navarrete et al. (2009) find that fear reduction, preceding an experimental fear-conditioning response of participants, takes longer when participants are exposed to facial male pictures, suggesting that gender categorization may play a key role in moderating stranger anxiety.

percentage points when the less productive worker is male; and a less productive male worker enjoys on average 15 percent less transfers than his female counterpart. Overall, Cappelen et al. (2019) argue that males falling behind are judged more critically by society than females falling behind.

The population of females and children are not only perceived as more deserving of help in general. In the specific context of immigration in general and, in particular in the course of the 2015-16 migration crisis, the female and children population are seen as having better motives to migrate. A message that right-wing politicians frequently pushed during the 2015-16 migration crisis is that individual men are not migrating to avoid persecution, but only for economic reasons. Otherwise, so their argument, they would not leave their family behind.

Barrera et al. (2020) study in the context of the migration crisis 2015-16 and the following French presidential election 2017 how being exposed to misleading information by politicians and true facts shape policy preferences and voting intentions related to immigration. In their experiment, they present statements of Marine Le Pen, leading French right-wing politician and presidential candidate in 2017, who stated during the 2017 French election campaign that "[a] very small minority of them are really political refugees [...]. I have seen the pictures of illegal immigrants coming down, who were brought to Germany, to Hungary, etc... Well, on these pictures there are 99 percent of men [...]. Men who leave their country leaving their families behind, it is not to flee persecution but of course for financial reasons. Let's stop telling stories. We are facing an economic migration, these migrants will settle" (p.5). Barrera et al. (2020) show that this narrative is effective in increasing support for right-wing political parties that wish to restrict migration. Bansak et al. (2016) conduct an experiment with 18,000 potential voters in 15 European countries to carve out attributes of refugee migrants that native population is willing to accept. Subjects were asked to evaluate 180,000 profiles of

refugee migrants based on nine relevant attributes.[7] Overall, they find that the probability to accept refugee migrants significantly decreases when having males instead of females in the profiles.

Finally, male migrants are often perceived as more dangerous for security than female migrants. This conclusion, in general, is not entirely wrong since statistically males commit more criminal acts than females (see, for example, Walker and Maddan (2011)). In particular, this is true for burglary and violent crimes such as rape or aggravated assault. The connection between migrant gender and criminal behavior is also frequently emphasized by right-wing political parties (Hestermann and Hoven (2020)).

Group Size I propose that the attitude towards migration is reflected in the number of people that news outlets on average picturize in their news stories: a higher average number indicates a more negative attitude and vice versa. Indeed, a large number of victims elicit less altruism than individuals (or small groups), that a large number of victims may even lead to "psychic numbing" (Slovic (2007)), and that a large number of migrants may also be seen as a threat to security and cultural identity (see, e.g., Fitzgerald, Curtis and Corliss (2012), Bloom, Arikan and Lahav (2015)).

Several studies in economics and psychology document that altruism towards individuals decreases in their number. Kogut and Ritov (2005) find that contributions for a single needy individual exceed those for a group of eight needy individuals. Andreoni (2007) studies how donations depend on the number of receivers. He finds that when the number of receivers doubles, the value of a donation to the giver increases by a factor less than two, i.e., keeping the marginal effect of a donation to a single recipient constant, donations increase in the

[7] The 180,000 hypothetical profiles of refugee migrants randomly varied in those nine attributes of interests, including gender, age, reason for migrating, religion, asylum testimony, country of origin, previous occupation, vulnerability, and language skills (see supplementary materials of Bansak et al. (2016) for further details on the survey experiment).

number of receivers, but at a decreasing rate. Schumacher, Kesternich, Kosfeld and Winter (2017) even find that individuals and groups receive roughly the same weight in the decider's utility function.

In the context of large-scale human disasters, Slovic (2007) argues that "psychic numbing" occurs when a large number of people suffer. It is relatively easy to elicit compassion when there is an identified individual victim "with a name and a face" (Slovic (2007), p. 86). However, people tend to be touched much less by disasters if the number of victims is large. This tendency is captured well in a quote from Mother Teresa (Slovic (2007), p. 86): "If I look at the mass I will never act. If I look at the one, I will."

Finally, news pictures showing large numbers of migrants may elicit fears of security threats and loss of cultural identity. A common view is that large numbers of migrants may import criminals as well as infectious diseases. Empirical findings do not support this view (e.g., Bersani (2014)). However, large numbers of migrants can pose a challenge for social cohesion in the receiving communities (Bloom et al. (2015)). For example, they may compete with the local population in the labor market (Borjas (1999)). Right-wing politicians often exploit the impression of "invasions" of migrants that enter a country. In his support of the "Vote Leave" Campaign for the British Referendum on EU membership 2016, Nigel Farage explicitly used a picture of a large number of mostly male migrants on their way towards the German border to stoke fear in voters.[8]

3.4 Data

For my main analysis, I use two datasets. First, I collect and code all news pictures that the largest German news outlets published on the topic of migration during the 2015-16 migration

[8] See, for example, the Guardian's article on June 16, 2016 (`https://www.theguardian.com/politics/2016/jun/16/nigel-farage-defends-ukip-breaking-point-poster-queue-of-migrants`, accessed 29 December 2021).

crisis (Dataset A). I describe this dataset in Subsection 3.4.1. Further, I collect and code pictures that political and ideological (pro- and anti-migration) campaigns use in their advertisement materials in connection with the topic of migration (Dataset B). In Subsection 3.4.2, I explain all details of this dataset. Finally, in Subsection 3.4.3, I describe all main and auxiliary variables that I record for all pictures.

3.4.1 Dataset A: Pictures from news outlets

I collect all news pictures that seven German news outlets published in 2015 and 2016 with regards to their news stories about the then ongoing migration crisis. These news outlets are as follows (ordered by ideological orientation from left- to right-leaning): *Junge Welt* (*JW*), *Tageszeitung* (*TAZ*), *Sueddeutsche Zeitung* (*SZ*), *Bild-Zeitung* (*Bild*), *Frankfurter Allgemeine Zeitung* (*FAZ*), *Die Welt* (*Welt*), and *Junge Freiheit* (*JF*). The news outlets *TAZ*, *SZ*, *FAZ*, and *Welt* are nationally distributed quality newspapers; *TAZ* is left-wing, *SZ* is moderately left-leaning, while *FAZ* and *Welt* are considered as conservative and moderately right-leaning. Friebel and Heinz (2014) and Freitag, Kerkhof and Münster (2021) provide a detailed discussion of the political positioning of these news outlets. In 2016, these four news outlets together sold above 3.4 million copies and represent by far the largest share of the market of quality daily newspapers in Germany. *Bild* is the only nationally distributed tabloid newspaper in Germany. In 2016, it sold 7.71 million copies and is the most influential news outlet in Germany (Statista (2021)). Its ideological position is difficult to pin down precisely. Finally, *JW* and *JF* are the two news outlets that are positioned at the extreme ends of the political spectrum. The *JW* defines itself as a "marxist newspaper", while the *JF* has close links to the AfD and defines itself as "conservative-nationalistic." Both of these news outlets have a rather small reach compared to the others. All news outlets appear on a daily basis, except *JF* which appears once per week.

I consider all news pictures published in these seven outlets between April 2015 and Septem-

ber 2016 (including these two months). For all news outlets in this dataset, we browsed each newspaper's page and hand-collect all pictures that were published in news stories related to the event of the 2015-16 migration crisis.[9] In total, I collect 2,589 news pictures from the seven news outlets (see Table B.2). Figure 3.2 shows the distribution of the number of news pictures over time for each of the seven news outlets. The number of news pictures published in news outlets essentially follows the severity of the migration crisis and reaches a peak in September 2015 for most news outlets.

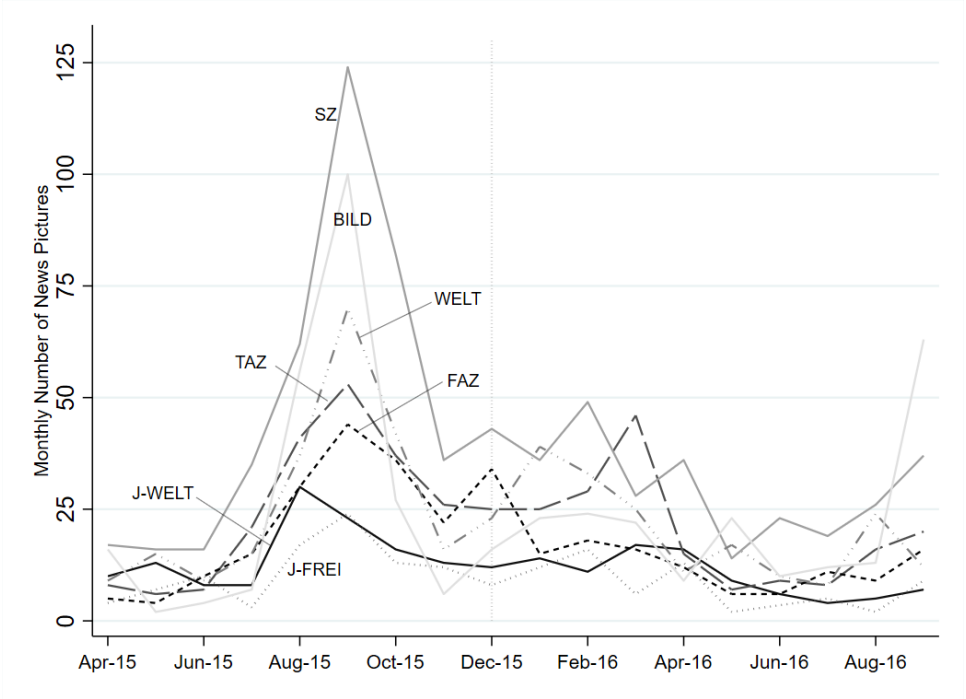

Figure 3.2. News pictures frequency over time, by news outlets.

Figure 3.2 shows that, abstracting from different levels of coverage, news outlets follow a

[9]Note that cartoons or graphical representation of information were excluded.

similar pattern of news pictures frequency.[10] That is, after a slight rise in coverage in the first half of the year 2015, the number of news pictures skyrockets in Q3/2015 for all newspapers to its peak, reflecting the significance and the height of the migration crises in Germany; with the exception of *JW*, all news outlets reach their highest level in the number of pictures in September 2015. Here, with little more than 120 news pictures, the *SZ* features the highest number of news pictures. After a sharp decline of coverage in Q4/2015, it increases slightly and for a short time in the first months of 2016, which correlates with the public debates over the sexual assaults in many German cities on New Year's Eve 2015/16. Except for the *Bild*, coverage by means of news pictures declines between Q2 and Q3/2016.

3.4.2 Dataset B: Pictures from ideologically motivated campaigns

My second dataset is a collection of pictures that pro- and anti-migration campaigns use on their websites and social media to advertise their cause. I define an ideological campaign as a campaigning organization that explicitly and strongly supports either a pro- or anti-immigration policy in the context of Germany. To the best of my knowledge, there is no official information that explicitly lists and positions organizations according to their attitudes towards migration. To this end, I define and use the following three criteria to determine campaigns: First, a campaign's vehicle of coverage (e.g., its website) should be officially, actively, and regularly operated and updated. Second, a campaign should clearly express its views and attitudes towards migration. Third, the event of the 2015-16 migration crisis should be of central importance to the campaign's agenda.

Following these three criteria, I examine a vast set of candidates, such as news outlets with

[10] In media economics, issues related to selection bias and media attention may exist if news outlets systematically under- or overrepresent certain events and stories (Hamilton (2006), Groeling (2013)). Figure 3.2 shows that media attention – measured as the number of news pictures published by news outlets – greatly coincides with the dynamics of incoming refugee migrants as illustrated in Figure 3.1, supporting the notion that issues linked to media attention seem to be less critical.

extreme positions, political parties, citizen associations, and non-government organizations.[11] In Appendix B.3, I provide a comprehensive documentation of this process. I end up with eight campaigns, four pro- and four anti-migration campaigns. Each side contains one major political party in Germany: The Green party on the pro-migration side and the AfD on the anti-migration side. Table B.3 provides an overview of the campaigns used in this paper. Finally, to collect pictures of campaigns, I consider websites, news articles, publications, and social media accounts of these campaigns and end up with 783 pictures.

3.4.3 Variables

For each news picture (i.e. observation) in dataset 3.4.1 and 3.4.2, I document a wide number of variables. Table B.4 provides an overview of the main variables that I use for this paper: gender composition, group size, and topics.

For each picture, I classify the individuals represented according to their identity, i.e. whether migrants, leaders and politicians, social workers, security staff, or police were shown. Next, I focus on migrants as the main group of subjects. To analyze whether news outlets differ in their coverage behavior with respect to gender composition, I measure the number and relative share of male and female migrants. I also document the number and share of children by counting migrants below approximatively twelve years, following a comparatively conservative age threshold used by the Federal Office for Migration and Refugees in Germany.[12]

Further, I use the total number of migrants covered in the pictures as a proxy of group size. Following previous studies analyzing visual coverage of migrants (e.g., Zhang and Hellmueller

[11] For example, I consider, among others, the classification by the Federal Agency of Civic Education (Bundeszentrale fuer politische Bildung, BPB) on the most right-leaning news media in Germany, which the BPB published in December 2016 (see `https://www.bpb.de/politik/extremismus/rechtsextremismus/239438/der-rechte-rand-verlage`, accessed 07 May 2021).

[12] During the 2015-16 Migration Crisis, the inflow of unaccompanied minors has been societally and politically of critical relevance in public debates (see `https://ec.europa.eu/eurostat/documents/portlet_file_entry/2995521/3-02052016-AP-DE.pdf/4e9e86e6-26ec-4d49-9484-bc8120dc1b62`, accessed 07 May 2021).

(2017)), I classify the size of groups on a given picture as portraits (1 migrant), small ($2-4$ migrants), medium ($5-14$ migrants), large ($15-24$ migrants), and huge ($25>$ migrants).

Finally, the topics variable captures the main news theme represented in the picture. These main topics visually cover migrants in the context of education, work, social and cultural events, security and criminal acts, or overloading of social and economic systems (e.g., long waiting queues of migrants at the Job Center); or represent migrants at boarder controls, on their route to Europe, and in their temporary home for asylum seekers.

3.5 Results: Static Polarization

In this section, I start my analysis by examining static polarization as defined in the conceptual framework of Section 3.3. First, in Subsection 3.5.1, I consider attitudes towards migration and polarization according to the gender composition of news pictures. Then, in Subsection 3.5.2, I repeat this analysis using the group size of news pictures. It will turn out that we obtain similar values of polarization for both measures. Finally, in Subsection 3.5.3, I complement this analysis by also comparing the topics represented in news pictures across news outlets.

3.5.1 Gender Composition

In a first step, I compare the pictures of pro- and anti-migration campaigns. The left graph in Figure 3.3 shows the share of non-male adult migrants that pro- and anti-migration campaigns show in their advertisement materials as well as the share of non-male adult migrants that is shown by the news outlets in my dataset. As a benchmark, I also show the official number of non-male refugee migrants who arrived in Germany in the considered time frame. This value is 33 percent and it is represented by the dashed line in the left graph in Figure 3.3 .

As expected, pro-migration campaigns show a higher share of non-males than anti-migration campaigns, 58 percent (sd = 0.42) vs. 24 percent (sd = 0.33). The difference of 34 percentage

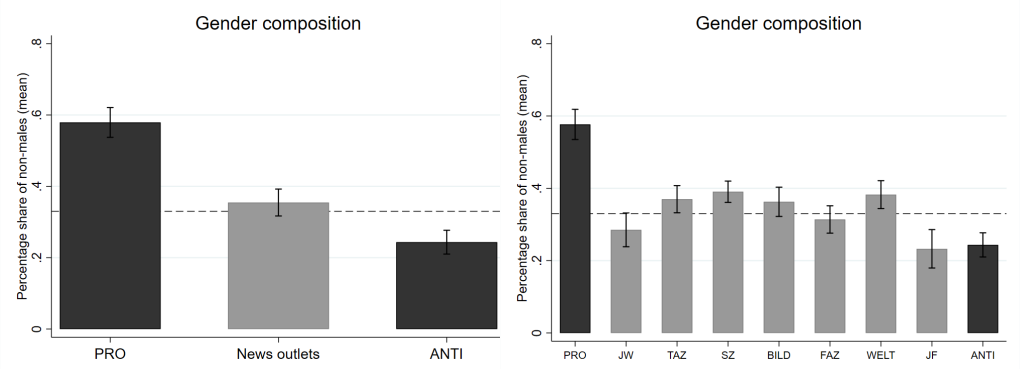

Figure 3.3. Percentage share of non-males: campaigns vs. news outlets.

points is significant (two-sided t-test, p-value = 0.0000). Pro-migration campaigns also show a significantly higher share of non-male migrants compared to the official number of 33 percent (t-test, p-value = 0.0000), while anti-migration campaigns show a significantly smaller share of non-males (t-test, p-value = 0.0000). In contrast, the average share of non-males shown by news outlets, 35 percent ($sd = 0.39$), is remarkably close to the official number and lies in between the shares of non-males shown by pro- and anti-migration campaigns.

Next, I compare the shares of non-male adult migrants between the individual news outlets and campaigns. The graph on the right of Figure 3.3 provides an overview. The largest share of non-male migrants among the news outlets is 39 percent (sd = 0.40) and shown by the left-leaning *SZ*. The smallest share of non-males among the news outlets is 23 percent (sd = 0.33) and shown by the right-leaning *JF*. The *SZ* shows significantly fewer non-males than pro-migration campaigns (t-test, p-value = 0.0000), while the *JF* shows a share of non-males that is very close to that used in pictures of anti-migration campaigns (t-test, p-value = 0.7483). Following my definition of polarization from equation 3.1, I obtain polarization according to gender composition of $\Delta^{gender} = 0.47$. Thus, in terms of gender composition, news outlets exploit less than 50 percent of the differentiation that campaigns use.

The other news outlets show the following shares of non-males: *JW* 29 percent (sd = 0.35),

TAZ 37 percent (sd = 0.38), *FAZ* 31 percent (sd = 0.33), and *Welt* 38 percent (sd = 0.40); in the tabloid *Bild*, the share of non-males is 36 percent (sd = 0.42). Therefore, left-leaning and right-leaning news outlets are not perfectly ranked according to the shares of non-male adult migrants, and all news-outlets are relatively close to the official number of 33 percent (see summary statistics in Table B.5).

The news outlets in the sample differ widely in their reach. The newspapers *JW* and *JF* are rather small and are sold to a few ten thousand readers. In contrast, the other news outlets are rather large for German standards.[13] To take this heterogeneity into account, I consider the influence-weighted polarization measure as defined in equation 3.4. For gender-composition its value equals $\Delta^{gender}_{weight} = 0.15$. Hence, if I take influence into account, the degree of polarization is substantially smaller. I summarize my results.

Result 1. Pro-migration campaigns show significantly more non-males than anti-migration campaigns. The polarization measure for gender composition equals $\Delta^{gender} = 0.47$. *Taking the influence of the news outlets into account, yields an influence-weighted polarization measure for gender composition of* $\Delta^{gender}_{weight} = 0.15$

3.5.2 Group Size

I now consider average group size as the measure that reflects attitudes towards migration of news outlets. The left graph in Figure 3.4 shows the average group size in the pictures of pro- and anti-migration campaigns, as well as the average group size that is shown in the news pictures of news outlets. In line with the conceptual framework from Section 3.3, pro-migration campaigns show on average fewer migrants: the average group size on their pictures is 8.49 (sd = 12.48); 23 percent of their pictures show portraits, and further 31 percent represents small groups of two to four migrants. In contrast, anti-migration campaigns portray on average

[13] For example, the *Bild* (*SZ*) sold more than 7.7 (1.47) million copies in 2016 (see Table B.2).

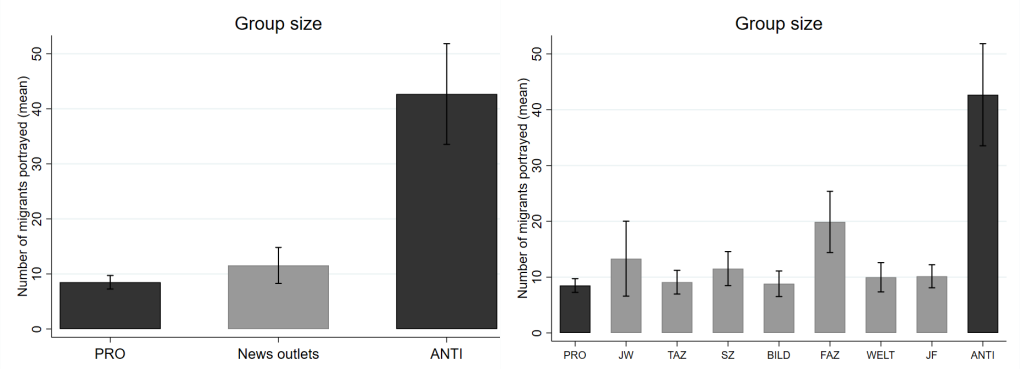

Figure 3.4. Average number of migrants: campaigns vs. news outlets.

a group size of 42.69 (sd = 91.73) migrants. Only about 12 percent of their pictures show portraits and about 11 percent of pictures display small groups with two to four migrants. The difference in the average group size between pro- and anti-migration campaigns is significant (two-sided t-test, p-value = 0.0000). The average group size shown by news outlets is 11.54 (sd = 35.41). Hence, it is relatively close to that of pro-migration campaigns (two-sided t-test, p-value = 0.0890) and significantly smaller than that of anti-migration campaigns (two-sided t-test, p-value = 0.0000).

In the graph on the right of Figure 3.4, I compare the average group sizes displayed by individual news outlets. The smallest average group size is shown by the left-leaning *TAZ* with an average group size of 9,10 (sd = 21.64) and by the tabloid *Bild* with an average group size of 8.81 (sd = 23.52). Nearly 24 percent (42 percent) of the pictures of the *TAZ* (*Bild*) are portraits, and further 31 percent (21 percent) show small groups of two to four migrants. The largest average group size is 19.89 (sd = 49.04) and shown by the moderately right-leaning *FAZ*; 11 percent of the pictures of this news outlet are portraits. The difference in the average group size between *TAZ* and *FAZ* is significant (two-sided t-test, p-value = 0.0001). *TAZ* and *Bild* show on average as many migrants on its pictures as pro-migration campaigns (two-sided t-test, p-value > 0.6313). The *FAZ* shows significantly fewer migrants than anti-migration

campaigns (two-sided t-test, p-value = 0.0001). The case of the *Bild* has to be taken with some care, which I will discuss it in the next section. Overall, I obtain polarization according to group size of $\Delta^{group} = 0.32$. Consistent with Result 1, I find that news outlet exploit less than 50 percent of the differentiation that ideological campaigns use.

The other news outlets show the following average group sizes: 13.31 in *JW* (sd = 51.04, 21 percent portraits), 11.52 in *SZ* (sd = 40.95, 28 percent portraits), 9.98 in *Welt* (sd = 27.30, 27 percent portraits), and 10.16 in *JF* (sd = 12.74, 17 percent portraits). The differences in average group size are not significant among *TAZ*, *SZ*, *Welt*, *JF*, and *BILD* (two-sided t-test, p-values $>$ 0.2221). Again, left- and right-leaning news outlets are not perfectly ranked according to their average group sizes (see summary statistics in Table B.6).

As for gender composition, I find that the degree of polarization is slightly smaller when taking the influence of news outlets into account. Following the definition in equation 3.4, I find an influence-weighted polarization measure according to group size of $\Delta^{group}_{weight} = 0.28$. I summarize my results as follows.

Result 2. Pro-migration campaigns show significantly smaller group sizes than anti-migration campaigns. The polarization measure for groups size equals $\Delta^{group} = 0.32$. *Taking the influence of the news outlets into account, yields an influence-weighted polarization measure for group size of* $\Delta^{group}_{weight} = 0.28$.

3.5.3 News Topics

In this section, I consider the topics shown in the news pictures as a variable to reflect attitudes towards migration of news outlets. In general, both news outlets and campaigns portray a large number of topics illuminating diverse aspects on migration. These topics show migrants in the context of work and education ("Integration"), and social and cultural events ("New Life"); portray security and criminal acts ("Security Issues"), or an overloading of social and

economic systems ("Socio-economic Challenges"); represent migrants crossing the sea route ("Sea/Vessel"); show migrants at boarder controls, on their route to Europe ("Route"), and in their temporary home for asylum seekers ("Asylum Homes").[14]

Figure B.4 shows the distribution of topics on campaign- and news outlet-level. In line with the conceptual framework outlining attitudes towards migration in Section 3.3, the opposing migration campaigns diverge in the topics they portray. That is, anti-migration campaigns show more frequently aspects of migration associated with security and criminal issues (12.95%) than pro-migration campaigns (5.29%). Conversely, pro-migration campaigns more frequently use pictures related to the category on integration (8.31%), representing migrants participating in work, education, and social and cultural events. The corresponding share for anti-migration campaigns is more than twice as low (3.63%).

The distribution of topics seems to provide a mixed takeaway with news outlets. The *JW* and *JF*, both minor news outlets positioned at the extreme ends of the politically left-right spectrum, tend to portray security and criminal acts, or an overloading of social and economic systems comparatively more often: *JW* uses more often news pictures linked to "Security Issues" (11.71%) or "Socio-economic Challenges" (13.06%); *JF* shows in 10.27% of its news pictures "Security Issues" and in 15.75% "Socio-economic Challenges". While the *SZ* represents also news pictures classified as "Security Issues" (10.26%) relatively more frequently, it shows more than twice as less pictures related to the category of "Socio-economic Challenges" (6.21%) than *JW* or *JF*. Conversely, the *FAZ* uses more often news pictures related to "Socio-economic Challenges" (14.66%), but shows less frequently "Security Issues" (8.14%).

SZ, *Bild*, *FAZ*, and *Welt* relatively often portray news pictures showing migrants in the context of work, education and social and cultural events. Notably, the *FAZ* has with 16.29% by far the highest share of news pictures related to the category "Integration", followed by

[14] In total, I propose the following categories underlying the topics variable: "Sea/Vessel", "Route", "Asylum Homes", "Socio-economic Challenges", "Security Issues", "Integration" , "New Life", "Portraits", and "Other".

Welt (9.13%) and *SZ* (7.51%). News pictures related to "New Life" are relatively more frequently used by *Bild* (17.04%), followed by *Welt* (14.66%) and *SZ* (12.43%).

In sum, I find that ideological campaigns present diverge aspects on migration. News outlets, as opposed to the metric of gender composition and group size, can be ranked less unambiguously according to their topics. In fact, each news outlet shows a number of diverse aspects.

3.6 Results: Polarization Dynamics

I discussed in Subsection 3.2.2 how the public opinion on migration changed in Germany from mid-2015 to mid-2016. My data allows me to check how news outlets changed their attitudes towards migration during that time. Specifically, I compare attitudes towards migration and the degree of polarization between 2015 and 2016. As in the previous section, I first use the gender composition of news pictures (Subsection 3.6.1) and then the group size (Subsection 3.6.2) as a measure of migration attitudes.

3.6.1 Gender Composition

Figure 3.5 shows the news outlets' attitudes towards migration in 2015 and 2016 according to gender composition, and indicates whether the differences are statistically significant (all test statistics in this figure originate from two-sided t-tests). All news outlets except the *Bild* show a higher fraction of non-males in their pictures in 2016 than in 2015. This effect is significant for the left-leaning news outlets *JW* and *TAZ* as well as for the moderately right-leaning *Welt*. These news outlets therefore seem to adopt a slightly more positive attitude towards migration even though public opinion to migration becomes more negative (see Table B.1).

The only exception from this trend is the tabloid *Bild*. This news outlet significantly decreases the share of non-male adult migrants in its pictures from 2015 to 2016 by 12 percentage points

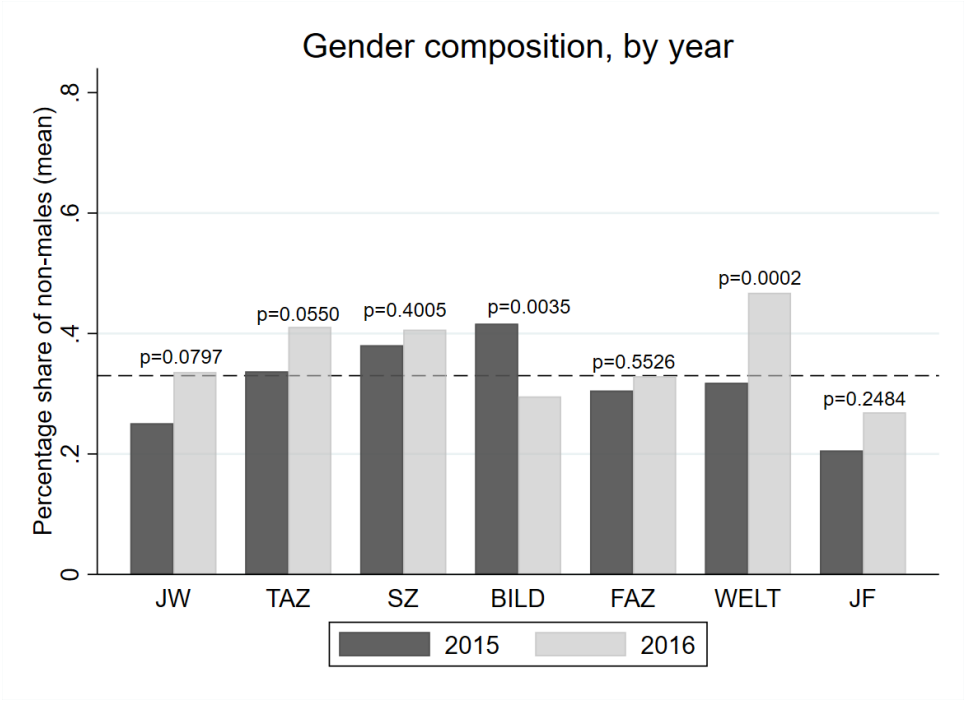

Figure 3.5. Gender composition in 2015 and 2016, by news outlets.

(two-sided t-test, p-value = 0.0035). Its coverage behavior therefore seems to correlate with the trend in public opinion to a larger extent than the other news outlets.

Next, I examine how the degree of polarization changed from 2015 to 2016. Following the definition in equation 3.1, I obtain polarization according to gender composition of $\Delta^{gender}_{2015} = 0.63$ in 2015 and $\Delta^{gender}_{2016} = 0.59$ in 2016. Thus, the year-specific measures of polarization are larger than the overall measure of polarization from the static analysis. However, there does not seem to be a time trend in polarization. The market for news exploits around 60 percent of the differentiation that political campaigns use. Taking the reach of the news outlets into account, I obtain an influence-weighted polarization measure for gender composition of $\Delta^{gender}_{2015,weight} = 0.24$ in 2015 and $\Delta^{gender}_{2016,weight} = 0.35$ in 2016. This increase is largely driven by the *Bild* which switches from a comparatively positive attitude in 2015 to a notably negative

attitude in 2016. I summarize my results as follows.

Result 3. According to the gender composition measure, most news outlets adopt a more positive attitude towards migration in 2016 than in 2015. A notable exception is the Bild, which appears to coincide with the trend in public opinion. The polarization according to gender composition is roughly the same in 2015 and 2016. However, the influence-weighted polarization measure for gender composition increases by around 11 percentage points.

3.6.2 Group Size

In the last step, I examine how the news outlets' attitude towards migrants changed from 2015 to 2016 according to the group size measure. This measure may be compromised as fewer refugee migrants entered Germany in 2016 compared to 2015 (see Figure 1). Hence, showing fewer migrants may not only reflect a change in attitude, but may be driven by changes in the context that the news pictures display (such as naturally formed groups of migrants becoming smaller).

Figure 3.6 shows how the news pictures' average group size of the news outlets changed from 2015 to 2016. It also displays whether the differences are statistically significant (according to a two-sided t-test). Indeed, I find that the average group size in the news pictures mostly decreased. The drop is significant not only for the left-leaning news outlets *TAZ* and *SZ*, but also for the right-leaning *Welt* and *JF*. The average group size increased only for the *FAZ*, but this change is not statistically significant. Importantly, the tabloid *Bild* shows roughly the same average group sizes in 2015 and 2016. Overall, these results are mostly in line with what I found using the gender composition measure: the news outlets' coverage of migration became slightly more positive over time (with the exception of the tabloid *Bild*). In particular, it did not systematically follow the trend in public opinion, which became negative in relative terms after the third quarter of 2015.

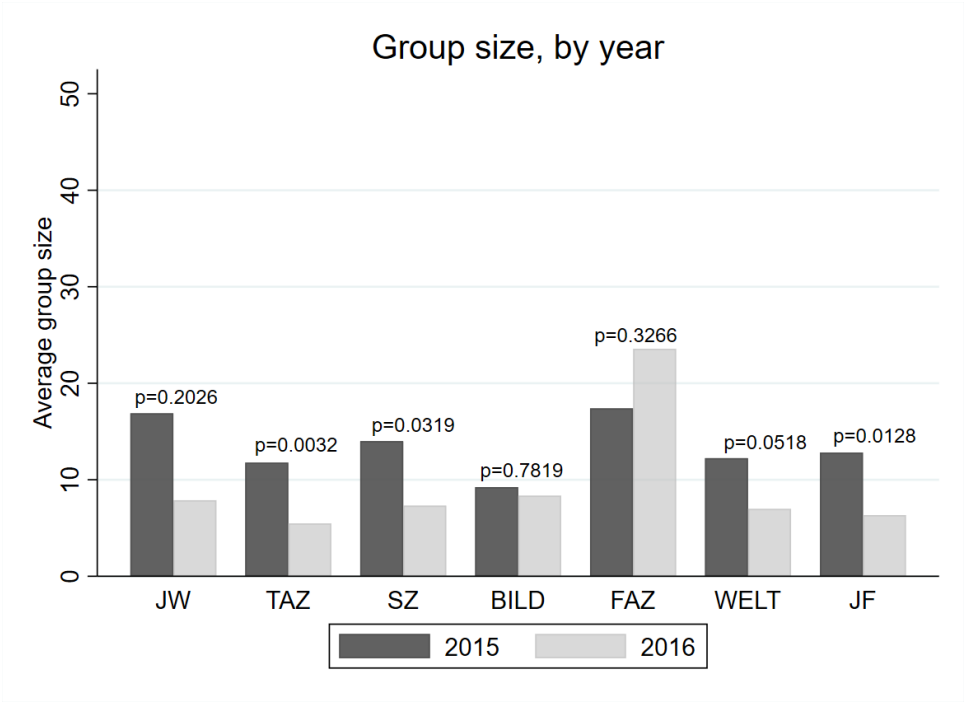

Figure 3.6. Average number of migrants in 2015 and 2016, by news outlets.

Eventually, I analyze how polarization changed according to group size. This measure is now more volatile: polarization was $\Delta^{group}_{2015} = 0.26$ in 2015 and $\Delta^{group}_{2016} = 0.53$ in 2016. If I take the news outlets' range into account, I obtain an influence-weighted polarization measure for group size of $\Delta^{gender}_{2015,weight} = 0.14$ in 2015 and $\Delta^{gender}_{2016,weight} = 0.48$ in 2016. Thus, all polarization measures show that the market for news does not fully exploit the differentiation that the campaigns use. I summarize my results as follows.

Result 4. According to the group size measure, several news outlets adopt a more positive attitude towards migration in 2016 than in 2015; no news outlet adopts a more negative attitude. Polarization according to group size increases from 2015 to 2016, both for the influence-unweighted and influence-weighted measure of polarization.

3.7 Conclusion

This paper introduces a novel approach to measuring attitudes towards migration of news outlets and polarization of news media. First, I propose a parsimonious framework to define the measure of polarization in the market for news. Conceptually, the main innovation relates to the incorporation of political and ideological campaigns for putting the coverage behavior and thereby the attitude towards migration of news outlets into a natural perspective. Second, I operationalize these attitudes of news media and ideological campaigns by focusing on gender composition, group size, and topics they portray on migration in their news stories. For this, I collect and analyze all news pictures that large news outlets published in their news stories between mid-2015 and mid-2016 in the context of the 2015-16 migration crisis in Germany. Using this unique dataset I compile the average attitude towards migration for each news outlet and the degree of polarization in the German market for newspapers.

I find that the coverage of news outlets exploits less than 50 percent of the differentiation that is used by ideological campaigns. This result holds for both indicators of attitude towards migration – gender composition and group size – and even if we include the most polarized news outlets in my sample. When taking news outlets' reach into account, the degree of differentiation is much smaller and at most 29 percent of the differentiation used by ideological campaigns. Next, I study the coverage behavior and thereby the change in attitude and polarization over time. I find that most news outlets changed their relative attitude to migration only very little between 2015 and 2016, even though public sentiment about migration changed negatively from 2015 to 2016, especially after Q3/2015. However, the coverage behavior of the largest news outlet in Germany, the tabloid *Bild*, provides a notable exception. For both indicators of attitude to migration – gender composition and group size –, the *Bild* becomes more negative in relative terms from 2015 to 2016.

The method proposed has several advantages. First, knowing extreme positions (e.g., of a

spectrum of an opinion or attitude) allows to objectivize observed differences among news outlets more structurally. This is not only vital but necessary for quantifying and interpreting measures linked to polarization of news media in a meaningful way. Second, this method is portable to other contexts, replicable, and relatively parsimonious. Most importantly, it can be applied to study attitudes and polarization in different markets and over time, as illustrated in Subsection 3.6.

While this paper provides an effective way of capturing news media's immigration attitudes, it remains agnostic about how news consumers' beliefs and views on migration might be affected and shaped through the news media. At this end, measures presented might fail to offer unambiguous answers as news pictures are multidimensional objects: it may be that a group of men looks friendly, while the picture of a small group of women looks worrisome.

To investigate such challenges, I conduct a large-scale survey in which a representative sample of the German population evaluates the news pictures of datasets 3.4.1 and 3.4.2. I present the survey design, data, and results in more detail in the next chapter.

4 Polarization and the Markets for News

With Matthias Heinz and Heiner Schumacher

4.1 Introduction

Migration is a contentious topic in Europe and the US, and peoples' attitudes towards migration are therefore a concern for both academics and policy makers. A crucial factor that shapes these attitudes is the coverage of migration in news media. There have been concerns that news media mostly frame migration as a threat, highlighting illegality or criminal behavior of migrants (Farris and Mohamed (2018), Alesina et al. (2018)). In many countries, however, there are also significant liberal media outlets that advocate migration in their reports. Hence, one could argue that the market for news is polarized: some news outlets highlight the benefits and humanitarian aspects of migration, while others focus on the social problems associated to migration. In this paper, we study attitudes to migration and the degree of polarization in the market for news.

Since news reports are high-dimensional objects, it is a challenge to measure attitudes to migration, i.e., the degree of negativity and polarization. Therefore, we propose a new method to quantify attitudes to migration in news coverage and the degree of polarization in the market for news. This method is portable to other contexts, replicable, and relatively affordable. In particular, it can be applied to study attitudes and polarization over time and

in different markets. In our concrete case, we apply it to evaluate attitudes to migration and polarization in Germany during the migration crisis in 2015-2016.

To examine the media coverage of the migration crisis, we use the news pictures that the largest newspapers in Germany published on migration. The news outlets in our sample cover the full spectrum of political views from left-wing to conservative to right-wing. The news pictures on migration in these outlets show a diverse set of contents: portraits of individual migrants, large groups of migrants, migrants as victims, or migrants involved in violent or illegal actions. To obtain a measure for attitudes to migration, we evaluate each picture by asking a number of human coders from a representative sample the question "How does this picture influence an observer's attitude towards economic migrants?"; answers are provided on a scale from -5 (very negative, against acceptance of economic migrants) to +5 (very positive, in favor of acceptance of economic migrants). We then compile for each news outlet the mean average rating of its migration pictures and use this measure as a proxy for the news outlets' attitude to migration.

Differences in the mean average rating between news outlets indicate differentiation in attitudes to migration. In order to evaluate the degree of polarization in the market for news, we additionally need proxies for the maximal and minimal possible values of the mean average rating. To obtain these values, we apply the same procedure to a large sample of pictures taken from political and ideological campaigns that are engaged in favor of or against migration (henceforth, *Pro* and *Anti* migration campaigns). These include the "Green Party", which in Germany is very supportive of immigration, and the "Alternative for Germany", which proposes to drastically limit immigration. In total, our sample contains 1282 pictures from news outlets and 391 pictures from ideological campaigns.

We use pictures instead of textual contents for the following reasons. First, news outlets have discretion over which, if any, news pictures they wish to attach to their news coverage.

They therefore can highlight certain narratives about immigration. Second, a large literature in psychology documents that pictures can have persuasive effects (see, e.g., Graber (1990), Huddy and Gunnthorsdottir (2000), Veneti et al. (2019)). Third, pictures draw a lot of attention, even if consumers do not read the news article or the headline. They are therefore heavily used in online media and often occupy a significant amount on the news pages. Fourth, a method using pictures is portable to other contexts, countries, and media formats (e.g., television). In psychology, political and communication sciences, researchers already document media bias using pictures in many studies (Puglisi and Snyder (2015), Veneti et al. (2019)). In media economics, a small but growing literature examines pictures in addition to news content (e.g., Ash et al. (2021)).

As expected, *Pro* and *Anti* migration campaigns use very different pictures in their promotional materials. The distance in their mean average rating on the -5 to +5 scale is 1.49. One can think of this number as the distance between the ends of an "Hotelling street." The question that arises is, where on this scale (or street) the news outlets are located and how large the differentiation between them is. We find that the news outlet that uses the most negative pictures (among news outlets) is on average more positive towards migration than the *Anti* migration campaigns, and the news outlet that uses the most positive pictures is more negative towards migration than the *Pro* campaigns. The distance between these two outlets on our Hotelling street is 0.92. Hence, news outlets only use 62 percent of the possible polarization (differentiation used by campaigns). If we take the influence – reflecting the circulation or reach – of news outlets into account, this number drops to 33 percent. This effect is driven by the fact that the most negative news outlet has only a small reach.

Each news outlet shows a diverse set of pictures on migration. To put this variety into perspective, we calculate for each news outlet the "within-outlet range", i.e., the mean average rating of the most positive pictures of this outlet minus the mean average rating of its most

negative pictures. For most outlets, the most negative sample of pictures has an average rating that is close to those pictures of *Anti* migration campaigns, while the most positive sample of pictures has an average rating that often exceeds that of the *Pro* campaigns. News outlets therefore show a broad variety of news pictures. This result is corroborated by the fact that the topics shown on the news pictures of each outlet are very diverse. This result is interesting in the context of consumers who wish to obtain an unbiased view on the subject matter. Mullainathan and Shleifer (2005) suggest that such consumers could just read all the available news in order to counter media bias. The variety of topics shown in news outlets implies that even a single outlet provides enough perspectives on the subject of migration to obtain a relatively unbiased picture. Alternatively, one could argue that most partisan individuals would find enough material in any news outlet to confirm their views.

The high-frequency nature of our data allows us to examine whether attitudes to migration and the degree of polarization change over time. Such a change is plausible as the public opinion on migration changed substantially in Germany from mid-2015 to mid-2016 (an overview is provided in Chapter 3). The question is therefore whether news outlets follow consumers and alter their attitude to migration in their reports following the change in public opinion. Such a finding may also explain the variety of views presented in news outlets when taking on a static perspective.

We examine the evolution in reporting in the different news outlets by quarter, from the second quarter of 2015 to the third quarter of 2016. Most news outlets do not systematically change their reporting as measured by the mean average rating of their migration pictures. A notable exception is the tabloid *Bild*, which moves from a fairly positive to a relatively negative attitude towards migration. In mid-2015, this news outlet essentially defined the most pro-migration perspective in the media. By mid-2016, it became the most negative news outlet with respect to migration. This evolution has been documented and it shows up very

significantly in our data. There is some variation though so that the degree of polarization as well as the influence-weighted degree of polarization is slightly higher in the individual quarters than in all quarters taken together. The within-outlet range is large in all news outlets and in all quarters.

Finally, we study to what extent consumers anticipate the attitudes to migration of news outlets and the degree of polarization. To this end, we run a short survey on news consumption and ask subjects to also rate the news outlets and campaigns. For each news outlet and campaign in our data we ask subjects to estimate the mean average rating of pictures that this news outlet or campaign, respectively, presents in its reports and advertising materials on the migration topic. It turns out that subjects correctly estimate the relative positions of news outlets, except the relative position of the *Bild*, which is perceived to be very negative towards migration. Interestingly, subjects on average estimated a degree of polarization of around 50 percent, which is very close to the actual value from the static analysis. Therefore, our results suggest that consumers in Germany are aware that the market for news is only modestly polarized.

The remainder of the paper is organized as follows. In Section 4.2, we present related contributions. In Section 4.3, we briefly describe the conceptual framework for our analysis. In Section 4.4, we describe our dataset and how we rated pictures from news outlets and political campaigns. In Section 4.5, we present our main findings. Section 4.6 concludes. The appendix contains additional information.

4.2 Related Literature

Our paper contributes to two economic literatures, the literature on media bias and the literature on attitudes towards migration.

Seminal papers on political media bias are concerned with empirically determining the

political position of news outlets and measuring different types of media bias, mainly classified as explicit or implicit biases of news outlets (see Groeling (2013), Puglisi and Snyder (2015), and Gentzkow, Shapiro and Stone (2016) for surveys; see Kerkhof and Münster (2021) for an extensive overview on various media bias measures). In assessing the relative position of news outlets based on an external, most possibly objective baseline, our paper relates methodologically to Groseclose and Milyo (2005), Gentzkow and Shapiro (2010), and Freitag et al. (2021). Groseclose and Milyo (2005) estimate the ideological scores for large US news media by comparing the coverage behavior – measured as the citation frequency of think-thanks and policy groups – of news outlets and members of Congress in the US. Relatedly, Gentzkow and Shapiro (2010) develop an index to measure media slant by analyzing the degree of similarity of US daily newspapers' textual coverage to phrases used by members of Congress. Most recently, Freitag et al. (2021) present a novel measure of the political position of German news outlets by analyzing news items that German Members of Parliament (MPs) shared on their Twitter account (see, e.g., Dallmann, Lemmerich, Zoller and Hotho (2015), Dewenter, Dulleck and Thomas (2016), and Garz, Sörensen and Stone (2020) for further studies proposing alternative measures of political media bias of news outlets in Germany).

Our paper deviates from the existing literature in two aspects. First, our approach complements the existing literature on political media bias by offering a measure that goes beyond the traditional left-right classification of news outlets. We measure polarization of news outlets by exploiting the news content from ideological pro- and anti-migration campaigns as a natural baseline mirroring the possible spectrum in the attitudes to migration. Second, our approach of measuring a news outlet's relative position and polarization in the market for news incorporates a large-scale, representative sample of news consumers. Approaches based on human coders to rate the news content may generate more holistic measures of news outlets actual political or ideological position. Additionally, our paper contributes to a growing

field in media economics analyzing news content of pictures (see, e.g., Ash et al. (2021)).[1] Ash et al. (2021) examine news pictures published in the web articles of the *New York Times* and *Fox News* between 2000 and 2020 to investigate gender- and stereotype-related biases.

The literature studying the attitudes towards migration has received strong attention in recent years, particularly caused by the 2015-16 migration crisis (see, e.g., Bansak et al. (2016), Alesina et al. (2018), Farris and Mohamed (2018); see Hainmueller and Hopkins (2014) for an extensive survey in the field of political science). Based on a large-scale survey experiment, Bansak et al. (2016) carve out migrants' personal characteristics that shape respondents' willingness to accept refugee migrants. Subjects were asked to evaluate 180,000 profiles of refugee migrants based on nine relevant attributes. They document that refugee migrants with higher employability or severe vulnerabilities receive the most support, and that the probability to accept refugee migrants significantly declines when having males instead of females in the profiles. Alesina et al. (2018) conduct a large-scale survey experiment to examine how natives in the US perceive migrants. The authors uncover several misperceptions that respondents may have about migrants. Respondents do not only strongly overestimate the number of migrants, but also tend to have pessimistic views towards migrants more generally. In fact, even providing favorable information about migrants seems to have no lasting effect on the respondents' attitude towards migration. Alesina et al. (2018) find a link between migration and redistributional preferences: the support for redistribution decreases in the share of migrants within a region. In the search of roots and reasons that might explain the pessimistic view on migrations, news media is often criticized for framing migration as a threat, highlighting illegality or criminal behavior of migrants (Farris and Mohamed (2018), Alesina et al. (2018)). We contribute to this end by offering a novel, holistic, and affordable approach to measure attitudes towards migration and polarization in the market for news.

[1] In psychology, political and communication sciences, several works already document media bias using pictures (Puglisi and Snyder (2015), Veneti et al. (2019)).

Our results provide valuable insights to the debate critically challenging the role of the news media as a catalyst of polarization in the context of migration.

4.3 Conceptual Framework

In this section, we describe a parsimonious formal setting for our analysis. It builds on the conceptual framework introduced in Chapter 3, Subsection 3.3. In Subsection 4.3.1, we briefly present the formal procedure to determine the degree of polarization in the market for news. In Subsection 4.3.2, we describe how we measure an outlet's attitude to migration by using a representative survey.

4.3.1 Attitudes to Migration and Polarization

The formal framework for our analysis builds on the Hotelling street setting introduced in Chapter 3, Subsection 3.3. There are n news outlets in the market for news with generic element i. A news outlet i chooses an attitude towards migration $x_i \in [x_R, x_L] \subset \mathbb{R}$; x_L denotes the most positive feasible attitude towards migration and x_R the most negative feasible attitude. Assume these extreme values to be the attitudes of ideological campaigns towards migration. The subscripts L, R then can be seen as the political or ideological stance of campaigns, where L denotes the attitudes of the left (pro-immigration campaigns) and R of the right (anti-immigration campaigns). We therefore have $x_L > x_R$ and $x_i \in [x_L, x_R]$ for all news outlets i. Our measure of polarization is then given by

$$\text{polarization measure} = \Delta = \frac{\max_i\{x_i\} - \min_i\{x_i\}}{x_L - x_R}. \tag{4.1}$$

In words, the degree of polarization in the market for news is defined as the ratio between the maximal difference in attitudes to migration in the market for news and the difference

in attitudes to migration of the opposing ideological campaigns. The polarization measure takes on values between zero and one.[2] A value near zero indicates that there is almost no polarization in the market for news as all news outlets take on roughly the same attitude towards migration. A value near one indicates that news outlets fully exploit the possible spectrum of attitudes towards migration.

As indicated in the last chapter, news outlets differ significantly in the influence they have in the market for news, rendering the basic measure of polarization in Equation 4.1 to exaggerate the degree of polarization by overweighting smaller, outlying news outlets. To adequately account for the influence of news outlets, we use an influence-weighted measure of polarization, as defined in Equation 3.4 in Chapter 3.

4.3.2 Measuring Attitudes towards Migration

In Chapter 3, we used the gender composition, group size, and topics of news pictures to determine a news outlet's attitude to migration. These are very specific measures that most likely do not reflect all aspects of news pictures. In order to obtain a more holistic measure, we apply the following procedure. We evaluate each picture by asking a number of human coders from a representative sample the question "How does this picture influence an observer's attitude towards economic migrants?" The answers are provided on a scale from -5 (very negative, against acceptance of economic migrants) to $+5$ (very positive, in favor of acceptance of economic migrants). We compile for each picture the average rating submitted by the coders. A news outlet i's attitude to migration x_i is then the mean average rating of all pictures of this news outlet. To obtain the bounds on attitudes to migration x_L, x_R, we apply the same procedure to a sample of pictures taken from political and ideological campaigns that are engaged in favor of or against migration.

[2] In our empirical analysis, we will find a degree of polarization larger than one in two specific cases (which is driven by some extreme outliers). We will discuss this in more detail at a later stage.

The pictures shown in a news outlet will typically exhibit different average ratings since they show a diverse set of motives. To describe the extent to which a news outlet offers different perspectives on migration, we introduce a measure that captures this diversity. We call it the *within-outlet range* (WOR hereafter). The within-outlet range of news outlet i, WOR_i, is defined as the difference between the means that the sample split creates, that is, the mean average rating of the most positive pictures of an outlet minus the mean average rating of the most negative pictures of the same outlet. The threshold for this sample split is a news outlet's mean average rating x_i, so that the most positive pictures of an outlet equals the set of news pictures having an average rating that exceeds x_i of that outlet. Conversely, the most negative pictures of an outlet equals the set of news pictures having an average rating being below of that outlet's x_i. The WOR_i takes on values between zero and ten. If $WOR_i = 0$, then all pictures exhibit exactly the same average rating. If $WOR_i = 10$, the most positive sample of pictures exhibits an average rating of 5 and the most negative sample of pictures exhibits the average rating of -5.

4.4 Data

For our analysis, we combine three datasets. First, we use a sample of all news pictures that the most influential news outlets published in their news stories on migration during the 2015-16 migration crisis in Germany. We describe this dataset in more details in Subsection 4.4.1. Second, we use data on pictures of political and ideological campaigns, i.e., pro- and anti-migration campaigns that clearly position themselves as in favor of or against immigration. We provide more detail on this dataset in Subsection 4.4.2. Third, for our main analysis, we use a unique dataset coming from a representative, large-scale survey conducted in collaboration with Forsa, one of Germany's leading polling institutions, to evaluate the pictures from the first two datasets. We describe this survey in detail in Subsection 4.4.3.

4.4.1 Data 1: News pictures sample from news outlets

Dataset 4.4.1 provides our final sample of news pictures shown to our subjects in the Forsa survey. This dataset is a stratified, randomized sample from the news pictures in Dataset 3.4.1 introduced in Chapter 3. Dataset 3.4.1 provides a unique collection of news pictures that the five largest and two minor, but extreme, German newspapers published in their news stories on the 2015-16 migration crisis between April 2015 and September 2016. We consider the following nationally distributed newspapers: *Junge Welt* (*JW*), *Tageszeitung* (*TAZ*), *Sueddeutsche Zeitung* (*SZ*), *Bild-Zeitung* (*Bild*), *Frankfurter Allgemeine Zeitung* (*FAZ*), *Die Welt* (*Welt*), and *Junge Freiheit* (*JF*). These news outlets differ with respect to their political orientation, market share and influence, as well as frequency of publication (see Subsection 3.4.1 in Chapter 3. for an extensive description of this dataset). Further, while the *TAZ*, *SZ*, *FAZ*, and *Welt* are considered as quality newspapers, the *Bild* is the only nationally distributed tabloid in Germany.

Our randomization protocol is as follows. Since our news outlets also differ in the number of news pictures they have published, we first ensure by stratification that our sample is proportionally balanced on newspaper-level. Second, we randomly assign a set of news pictures to our final sample for each news outlet. In total, our sample consists of 1282 news pictures, which is approximately 50 percent of all news pictures' in the original sample. To check for successful sample balance with respect to our main variables which include gender composition, group size, and topics (see Subsection 3.3.2 in Chapter 3 for motivation), we run the following Binary Logistic regression for each news outlet:

$$Sample_i = \beta_0 + \beta_{Gender} ShareMales_i + \beta_{Migrants} Migrants_i + \boldsymbol{\beta}'_{Topic} \boldsymbol{Topic}_i + \boldsymbol{\beta}'_{Quarter} \boldsymbol{Q}_i + \epsilon_i, \qquad (4.2)$$

where the dependent variable $Sample_i$ is a binary and indicates whether or not picture i from the respective news outlet is in the sample (1=in the Forsa sample, 0=not in the Forsa sample).

The independent variable $ShareMales_i$ reflects the share of male migrants represented in picture i, $Migrants_i$ reflects the overall number of migrants in picture i. $\boldsymbol{Topic}_i$ is a vector of topic dummies. To ensure that our sample is also proportionately balanced over time, we also consider $\boldsymbol{Q}_i$ that reflects a vector of quarter-specific dummies. Columns 3 to 9 in Table C.1 show the results of these regressions for all news outlet and illustrates that our sample is well-balanced.

4.4.2 Data 2: Pictures sample from ideological campaigns

Dataset 4.4.2 provides our final sample of pictures from ideological campaigns that are used in the Forsa survey. This dataset is a randomized sample of pictures originating from ideological campaigns. These are defined as organizations that actively advertise their ideological agenda, which is either in favor of or against immigration, on their websites and social media. According to its definition in Chapter 3, the event of the 2015-16 migration crisis is central to the agenda of the campaigns (see Subsection 3.4.1 in Chapter 3 for further details on the selection criteria and procedures of this dataset). Ideological campaigns include news outlets with extreme positions, political parties, citizen associations, and non-government organizations. Each picture in the final collection thus originates from either a pro- or an anti-immigration campaign. Our sample consists of 391 randomly drawn pictures, which corresponds to around 50 percent of the entire number of pictures from ideological campaigns. Columns 2 and 10 in Table C.1 show the respective balance regression results for each ideological campaign.

4.4.3 Data 3: Large-scale, representative survey experiment

Our third dataset stems from a survey with $M = 2000$ subjects that is representative for the population in Germany. The survey was conducted in collaboration with Forsa, one of Germany's leading market research institutions, between April and May 2021. This survey

involves three parts. Not all of them are relevant for the present paper. Nevertheless, for the sake of completeness, we describe all of them in the following.

Part 1: Scores of pictures In the first part of the survey experiment, each subject was asked to evaluate a randomly assigned set of 20 pictures from Datasets 4.4.1 and 4.4.2. Before subjects were asked to rate the sample pictures, they were generically informed about the sources of the pictures in Datatsets 4.4.1 and 4.4.2 and that these were shown in the context of the 2015-16 migration crisis by the news media and/or ideological campaigns. For each picture, we asked subjects the following question: "How does this picture influence an observer's attitude towards economic migrants?" The answer had to be provided on a Likert scale from -5 (very negative, against acceptance of economic migrants) to $+5$ (very positive, in favor of acceptance of economic migrants). Additionally, subjects could choose the option "do not know/no indication" (only for 0.04 percent of the pictures this option was chosen). Each picture was evaluated independently by around 20 subjects. Subjects were not provided with any information about the pictures' sources. However, the news pictures of the *Bild* are lightly watermarked with the *Bild*'s parent company name. Thus, the news pictures of the *Bild* were evaluated in a separate session. Figure 4.1 shows the distribution of the average ratings of the overall picture sample ($N = 1673$) from news outlets and ideological campaigns.

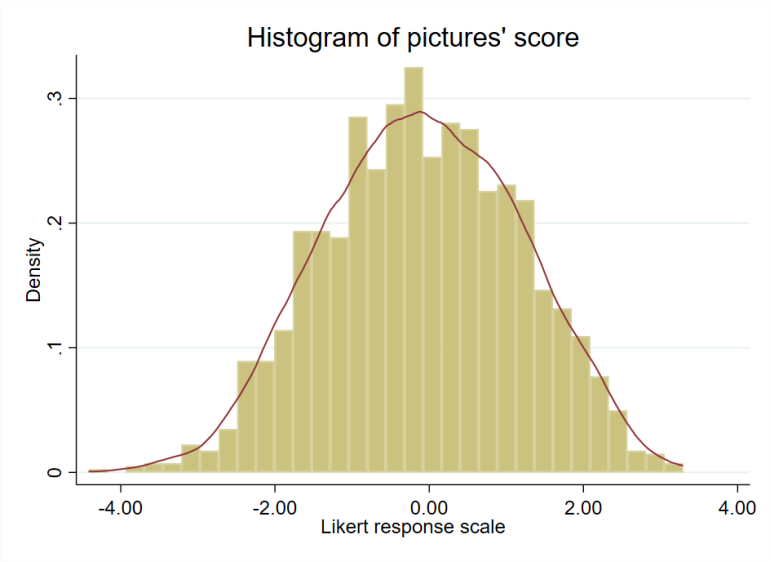

Figure 4.1. Histogram: Average rating of the pictures, (pooled) from news outlets and ideological campaigns.

Notes: The histogram in Figure 4.1 starts at value -4.41 and its bins have a width of 0.24. The red line in Figure 4.1 illustrates the kernel density.

Part 2: Scores of news outlets In the second part of the survey, each subject was asked to rate the news outlets from dataset 4.4.1 and the ideological campaigns from dataset 4.4.2 with respect to their attitude towards migration during the 2015-16 migration crisis in Germany. Specifically, we asked the following question: "Please, estimate how the pictures of a particular news outlet influenced an observer's attitude towards economic migrants." Again, answers had to be provided on the scale from -5 (very negative, against acceptance of economic migrants) to $+5$ (very positive, in favor of acceptance of economic migrants).[3] Subjects could also choose the options "do not know" and "do not know the news outlet." The seven news outlets were shown in a random sequence.

[3]Notice that the subjects were told at the introduction of the survey that the pictures, which the would see and evaluate in Part 1, were published by the news media in 2015-16. Since they had no information about the pictures' underlying source (expect for some pictures of the *Bild* which exhibited light watermarks), they could not match pictures to news outlets. Thus, subjects had to hypothesize what kind of pictures a given outlet would use.

For the ideological campaigns, we adjusted this question as follows. We asked subjects to imagine an organization (political party, campaign) that advocates for or against accepting economic refugees and provided some examples of these organizations. Then we asked subjects the same question as above, for pictures that such an organization would use in its promotional materials (on websites, blogs, flyers, posters, etc.).

Part 3: Media use survey and political preferences In the third part of the survey, we first measured news consumption of the subjects. Specifically, we asked each subject about the sources of information that he or she would use in order to obtain information about the latest news on politics, business, and society. Subjects were provided an extensive list of potential news sources (radio, TV stations, podcasts, social media, newspapers, and magazines; see Figure C.14 in the appendix for the related question in the Forsa survey). We requested them to state the average number of days per week on which they consume these news sources. Finally, we asked subjects about their basic demographics and measured their political preferences. To this end, we asked subjects to position themselves on a one-dimensional left-right political spectrum, and to indicate their preferred political party (from the German political system).

4.5 Results

In this section, we investigate the attitudes to migration and the polarization of news media using the concept outlined in Subsection 4.3. First, in Subsection 4.5.1, we adopt a static perspective and compare the mean average ratings of the news outlets in our sample for the time frame between Q2/2015 and Q3/2016. Then, in Subsection 4.5.2, we analyze the dynamics in the attitudes to migration and polarization for this time frame. During this period the public opinion with respect to migration changed substantially, and our data allows us to examine the extent to which news outlets reacted to this development. Finally, in Subsection 4.5.3, we

study in more detail which aspects of news pictures on the migration topic influence their average ratings in our survey.

4.5.1 Static polarization

Figure 4.2 shows the mean average ratings of the pictures published by the news outlets and ideological campaigns in our sample. We treat these values as a proxy for the attitude towards migration of an organization (x_i). As expected, the mean average ratings of the ideological campaigns mark the endpoints of the spectrum. That is, the mean average rating of pro-migration campaigns (x_L) is 0.46 ($sd = 1.05$), while the mean average rating of anti-migration campaigns x_R equals -1.03 ($sd = 1.20$). The difference of 1.49 units between pro- and anti-immigration campaigns is statistically significant (two-sided t-test, p-value = 0.00) and can be interpreted as the length of our "Hotelling street."

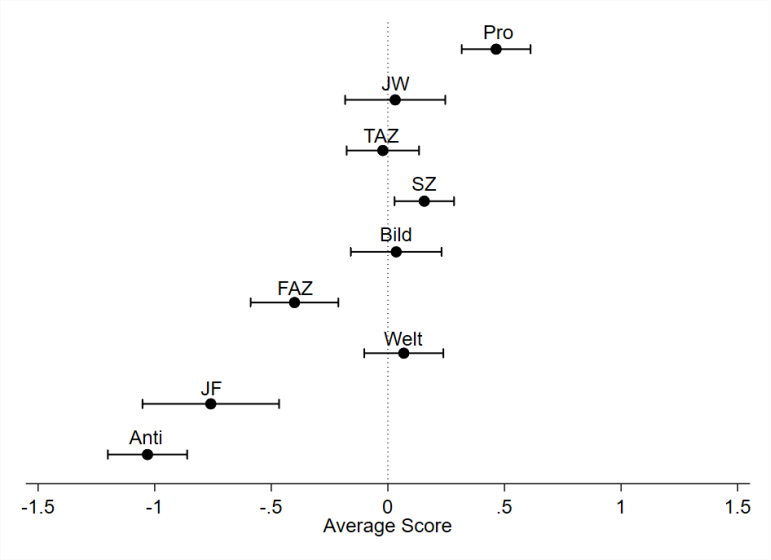

Figure 4.2. Result: Static polarization.

Notes: The Figure 4.2 shows the mean average rating and its 95% confidence interval for both news outlets and ideological campaigns. The mean average rating is derived from the subjects' responses on the Likert scale.

Next, we consider the mean average ratings for the news outlets in our sample. As Figure

4.2 shows, the right-leaning *JF* exhibits the most negative mean average rating with a value of -0.76 ($sd = 1.22$). In contrast, the left-leaning *SZ* adopts the most positive attitude to migration with a mean average rating of 0.16 ($sd = 1.19$). In both cases, the difference between news outlets and the corresponding ideological campaigns is statistically significant (t-test, p-values < 0.06). Hence, the ideological campaigns exhibit the most extreme attitudes towards migration on both ends of the spectrum. We obtain a static polarization measure of $\Delta^{score} = 0.62$. Therefore, news outlets exploit around 60 percent of the maximal possible differentiation.

Most of the other news outlets are closely located around a mean average rating of zero and hence closer to pro- than to anti-migration campaigns: *TAZ* -0.02 ($sd = 1.12$), *JW* 0.03 ($sd = 1.18$), and *Welt* 0.07 ($sd = 1.24$). Similarly, the tabloid *Bild*'s mean average rating is 0.04 ($sd = 1.39$). The only exception is the *FAZ*, which exhibits a rather negative mean average rating of -0.40 ($sd = 1.17$). Overall, we find that news outlets are roughly ranked according to their political left-right orientation (see Chapter 3.4.1 for details on the political leaning of the news outlets).

The news outlets in our sample differ substantially in their reach, see Table C.2 in the appendix. Specifically, the two politically extreme news outlets *JW* and *JF* are relatively small and consumed at most by one percent of our subjects. The *TAZ*, *SZ*, *FAZ*, *Welt*, and the tabloid *Bild* have a substantially larger reach in the market for news in Germany. Yet, these influential news outlets also differ in their reach. In order to take reach into account, we use the influence-weighted polarization measure from Equation 3.4 in Chapter 3 and obtain an influence-weighted polarization measure of $\Delta^{score}_{weight} = 0.33$. Hence, the degree of polarization is even smaller if we take news outlets' reach into account. We summarize our results.

Result 1. The mean average rating of the pro-migration campaigns is significantly higher than that of anti-migration campaigns. Most of the influential news outlets have a mean average rating

around zero. The degree of polarization based on the pictures' average score equals $\Delta^{score} = 0.62$. *When taking the reach of news outlets into account, we obtain an influence-weighted polarization measure of* $\Delta^{score}_{weight} = 0.33$.

The standard deviation of the pictures' average ratings indicates that each news outlet shows a broad variety of pictures. Figure 4.3 shows the distribution of the average rating of pictures for each news outlet and ideological campaigns. To further put this variety into perspective, we consider in the following the within-outlet range WOR of news outlets, as defined in Subsection 4.3.2. It is defined as the mean average rating of the most positive set of pictures (x_i^L) minus the mean average rating of the most negative set of pictures (x_i^R) of a given news outlet i, where the split between positive and negative pictures was made according to the threshold of that outlet (which equals the mean average rating of that outlet, x_i). We interpret the within-outlet range as a measure for the diversity of viewpoints that a news outlet offers with respect to the topic of migration. To evaluate the within-outlet range, we recall that the difference in the mean average ratings between the ideological campaigns was 1.49.

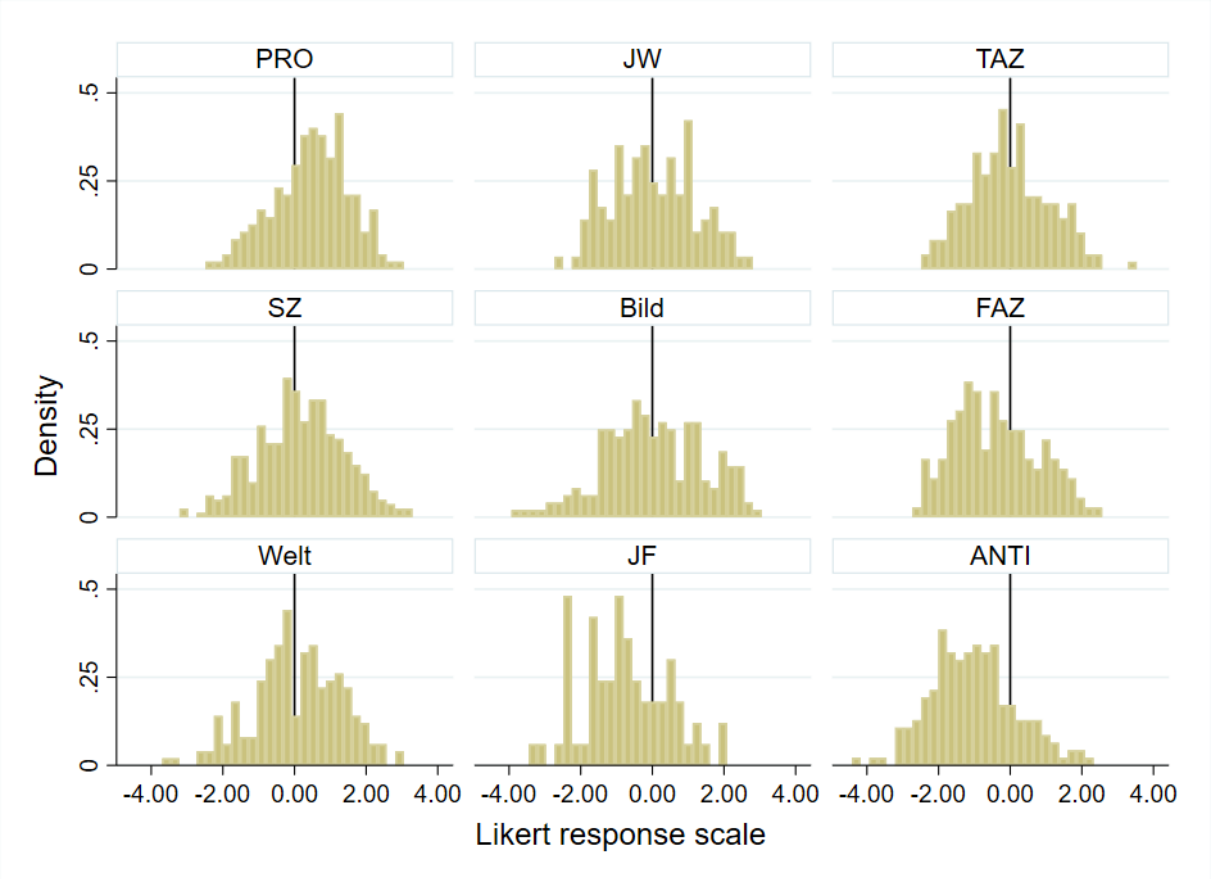

Figure 4.3. Histogram: Average rating of the pictures, by news outlets and ideological campaigns.

Notes: The black vertical line in Figure 4.3 marks the reference value of zero on the x-axis.

Column 6 in Table 4.1 shows the within-outlet range of news outlets. We find that it is substantial for all of them. For all outlets, the negative sample of pictures is on average rated as almost as negative as (or even more negative than) the pictures of the anti-migration campaigns. Except for the right-leaning *JF*, the positive set of pictures is rated more positively than the pictures of the pro-migration campaigns on average. For all news outlets, the within-outlet range is 1.80 or larger and hence exceeds the difference between pro- and anti-migration campaigns of 1.49. Overall, this finding suggests that each news outlet tends to provide diverse views on the topic of migration. We summarize this in our second main result.

Result 2. Each news outlet provides broad perspectives on the topic of migration. For each outlet, the within-outlet range exceeds the difference in attitudes to migration of the ideological campaigns.

Lastly, our data allows us to study to what extent news consumers anticipate attitudes towards migrants of news outlets and the level of polarization among these outlets. Figure 4.4 shows the estimated mean average rating of the news outlets and ideological campaigns based on subjective ratings by respondents (see Part 2, Subsection 4.4.3).

For each news outlet in Dataset 4.4.1 and campaign in Dataset 4.4.2 we asked subjects to estimate the mean average rating of pictures that the news outlet and campaign, respectively, used in their news stories and promotion materials. Let $\tilde{x}_i$ denote the mean average rating of the pictures of outlet i estimated by the subjects in the Forsa survey.

Overall, we find that subjects fairly correctly estimate the relative position of news outlets. The exception is the position of the tabloid *Bild*, which subjects estimated to have very negative attitudes towards migration. Column 7 in Table 4.1 summarizes the estimated mean average rating of news outlets and campaigns. Further, we find that subjects on average estimate a degree of polarization of 54 percent, which is very close to the actual level of polarization in the static analysis (see Result 1). We summarize our results.

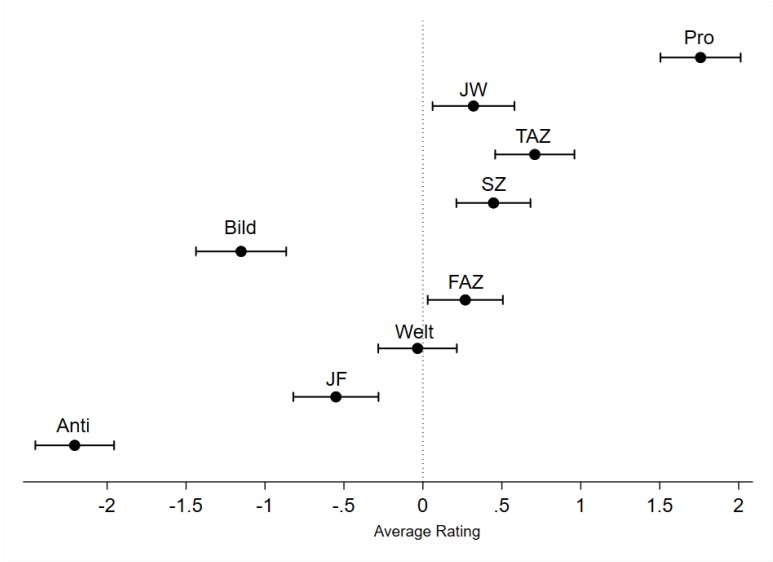

Figure 4.4. Result: Estimated Polarization.

Notes: The Figure 4.4 shows the estimated mean average rating and its 95% confidence interval for both news outlets and campaigns. The mean average rating represents the subjects' estimation on the Likert response scale.

Result 3. Consumers estimate the relative position (in terms of mean average rating) of the news outlets in our sample mostly correctly. One notable exception is the relative position of the tabloid Bild, which is estimated to be more negative. The estimated degree of polarization is 0.54 and therefore close to the actual value from Result 1.

Table 4.1 summarizes the attitudes to migration of news outlets and campaigns from our Results 1-3.

Table 4.1. Attitudes to migration of news outlets and ideological campaigns.

	Observations	x_i	x_L^i	x_R^i	WOR_i	$\tilde{x_i}$
Pro	197	0,46				2,29
JW	118	0,03	1,03	-0,93	1,95	0,98
TAZ	201	-0,02	0,92	-0,88	1,80	0,83
SZ	336	0,16	1,12	-0,79	1,91	0,62
Bild	200	0,04	1,23	-1,04	2,27	0,32
FAZ	151	-0,4	0,67	-1,30	1,96	0,24
Welt	207	0,07	1,07	-0,94	2,00	-0,65
JF	69	-0,76	0,33	-1,65	1,99	-1,80
Anti	194	-1,03				-2,86

Notes: Tables 4.1 provides a summary of the news outlets' and campaigns' attitudes towards migration. Column 3 shows the actual values of mean average rating (x_i) that we derived based on the pictures' rating. Column 4 shows the mean average rating of the positive set of pictures after the sample split (x_L^i). Analogously, Column 5 shows the mean average rating of the negative set of pictures after the sample split (x_R^i). Column 6 provides the within-outlet range of a news outlet (WOR_i). Finally, Column 7 indicates the estimated mean average rating of pictures ($\tilde{x_i}$) that subjects link to news outlets and campaigns.

4.5.2 Time Trends in Attitudes to Migration and Polarization

In the period between Q2/2015 and Q3/2016, the public opinion on migration shifted significantly in Germany. On average, people became much more critical with respect to economic migration, mostly due to fiscal and security concerns (Subsection 3.2.2 in Chapter 3 provides an extensive overview of this matter). Our data allows us to test whether news outlets followed this development in their coverage, or whether they kept their attitude towards migration stable over time. In the following, we first consider the news' outlets attitudes to migration from a dynamic perspective. Then we study polarization and within-outlet range dynamics in the market for news. In both cases, we aggregate data on the quarter-level, i.e., we consider the developments from quarter Q2/2015 to quarter Q3/2016.

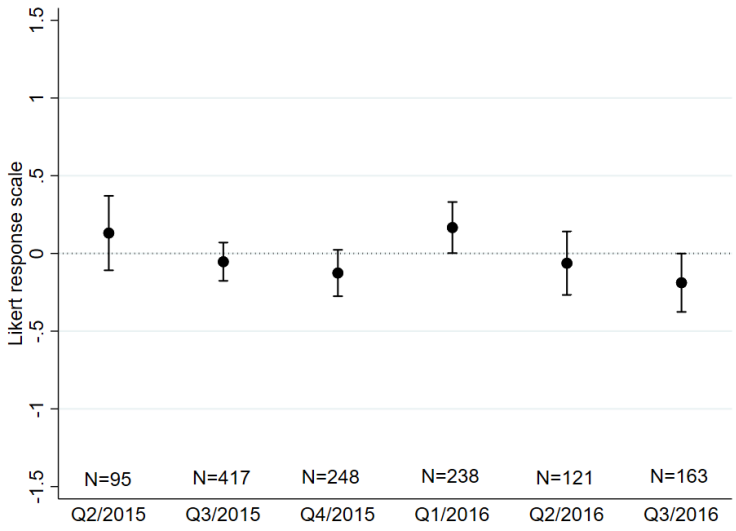

Figure 4.5. Average rating of pooled news pictures from Q2/2015 to Q3/2016.

Notes: The Figure 4.5 shows the mean average rating of news pictures and its 95% confidence interval.

Figure 4.5 shows the mean average rating of all news pictures for the six quarters of interest. As the regression in Column 1 of Table C.4 shows, we find that the quarter-dummy variable coefficients are mostly insignificant, indicating that the mean average rating of news pictures remains stable over time relative to the benchmark quarter Q2/2015. Exceptions relates to Q4/2015 and Q3/2016, where the quarter-dummy variable coefficients of -0.26 and -0.32 are significant, indicating that the average rating of news pictures in Q4/2015 and Q3/2016 are relatively smaller than in Q2/2015.

Next, we consider the dynamics of the individual news outlets. Figure 4.6 shows the mean average rating for each news outlet in our sample from Q2/2015 to Q3/2016. Table C.4 shows the results from a linear regression where, for each news outlet, the dependent variable is the mean average rating and the independent variables are quarter-dummies; the benchmark quarter is again Q2/2015. We find that most news outlets roughly maintain their attitude towards migration over time. The change from Q2/2015 to Q3/2016 is particularly small (and

sometimes even positive) for the left-leaning news outlets *SZ*, *TAZ*, and *JW*. It is somewhat larger for the conservative news outlets *FAZ* and *Welt*, but still not significant. A notable exception is the tabloid *Bild*: it significantly changed its attitude to migration from a very positive attitude in quarter Q2/2015 to a fairly negative one in quarter Q3/2016 (see Column 5 in Table C.4).

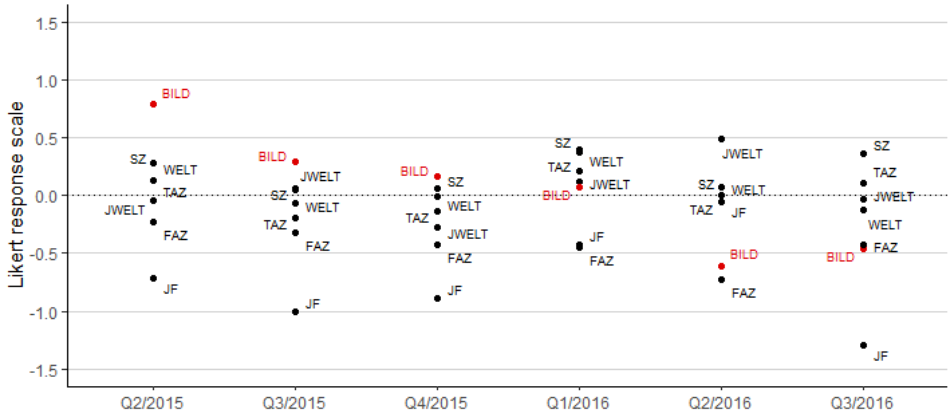

Figure 4.6. Average rating of pictures from Q2/2015 to Q3/2016, on news outlet-level.

Further, we consider polarization from a dynamic perspective. Table C.3 shows the value of our polarization measure Δ for each quarter from Q2/2015 to Q3/2016. Overall, we find that the degree of polarization is larger in a dynamic perspective. The value of Δ varies between 0.57 and 1.11; in two quarters, the difference in the mean average rating between the most positive and the most negative news outlet exceeds the difference between pro- and anti-migration campaigns. This result has to be taken with caution since in some quarters the number of news pictures on migration is rather small for some outlets (in particular, this holds for the *JF*, which drives the results on polarization). When we take the news outlets' range into account, the degree of polarization declines and remains relatively stable with values between 0.23 and 0.47. The influence-weighted polarization is smallest in the quarter in which the public sentiment towards migration in Germany was relatively positive (Q3/2015), and

highest in Q2/2016. We summarize these results as follows.

Result 4. Most news outlets roughly maintain a stable attitude towards migration from Q2/2015 to Q3/2016. A notable exception is the tabloid Bild, which moves from a fairly positive to a relatively negative attitude towards migration. Time-specific measures of polarization tend to be larger than the static polarization measure. However, the influence-weighted polarization is never larger than 47 percent of the difference between pro- and anti-migration campaigns.

In a final step, we analyze the dynamics of the news outlets' within-outlet range in our sample. In Subsection 4.5.1, we learned that all news outlets show a diverse set of pictures in their news stories on migration. The within-outlet range even exceeds the differentiation of ideological campaigns. This result could be driven by two patterns: First, news outlets maintain a large within-outlet range over time. Second, news outlets have a small within-outlet range at a given moment, but vary their attitude towards migration over time. We examine which hypothesis better explains the finding from the static analysis.

Table C.5 shows the within-outlet range of news outlets for each quarter from Q2/2015 to Q3/2016. While there is some variation in the within-outlet range over time, it is fairly large for all quarters and news outlets. It varies between 1.24 (*FAZ* in Q2/2016) and 2.80 (*JF* in Q2/2015). This finding supports the first hypothesis from above: News outlets continuously provide a large variety of perspectives on the topic of migration. We summarize this finding as follows.

Result 5. All news outlets continuously maintain a large within-outlet range from Q2/2015 to Q3/2016.

4.5.3 Potential drivers of pictures' average rating

In this subsection, we explore the determinants affecting the average rating of the pictures. At this end, we use the three main metrics proposed in Chapter 3 as natural candidates for being drivers of subjects' responses: gender composition, group size, and topics of pictures. Following the variables' motivation in Chapter 3, we formulate three hypotheses: First, pictures with a higher share of non-male migrants (i.e., the share of females and children) obtain ceteris paribus a more positive evaluation, so that we expect a strongly significant positive association between the share of non-males and the average rating of pictures. Second, pictures showing a larger group size obtain ceteris paribus a more negative evaluation; we expect a strongly significant negative association between different categories of group sizes and the average rating of pictures. Third, pictures representing negative aspects of migration (e.g., criminal acts, security issues, overloading social and economic systems) obtain ceteris paribus a more negative evaluation than those displaying migrants in a positive context (e.g., work, education).

We estimate the following OLS regression

$$AvgScore_i = \beta_0 + \beta_{Gender} ShareNonMales_i + \boldsymbol{\beta}'_{Group} \boldsymbol{Groupsize}_i + \boldsymbol{\beta}'_{Topic} \boldsymbol{Topic}_i + \epsilon_i, \quad (4.3)$$

where $AvgScore_i$ indicates the average rating of picture i. $ShareNonMales_i$ reflects the share of non-male migrants, while $\boldsymbol{Groupsize}_i$ is a vector of group size dummies containing "Portrait (1 migrant)", "Small (2-4 migrants)", "Medium (5-15 migrants)", "Big (16-25 migrants)", and "Mass (>25 migrants)". We adapt this classification of group size dummies from previous papers studying news pictures of migrants (see, e.g., Zhang and Hellmueller (2017)). $\boldsymbol{Topic}_i$ is a vector of topic dummies including "Sea/Vessel", "Route", "Asylum Homes", "Socio-economic Challenges", "Security Issues", "Integration" , "New Life", "Portraits", and "Other".

Following our hypotheses from above, the coefficients of interest are β_{Gender}, β_{Gender}, and β_{Topic}. β_{Gender} measures the change in the average picture rating associated with a one unit change in the share of non-males, ceteris paribus. $\boldsymbol{\beta}_{Group}$ measures the change in the average rating associated with a change in group size relative to the omitted benchmark category "Portrait (1 migrant)", ceteris paribus. Finally, $\boldsymbol{\beta}_{Topic}$ measures the change in the average rating associated with a change in the topic relative to the omitted benchmark category "Route", ceteris paribus. Both omitted benchmark categories ("Portrait (1 migrant)" and "Route") have average ratings roughly around zero.

Table 4.2 shows the results of the regression in Equation 4.3.

Table 4.2. Potential drivers of the average ratings of pictures

	(1)	(2)	(3)
	Average Rating	Average Rating	Average Rating
Share non-males	1.274***	1.155***	1.170***
	(0.090)	(0.099)	(0.077)
Small (2-4 migrants)		0.026	-0.101
		(0.149)	(0.087)
Medium (5-15 migrants)		-0.326*	-0.432***
		(0.159)	(0.109)
Big (16-25 migrants)		-0.440***	-0.669***
		(0.123)	(0.114)
Mass (>25 migrants)		-0.803***	-0.969***
		(0.144)	(0.172)
Sea/Vessel			0.881***
			(0.119)
Asylum Homes			-0.203
			(0.112)
Socio-economic Challanges			-0.565***
			(0.048)
Security Issues			-0.809***
			(0.085)
Integration			1.110***
			(0.169)
New Life			-0.009
			(0.127)
Portraits			-0.613***
			(0.098)
Other			-0.312**
			(0.110)
Constant	-0.551***	-0.294*	-0.158*
	(0.133)	(0.136)	(0.073)
R^2	0.159	0.204	0.375
N	1673	1673	1673

Notes: OLS Regression. Robust standard errors in parentheses. Standard errors are clustered on news outlet level. The dependent variable is the average rating of pictures, resulting from the subjects evaluation on the Likert response scale. Share non-males reflects the relative share of females and children among migrants shown on a picture. "Small (2-4 migrants)", "Medium (5-15 migrants)", "Big (16-25 migrants)", and "Mass (>25 migrants)" are dummy variables equal to 1 if the number of migrants falls into the corresponding range; "Portrait (1 migrant)" is the omitted baseline category. "Sea/Vessel", "Asylum Homes", "Socio-economic Challenges", "Security Issues", "Integration" , "New Life", "Portraits", and "Other" are dummy variables equal to 1 if the underlying picture matches to that topic; "Route" is the omitted baseline category. $^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$.

We find support for all three hypotheses, see Column 3 in Table 4.2. The coefficient β_{Gender} has a positive value of 1.17 and is highly significant, statistically supporting the association between the share of non-males and positive ratings of pictures (Hypothesis 1). For all group size categories larger than "Small (2-4)", the coefficient β_{Group} is negative and highly significant, which is mainly in line with Hypothesis 2. Interestingly, we find that the magnitude of the negative coefficient β_{Group} increases as the group size categories rise. For instance, *Mass*-pictures are evaluated on average, and relative to the benchmark category of *Portrait*-pictures, more than twice as negative as *Medium*-pictures. Lastly, we find that pictures showing negative aspects of migration (e.g., criminal acts) are statistically strongly associated with negative average rating of pictures, while the opposite holds for pictures representing positive aspects. This result supports our Hypothesis 3.

4.6 Conclusion

In this paper, we studied attitudes to migration and the corresponding degree of polarization in the market for news. To evaluate the attitude towards migration of a news outlet, we used a novel method: The rating of news pictures published by this outlet in its coverage on migration generated by human coders. This method exploits the fact that news outlets have full discretion over which pictures (if any) they want to show in their news stories.

We found that news outlets are differentiated with respect to their attitudes towards migration. This differentiation roughly reflects their political views. Importantly, the degree of polarization is significantly smaller than the maximal possible degree of differentiation as defined by the advertising material of ideological campaigns. Therefore, the coverage in news outlets is not as polarized as the views of ideological campaigns that are in favor of or against economic migration. Interestingly, all news outlets show a large variety of pictures and thus offer very different perspectives on the topic of migration.

The setting of our study allowed us to test whether the coverage in news outlets follows the public opinion on migration or remains stable over time. During the migration crisis in Germany, public opinion worsened over time in the German population due to fiscal and security concerns. We found that the news outlets' attitudes to migration mostly did not follow this trend. A notable exception is the coverage of the tabloid *Bild*, which was very supportive of migration at the beginning of the crisis in 2015 and became very critical in 2016. Therefore, it is difficult to draw a general conclusion for the demand and supply debate from our results. It seems that news outlets with high reputation for accurate reporting do not easily change their attitude towards a topic even when public views on this topic change. However, news outlets with less reputation may react more flexibly towards changes in public sentiment.

Our method is very flexible and can be applied to different contexts. For example, one could study news outlets' attitudes to a number of different topics such as economic policy, inequality, climate change, or party politics. Moreover, since our method only uses news pictures, it allows to compare the news outlets' attitude between different regions or countries, overcoming major concerns related to natural language processing. This could be a promising next step to better understand attitudes to migration across societies.

5 Conclusion

This thesis advances our understanding of the economics of credence goods. In credence goods markets, specialized or qualified experts offer goods and services that consumers wish to consume. Even after having consumed a credence good, consumers typically cannot accurately assess its quality. These informational asymmetries provide leeway for experts to behave opportunistically, which may lead to socially harmful market outcomes.

Motivated by phenomena from real-world markets for expert services, this thesis zooms in on two particular aspects.

First, in Chapter 2 the thesis carves out an efficiency-based justification for regulation policies, specifically designed for markets for expert services. The key purpose of price regulation in this context is to ensure a sufficient level of income for experts, thereby stimulating their preferences' moral part making them provide higher service qualities. Yet, if market entry is endogenous, price regulation incentivizes new experts to enter the market, which counteracts the intended purpose. Hence, capping the entry of experts restores the effectiveness of price regulation. Our theory presents a novel economic intuition on why a joint regulation of prices and entry, which exists in many real-world credence goods markets, can be indeed a useful policy. Our analysis also opens a set of interesting further research questions. Theoretically, it would be interesting to illuminate how the composition of experts changes in response to a change in the experts' income level if experts have heterogeneous social preferences. Which types of experts select to enter the market if incomes increase and which types might quit?

Empirically, it would be interesting to investigate the link between the income of experts and service quality and to explore differences across distinct credence goods occupations and countries. Takeaways from these analyses would inform policymakers on (re-)designing the markets for expert services.

Second, the thesis proposes and applies in Chapters 3 and 4 a novel conceptual framework to measure attitudes towards migration and polarization in the market for news. In evaluating media polarization, a general obstacle relates to finding an adequate approach to objectivize the observed differences among news outlets. In the concrete context of the 2015-16 migration crisis, we exploit the coverage of ideological organizations (pro- and anti-migration campaigns) as a baseline to define the possible spectrum of attitudes to migration. Based on three unique, large-scale datasets, the news outlets' attitudes to migration and the degree of polarization are measured both statically and over time. Chapters 3 and 4 offer consistent insights. News outlets exploit approximately between 50 to 60 percent of the differentiation used by ideological campaigns. Polarization drops to approximately 30 percent if taking the reach of news outlets into account. Additionally, we find that each news outlet shows diverse aspects of migration. Apart from the tabloid *Bild*, news outlets largely maintain their relative attitudes to migration over time, despite a notable shift in the public sentiment on migration over 2015-16. Given the flexibility of our approach, it offers several extensions and directions for future work. First, the used methodology can be adapted to different issues and settings. For instance, one could study news outlets' attitudes to a number of other significant issues such as global pandemic, economic policy, inequality, climate change, or party politics. Second, it can be applied to explore the attitudes of news outlets towards migration and polarization across countries, especially political regimes. Using news pictures may overcome major methodological concerns associated to natural language processing that might arise when comparing textual contents in different languages. Another avenue of research is the development of measures that unifies

both pictorial and textual content of news. Here, it would be interesting to analyze whether pictures and texts in a news story are aligned in the sense that they convey similar messages. Finally, our approach could be applied to study polarization across different media outlets, such as TV news or social media.

A Appendix to Chapter 2

A.1 Omitted Proofs

This section collects all proofs omitted from the main text.

A.1.1 Discussion of Assumption (2.6)

To gain insights about the properties of W, v, and c, under which assumption (2.6) holds, we rewrite the expert's quality choice as a direct choice of consumer utility. In particular, using

$$u_b = v(a_b) - p_b \ ,$$

we can write expert utility as (in the bilateral setting of Section 2.4)

$$\overline{u}_e = W(p_b - \tilde{c}(u_b + p_b)) + u_b \ .$$

Here, $\tilde{c}(x) \equiv c(v^{-1}(x))$ measures the cost of providing utility-from-treatment (i.e., utility gross of the price) of x to the consumer.

Given a price offer p_b, expert e now chooses u_b to maximize her utility $\overline{u}_e$. The derivative of $\overline{u}_e$ with respect to u_b is

$$-W'(p_b - \tilde{c}(u_b + p_b))\tilde{c}'(u_b + p_b) + 1 \ .$$

By assumption (2.4), this derivative is weakly negative at $p_b = \tilde{c}(v(0))$ and $u_b = v(0) - \tilde{c}(v(0))$. For concreteness, suppose now that this assumption indeed holds exactly, that is,

$$W'(0)\tilde{c}'(v(0)) = 1 \ .$$

Then, since the second derivative of $\overline{u}_e$ with respect to u_b is strictly negative everywhere, the effect of raising p_b on the optimal choice u_b is qualitatively given by the sign of

$$\frac{\partial^2 \overline{u}_e}{\partial u_b \partial p_b} = -W''(p_b - \tilde{c}(u_b + p_b))(1 - \tilde{c}(u_b + p_b))\tilde{c}'(u_b + p_b) - W'(p_b - \tilde{c}(u_b + p_b))\tilde{c}''(u_b + p_b) \ .$$

At the competitive equilibrium values $p_b = \tilde{c}(v(0))$ and $u_b = v(0) - \tilde{c}(v(0))$, the cross-derivative is positive if and only if

$$-\frac{W''(0)}{W'(0)}(1 - \tilde{c}'(v(0))) > \frac{\tilde{c}''(v(0))}{\tilde{c}(v(0))} \ .$$

If and only if this is satisfied, assumption (2.6) holds and the collectively optimal price offer of consumers exceeds the competitive price $\tilde{c}(v(0))$. Hence, for this to be true, the cost function $\tilde{c}$ must have sufficiently small curvature at $v(0)$. Put differently, the marginal cost of providing additional utility-from-treatment to consumers must not increase too quickly around the competitive equilibrium.

A.1.2 Proof of Lemma 1

Let

$$A(p_b, y_e, a_b) \coloneqq W'(y_e)\left[p_b - c(a_b)\right] + v(a_b) - p_b$$

denote the marginal utility for expert e of adding consumer b to her set of clients B_e if she provides quality a_b to b.

Expert e's actual quality choice for consumer b follows from conditions (2.7) as a function of the expert's income y_e. Denote this quality by $a_b^{IC}(y_e)$. Then, the expert's actual marginal utility from serving consumer b, taking into account her quality choice $a_b^{IC}(y_e)$, becomes

$$A^{IC}(p_b, y_e) \coloneqq A(p_b, y_e, a_b^{IC}(y_e)) .$$

Expert e will accept an offer p_b if and only if $A^{IC}(p_b, y_e) \geq 0$. Hence, the equality $A^{IC} = 0$ defines the acceptance threshold described by Lemma 1.

Before deriving the claimed properties of the threshold, note that

$$A^{IC}(p_b, y_e) = \max_{a \geq 0} A(p_b, y_e, a) \tag{A.1}$$

by definition of $a_b^{IC}(y_e)$. In words, the expert chooses the service quality for b such as to maximize her utility from serving b.

Case 1: $y_e \leq 0$**.** By assumption (2.4), we have $a_b^{IC}(y_e) = 0$ for all $y_e \leq 0$. Hence, $A^{IC}(c(0), y_e) = 0$ for all $y_e \leq 0$. That is, if the expert has negative income, she just accepts an offer at $c(0)$. Since A^{IC} is strictly increasing in p_b, we have that for all $y_e \leq 0$, $A^{IC}(p_b, y_e) \geq 0$ if and only if $p_b \geq c(0)$. This proves the first piece of the acceptance threshold in Lemma 1.

Case 2: $y_e > 0$**.** As in Lemma 1, denote the acceptance threshold for $y_e > 0$ by $\tilde{p}(y_e)$, that is, $A^{IC}(\tilde{p}(y_e), y_e) = 0$.

First note that $A(c(0), y_e, 0) = 0$ for all y_e. Hence, $A^{IC}(c(0), y_e) \geq 0$ for all y_e. Therefore, the acceptance threshold satisfies $\tilde{p}(y_e) \leq c(0)$ for all y_e.

It remains to show that $\tilde{p}(y_e)$ is decreasing in y_e. For that, consider $y_e^{(2)} > y_e^{(1)} > 0$. From the definition of A we see that A is increasing in y_e if $p_b \leq c(0)$. Since $\tilde{p}(y_e^{(1)}) \leq c(0)$, we

obtain the following inequalities:

$$\begin{aligned} A^{IC}\left(\tilde{p}\left(y_e^{(2)}\right), y_e^{(2)}\right) &= 0 \\ &= A\left(\tilde{p}\left(y_e^{(1)}\right), y_e^{(1)}, a_b^{IC}\left(y_e^{(1)}\right)\right) \\ &\leq A\left(\tilde{p}\left(y_e^{(1)}\right), y_e^{(2)}, a_b^{IC}\left(y_e^{(1)}\right)\right) \\ &\overset{\text{by (A.1)}}{\leq} A\left(\tilde{p}\left(y_e^{(1)}\right), y_e^{(2)}, a_b^{IC}\left(y_e^{(2)}\right)\right) \\ &= A^{IC}\left(\tilde{p}\left(y_e^{(1)}\right), y_e^{(2)}\right) \ . \end{aligned}$$

Using that A^{IC} is always increasing in p_b, the inequality between the first and the last expression implies $\tilde{p}(y_e^{(2)}) \leq \tilde{p}(y_e^{(1)})$.

A.1.3 Proof of Proposition 1

We prove Proposition 1 via the following lemma.

Lemma 4. *Consider the game described by stages 1 and 2. In any subgame perfect equilibrium all offers are symmetric, $p_b = p_{b'}$ for all $b, b' \in B$, all offers are accepted, and all quality levels are symmetric, $a_b = a_{b'}$ for all $b, b' \in B$.*

Proof. **Step 1.** The thresholds in Lemma 1 imply that an offer $p_b = c(0)$ is always accepted. Since $v(0) - c(0) \geq \underline{v}$ and agents always opt against their outside option in case of indifference, consumers always prefer to make the offer $c(0)$ over any offer that is not accepted. Hence, offers that are not accepted are strictly dominated and cannot be part of a subgame perfect equilibrium.

Step 2. Consider now all consumers $b \in B_e$ for a given expert e. By the Kuhn-Tucker conditions (2.7), these consumers all receive the same quality level. Moreover, they face the same acceptance threshold. Since all consumers take expert e's income as given, they

anticipate the quality they receive to be independent of their offers. Hence, they offer exactly the acceptance threshold, which is the same across all consumers.

Step 3. By Step 2, any expert e receives the same offers from all consumers matched to her. Suppose now that these offers are strictly higher for some expert e than for another expert e'. Denote the offer level for e by p and for e' by p'. By Step 1, all offers are accepted. So, experts' revenue equals their offer level,

$$\int_{B_e} p_b \, db = p > \int_{B_{e'}} p_b \, db = p' \, .$$

Using this in the Kuhn-Tucker conditions (2.7), it is easy to show that expert e will also have greater income than expert e', $y_e \geq y_{e'}$. But then, by Lemma 1, the acceptance threshold of expert e is smaller than that of expert e'. Hence, consumers matched to e offer lower payments than consumers matched to e'. This contradicts the initial assumption of $p > p'$.

We have therefore established that all consumers offer the same payments and all offers are accepted in any subgame perfect equilibrium. The Kuhn-Tucker conditions (2.7) then immediately imply that quality levels are the same for all consumers in any subgame perfect equilibrium as well. □

Proposition 1 is now proven as follows. By Lemma 4, there is a common offer level $p = p_b$ for all $b \in B$. By Lemma 1, offers $p_b = c(0)$ are always accepted. Moreover, consumers always offer payments exactly equal to the expert's acceptance threshold. So, the common offer level p can be at most $c(0)$.

Suppose that $p < c(0)$. Then, any expert e has negative income, $y_e \leq 0$. But for $y_e \leq 0$, Lemma 1 says that offers below $c(0)$ are rejected. Hence, we must have $p = c(0)$ in any subgame perfect equilibrium. The Kuhn-Tucker conditions (2.7) then imply $a_b = 0$ for all $b \in B$ in any subgame perfect equilibrium.

A.1.4 Proof of Proposition 3

The only part of the proposition that remains to be shown is that an allocation is fully efficient if and only if $a_b = a^{**}$ for almost all $b \in B$.

(⇒) We first prove the "only if" part of the claim. To show that no allocation other than those described above is fully efficient, take an arbitrary allocation q, $\{p_b^q\}_{b\in B}$, $\{B_e\}_{e\in E}$, $\{a_b^q\}_{b\in B}$, with $a_b^q \neq a^{**}$ for some non-zero measure of consumers. Construct a new allocation r with $a_b^r = a^{**}$ for all $b \in B$, $B_e^r = B_e^q$ for all $e \in E$, and

$$p_b^r = p_b^q + v(a_b^r) - v(a_b^q) \ .$$

Comparing r to q, the utility of consumers is unchanged by construction of r. For an expert e the utility change is $W(y_e^r) - W(y_e^q)$. Its sign depends on the difference in incomes $y_e^r - y_e^q$. Using the construction of payments p_b^r in allocation r, this income difference becomes

$$y_e^r - y_e^q = \int_{B_e^q} \left[v(a_b^r) - c(a_b^r) - v(a_b^q) + c(a_b^q)\right] \, db \ .$$

Since a^{**} uniquely maximizes $v(a) - c(a)$, the income difference is positive, $y_e^r - y_e^q > 0$. Hence, experts strictly prefer allocation r to q. Since consumers are indifferent between the two, allocation r Pareto-dominates q. Allocation q can therefore not be fully efficient.

(⇐) To see that any allocation with $a_b = a^{**}$ for almost all b is fully efficient, suppose such an allocation (call it s) is Pareto-dominated by some other allocation (call it t). If t has $a_b \neq a^{**}$ for a non-zero measure of consumers, part (⇒) above implies that there exists an allocation t' with $a_b^{t'} = a^{**}$ almost everywhere that Pareto-dominates t. By transitivity, t' will then also Pareto-dominate s. Hence, we can focus on allocations t that feature $a_b^t = a^{**}$ for almost all b.

Allocations s and t then only differ in the distribution of payments over experts and consumers. Since this distribution is zero-sum, none of the allocations can Pareto-dominate

the other. We have thereby established that any allocation with $a_b = a^{**}$ almost everywhere is fully efficient.

A.1.5 Proof of Lemma 2

Given a non-empty set of active experts E, the subgame described by stages 2' and 3' is very similar to the game with exogenous entry described by stages 1 and 2 in Section 2.5. The main difference is that expert e's marginal cost of serving an additional consumer b is $c(a_b)+k'(|B_e|)$ instead of $c(a_b)$ only. The proof of the acceptance threshold in Lemma 2 therefore proceeds in close analogy to the proof of the acceptance threshold from the exogenous entry setting in Lemma 1.

Let

$$\hat{A}(p_b, B_e, \hat{y}_e, a_b) \coloneqq W'(\hat{y}_e)\left[p_b - c(a_b) - k'(|B_e|)\right] + v(a_b) - p_b - v(0) + k'(|B_e|)$$

denote expert e's marginal utility from adding consumer b to her set of clients B_e if she provides quality a_b to the consumer.

Expert e's actual quality choice follows from the Kuhn-Tucker conditions (2.7) as a function of $\hat{y}_e$. Denote this quality by $\hat{a}_b^{IC}(\hat{y}_e)$. Then, the expert's actual marginal utility from accepting the offer p_b, taking into account her quality choice $\hat{a}_b^{IC}(\hat{y}_e)$, becomes

$$\hat{A}^{IC}(p_b, B_e, \hat{y}_e) \coloneqq \hat{A}(p_b, B_e, \hat{y}_e, \hat{a}_b^{IC}(\hat{y}_e))\,.$$

Expert e will accept p_b if and only if $\hat{A}^{IC}(p_b, B_e, \hat{y}_e) \geq 0$. The equality $\hat{A}^{IC} = 0$ therefore defines the acceptance threshold from Lemma 2.

Note at this point that

$$\hat{A}^{IC}(p_b, B_e, \hat{y}_e) = \max_{a \geq 0} A(p_b, B_e, \hat{y}_e, a) \tag{A.2}$$

by definition of $\hat{a}_b^{IC}(\hat{y}_e)$.

Case 1: $\hat{y}_e \leq 0$**.** Assumption (2.4) implies $\hat{a}_b^{IC}(\hat{y}_e) = 0$ for all $\hat{y}_e \leq 0$. So, $\hat{A}^{IC}(k'(|B_e|), \hat{y}_e) = 0$ for all $\hat{y}_e \leq 0$. That is, at negative income the expert just accepts an offer at marginal cost $k'(|B_e|)$. Since $\hat{A}^{IC}$ is strictly increasing in p_b, it holds for all $\hat{y}_e \leq 0$ that $\hat{A}^{IC}(p_b, B_e, \hat{y}_e) \geq 0$ if and only if $p_b \geq k'(|B_e|)$. We have thus proven the first piece of the acceptance threshold in Lemma 2.

Case 2: $\hat{y}_e > 0$**.** Denote the acceptance threshold for $\hat{y}_e > 0$ by $\hat{p}(\hat{y}_e, B_e)$, that is, $\hat{A}^{IC}(\hat{p}(\hat{y}_e, B_e), B_e, \hat{y}_e) = 0$.

Note that $\hat{A}(k'(|B_e|), B_e, \hat{y}_e, 0) = 0$ for all $\hat{y}_e$ and B_e. Thus, $\hat{A}^{IC}(k'(|B_e|), B_e, \hat{y}_e) \geq 0$ for all $\hat{y}_e$ and B_e. Hence, we have $\hat{p}(\hat{y}_e, B_e) \leq k'(|B_e|)$ for all $\hat{y}_e$ and B_e.

It remains to prove that $\hat{p}(\hat{y}_e, B_e)$ is decreasing in $\hat{y}_e$. Take any B_e and any two income levels $\hat{y}_e^{(2)} > \hat{y}_e^{(1)} > 0$. From the definition of $\hat{A}$, it is clear that $\hat{A}$ increases in $\hat{y}_e$ if $p_b \leq k'(|B_e|)$. Since $\hat{p}(\hat{y}_e^{(1)}, B_e) \leq k'(|B_e|)$, the following applies:

$$\begin{aligned}
\hat{A}^{IC}\left(\hat{p}\left(\hat{y}_e^{(2)}, B_e\right), B_e, \hat{y}_e^{(2)}\right) &= 0 \\
&= A\left(\hat{p}\left(\hat{y}_e^{(1)}, B_e\right), B_e, y_e^{(1)}, \hat{a}_b^{IC}\left(\hat{y}_e^{(1)}\right)\right) \\
&\leq \hat{A}\left(\hat{p}\left(\hat{y}_e^{(1)}, B_e\right), B_e, \hat{y}_e^{(2)}, \hat{a}_b^{IC}\left(\hat{y}_e^{(1)}\right)\right) \\
&\overset{\text{by (A.2)}}{\leq} \hat{A}\left(\hat{p}\left(\hat{y}_e^{(1)}, B_e\right), B_e, \hat{y}_e^{(2)}, \hat{a}_b^{IC}\left(\hat{y}_e^{(2)}\right)\right) \\
&= \hat{A}^{IC}\left(\hat{p}\left(\hat{y}_e^{(1)}, B_e\right), B_e, \hat{y}_e^{(2)}\right) .
\end{aligned}$$

Since $\hat{A}^{IC}$ always increases in p_b, the inequality between the first and the last expression

implies $\hat{p}(\hat{y}_e^{(2)}, B_e) \leq \hat{p}(\hat{y}_e^{(1)}, B_e)$.

A.1.6 Proof of Lemma 3

To prepare the proofs of Lemma 3 and Proposition 4, we prove the following lemma.

Lemma 5. *Take any non-empty set of active experts E and consider the subgame after E described by stages 2' and 3'. In any subgame perfect equilibrium of this subgame all offers are symmetric, $p_b = p_{b'}$ for all $b, b' \in B$, all offers are accepted, and all quality levels are symmetric, $a_b = a_{b'}$ for all $b, b' \in B$.*

Proof. Take a non-empty set of active experts E and consider the subgame after E described by stages 2' and 3'. This subgame is almost equivalent to the game with exogenous entry described by stages 1 and 2 in Section 2.5. Hence, the proof of Lemma 5 closely follows the proof of Lemma 4.

Step 1. The maximum size of B_e for any expert e is M. Hence, Lemma 2 implies that experts always accept an offer $p_b \geq k'(M)$. Since $v(0) - k'(M) \geq \underline{v}$ and agents always decide against their outside option in case of indifference, any consumer b prefers the offer $p_b = k'(M)$ over any offer that is not accepted. So, consumers only make offers that are accepted in equilibrium.

Step 2. This step is identical to step 2 in the proof of Lemma 4. We repeat it here for convenience. Consider all consumers $b \in B_e$ for a given expert e. By the Kuhn-Tucker conditions (2.7) (using $\hat{y}_e$ instead of y_e in the conditions), these consumers all receive the same quality level. Moreover, they face the same acceptance threshold. Since all consumers take expert e's income as given, they anticipate the quality they receive to be independent of their offers. Hence, they offer exactly the acceptance threshold, which is the same across all consumers.

Step 3. By Step 2, any expert e receives the same offers from all consumers matched to her. To derive a contradiction, suppose that these offers are strictly higher for some expert e than

for another expert e'. Denote the offer level for e by p and for e' by p'. By Step 1, all offers are accepted. So, the revenues of e and e' are given by

$$\int_{B_e} p_b \, db = \frac{M}{N} p > \frac{M}{N} p' = \int_{B_{e'}} p_b \, db \, .$$

Using this together with the fact that $|B_e| = |B_{e'}|$, the Kuhn-Tucker conditions (2.7) imply that expert e will have a greater income than e', $\hat{y}_e \geq \hat{y}_{e'}$. Then, again because $|B_e| = |B_{e'}|$, Lemma 2 implies that the acceptance threshold of expert e is smaller than that of e'. So, consumers matched to e make smaller offers than those matched to e', contradicting the initial assumption $p > p'$.

We have therefore established that all consumers offer the same payments and all offers are accepted in any subgame perfect equilibrium. The Kuhn-Tucker conditions (2.7) then immediately imply that quality levels are the same for all consumers in any subgame perfect equilibrium as well. □

We prove now each of the three cases of Lemma 3. Since by Lemma 5 all offers are accepted, we can set $|B_e| = M/N$ for all active experts $e \in E$ throughout the proof.

1. We first show that $\hat{y}_e > 0$ for all $e \in E$. To derive a contradiction, suppose that $\hat{y}_e \leq 0$ for some $e \in E$. Using Lemma 2, this implies that all consumers $b \in B_e$ offer $p_b = k'(M/N)$. Moreover, the Kuhn-Tucker conditions (2.7) imply that $a_b = 0$ for all $b \in B_e$. But then we obtain for expert e's income:

$$\hat{y}_e = \frac{M}{N} k' \left(\frac{M}{N} \right) - k \left(\frac{M}{N} \right) - F > 0 \, ,$$

a contradiction.

So, $\hat{y}_e > 0$ for all $e \in E$. From Lemma 2 we then obtain $p_b \leq k'(M/N)$ for all $b \in B$.

For experts' utility, note that $a_b \geq 0$ and $p_b \leq k'(M/N)$ for all b imply

$$v(a_b) - p_b - v(0) + k'\left(\frac{M}{N}\right) > 0 \ .$$

Hence, using $\hat{y}_e > 0$,

$$W(\hat{y}_E) + \int_{B_e} \left[v(a_b) - p_b - v(0) + k'\left(\frac{M}{N}\right) \right] db > W(0)$$

for all $e \in E$.

2. We show that $\hat{y}_e = 0$ for all $e \in E$. To derive a contradiction, suppose first that $\hat{y}_e > 0$ for some $e \in E$. But then $p_b \leq k'(M/N)$ for all $b \in B_e$ by Lemma 2. Together with $a_b \geq 0$ for all b, this implies

$$\hat{y}_e \leq \frac{M}{N} k'\left(\frac{M}{N}\right) - k\left(\frac{M}{N}\right) - F = 0 \ ,$$

a contradiction. Suppose now that $\hat{y}_e < 0$ for some $e \in E$. Then, $p_b = k'(M/N)$ for all $b \in B$ by Lemma 2. Moreover, expert e's quality choice yields $a_b = 0$ for all $b \in B_e$ by conditions (2.7). Hence we obtain for expert e's income:

$$\hat{y}_e = \frac{M}{N} k'\left(\frac{M}{N}\right) - k\left(\frac{M}{N}\right) - F = 0 \ ,$$

a contradiction.

So, $\hat{y}_e = 0$ for all $e \in E$. Using Lemma 2, we obtain $p_b = k'(M/N)$ for all $b \in B$.

Moreover, $\hat{y}_e = 0$ for all $e \in E$ implies $a_b = 0$ for all $b \in B$. So,

$$v(a_b) - p_b - v(0) + k'(M/N) = 0$$

for all $b \in B$. Experts' utility thus becomes

$$W(0) + \int_{B_e} \left[v(0) - k'\left(\frac{M}{N}\right) - v(0) + k'\left(\frac{M}{N}\right) \right] db = W(0)$$

for all $e \in E$.

3. We first show that $\hat{y}_e < 0$ for all $e \in E$. To derive a contradiction, suppose $\hat{y}_e \geq 0$ for some $e \in E$. Then, $p_b \leq k'(M/N)$ for all $b \in B_e$ by Lemma 2. Using $a_b \geq 0$ for all b, we obtain

$$\hat{y}_e \leq \frac{M}{N} k'\left(\frac{M}{N}\right) - k\left(\frac{M}{N}\right) - F < 0 \,,$$

a contradiction.

So, $\hat{y}_e < 0$ for all $e \in E$. With Lemma 2 we then obtain $p_b = k'(M/N)$ for all $b \in B$.

Moreover, $\hat{y}_e < 0$ for all e implies $a_b = 0$ for all b. Experts' utility hence satisfies

$$W(\hat{y}_e) + \int_{B_e} \left[v(0) - k'\left(\frac{M}{N}\right) - v(0) + k'\left(\frac{M}{N}\right) \right] db < W(0)$$

for all $e \in E$.

A.1.7 Proof of Proposition 4

Since all offers are accepted by Lemma 5, we can again set $|B_e| = M/N$ throughout the proof.

From conditions (2.11) and (2.12), we have $M/N \to m$ as $M \to \infty$. Moreover,

$$\frac{M}{N} k'\left(\frac{M}{N}\right) - k\left(\frac{M}{N}\right) - F \to 0 \,.$$

We first show that $\hat{y}_e \to 0$ for all $e \in E$ as $M \to \infty$. For that, take any unbounded sequence of consumer masses M. To derive a contradiction, suppose first that there exists

a subsequence such that $\hat{y}_e$ is positive and bounded away from zero along this subsequence. Since $p_b \leq k'(M/N)$ for all $b \in B$ by Lemma 2 and because $a_b \geq 0$ for all b, we have

$$\hat{y}_e \leq \frac{M}{N} k' \left(\frac{M}{N} \right) - k \left(\frac{M}{N} \right) - F \ .$$

But the right-hand-side of the inequality converges to zero along the subsequence. Hence, $\hat{y}_e$ cannot be positive and bounded away from zero.

Suppose now that there is a subsequence of consumer masses along which $\hat{y}_e$ remains negative and bounded away from zero for some $e \in E$. Then by Lemma 2, $p_b = k'(M/N)$ along the subsequence. Moreover, $a_b = 0$ for all $b \in B_e$ along the subsequence by conditions (2.7). Thus,

$$\hat{y}_e = \frac{M}{N} k' \left(\frac{M}{N} \right) - k \left(\frac{M}{N} \right) - F \to 0 \ ,$$

a contradiction.

We have therefore established that $\hat{y}_e \to 0$ for all $e \in E$ as $M \to \infty$. From conditions (2.7), we then immediately obtain $a_b \to 0$ for all $b \in B$.

Finally by Lemma 5, there is a common payment level p and a common quality level a for all consumers. Income of expert e thus becomes

$$\hat{y}_e = \frac{M}{N} p - \frac{M}{N} c(a) - k \left(\frac{M}{N} \right) - F \ ,$$

and hence

$$p = \frac{N}{M} \hat{y}_e + c(a) + \frac{N}{M} k \left(\frac{M}{N} \right) + \frac{N}{M} F \ .$$

Since $M/N \to m$, $a \to 0$, and $\hat{y}_e \to 0$, we can use the definition of m to show that the right-hand-side of the equation goes to $k'(m)$ as $M \to \infty$. Therefore, $p_b \to k'(m)$ for all $b \in B$.

A.1.8 Proof of Proposition 5

Part 1. Consider first the regulation $(\hat{p}^*, \hat{N})$. In the main text we have already shown that the proposed regulation Pareto-dominates the unregulated (or, competitive) outcome for sufficiently large M if the actual number of active experts $\tilde{N}$ equals the cap $\hat{N}$. To see that we will indeed have $\tilde{N} = \hat{N}$, consider the competitive outcome at a given M. From Proposition 4, it is easy to see that experts' utility in the competitive outcome approaches $W(0)$ as $M \to \infty$. Again from Proposition 4, we know that $p_b \to k'(m)$ for all b as $M \to \infty$. Hence, for sufficiently large M the regulated price $\hat{p}^*$ strictly exceeds the competitive price. Holding the number of active exerts constant at $\hat{N}$, an increase in the level of payments strictly increases experts' utility. So for large M and holding the number of experts at $\hat{N}$, experts' utility from the regulated price $\hat{p}^*$ strictly exceeds $W(0)$. But that means that all $\hat{N}$ experts indeed choose to enter the market under the regulation $(\hat{p}^*, \hat{N})$ for sufficiently large M. Hence, the cap of $\hat{N}$ is binding, $\tilde{N} = \hat{N}$.

Part 2. Consider next the pure price regulation $(\hat{p}^*, \infty)$. Denote the number of active experts under this regulation by $\tilde{N}$ and compare it to the regulated number of experts $\hat{N}$ from Part 1. By Part 1, experts' utility under the joint regulation $(\hat{p}^*, \hat{N})$ converges to a level strictly above $W(0)$. Moreover as $M \to \infty$, the impact of an additional entrant on experts' utility approaches zero. Hence, without entry regulation the expert $\hat{N} + 1$ finds it beneficial to enter the market. So, $\tilde{N} > \hat{N}$. Since experts' utility declines in the number of active experts for given prices, experts' utility is strictly smaller under the pure price regulation than under the joint regulation of Part 1.

Moreover, suppose that experts' income $\hat{y}_e$ is greater under the pure price regulation than under the joint regulation. This would imply that service quality is higher under the pure price regulation as well. But with a higher service quality and a larger number of active experts, income must be strictly smaller under the pure price regulation than under joint regulation.

Hence, experts' income is indeed strictly smaller under the pure price than under the joint regulation.

Finally, under the joint regulation we have $a_b > 0$ for all consumers. So experts' quality choice problem has an interior solution. In the neighborhood of such an interior solution, quality strictly decreases in income. So, service quality must be strictly smaller under the pure price regulation than under the joint regulation. Since the payments p_b are the same in both cases, we obtain that consumers' utility is strictly smaller under the pure price regulation than under the joint regulation. This establishes that the joint regulation Pareto-dominates the pure price regulation.

A.2 Price Competition

In this section we present an alternative trading mechanism where experts instead of consumers make price offers. The environment is the same as in the main text, that is, the one introduced in Section 2.3. The mechanism works as follows.

Stage 1" Each expert $e \in E$ makes price offers $\{p_{e,b}\}_{b \in B}$ to all consumers.

Stage 2" Each consumer $b \in B$ observes his offers $\{p_{e,b}\}_{e \in E}$ but not the offers received by other consumers. Consumer b then accepts or rejects each of his offers. Each consumer can accept at most one offer.

Stage 3" For each expert e, let $B_e \subset B$ denote the set of consumers who accepted e's offers. Expert e observes consumers' acceptance decisions and chooses the service quality a_b for each consumer $b \in B_e$.[1]

For each consumer $b \in \cup_{e \in E} B_e$, set p_b equal to the offer consumer b accepted, that is, $p_b = p_{e,b}$ for e such that $b \in B_e$. Then, each expert receives utility 2.2. Each consumer $b \in \cup_{e \in E} B_e$ receives utility 2.1, and all other consumers receive the outside option $\underline{v}$.

Note that in contrast to the consumer-proposing mechanism from the main text, consumers receive offers from all experts instead of being matched to only one expert each. Our results are robust to adding a matching stage where consumers are matched to only a few, but at least two, experts whom they receive offers from. The minimum number of two experts per consumer is necessary to initiate price competition.

The second noteworthy assumption is that consumers do not observe the offers received by other consumers. This seems appropriate in the context of service provision, where sellers

[1] Whether experts observe only the acceptance decisions on their own offers or on all experts' offers does not matter for our results. For concreteness we assume here that experts observe all acceptance decisions of all consumers.

interact directly, and often privately, with each buyer to deliver the service. The assumption is not relevant for our first result on the existence of an equilibrium that replicates the outcome of the consumer-proposing mechanism from the main text. The structure of other equilibria however may change when making a different informational assumption.

A.2.1 Competitive Outcome

Stages 1" to 3" describe a sequential game of (complete, but) imperfect information. We study its perfect Bayesian equilibria (PBE) in the following. We start by constructing a PBE that replicates the competitive outcome of the consumer-proposing mechanism from Proposition 1.

Proposition 6. *Consider the game described by stages 1" to 3". There exists a PBE in which all consumers accept offers at marginal cost, $p_b = c(0)$ for all $b \in B$, and receive a service of zero quality, $a_b = 0$ for all $b \in B$.*

Proof. We construct a PBE with the desired properties. The PBE consists of the following elements.

- Expert strategies (for all $e \in E$): for any set B_e, expert e's quality choices on stage 3" are determined by the Kuhn-Tucker conditions (2.7). Moreover, expert e's price offers on stage 1 are $p_{e,b} = c(0)$ for all $b \in B$.

- Consumer strategies (for all $b \in B$): for any set of offers $\{p_{e,b}\}_{e \in E}$, consumer b accepts the smallest offer if

$$\min_{e \in E} p_{e,b} \leq v(0) - \underline{v} \,. \tag{A.3}$$

  Otherwise, b rejects all offers. If there are multiple smallest offers satisfying equation (A.3), b chooses one of them randomly (the exact distribution of the randomization does not matter).

- Expert beliefs: experts' beliefs about the history at any of their information sets is consistent with their observations. Since they observe all events, this uniquely identifies experts' beliefs.

- Consumer beliefs: at any of his information sets, any consumer $b \in B$ believes that all experts $e \in E$ offered $p_{e,b'} = c(0)$ to all other consumers $b' \in B \setminus \{b\}$.

Note first that the proposed beliefs are consistent with equilibrium strategies.

Second, strategies strategies are sequentially rational. To see this, start with experts' quality choices given B_e. Since experts' problem of choosing quality levels to maximize utility is (strictly differentially) concave, the Kuhn-Tucker conditions (2.7) identify the unique solution to this problem. Moreover, given that consumers always accept the lowest price if it does not exceed the threshold $v(0) - \underline{v}$ and given that all other experts make offers at $c(0)$, there is no profitable deviation from the proposed equilibrium offers. Hence, offers $p_{e,b} = c(0)$ for all $b \in B$ are rational for all experts $e \in E$.

Turning to consumers, note that any consumer b's belief together with other consumers' equilibrium strategies implies $y_e = 0$ for all experts $e \in E$ and at any information set of b. Hence, consumers believe to receive zero quality at all of their information sets. So, choosing any of the lowest offers if they are below $v(0) - \underline{v}$ and rejecting all offers otherwise is rational for consumers given their belief. □

The intuition behind Proposition 6 is standard. Consumers accept the lowest prices and experts undercut each other's prices until they hit marginal cost.

In contrast to standard price competition à la Bertrand, however, equilibria with other outcomes exist. Such equilibria are of two types. In the first type, consumers coordinate to buy only from certain sellers but not from others. Suppose for example that all consumers accept the offer of expert 1 as long as it does not exceed a certain threshold level. Expert 1 will

then offer the threshold price and all other experts' offers become irrelevant. Consumers may act rationally in this situation because all experts except for expert 1 have zero income and would therefore provide low quality services.

In the second type of equilibrium, consumers coordinate to buy only from those experts who offer a specific price. As soon as some expert deviates from this offer, consumers believe her profits to be zero, because they believe that no other consumer buys from this expert anymore. So, consumers believe that such a deviating expert provides zero quality and may thus indeed shun her rationally.

Both types of equilibria require a high degree of coordination between consumers. For the first type, consumers must believe all other consumers to accept offers only from a certain, arbitrary set of experts. For the second type, they must believe all other consumers to accept only offers at a certain, arbitrary price. We consider such coordination among consumers implausible as a description of many real-world credence goods markets.

To make this reasoning precise, we propose two criteria for equilibrium selection tailored to our environment.The criteria restrict consumers' ability to coordinate. Both of them leave only those equilibria that lead to the competitive outcome described in Proposition 6.

A.2.2 Equilibrium Selection by Insufficient Reason

Any consumer's decision problem is affected by other consumers' actions exclusively via experts' income levels. Beliefs about experts' incomes are hence crucial for sustaining coordination among consumers. In particular, the types of coordination described above require consumers to entertain different beliefs about different experts' incomes at some of their information sets. To curb such coordination we therefore require consumers' strategies to be optimal even under a belief that treats all experts' incomes identically.

A belief that treats all experts' incomes identically is reminiscent of the Principle of Insuffi-

cient Reason. Facing a set of events and no particular reason to believe that one of them is more likely than the others, the Principle of Insufficient Reason advises to assign equal probability to all events. Here, from the perspective of a given consumer, differences in experts' incomes can only stem from other consumers' strategies. Since many such strategies are compatible with PBE, a given consumer has little reason to perceive one set of other consumers' strategies as more likely than another. Hence, according to the Principle of Insufficient Reason, he entertains a belief that does not discriminate between experts.[2]

Definition 1. A PBE is robust to insufficient reason if and only if consumer strategies satisfy the following. Take any set of offers $\{p_{e,b}\}_{e\in E}$ for any consumer b. Let $\infty_{(e,b)}$ be an indicator function equal to one if b accepts $p_{e,b}$ and zero otherwise, and let $a^{IC}(y_e)$ denote the solution to the Kuhn-Tucker conditions (2.7) given y_e. Then, consumer b's acceptance decision following the offers $\{p_{e,b}\}_{e\in E}$ must maximize

$$\int_{\mathbb{R}^N}\left[\sum_{e\in E}\infty_{(e,b)}\left(v(a^{IC}(y_e))-p_{e,b}\right)\right]\pi(y_1,y_2,...,y_N)\,d(y_1,y_2,...,y_N)+\left(1-\sum_{e\in E}\infty_{(e,b)}\right)\underline{v} \tag{A.4}$$

for some probability density function ϕ such that the marginal distributions of the y_e are identical for all e, that is,

$$\tilde{\pi}_e=\tilde{\pi}_{e'}\quad\text{for all } e,e'\in E\ ,$$

where $\tilde{\pi}: y_e\mapsto\mathbb{R}_+$,

$$\tilde{\pi}_e(y_e)\coloneqq\int_{\mathbb{R}^{N-1}}\pi(y_1,y_2,...,y_N)\,d(y_1,...,y_{e-1},y_{e+1},...,y_N)\ ,$$

[2] The Principle of Insufficient Reason is known to fail as a positive theory of choice under uncertainty when individuals face a decision between a risky (with known probabilities) and an uncertain option (with unknown probabilities). See the Ellsberg Paradox (Ellsberg, 1961). Here, there is no way for consumers to escape the uncertainty about other consumers' choices (and hence experts' incomes). So, the critique based on the Ellsberg Paradox does not apply.

is the marginal density for y_e.

Robustness to insufficient reason rules out all PBE with consumer strategies that are optimal only under beliefs that discriminate between experts. Since consumer coordination as described above requires such discriminatory beliefs, the robustness criterion excludes all PBE that rely on consumer coordination.

It turns out that only those PBE survive the selection that lead to the competitive outcome of Proposition 6.

Proposition 7. *Consider the game described by stages 1" to 3". In any PBE that is robust to insufficient reason (see Definition 1), all consumers accept offers at marginal cost, $p_b = c(0)$ for all $b \in B$, and receive services of zero quality, $a_b = 0$ for all $b \in B$.*

Proof. **Step 1.** Robustness to insufficient reason imposes a clear structure on consumer strategies. In particular, since the marginal distributions of experts' incomes are identical under π, maximizing (A.4) is equivalent to choosing the least price offer if

$$\min_{e \in E} p_{e,b} \leq \int_{\mathbb{R}} v(a^{IC}(y_e))\tilde{\pi}(y_e)\, dy_e - \underline{v}$$

and rejecting all offers otherwise. Since $a^{IC} \geq 0$,

$$\int_{\mathbb{R}} v(a^{IC}(y_e))\tilde{\pi}(y_e)\, dy_e \geq v(0)\ .$$

So, if the minimal offer is unique and equal to $c(0)$, it is accepted with certainty.

Step 2. Given the consumer strategies from step 1 the standard logic of Bertrand competition implies that we can never have a situation where consumers accept offers strictly greater than $c(0)$. Moreover, suppose some consumer b accepts no offer. Then, some expert e could offer $p_{e,b} = c(0)$ and consumer b would accept. Both e and b would decide for this deviation,

because we assumed that all agents decide against their outside option in case of indifference. So, the only PBE that are robust to insufficient reason have all consumers accept offers at marginal cost $c(0)$.

Step 3. Finally by step 2, we have $y_e = 0$ for all $e \in E$ while all consumers accept some offer. The Kuhn-Tucker conditions (2.7) then imply $a_b = 0$ for all $b \in B$. This must again hold in any PBE that is robust to insufficient reason. □

A.2.3 Equilibrium Selection by Ambiguity Aversion

A critique of robustness to insufficient reason is that consumer strategies must be optimal only under a specific belief π. If consumers cannot coordinate and there are many different equilibrium strategies for consumers, where should such a specific belief come from?

Our second criterion allows consumers to entertain many beliefs and perceive experts' incomes as ambiguous, or uncertain in the Knightian sense. If we additionally assume that consumers are ambiguity averse in the sense of Gilboa and Schmeidler (1989), we obtain the following robustness criterion.

Definition 2. A PBE is robust to strategic ambiguity if and only if consumer strategies satisfy the following. Take any set of offers $\{p_{e,b}\}_{e\in E}$ for any consumer b. Let $\infty_{(e,b)}$ be an indicator function equal to one if b accepts $p_{e,b}$ and zero otherwise, and let $a^{IC}(y_e)$ denote the solution to the Kuhn-Tucker conditions (2.7) given y_e. Then, consumer b's acceptance decision following the offers $\{p_{e,b}\}_{e\in E}$ must maximize

$$\min_{(y_1,y_2,\ldots,y_N)\in\mathbb{R}^N} \sum_{e\in E} \infty_{(e,b)} \left(v(a^{IC}(y_e)) - p_{e,b}\right) + \left(1 - \sum_{e\in E} \infty_{(e,b)}\right) \underline{v} \,. \tag{A.5}$$

In a PBE that is robust to strategic ambiguity, consumer strategies are supported by two considerations. First, as is usual in a PBE, consumers can anticipate other agents' strategies,

form beliefs about unobserved events accordingly, and choose their strategies as a best response to the anticipated behavior of others. Second, consumers may perceive the behavior of others as ambiguous and choose the strategies that optimize the worst-case outcome.[3]

The only PBE that are robust to strategic ambiguity are those leading to the competitive outcome of Proposition 6.

Proposition 8. *Consider the game described by stages 1" to 3". In any PBE that is robust to strategic ambiguity (see Definition 2), all consumers accept offers at marginal cost, $p_b = c(0)$ for all $b \in B$, and receive services of zero quality, $a_b = 0$ for all $b \in B$.*

Proof. In analogy to the proof of Proposition 7, robustness to strategic ambiguity has clear implications for consumer strategies. In particular, the worst-case outcome for consumers for any acceptance decision they make is when $y_e \leq 0$ for all $e \in E$. So, maximizing (A.5) is equivalent to maximizing

$$\sum_{e \in E} \infty_{(e,b)} \left(v(0) - p_{e,b} \right) + \left(1 - \sum_{e \in E} \infty_{(e,b)} \right) \underline{v} \, .$$

This expression is maximized by accepting the least price offer if

$$\min_{e \in E} p_{e,b} \leq v(0) - \underline{v}$$

and rejecting all offers otherwise. This is essentially the same result as obtained from step 1 in the proof of Proposition 7. The remainder of the proof is then analogous to steps 2 and 3 of the proof of Proposition 7. □

[3]Moreover, the combination of the usual PBE requirements with robustness to strategic ambiguity allows consumers to engage in considerations of the following type in equilibrium. Any given consumer anticipates that all other consumers perceive others' behavior as ambiguous and optimize their worst-case outcomes. The given consumer then chooses his strategy as a best response to this anticipated behavior of others.

A.2.4 Special Case: Two Experts

As a final remark, for $N = 2$ experts the selection criteria can be relaxed substantially. In particular, with two experts it is sufficient to restrict the off-equilibrium part of consumers' strategies. For expositional reasons we focus on robustness to strategic ambiguity here.

Definition 3. A PBE is weakly robust to strategic ambiguity if and only if any consumer b's actions following any off-equilibrium set of offers $\{p_{e,b}\}_{e \in E}$ satisfy the requirements of robustness to strategic ambiguity described in Definition 2.

The reduction to off-equilibrium actions is substantial. The weakened criterion allows consumers to believe in coordination on any arbitrary set of strategies. Only once they observe an event that is incompatible with the strategies they believed in, consumers revert to ambiguity-averse behavior without committing to any specific new belief about other agents' actions.

For two experts, the weak robustness criterion is sufficient to exclude all outcomes except for the competitive one.

Proposition 9. *Consider the game described by stages 1" to 3" and suppose that $N = 2$. Then in any PBE that is weakly robust to strategic ambiguity (see Definition 2) and has experts play pure strategies, all consumers accept offers at marginal cost, $p_b = c(0)$ for all $b \in B$, and receive services of zero quality, $a_b = 0$ for all $b \in B$.*

Proof. Note first that all consumers under all circumstances prefer to accept an offer smaller or equal to $v(0) - \underline{v}$ to rejecting all offers.

Suppose now that in some PBE as described in the proposition, some consumer b accepts no offer. Then in such a PBE, all offers for consumer b must be strictly above $v(0) - \underline{v}$. But then, expert 1 could deviate to offer $p_{1,b} = v(0) - \underline{v}$. This deviation makes consumer b optimize his worst-case outcome according to weak robustness to strategic ambiguity. Thus, b accepts

the least price offer if it does not strictly exceed $v(0) - \underline{v}$. Hence, b accepts $p_{1,b}$. But since $p_{1,b} = v(0) - \underline{v} \geq c(0)$, expert 1 is better off through her initial deviation. So there cannot be a PBE as described in the proposition where some consumer rejects all offers.

Next suppose that in some PBE as described in the proposition, some consumer b accepts an offer $p_{2,b} > c(0)$. Then, expert 1 can deviate to some offer $p_{1,b}$ such that $p_{1,b} < p_{2,b}$ and $p_{1,b} \in [c(0), v(0) - \underline{v}]$. The deviation again makes b optimize his worst-case outcome, so b accepts $p_{1,b}$. This makes expert 1 better off, so the deviation is profitable for expert 1. Thus, there cannot be a PBE as described in the proposition where some consumer accepts an offer above marginal cost.

Hence we have shown that in any PBE as described in the proposition, all consumers accept offers at marginal cost $c(0)$. This immediately implies $y_e = 0$ for all experts and, by conditions (2.7), $a_b = 0$ for all consumers. □

A.3 Empirical analysis

Our theoretical model builds on the assumption that prosocial behavior increases in income. Complementing the discussion from Section 2.8, this section provides further empirical evidence that supports the plausibility of this assumption. In particular, we use data from the German Socio-Economic Panel to demonstrate that income has a causal positive effect on the extensive and on the intensive margin of financial donations, which we use as an indicator of prosocial behavior. As far as we know, we are the first to unveil a causal effect of income on prosocial behavior from survey data.

A.3.1 Data and empirical strategy

Our empirical analysis is based on data from the German Socio-Economic Panel (SOEP). The SOEP provides nationally representative longitudinal data on several thousand private individuals and households in Germany, including their economic and social circumstances, behavior, attitudes, and subjective well-being.[4] There are two types of questions: basic questions that are raised in each wave of the survey (e.g., on the individuals' current occupation and income), and specialized questions that are raised every few years. In 2010 and 2015, individuals were asked two questions on their financial donations:

1. Did you donate money last year, not counting membership fees?

2. How high was the total amount of money that you donated last year?

Following the literature (see Section 2.8 for a discussion), we argue that financial donations indicate prosocial behavior. Thus, to support the plausibility of our key theoretical assumption, we demonstrate that income has a causal positive effect on individual financial donations.

[4] See `https://www.diw.de/en/diw_01.c.600489.en/about.html`. Viewed: April 2020.

A major challenge in the analysis is that a naive regression of financial donations on income is unlikely to yield a causal effect. As argued in Section 2.8, correlational studies typically document a positive relationship, but self-selection and reverse causality could lead to over- or underestimation of the effect. For instance, low-earning individuals could be more social per se; similarly, individuals who exhibit a strong prosocial attitude might self-select into occupations that are poorly paid. Both scenarios would entail downward biased coefficients.

To eliminate endogeneity in income, we proceed in two steps. First, we exploit the panel structure of our data to erase individual fixed effects from the regression. In other words, we consider each individual's *change* in income and financial donations between 2010 and 2015 and estimate equation (2.16) from Section 2.8

$$\Delta fdon_i = \beta_0 + \beta_1 \Delta netinc_i + \beta_2 \Delta \mathbf{X_i} + \varepsilon_i, \tag{A.6}$$

where $\Delta fdon_i$ corresponds to individual i's change in financial donations on the extensive (denoted by $\Delta ddonate_i$) or on the intensive margin (denoted by $\Delta donation_i$). Note that $\Delta ddonate_i \in \{-1, 0, 1\}$, while $\Delta donation_i$ can take on all values. Furthermore, $\Delta netinc_i$ refers to i's change in net income; for retirees, $\Delta netinc_i$ is i's change in retirement pay.[5] We also consider a broad range of control variables $\Delta \mathbf{X_i}$, including i's change in bonus payments (Christmas, vacation, and annual bonus), employment circumstances (weekly working hours, side job, activity status, tenure, temporal employment), marital and health status, and life satisfaction.[6] The parameter of interest is β_1: it measures the marginal effect of an absolute change in $\Delta netinc_i$ on $\Delta fdon_i$. Following our theory, we expect that an increase in $\Delta netinc_i$ has a positive effect on $\Delta fdon_i$, i.e., $\hat{\beta}_1 > 0$.

Although equation (2.16) controls for many confounding factors, omitted variables may

[5] See Section A.3.3 for a robustness check where we consider the individuals' difference in gross income instead of net income, and Section A.3.3 for a robustness check where we exclude retirees from the analysis.

[6] Note that we are limited to variables that exist in the 2010 *and* the 2015 version of the survey.

affect i's change in financial donations and her change in net income at the same time. For instance, if i became more selfish over time, she might self-select into an occupation that yields higher earnings and simultaneously decrease her monetary donations, leading to downward biased coefficients. Thus, as a second step, we use the *change in the average net income within occupation groups* between 2010 and 2015, denoted by $\Delta avinc_i$, to instrument for $\Delta netinc_i$. We argue that $\Delta avinc_i$ meets the requirements of a valid instrument: it is strongly correlated with $\Delta netinc_i$, but otherwise exogenous to any of i's decisions. In particular, the change in the average net income within her occupation group does not affect an individual's financial donations except through $\Delta netinc_i$.

The instrument $\Delta avinc_i$ is computed directly from the SOEP data. Based on the International Standard Classification of Occupations 88 (ISCO-88), the SOEP classifies individuals' occupations into one out of ten groups.[7] We augment this classification with an eleventh group for retirees; see Table A.1 for an overview.[8] Then, we compute the change in average net income between 2010 and 2015 for each occupation group and set up the first stage equation (2.17) from Section 2.8

$$\Delta netinc_i = \pi_0 + \pi_1 \Delta avinc_i + \pi_2 \Delta \mathbf{X_i} + u_i. \tag{A.7}$$

Equation (2.17) initiates a causal chain: exogenous variation in $\Delta avinc_i$ generates exogenous variation in $\Delta netinc_i$, which is isolated by the first stage. Using this variation, we can consistently estimate $\hat{\beta}_1$ in equation (2.16) by Two Stage Least Squares (2SLS).

[7] The ISCO-88 is an International Labour Organization (ILO) classification structure for organizing information on labor and jobs. It groups occupations based on the similarity of skills required to fulfill the tasks and duties of the jobs; see `https://www.ilo.org/public/english/bureau/stat/isco/isco88/index.htm`. Viewed: April 2020.

[8] Data on the current occupation is missing for some individuals for some years. In our main analysis, we assume that an individual's occupation has not changed unless the individuals states a different occupation or states to have changed its activity status (e.g., retired or lost her job). Section A.3.3 proves the robustness of our results when we exclude all observations for whom we lack data on their current occupation.

Crucially, we can only assume that $\Delta avinc_i$ is exogenous to any of i's decisions if i did not change her occupation group between 2010 and 2015. In particular, if selecting into a better paid occupation group was driven by omitted variables that also affect i's financial donations, our instrument would be invalid. To avoid such confounds, we exclude all individuals who changed their occupation group between 2010 and 2015 from the analysis. Moreover, we consider only individuals for whom we observe net income and at least one of the dependent variables, $\Delta ddonate_i$ or $\Delta donation_i$. In sum, we are left with $5,490$ observations; see Table A.2 for an overview of all variables used in the analysis.

A.3.2 Results

Extensive margin Table A.3 shows the results on the extensive margin of financial donations. To enhance readability of the estimates, we have scaled $\Delta netinc_i$ with the factor 100, i.e., a one unit increase in $\Delta netinc_i$ corresponds to a 100 Euro increase in net income between 2010 and 2015.

Columns 1 to 6 show the results of the potentially biased OLS estimation of equation (2.16). In column 1, we run the regression without any control variables; in columns 2 to 5, we add controls for the change in (i) bonus payments, (ii) life circumstances, and (iii) employment circumstances. In column 6, we also control for temporal employment and tenure; since this information is missing for about half of our observations, we include these variables only into the last specification. The estimates for β_1 are positive throughout all specifications, thus, there is a positive correlation between the change in i's net income and the change in her probability to donate. The estimates are statistically significant at the 5% level in columns 1 to 3, and weakly statistically significant at the 10% level in columns 4 and 5. The magnitude of the estimates is small: according to column 1, a 100 Euro increase in i's change in net income is associated with a 0.18 percentage point increase in the change of i's probability to donate. A

one standard deviation increase in $\Delta netinc_i$ is associated with a 1.6 percentage point increase in the change of her probability to donate, which corresponds to 3.1 of a standard deviation in the dependent variable.

Columns 7 to 12 show the results of the 2SLS estimation of equations (2.16) and (2.17). Again, the estimates for β_1 are positive throughout all specifications. Moreover, they are statistically significant at the 1% level (columns 7, 8, and 10) or at the 5% level (columns 9, 11, and 12). In line with the concerns about downward biased OLS estimates, the 2SLS estimates are more than ten times larger than their OLS counterparts. E.g., according to column 7, a 100 Euro increase in i's change in net income leads to a 2.4 percentage point increase in the change of her probability to donate. A one standard deviation increase in $\Delta netinc_i$ leads to a 20.9 percentage point increase in the change of her probability to donate, which corresponds to about 41% of a standard deviation in the dependent variable. The first stage diagnostics support the validity of our empirical strategy: the estimate for π_1 in equation (2.17) is highly statistically significant throughout all specifications, and $F > 30$ in all columns. Thus, we conclude that net income has a causal positive effect on the extensive margin of donation behavior.[9]

Intensive margin Table A.4 shows the results on the intensive margin of donation behavior. Columns 1 to 6 show the results of the potentially biased OLS estimation of equation (2.16). Analogous to Table A.3, we run the regression without any control variables in column 1. In columns 2 to 5, we add controls for the change in (i) bonus payments, (ii) life circumstances, and (iii) employment circumstances; in column 6, we also control for temporal employment and tenure. The estimates for β_1 are positive throughout all specifications, but not statistically significant. Their magnitude is small: a 1 Euro increase in i's change in net income is associated with a 0.01 Euro increase in the change of the amount of money donated. A one standard

[9] See Section A.3.3 for a robustness check where we use an ordered probit instead of a linear model.

deviation increase in $\Delta netinc_i$ is associated with a 8.72 Euro increase in the amount donated, which corresponds to 2.4% of a standard deviation in the dependent variable.

Columns 7 to 12 show the results of the 2SLS estimation of equations 2.16 and 2.17. Again, the estimates for β_1 are positive throughout all specifications. Moreover, they are statistically significant at the 1% level (columns 10 and 11) or at the 5% level (columns 7, 8, 9, and 12). The 2SLS estimates are several times larger than their OLS counterparts: e.g., according to column 7, a 1 Euro increase in i's change in net income leads to a 0.13 Euro increase in the change of the amount of money donated. A one standard deviation increase in $\Delta netinc_i$ leads to a 115.21 Euro increase in the change in the amount donated, which corresponds to about 31.7% of a standard deviation in the dependent variable. Again, the first stage diagnostics support the validity of our empirical strategy: the estimate for π_1 in equation (2.17) is highly statistically significant throughout all specifications, and $F > 30$ in all columns. Thus, we conclude that net income has a causal positive effect on the intensive margin of donation behavior, too.

A.3.3 Robustness checks

This section probes the robustness of our results with respect to functional form, using gross instead of net income, and excluding retirees, occupation groups with few observations, and observations for whom we lack data on their current occupation from the analysis.

Ordered probit model

The dependent variable $\Delta ddonate_i$ can only take on three distinct values $\in \{-1, 0, 1\}$, yet, we estimate a linear model in Section A.3.2. The main advantage is that the coefficients of a linear model are straightforward to interpret. On the other hand, if the partial effect of $\Delta netinc_i$ was non-linear or if one wants to avoid that certain combinations of independent variables lead to predicted outcomes below -1 or above 1, estimating an ordered choice model

would be more appropriate.

To demonstrate that the findings from Section A.3.2 do not hinge on the functional form of the model, this section presents the results from a maximum likelihood estimation of an ordered probit model with three outcome categories. Again, to account for endogeneity in $\Delta netinc_i$, we augment the procedure by estimating the first stage equation (2.17). Moreover, analogous to Table A.3, we scale $\Delta netinc_i$ with the factor 100 to enhance readability and comparability of the coefficients.

Table A.5 shows the results. Columns 1 to 6 show the potentially biased coefficients of a maximum likelihood estimation of the ordered probit model without the first stage. As in Table A.3, we do not include control variables in column 1, add controls for the change in (i) bonus payments, (ii) life circumstances, and (iii) employment circumstances in columns 2 to 5, and also control for temporal employment and tenure in column 6. Just as their counterparts in Table A.3, the coefficients are positive and statistically significant at the 5% level in columns 1 to 3, and at the 10% level in columns 4 and 5.

One disadvantage of estimating an ordered choice model is that the magnitudes of the coefficients are not meaningful by themselves. Also, in contrast to binary choice models, the partial effects do not always have the same sign as the coefficients, but must be evaluated separately for each outcome category. Thus, Table A.5 also reports the average partial effects (APE) of $\Delta netinc_i$ for the three outcome categories $\Pr(\Delta ddonate_i = -1)$, $\Pr(\Delta ddonate_i = 0)$, and $\Pr(\Delta ddonate_i = 1)$. For all specifications, the APE of $\Delta netinc_i$ is negative for $\Pr(\Delta ddonate_i = -1)$ and positive for $\Pr(\Delta ddonate_i = 1)$. In other words, we find a positive correlation between $\Delta netinc_i$ and $\Delta ddonate_i$, which is in line with our theory and our findings from Section A.3.2.

In columns 7 to 12, we take the first stage 2.17 into account. Just as their counterparts in Table A.3, the coefficients are positive throughout all specifications and statistically significant

at the 1% level (columns 7, 8, and 10) or at the 5% level (columns 9, 11, and 12). The APEs have the same signs as in columns 1 to 6, but several times larger, in line with the concern that endogeneity in $\Delta netinc_i$ may lead to downward biased estimates if not taken into account. We conclude that the ordered probit, too, provides evidence of a causal positive effect of $\Delta netinc_i$ and $\Delta ddonate_i$. Yet, since the coefficients of an ordered probit model cannot be interpreted without a fair amount of extra calculation, we limit our attention to estimating the linear model consisting of equations (2.16) and 2.17 in the robustness checks below.

Gross income

Next, we show that our results are robust to considering the effect of gross income instead of net income. To this end, we replace $\Delta netinc_i$ in equations (2.16) and (2.17) with $\Delta grossinc_i$, which corresponds to the change in i's gross income. Moreover, we use $\Delta avincgross_i$ – the change in the average gross income of i's occupation group – as an instrument for $\Delta grossinc_i$ in equation (2.17).

Extensive margin Table A.6 shows the results on the extensive margin on financial donations. Analogous to Table A.3, we have scaled $\Delta grossinc_i$ with the factor 100 to enhance the readability of the results.

The 2SLS estimates for β_1 are positive for all specifications. Moreover, the estimates are statistically significant at the 1% level in columns 1, 2, 4, and 6, and at the 5% level in columns 3 and 5. Although the magnitude of the estimates is smaller than in Table A.3, the effect sizes are comparable: e.g., according to column 1, a 100 Euro increase in i's change in gross income leads to a 1.4 percentage point change in $\Delta ddonate_i$. A one standard deviation increase in $\Delta grossinc_i$ leads to a 21 percentage point increase in $\Delta ddonate_i$, which corresponds to 41% of a standard deviation in the dependent variable. The first stage diagnostics support the validity of our empirical strategy based on gross income: the estimate for π_1 in equation (2.17)

is highly statistically significant throughout all specifications, and $F > 15$ in all columns.

Intensive margin Table A.7 shows the results on the intensive margin on financial donations. As in Table A.4, the 2SLS estimates for β_1 are positive for all specifications. Moreover, the estimates are statistically significant at the 5% level in columns 1, 3, and 5, and at the 10% level in columns 2, 4, and 6. As for the extensive margin, the magnitude of the estimates is smaller than in Section A.3.2, while the effect size is comparable: e.g., according to column 1, a 1 Euro increase in $\Delta grossinc_i$ leads to 0.09 Euro increase in $\Delta donation_i$. A one standard deviation increase in $\Delta grossinc_i$ leads to a 133.14 Euro increase in $\Delta donation_i$, which corresponds to 36.7% of a standard deviation in the dependent variable. Again, the first stage diagnostics support the validity of our empirical strategy based on gross income: the estimate for π_1 in equation (2.17) is highly statistically significant throughout all specifications, and $F > 15$ in all columns.

Exclude retirees

Our main analysis considers retirees alongside individuals who still participate in the labor market. To rule out that retirees – whose donation behavior might be very different from the working population – drive our results, this section demonstrates that the findings from Section A.3.2 are robust to excluding them from the analysis.

Extensive margin Table A.8 shows the 2SLS results on the extensive margin on financial donations without retirees. Just as their counterparts in Table A.3, all estimates are positive. Due to the reduced number of observations, the standard errors are larger than in Table A.3, but all estimates are statistically significant at the 5% level. Moreover, the magnitude of the estimates increases: e.g., according to column 1, a 100 Euro increase leads to a 3 percentage point increase in $\Delta ddonate_i$ and a one standard deviation increase in $\Delta netinc_i$ leads to a 26

percentage point increase in $\Delta ddonate_i$, which corresponds to 51% of a standard deviation in the dependent variable. The first stage diagnostics support the validity of our empirical strategy when we exclude retirees: the estimate for π_1 in equation (2.17) is highly statistically significant throughout all specifications, and $F > 20$ in all columns.

Intensive margin Table A.8 shows the 2SLS results on the intensive margin on financial donations without retirees. As in Table A.4, all estimates are positive. Similar to the extensive margin, the standard errors increase due to the reduced number of observations, but all estimates are statistically significant at the 5% level. Moreover, they are slightly larger than their counterparts in Table A.4: e.g., according to column 1, a 1 Euro increase in $\Delta netinc_i$ leads to a 0.16 Euro increase in $\Delta donation_i$ and a one standard deviation increase in $\Delta netinc_i$ leads to a 139.52 Euro increase in $\Delta donation_i$, which corresponds to 38.4% of a standard deviation in the dependent variable.

Exclude occupation groups 06 and 10

Next, we exclude occupation groups 06 and 10 – i.e., skilled agricultural, forestry and fishery workers and armed forces occupations – from the analysis, because the number of observations for each group is small (see also Table A.1). Thus, each individual could have a sizable impact on $\Delta avinc_i$, rendering it unclear if the exclusion restriction holds. This section shows that our main results are robust to excluding these observations.

Extensive margin Table A.10 shows the 2SLS results on the extensive margin of financial donations when we exclude occupation groups 06 and 10. The estimates are positive, but slightly smaller than their counterparts in Table A.3. Moreover, the standard errors are larger than in Table A.3, but all estimates are statistically significant at the 5% level (columns 1, 2, 4, and 5) or at the 10% level. The first stage diagnostics, too, are similar to Table A.3: all first

stage estimates are highly statistically significant, and $F > 25$ in all columns.

Intensive margin Table A.11 shows the 2SLS results on the intensive margin of financial donations when we exclude occupation groups 06 and 10. The estimates are positive and slightly smaller than their counterparts in Table A.4; the relative magnitude of the standard errors remains nearly unchanged. The first stage diagnostics are similar to Table A.4, too: all first stage estimates are highly statistically significant, and $F > 25$ in all columns.

Reported profession

As a final robustness check, we exclude all individuals who do not report their current occupation in 2010 or 2015, but have done so in a preceding wave of the survey and did not state to have changed their occupation or activity status. Tables A.12 and A.13 show the results: they are nearly equivalent to our main results in Section A.3.2.

Table A.1. Occupation groups

Group	Label	Obs.	Percent
01	Managers	146	2.66
02	Professionals	781	14.21
03	Technicians and associate professionals	852	15.50
04	Clerical support workers	297	5.40
05	Service and sales workers	331	6.02
06	Skilled agricultural, forestry and fishery workers	23	0.42
07	Craft and related trades workers	364	6.62
08	Plant and machine operators and assemblers	175	3.18
09	Elementary occupations	140	2.55
10	Armed forces occupations	12	0.22
11	Retirees	2,375	43.21
Total		5,496	100.00

Notes: Table A.1 gives an overview of all occupation groups considered in the analysis. Groups 01 to 10 are based on the ISCO 88 classification by the International Labor Organization; Group 11 classifies retirees.

Table A.2. Summary statistics

Variable	Label	Obs	Mean	Std. Dev.	Min	Max	Median
Main analysis:							
$\Delta ddonate_i$	Change in fin. donations, extensive margin	5,496	0.048	0.509	-1	1	0
$\Delta donation_i$	Change in fin. donations, intensive margin	5,449	36.883	363.122	-5,000	5,000	0
$\Delta netinc_i$	Change in net income	5,496	233.889	872.849	-14,210	24,000	135
$\Delta avinc_i$	Change in av. net income of occupation group	5,496	121.474	35.332	57.671	668.247	113.631
ΔX_{1i} :							
$\Delta bonus_i$	Change in annual bonus	5,496	18.759	919.527	-20,000	10,000	0
$\Delta vacbonus_i$	Change in vacation	5,496	10.873	515.246	-8,200	10,000	0
$\Delta xmasbonus_i$	Change in Christmas bonus	5,496	35.151	726.756	-6,000	10,000	0
ΔX_{2i} :							
$\Delta sidejob_i$	Change in having a side job	5,496	-0.002	0.2	-1	1	0
$\Delta workhours_i$	Change in weekly working hours	5,413	-0.593	8.513	-70	55	0
$\Delta activstatus_i$	Change in activity status	5,496	0.12	0.325	0	1	0
ΔX_{3i} :							
$\Delta happiness_i$	Change in self-reported life satisfaction	5,480	-0.015	1.593	-8	10	0
$\Delta health_i$	Change in self-reported health status	5,485	0.12	0.838	-3	3	0
$\Delta married_i$	Change in marital status	5,496	-0.001	0.294	-1	1	0
ΔX_{4i} :							
$\Delta tenure_i$	Change in being tenured	2,818	0.073	0.38	-1	1	0
$\Delta tempemp_i$	Change in being temporally employed	2,811	-0.01	0.147	-1	1	0
Robustness checks:							
$\Delta grossinc_i$	Change in gross income	5,258	311.763	1496.684	-58,723	30,000	150
$\Delta avincgross_i$	Change in av. gross income of occupation group	5,496	161.31	68.098	55.912	760.509	127.26

Notes: Table A.2 lists all variables used in the analysis. The underlying variables for $\Delta ddonate_i$, $\Delta sidejob_i$, $\Delta activstatus_i$, $\Delta married_i$, $\Delta tenure_i$, and $\Delta tempemp_i$ are dummy variables, hence, the corresponding differences can take on the values -1, 0, and 1. The underlying variables for $\Delta happiness_i$ and $\Delta health_i$ are originally measured on a scale from 0 to 10, where 0 indicates the worst and 10 the best outcome. Hence, the corresponding differences can take on all integer values from the interval $[-10, 10]$. The underlying variables for the remaining variables are continuous, hence, their corresponding differences can take on all values.

Table A.3. The effect of net income on the extensive margin of financial donations

	OLS						2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\Delta netinc_i$	0.0018**	0.0018**	0.0017**	0.0016*	0.0015*	0.0013	0.0241***	0.0239***	0.0232**	0.0233***	0.0222**	0.0296**
	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0022)	(0.0091)	(0.0092)	(0.0094)	(0.0089)	(0.0093)	(0.0119)
ΔX_{1i}		X			X	X		X			X	X
ΔX_{2i}			X		X	X			X		X	X
ΔX_{3i}				X	X	X				X	X	X
ΔX_{4i}						X						X
Intercept	0.044***	0.044***	0.045***	0.041***	0.041***	0.027**	-0.008	-0.005	-0.009	-0.007	-0.053	-0.053
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.013)	(0.022)	(0.023)	(0.023)	(0.022)	(0.022)	(0.036)
							First stage					
$\Delta avinc_i$							0.021***	0.020***	0.020***	0.021***	0.020***	0.016***
							(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
F-statistic							33.74	32.86	32.53	35.22	33.22	39.94
N	5,496	5,496	5,470	5,413	5,390	2,749	5,496	5,496	5,470	5,413	5,390	2,749

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta ddonate_i$, which is the change in financial donations on the extensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. To enhance readability of the estimates, $\Delta netinc_i$ is scaled with the factor 100.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.4. The effect of net income on the intensive margin of financial donations

	OLS						2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\Delta netinc_i$	0.0130	0.0130	0.0125	0.0131	0.0127	0.0444*	0.132**	0.134**	0.134**	0.130***	0.134***	0.113**
	(0.0205)	(0.0206)	(0.0207)	(0.0208)	(0.0210)	(0.0267)	(0.0521)	(0.0530)	(0.0524)	(0.0502)	(0.0511)	(0.0476)
ΔX_{1i}		X			X	X		X			X	X
ΔX_{2i}			X		X	X			X		X	X
ΔX_{3i}				X	X	X				X	X	X
ΔX_{4i}						X						X
Intercept	33.84***	33.49***	33.83***	31.85***	31.33***	19.38**	5.86	5.34	5.36	4.56	3.55	-0.24
	(7.22)	(7.21)	(7.09)	(7.35)	(7.25)	(9.40)	(12.17)	(12.25)	(12.41)	(11.61)	(11.86)	(13.70)
							First stage					
$\Delta avinc_i$							2.06***	2.03***	1.97***	2.12***	2.03***	1.60***
							(0.36)	(0.36)	(0.35)	(0.36)	(0.35)	(0.25)
F-statistic							33.50	32.62	32.31	34.97	32.98	39.55
N	5,449	5,449	5,424	5,369	5,347	2,731	5,449	5,449	5,424	5,369	5,347	2,731

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta donation_i$, which is the change in financial donations on the intensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.5. Ordered probit: The effect of net income on the extensive margin of financial donations

	Ordered Probit						Ordered Probit with IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\Delta netinc_i$	0.004**	0.004**	0.004**	0.004*	0.003*	0.003	0.052***	0.052***	0.050**	0.050***	0.049***	0.064***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.016)	(0.016)	(0.017)	(0.016)	(0.017)	(0.022)
Av. partial effects of $\Delta netinc_i$:												
$\Pr(\Delta ddonate_i = -1)$	-0.0008**	-0.0008**	-0.0007**	-0.0007*	-0.0006*	-0.0005	-0.011***	-0.011***	-0.011**	-0.011***	-0.010**	-0.014**
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0010)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)
$\Pr(\Delta ddonate_i = 0)$	-0.0002**	-0.0002**	-0.0002*	-0.0002*	-0.0002*	-0.0001	-0.0022***	-0.0022***	-0.0021***	-0.0021***	-0.0020***	-0.0024***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0007)
$\Pr(\Delta ddonate_i = 1)$	0.0010**	0.0010**	0.0010**	0.0009*	0.0008*	0.0007	0.0132***	0.0131***	0.0127***	0.0128***	0.0122**	0.0161***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0012)	(0.0046)	(0.0047)	(0.0048)	(0.0045)	(0.0048)	(0.0060)
ΔX_{1i}		X			X	X		X			X	X
ΔX_{2i}			X		X	X			X		X	X
ΔX_{3i}				X	X	X				X	X	X
ΔX_{4i}						X						X
							First stage					
$\Delta avinc_i$							0.021***	0.020***	0.020***	0.021***	0.020***	0.016***
							(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
F-statistic							33.74	32.86	32.53	35.22	33.22	39.94
N	5,496	5,496	5,470	5,413	5,390	2,749	5,496	5,496	5,470	5,413	5,390	2,749

Notes: Robust standard errors in parentheses. The outcome categories of the ordered probit are $\Pr(\Delta ddonate_i = -1)$, $\Pr(\Delta ddonate_i = 0)$, and $\Pr(\Delta ddonate_i = 1)$, where $\Delta ddonate_i$ is the change in financial donations on the extensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. To enhance readability of the estimates, $\Delta netinc_i$ is scaled with the factor 100.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.6. Robustness check: The effect of gross income on the extensive margin of financial donations

	2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta grossinc_i$	0.014***	0.014***	0.013**	0.013***	0.013**	0.019***
	(0.0052)	(0.0053)	(0.0052)	(0.0051)	(0.0052)	(0.0064)
ΔX_{1i}		X			X	X
ΔX_{2i}			X		X	X
ΔX_{3i}				X	X	X
ΔX_{4i}						X
Intercept	0.004	0.004	0.006	0.003	0.005	-0.243
	(0.017)	(0.017)	(0.017)	(0.016)	(0.017)	(0.036)
	First stage					
$\Delta avincgross_i$	0.025***	0.025***	0.024***	0.026***	0.024***	0.021***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
F-statistic	17.43	16.62	19.29	17.58	18.56	51.99
N	5,258	5,258	5,232	5,190	5,167	2,555

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta ddonate_i$, which is the change in financial donations on the extensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. To enhance readability of the estimates, $\Delta netinc_i$ is scaled with the factor 100.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.7. Robustness check: The effect of gross income on the intensive margin of financial donations

	2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta grossinc_i$	0.089**	0.090***	0.091**	0.088***	0.090**	0.090***
	(0.044)	(0.045)	(0.043)	(0.043)	(0.043)	(0.033)
ΔX_{1i}		X			X	X
ΔX_{2i}			X		X	X
ΔX_{3i}				X	X	X
ΔX_{4i}						X
Intercept	8.20	7.786	7.426	6.376	5.30	-7.132
	(13.03)	(13.17)	(13.11)	(12.69)	(12.80)	(12.520)
	First stage					
$\Delta avincgross_i$	2.516***	2.468***	2.439***	2.574***	2.451***	2.118***
	(0.604)	(0.606)	(0.556)	(0.614)	(0.569)	(0.295)
F-statistic	17.37	16.57	19.27	17.59	18.57	51.52
N	5,215	5,215	5,190	5,149	5,127	2,540

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta donation_i$, which is the change in financial donations on the intensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.8. Robustness check: The effect of net income on the extensive margin of financial donations, no retirees

	2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta netinc_i$	0.030**	0.030**	0.030**	0.029**	0.029**	0.029**
	(0.0125)	(0.0126)	(0.0131)	(0.0120)	(0.0128)	(0.0120)
ΔX_{1i}		X			X	X
ΔX_{2i}			X		X	X
ΔX_{3i}				X	X	X
ΔX_{4i}						X
Intercept	-0.043	-0.043	-0.043	-0.046	-0.048	-0.051
	(0.041)	(0.041)	(0.042)	(0.041)	(0.043)	(0.037)
	First stage					
$\Delta avinc_i$	0.015***	0.015***	0.015***	0.016***	0.015***	0.016***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
F-statistic	24.02	23.58	22.68	26.38	24.26	39.24
N	3,121	3,121	3,106	3,048	3,035	2,686

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta ddonate_i$, which is the change in financial donations on the extensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. The results are based on estimations that exclude retirees from the analysis. To enhance readability of the estimates, $\Delta netinc_i$ is scaled with the factor 100.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.9. Robustness check: The effect of net income on the intensive margin of financial donations, no retirees

	2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta netinc_i$	0.160**	0.163**	0.165**	0.151***	0.158**	0.110**
	(0.067)	(0.068)	(0.068)	(0.062)	(0.064)	(0.048)
ΔX_{1i}		X			X	X
ΔX_{2i}			X		X	X
ΔX_{3i}				X	X	X
ΔX_{4i}						X
Intercept	-9.735	-10.82	-11.53	-6.55	-9.95	1.050
	(19.80)	(19.86)	(20.33)	(19.17)	(19.82)	(14.036)
	First stage					
$\Delta avinc_i$	1.553***	1.536***	1.479***	1.614***	1.511***	1.578***
	(0.319)	(0.318)	(0.312)	(0.316)	(0.308)	(0.253)
F-statistic	23.77	23.34	22.46	26.11	24.03	38.84
N	3,096	3,096	3,082	3,026	3,014	2,668

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta donation_i$, which is the change in financial donations on the intensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. The results are based on estimations that exclude retirees from the analysis.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.10. Robustness check: The effect of net income on the extensive margin of financial donations, no occupation groups 06 and 10

	2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta netinc_i$	0.020**	0.019**	0.019*	0.018**	0.018**	0.023*
	(0.0095)	(0.0097)	(0.0099)	(0.0091)	(0.0096)	(0.0124)
ΔX_{1i}		X			X	X
ΔX_{2i}			X		X	X
ΔX_{3i}				X	X	X
ΔX_{4i}						X
Intercept	0.001	0.002	0.005	0.001	0.005	-0.035
	(0.023)	(0.023)	(0.024)	(0.022)	(0.023)	(0.037)
	First stage					
$\Delta avinc_i$	0.032***	0.032***	0.031***	0.034***	0.032***	0.027***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.004)
F-statistic	29.40	27.84	28.06	29.84	32.73	56.94
N	5,461	5,461	5,436	5,380	5,358	2,724

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta ddonate_i$, which is the change in financial donations on the extensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. The results are based on estimations that exclude occupation groups 06 and 10 from the analysis. To enhance readability of the estimates, $\Delta netinc_i$ is scaled with the factor 100.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.11. Robustness check: The effect of net income on the intensive margin of financial donations, no occupation groups 06 and 10

	2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta netinc_i$	0.191***	0.195**	0.197***	0.184***	0.191***	0.173***
	(0.074)	(0.076)	(0.075)	(0.069)	(0.072)	(0.067)
ΔX_{1i}		X			X	X
ΔX_{2i}			X		X	X
ΔX_{3i}				X	X	X
ΔX_{4i}						X
Intercept	-8.30	-9.07	-9.57	-8.18	-10.09	-17.84
	(16.52)	(16.77)	(17.03)	(15.28)	(15.87)	(18.025)
	First stage					
$\Delta avinc_i$	3.226***	3.160***	3.105***	3.422***	3.232***	2.641***
	(0.598)	(0.602)	(0.589)	(0.601)	(0.595)	(0.354)
F-statistic	29.10	27.56	27.80	32.38	29.52	55.79
N	5,414	5,414	5,390	5,336	5,315	2,706

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta donation_i$, which is the change in financial donations on the intensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. The results are based on estimations that exclude occupation groups 06 and 10 from the analysis.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.12. Robustness check: The effect of net income on the extensive margin of financial donations, reported occupations

	2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta netinc_i$	0.024***	0.024***	0.023**	0.023***	0.022**	0.030**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.012)
ΔX_{1i}		X			X	X
ΔX_{2i}			X		X	X
ΔX_{3i}				X	X	X
ΔX_{4i}						X
Intercept	-0.009	-0.008	-0.006	-0.009	-0.007	-0.053
	(0.022)	(0.022)	(0.023)	(0.022)	(0.023)	(0.036)
	First stage					
$\Delta avinc_i$	0.021***	0.021***	0.020***	0.021***	0.020***	0.016***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
F-statistic	34.12	33.20	32.92	34.45	32.43	40.00
N	5,428	5,428	5,402	5,346	5,323	2,745

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta ddonate_i$, which is the change in financial donations on the extensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. The results are based on estimations that exclude observations on whom we lack data on the current occupation from the analysis. To enhance readability of the estimates, $\Delta netinc_i$ is scaled with the factor 100.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.13. Robustness check: The effect of net income on the intensive margin of financial donations, reported occupations

	2SLS					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta netinc_i$	0.128**	0.131**	0.130**	0.129**	0.133**	0.113**
	(0.051)	(0.052)	(0.051)	(0.051)	(0.051)	(0.047)
ΔX_{1i}		X			X	X
ΔX_{2i}			X		X	X
ΔX_{3i}				X	X	X
ΔX_{4i}						X
Intercept	6.093	5.540	5.76	4.85	3.92	-0.111
	(12.15)	(12.23)	(12.41)	(11.71)	(12.01)	(13.67)
	First stage					
$\Delta avinc_i$	2.113***	2.081***	2.023***	2.128***	2.004***	1.605***
	(0.363)	(0.362)	(0.354)	(0.364)	(0.353)	(0.255)
F-statistic	33.87	32.97	32.69	34.23	32.22	39.61
N	5,381	5,381	5,356	5,302	5,280	2,727

Notes: Robust standard errors in parentheses. The dependent variable is $\Delta donation_i$, which is the change in financial donations on the intensive margin. The F-statistic corresponds to the first stage F-statistic of the excluded instrument. The results are based on estimations that exclude observations on whom we lack data on the current occupation from the analysis.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

B Appendix to Chapter 3

B.1 Additional background material

Figure B.1. Newspaper pages of two influential German newspapers, left (*SZ*), right (*FAZ*).

Table B.1. Surveys on public opinion and policy preferences on migration in Germany in 2015-16

Survey question	Measure	Q1-2/2015	Q3/2015	Q4/2015	Q1/2016	Q2/2016	Q3-4/2016
infratest dimap - ARD-DeutschlandTREND							
What is your opinion on the topic of immigration in general: Does Germany (through immigration) rather have advantages or rather disadvantages?	%-share reporting "Rather disadvantages"		33 (Sep-15)	44 (Nov-15)	41 (Jan-16)	42 (Jun-16)	
I will now list some measures for dealing with refugee migrants in Germany and you please tell me whether you think this is right or not right.	%-share endorsing "border controls"		45 (Sep-15)		57 (Jan-16)		
I will now name a few concerns that are mentioned in connection with the refugee migrants coming to us. Please tell me in each case whether you personally have this concern or not.	%-share worrying about "housing market"			57 (Dec-15)	72 (Feb-16)	56 (May-16)	
I will now name a few concerns that are mentioned in connection with the refugee migrants coming to us. Please tell me in each case whether you personally have this concern or not.	%-share worrying about "labor market"			34 (Dec-15)	45 (Feb-16)	29 (May-16)	
Do you think it is right or not right for Germany to take in refugees who have fled because they have no work and no livelihood in their home country?	%-share reporting "reasonable"	41 (Jan-15)	28 (Aug-15)				
Politikbarometer							
Number of refugee migrants: can Germany cope?	%-share reporting "yes"		64 (Jul-15)	49 (Oct-15)	43 (Jan-16)	61 (Jun-16)	
Attitudes towards upper limit regarding number of refugee migrants:	%-share endorsing "upper limit"				41 (Jan-16)		54 (Sep-16)
YouGov							
In general, do you think that Germany could welcome more asylum seekers or do you think that the number is already too high?	%-share reporting "already too high"	45 (Feb-15)	42 (Jul-15)	56 (Oct-15)	62 (Jan-16)		

Notes: As noted earlier, the immigration policy in 2015 of the Merkel administration was found to be immigration-friendly; hence, opposing or being not satisfied with Merkel's immigration policy in 2015 tends to be, in the context at hand, indicative of favoring a rather restrictive immigration policy.

Table B.2. Overview: Dataset 3.4.1

News outlet i	Observations N	Appearance cycle	Sold copies
BILD-Zeitung (*Bild*)	405	daily	7.71 Mio.
Süddeutsche Zeitung (*SZ*)	694	daily	1.47 Mio.
Frankfurter Allg. Zeitung (*FAZ*)	307	daily	1.02 Mio.
Die Welt (*Welt*)	416	daily	0.73 Mio.
Tageszeitung (*TAZ*)	399	daily	0.21 Mio.
Junge Welt (*JW*)	222	daily	
Junge Freiheit (*JF*)	146	weekly	0.11
Total	2,589		

Notes: Column 1 lists the set of news outlets in my data. Column 2 indicates the number of observations (i.e., news pictures) per news outlet in the dataset. Column 3 indicates if the news outlet is published daily or weekly (note that *JF* is the only news outlet to occur on weekly-basis in my data). Column 4 provides the annual number of sold copies in Germany in 2016, which, with the exception of the *JW*, stem from Statista (2021).

B.2 Additional information on ideological campaigns

Table B.3. Overview: Dataset 3.4.2

Ideological campaigns			
Pro-immigration		Anti-immigration	
Campaign	*N*	Campaign	*N*
Pro Asyl e.V.	170	Tichys Einlick	103
Die Gruene	34	AfD - Alternative fuer Deutschland	45
Medico International e.V.	78	Compact Magazin	114
Caritas International e.V.	115	Abakus.News	124
Total	397	Total	386

Notes: Column 1 (and 3) lists the official names of organizations considered as pro-immigration (anti-immigration) campaigns in this dataset. Column 2 (and 4) provides the associated number of observations collected for these pro-immigration (and anti-immigration) campaigns.

Definition of ideological campaigns This section provides a more rigorous documentation on how I define and determine ideologically motivated campaigns. As outlined in Subsection 3.4.2, I follow three criteria to identify ideological campaigns: First, a campaign's vehicle of coverage (e.g., its website) should be officially, actively, and regularly operated and updated. Second, a campaign should explicitly state its attitudes towards migration. Third, the event of the 2015-16 migration crisis should be central to the campaign's agenda. As said earlier, official information ranking organizations according their attitudes towards immigration does not exist. There is, however, much reliable information on the political orientation of news outlets and further organization, particularly alongside a conventional one-dimensional political left-right spectrum. For example, the Federal Agency of Civic Education (Bundeszentrale fuer politische Bildung, BPB) published in December 2016 rich information on influential right-leaning news outlets and magazines in Germany.[1] Moreover, while the event of the 2015-16 migration crisis, several organizations and political parties in Germany have had clearly campaigned their stance on immigration. Examples for pro-immigration campaigns include NGOs such as Pro-Asyl, Caritas, Medico, Unicef, or politically left- and green-leaning German parties; anti-immigration attitudes have been campaigned by news outlets and organizations like Compact Magazin, Blaue Narzisse and Zuerst, or right-wing political parties such as the AfD party in Germany.[2]

Google search, keywords Apart from these natural candidates, which basically represent well-known parties and institutions that were especially during 2015-16 migration crisis active, I additionally aimed at discovering further campaigns on Google. I first prescribed a large set

[1] See `https://www.bpb.de/politik/extremismus/rechtsextremismus/239438/der-rechte-rand-verlage`, accessed 10 March 2021.

[2] See `https://www.bpb.de/politik/extremismus/rechtsextremismus/239620/der-rechte-rand-publikationen`, accessed 10 March 2021.

of search items and keywords to both sides of campaigns. Then, I considered for each search item all relevant Google hits occurring on the first ten Google pages in sequence (which is an equivalent of the first 100 hits). To find eligible candidates for pro-immigration campaigns, search keywords included e.g. "Organizations Refugees Relief", "Campaigns Refugees Relief", "Rescue Refugees", "Support Refugees", "Sea Rescue Refugees", "Refugee Crisis 2015", "Initiation Refugees", and "Integration Refugee" (originally in German language). Next, I focused on potential candidates for anti-immigration campaigns; search items include "Illegal Migration", "Uncontrolled Immigration", "Criminal Refugees 2015", "Stop Mass Immigration Germany", "Stop Illegal Immigration Germany", "Against Illegal Immigration Germany", "Stop Illegal Immigration Germany", "Foreign Domination", and "Increased Criminality Refugee". On top of that, I also checked for further left- and right-leaning parties, citizen's movement and associations on Wikipedia (accessed 21 December 2020). Finally, I examined social media (i.e., Twitter, Facebook, and Instagram) accounts of top-ranking politicians of political parties such as the The Left, The Green, and AfD party).

Final set of ideological campaigns On this broad route to determining campaigns, I initially shortlisted 44 candidates, mainly representing ideologically and politically motivated news media, non-governmental organizations, foundations and political parties, both national and regional, citizen's movements and associations, politicians' social media account, and blogs. Yet, before I started to collect the news pictures they portray, I evaluated for each candidate whether or not the three main criteria introduced in Subsection 3.4.2 were satisfied: I scrutinized thoroughly the overall coverage of each potential campaign's website and social media account (if any exits). In particular, I focused closely on all news stories and contributions, special publications, statements and online content that were available in regard to the 2015-16 migration crisis event. While almost all candidates implicitly fulfilled the second criteria

requiring a clear stance towards immigration, many of them fail to meet criteria one and/or three. In fact, a large subset of these 44 candidates appeared to (partially) cover content related to the 2015-16 migration crisis. Many of them, however, neither updated nor actively operated their platform, why I precluded them from my analysis. I also preclude the humanitarian organization UNICEF, because the welfare of children and women is central to the agency's program, whereby they might also portraying proportionally more children and woman as a result of the agency's idiosyncratic objective. Finally, conditional on having insisted on this procedure described, I was left with eight eligible ideological campaigns. Table B.3 provides a summary of the final set of campaigns. I collected all pictures that were related to event of the migration from each of these campaigns. Here, I analyzed the full history of their website (including coverage from publication, special report, short articles, etc.) and social media account.

Table B.4. Overview: main variables

Variables	Description and classification on picture-level
Gender composition	
Share Children	Percentage share of children (number of children/number of migrants)
Share Females	Percentage share of females (number of females/number of migrants)
Share Males	Percentage share of males (number of males/number of migrants)
Group Size	Indicates the number of migrants
Portrait	1 migrant is covered
Small	A group of $2-4$ migrants are covered
Medium	A group of $5-14$ migrants are covered
Big	A group of $15-24$ migrants are covered
Huge	A group of $25>$ migrants are covered
News topics	Relates to the main theme of a picture
Route	Migrants on their route to Europe (e.g., border crossing)
Sea/Vessel	Migrants crossing a sea via vessels or boats
Asylum Homes	Life in their temporary asylum homes
Socio-economic-Challenges	Migrants queuing up at public authorities (e.g., Job Center)
Security Issues	Criminal acts and police involvement
Integration	Participating in work and education
New Life	Engaging in social and cultural activities
Portraits	Portraits of single migrants
Other	Migrants sitting in rooms or waking around; repatriation

Table B.5. Summary statistics: gender composition

	N	Mean	SD	Min	p25	Median	p75	Max
Pro	397	0.58	0.42	0	0.00	0.67	1.00	1
JW	222	0.29	0.35	0	0.00	0.13	0.50	1
TAZ	399	0.37	0.38	0	0.00	0.27	0.67	1
SZ	694	0.39	0.40	0	0.00	0.28	0.75	1
Bild	405	0.36	0.42	0	0.00	0.13	0.80	1
FAZ	307	0.31	0.34	0	0.00	0.23	0.50	1
Welt	416	0.38	0.40	0	0.00	0.24	0.75	1
JF	146	0.23	0.33	0	0.00	0.05	0.38	1
Anti	386	0.24	0.33	0	0.00	0.08	0.34	1
Total	3372	0.37	0.39	0	0.00	0.22	0.71	1

Notes: Subsequent to the analysis in Subsection 3.5.1, Table B.5 reports the descriptive statistics for gender composition – reflected by the percentage share of non-males – on news outlet- and campaign-level.

Influence-weighted polarization measure To calculate influence-weighted measures of polarization as defined in Equation 3.4, I first need to determine the influence-weights π_i for each news outlet. As mentioned in the Footnote 5, I derive these weights from a large-scale Forsa survey where subjects were asked about their media consumption, see Table XXX in Chapter XXX for details. The Forsa survey generates the following (adjusted) influence weights: $\pi_{SZ} = 0.2264, \pi_{Welt} = 0.2135, \pi_{FAZ} = 0.2008, \pi_{Bild} = 0.1803, \pi_{TAZ} = 0.1193, \pi_{JF} = 0.0127$, and $\pi_{JW} = 0.0071$.

To determine the influence-weighted polarization measure according to gender composition, say, consider its mean values in Column 2 of Table B.5. Ranking news outlets according their attitude towards migration generates the following sequence: $x_{SZ} = 0.39 > x_{Welt} = 0.38 > x_{TAZ} = 0.37 > x_{Bild} = 0.36 > x_{FAZ} = 0.31 > x_{JW} = 0.29 > x_{JF} = 0.23$. Then, the average attitude towards migration in the market for news is $\bar{x} = 0.3632$.

Following $\bar{x}$ I split the market for news by grouping news outlets into a set of "positive" (i.e., $x_i > \bar{x}$) and "negative" (i.e., $x_i < \bar{x}$) news outlets. The resulting influence-weighted attitude towards migration of (positive) news outlets is $x_L^{news} = 0.3835$. Similarly, the influence-weighted attitude towards migration of (negative) news outlets equals $x_R^{news} = 0.3327$. Inserting x_L^{news} and x_R^{news} into Equation 3.4 gives an influence-weighted of $\Delta_{weight}^{gender} = 0.15$.

Analogously, the influence-weighted polarization measure according to group size equals $\Delta_{weight}^{group} = 0.28$. Notice that dividing news outlets into positive and negative set of outlets follows by having $x_i < \bar{x}$ (for "positive") and $x_i > \bar{x}$ (for "negative") an opposite splitting rule as in the case of gender composition; because a larger average group size implies negative attitude towards migration and vice versa.

Table B.6. Summary statistics: group size

	N	Mean	SD	Min	p25	Median	p75	Max
Pro	397	8.49	12.48	1	2.00	4.00	10.00	86
JW	222	13.31	51.05	1	2.00	4.00	11.00	663
TAZ	399	9.10	21.64	1	2.00	4.00	9.00	326
SZ	694	11.53	40.95	1	1.00	4.00	9.00	705
Bild	405	8.81	23.52	1	1.00	2.00	8.00	338
FAZ	307	19.89	49.04	1	3.00	7.00	18.00	705
Welt	416	9.98	27.30	1	1.00	4.00	8.50	456.5
JF	146	10.16	12.74	1	2.00	5.50	13.00	87
Anti	386	42.69	91.73	1	5.00	13.00	35.00	922
Total	3372	14.75	45.21	1	2.00	4.00	12.00	922

Notes: Subsequent to the analysis in Subsection 3.5.2, Table B.6 reports the descriptive statistics for group size – reflected by the number of migrants covered in the pictures – on news outlet- and campaign-level.

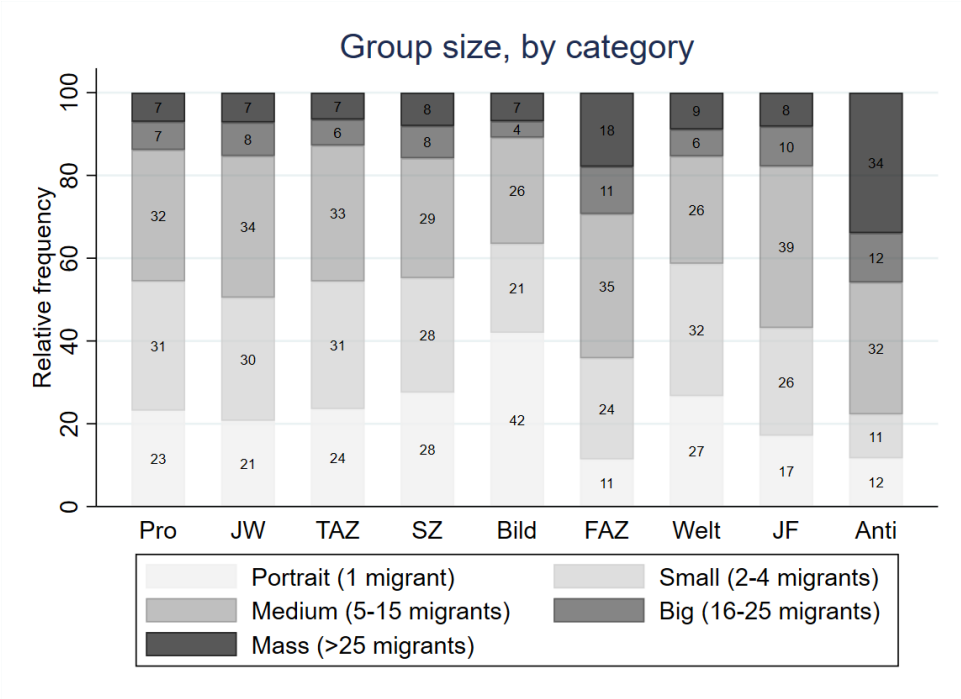

Figure B.2. Group size: campaigns vs. news outlets.

Notes: As outlined in Subsection 3.4.3, I use the number of migrants covered on the pictures to categorize group size as follows: Portraits (1 migrants), Small ($2-4$ migrants), Medium ($5-14$ migrant), Big ($15-24$ migrants), and Mass ($25>$ migrants).

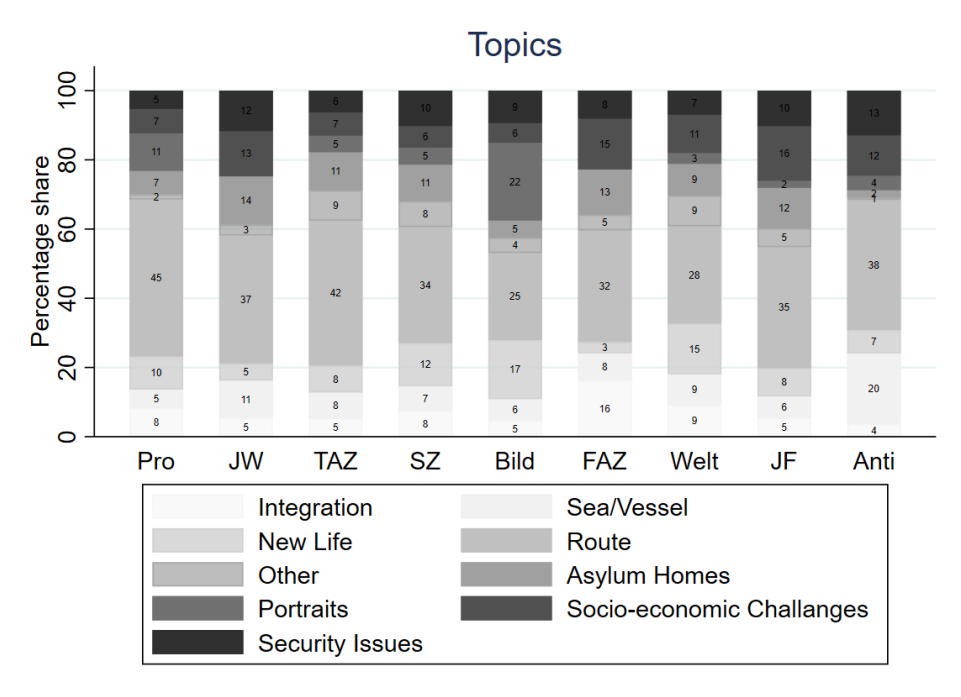

Figure B.4. Topics distribution: campaigns vs. news outlets.

B.3 Robustness checks

I probe the robustness of my Results 1-4. Specifically, I test the extent to which these results are robust to using an alternative measure of central tendency other than mean, the median. By construction, a median is robust to outliers and skewed data. See Table B.5 for the median values of gender composition (i.e. share non-males) and Table B.6 for the median values of group size (i.e. number of migrants). Below I discuss the robustness of each result in detail.

Result 1. In line with the main analysis, I find that pro-migration campaigns (67 percent) shows a much higher share of non-males than anti-migration campaigns (8 percent). Ranking news outlets according to their median share of non-males generates a sequence similar to the main analysis: the left-leaning *SZ* (28 percent) and *TAZ* (27 percent) show the highest share of non-males, the two extreme news outlets *JW* (14 percent) and *JF* (5 percent) portray the least share of non-males. The (median-based) basic polarization measure for gender composition is $\Delta^{gender} = 0.39$. Considering the influence of the news outlets produces an (median-based) influence-weighted polarization measure for gender composition of $\Delta^{gender}_{weight} = 0.15$. Notice that the influence-weighted polarization measure is smaller than the basic polarization measure too. Overall, Result 2 tends to be robust to using the median as alternative measure of central tendency.

Result 2. Consistent with the main analysis, pro-migration campaigns represent much smaller groups of migrants than anti-migration campaigns. The median group size of pro-migration campaigns is 4, the corresponding number of anti-migration campaigns is 13, and thus almost as twice as the number of migrants portrayed in the *FAZ*, which is with 7 migrants the news outlet with the highest median group size. However, the median group size of *Bild* with 2 migrants lies even below that of pro-migration campaigns. The *Welt*, *SZ*, *TAZ*, and *JW* exhibit a median group size value of 4, while the *JF* portrays 5.5 migrants. The (median-based) basic polarization measure for group size is $\Delta^{group} = 0.56$, deviating from the degree

of polarization in the main analysis. The (median-based) influence-weighted polarization measure for group size is $\Delta^{group}_{weight} = 0.37$. Again, the influence-weighted polarization measure is also smaller than the basic polarization measure. With the exception of the outlying *Bild* and moderate differences in levels, Result 2 tends to be robust to using the median as alternative measure of central tendency.

Result 3. Aligned with the findings in Result 3, I find that most news outlets adopt a more positive attitude towards migration from 2015 to 2016 according to the gender composition measure. The tabloid *Bild* provides still a remarkable exception and changes from being the relatively most positive news outlet in 2015 (median of 0.29) to the relatively most negative news outlet in 2016 (median of 0). These changes of news outlets' attitudes towards migrants, particularly the comparatively strong shift of the *Bild*, are reflected in the overall polarization dynamics: while the (median-based) basic polarization measure for gender composition is $\Delta^{gender}_{2015} = 0.41$ in 2015, below that of the mean-based measure in the main analysis, it strongly increases to $\Delta^{gender}_{2016} = 0.85$ in 2016. The (median-based) influence-weighted polarization measure for gender composition is 0.14 in 2015 and 0.47 in 2016, qualitatively coinciding with the pattern of Result 3. Overall, I find some notable differences in the levels by which news outlets' attitudes towards migration change from 2015 to 2016. However, qualitatively, the findings in Result 2 tend to be robust to using the median as alternative measure of central tendency.

Result 4. Consistent with Result 4, most news outlets adopt a more positive attitude towards migration from 2015 to 2016 according to the group size measure. The (median-based) polarization increases slightly from 2015 $\Delta^{group}_{2015} = 0.56$ to 2016 $\Delta^{group}_{2015} = 0.61$, whereas in Result 4 it increases from 0.26 to 0.53. The (median-based) influence-weighted polarization measure for gender composition in 2015 is $\Delta^{group}_{2015,weight} = 0.29$ and in 2016 $\Delta^{group}_{2016,weight} = 0.51$, qualitatively following the pattern of Result 3. This robustness test reveals that the (median-based)

levels of the polarization tend to be in general (slightly) higher than the levels with means. Qualitatively, the findings in Result 4 tend to be robust to using the median as measure of central tendency.

C Appendix to Chapter 4

C.1 Additional background material

Table C.1. Randomization check: final sample of pictures in the Forsa survey

	(1) *Overall*	(2) *Pro*	(3) *JW*	(4) *TAZ*	(5) *SZ*	(6) *Bild*	(7) *FAZ*	(8) *Welt*	(9) *JF*	(10) *Anti*
RatioMales	0.079	-0.112	0.028	-0.182	0.144	0.010	0.256	0.224	-0.401	0.178
	(0.090)	(0.265)	(0.397)	(0.282)	(0.200)	(0.254)	(0.362)	(0.263)	(0.534)	(0.337)
Migrants	-0.001	-0.016*	-0.005	0.004	-0.002	-0.001	0.000	-0.004	0.000	-0.001
	(0.001)	(0.009)	(0.004)	(0.007)	(0.003)	(0.006)	(0.002)	(0.003)	(0.016)	(0.001)
Route	0.022	-0.492	-0.454	0.531	0.254	0.124	0.011	0.029	0.041	0.075
	(0.134)	(0.499)	(0.510)	(0.425)	(0.328)	(0.540)	(0.475)	(0.409)	(0.880)	(0.291)
Asylum Homes	0.094	-0.341	0.199	0.593	-0.040	-0.285	0.624	-0.071	-0.408	0.524
	(0.169)	(0.608)	(0.577)	(0.506)	(0.386)	(0.703)	(0.534)	(0.488)	(1.017)	(0.753)
Socio-economic Challanges	0.029	-0.280	0.002	0.176	0.508	0.120	-0.107	-0.413	0.281	0.140
	(0.166)	(0.584)	(0.583)	(0.563)	(0.430)	(0.664)	(0.517)	(0.471)	(0.947)	(0.391)
Security Issues	-0.027	0.158	-0.145	0.647	-0.145	0.604	-0.162	-0.090	-0.710	-0.160
	(0.167)	(0.623)	(0.585)	(0.572)	(0.385)	(0.591)	(0.574)	(0.523)	(1.064)	(0.367)
Integration	0.151	-0.131	-0.555	1.391**	0.427	0.638	-0.335	-0.026	0.526	-0.594
	(0.178)	(0.596)	(0.743)	(0.631)	(0.411)	(0.692)	(0.513)	(0.496)	(1.132)	(0.606)
New Life	-0.037	-0.450	-0.096	1.048*	0.102	-0.029	-0.355	-0.455	-0.370	0.668
	(0.165)	(0.579)	(0.757)	(0.539)	(0.373)	(0.562)	(0.788)	(0.456)	(1.070)	(0.493)
Portraits	0.221	-0.634		0.681	0.932**	0.688		-0.143	0.513	-0.822
	(0.187)	(0.586)		(0.604)	(0.467)	(0.582)		(0.679)	(1.292)	(0.588)
Other	0.305	-0.480	-0.575	0.611	0.428	0.575	0.750	0.688	0.517	0.000
	(0.195)	(0.970)	(0.952)	(0.530)	(0.412)	(0.704)	(0.720)	(0.514)	(1.271)	(.)
Q3/2015	0.025		0.609	-0.274	0.249	-0.639	-0.483	-0.265	0.688	
	(0.166)		(0.471)	(0.518)	(0.328)	(0.572)	(0.572)	(0.427)	(0.708)	
Q4/2015	-0.171		0.813	-0.866	0.160	-0.895	-0.447	-0.454	-0.200	
	(0.174)		(0.519)	(0.532)	(0.339)	(0.615)	(0.559)	(0.453)	(0.757)	
Q1/2016	-0.145		0.709	-0.599	0.108	-0.633	-0.887	-0.424	0.617	
	(0.175)		(0.507)	(0.517)	(0.354)	(0.602)	(0.608)	(0.448)	(0.783)	
Q2/2016	-0.059		-0.134	-0.256	0.384	-0.939	-1.206*	-0.006	0.946	
	(0.196)		(0.546)	(0.595)	(0.383)	(0.652)	(0.647)	(0.510)	(0.848)	
Q3/2016	-0.051		0.920	-0.523	-0.165	-0.715	-0.262	-0.484	1.631*	
	(0.190)		(0.677)	(0.582)	(0.378)	(0.610)	(0.621)	(0.516)	(0.919)	
Constant	-0.048	0.555	-0.112	0.005	-0.493	0.370	0.305	0.272	-0.340	-0.103
	(0.184)	(0.529)	(0.592)	(0.561)	(0.419)	(0.530)	(0.611)	(0.479)	(0.963)	(0.376)
Observations	3366	397	222	398	692	405	307	416	146	380

Notes: Binary Logistic Regression. The dependent variable reflects the likelihood of pictures being in the Forsa sample of 1. The independent variables involve gender composition, group size, and time-dummies. Gender composition is reflected by the relative share of males; migrants is indicates by number of migrants;"Sea/Vessel", "Route", "Asylum Homes", "Socio-economic Challenges", "Security Issues", "Integration" , "New Life", "Portraits", and "Other" indicate the labels of the topics variable; and "Q2/2015", "Q3/2015", "Q4/2015", "Q1/2016", "Q2/2016", and "Q3/2016" indicate the labels of the time-dummy variable. The baseline for the topics variable is Sea/Vessel; the baseline for the time-specific dummy variable is Q2/2015. As in the main analysis, ideological campaigns are not labeled according to their time. p-values are in parenthesis. $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

Influence-weighted polarization measure. We construct an influence-weighted polarization measures according to its definition in Equation 4.1 as follows. First, we calculated for each news outlet i its adjusted relative influence weight π_i. For this, we determined for each news outlet i its relative influence – measured as the relative share of subjects who reported to consume news outlet i in our survey experiment (see Screens C.13 to C.15 for the corresponding questions). Column 3 in Table C.2 provides an overview of the relative influence of news outlets. Since by definition the influence-weighted polarization measure requires the sum of the influence weights to equal 1, i.e., $\sum_{i=1}^{n} \pi_i = 1$, we adjust our relative influence weights accordingly such that the sum of its adjusted influence weights sum up to 100% (Column 4).

Second, in line with our conceptual framework, we first order the set of news outlets according to their average attitude (i.e., average score of pictures) x_i, which yield $x_{SZ} > x_{Welt} > x_{Bild} > x_{JW} > x_{TAZ} > x_{FAZ} > x_{JF}$. Using the adjusted influence weights π_i yields an influence-weighted) average attitude of the market for news of $\bar{x} = -0.026$. Similarly, the influence-weighted positive attitude towards migration of news outlets is $x_L^{news} = 0.079$, and the influence-weighted negative attitude towards migration of news outlets equals $x_R^{news} = -0.413$. This entails an influence-weighted measure of polarization of $\Delta_{weight}^{score} = 0.33$ according to average rating of pictures.

Table C.2. News consumption

Survey question	Measure	Relative influence	Adjusted influence weights (π_i)
"Consider the last four weeks. Which of the following newspapers or magazines have you used to inform about news in politics, business, and society?"	%-share reporting at least once a week	81.15%	
"Which of the following newspapers and magazines – printed and/or online – have you used to inform yourself about current news from politics, business, and society?"	%-share selecting *SZ*	20.76%	26.64%
"Which of the following newspapers and magazines – printed and/or online – have you used to inform yourself about current news from politics, business, and society?"	%-share selecting *Welt*	16.65%	21.35%
"Which of the following newspapers and magazines – printed and/or online – have you used to inform yourself about current news from politics, business, and society?"	%-share selecting *FAZ*	15.65%	20.08%
"Which of the following newspapers and magazines – printed and/or online – have you used to inform yourself about current news from politics, business, and society?"	%-share selecting *Bild*	14.05%	18.03%
"Which of the following newspapers and magazines – printed and/or online – have you used to inform yourself about current news from politics, business, and society?"	%-share selecting *TAZ*	9.03%	11.93%
"Which of the following newspapers and magazines – printed and/or online – have you used to inform yourself about current news from politics, business, and society?"	%-share selecting *JF*	0.99%	1.27%
"Which of the following newspapers and magazines – printed and/or online – have you used to inform yourself about current news from politics, business, and society?"	%-share selecting *JW*	0.55%	0.71%
	Sum	77.94%	100.00%

Notes: We obtain the adjusted influence weights in Column 4 by scaling up the values in Column 3 by the factor 1.283, following from the ratio 1/0.7794.

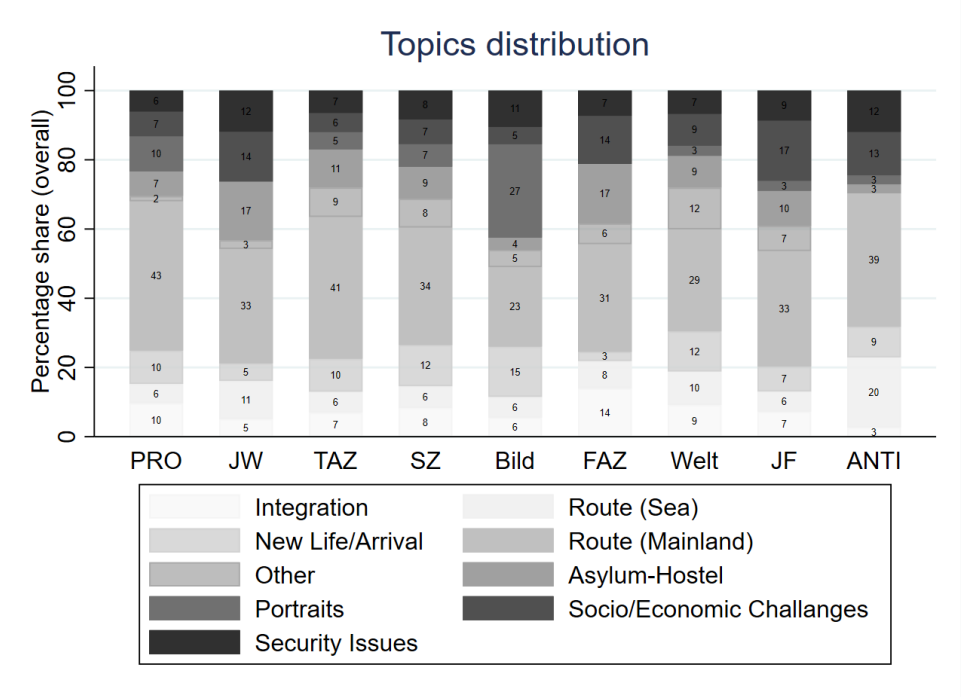

Figure C.1. Topics distribution, by news outlets and campaigns.

Table C.3. Polarization Dynamics

News Outlet i	Q2/2015	Q3/2015	Q4/2015	Q1/2016	Q2/2016	Q3/2016
JW	-0,04	0,06	-0,27	0,12	0,49	-0,03
TAZ	0,12	-0,19	-0,14	0,21	-0,06	0,11
SZ	0,28	0,05	0,06	0,4	0,07	0,36
BILD	0,79	0,29	0,17	0,07	-0,61	-0,46
FAZ	-0,23	-0,32	-0,43	-0,45	-0,73	-0,42
WELT	0,13	-0,07	0	0,37	0	-0,12
JF	-0,71	-1,01	-0,89	-0,42	-0,05	-1,29
$\max_i\{x_i\} - \min_i\{x_i\}$	1,5	1,3	1,06	0,85	1,22	1,65
$x_{Pro} - x_{Anti}$	1,49	1,49	1,49	1,49	1,49	1,49
Polarization (Δ^{score})	1,01	0,87	0,71	0,57	0,82	1,11
Polarization (Δ^{score}_{weight})	0,34	0,23	0,27	0,37	0,47	0,41

Table C.4. Average rating dynamics of news outlets from Q2/2015 to Q3/2016.

	(1) *Overall*	(2) *JW*	(3) *TAZ*	(4) *SZ*	(5) *Bild*	(6) *FAZ*	(7) *Welt*	(8) *JF*
Q3/2015	-0.184	0.102	-0.316	-0.232	-0.498	-0.094	-0.200	-0.295
	(0.136)	(0.404)	(0.300)	(0.274)	(0.381)	(0.369)	(0.282)	(0.724)
Q4/2015	-0.257*	-0.236	-0.260	-0.217	-0.621	-0.197	-0.139	-0.180
	(0.142)	(0.406)	(0.322)	(0.277)	(0.466)	(0.363)	(0.314)	(0.820)
Q1/2016	0.035	0.161	0.082	0.123	-0.718	-0.222	0.240	0.289
	(0.146)	(0.405)	(0.307)	(0.296)	(0.460)	(0.447)	(0.302)	(0.758)
Q2/2016	-0.194	0.528	-0.182	-0.210	-1.398**	-0.495	-0.131	0.661
	(0.158)	(0.522)	(0.357)	(0.292)	(0.544)	(0.396)	(0.321)	(0.787)
Q3/2016	-0.320**	0.012	-0.013	0.079	-1.249***	-0.190	-0.259	-0.579
	(0.153)	(0.569)	(0.330)	(0.308)	(0.387)	(0.396)	(0.414)	(0.752)
Constant	0.131	-0.039	0.124	0.277	0.786**	-0.230	0.135	-0.711
	(0.120)	(0.346)	(0.260)	(0.245)	(0.349)	(0.319)	(0.235)	(0.684)
Observations	1282	118	201	336	200	151	207	69

Notes: OLS Regression. The dependent variable is the average score of the news pictures. "Q2/2015", "Q3/2015", "Q4/2015", "Q1/2016", "Q2/2016", and "Q3/2016" indicate the respective time-dummy variable regarding the quarters of 2015 and 2016, respectively. The baseline category is Q2/2015. Robust standard errors are in parenthesis. $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

Table C.5. Within-outlet range dynamics

News outlet i	Quarter t	N	$\bar{x}_i^t$	x_L^i	x_R^i	$\|x_L^i - x_R^i\|$
JW	Q2/2015	14	-0,04	1,09	-1,17	2,26
JW	Q3/2015	34	0,06	1,00	-0,87	1,86
JW	Q4/2015	24	-0,27	0,56	-1,11	1,67
JW	Q1/2016	25	0,12	0,96	-0,78	1,74
JW	Q2/2016	12	0,49	1,58	-0,60	2,18
JW	Q3/2016	9	-0,03	1,33	-1,11	2,43
TAZ	Q2/2015	12	0,12	0,79	-0,54	1,33
TAZ	Q3/2015	63	-0,19	1,02	-0,94	1,95
TAZ	Q4/2015	37	-0,14	0,75	-1,17	1,92
TAZ	Q1/2016	48	0,21	1,18	-0,69	1,87
TAZ	Q2/2016	19	-0,06	0,93	-0,77	1,70
TAZ	Q3/2016	22	0,11	0,70	-0,73	1,43
SZ	Q2/2015	21	0,28	1,03	-0,73	1,76
SZ	Q3/2015	111	0,05	1,20	-0,93	2,13
SZ	Q4/2015	77	0,06	0,94	-0,85	1,79
SZ	Q1/2016	54	0,40	1,36	-0,56	1,91
SZ	Q2/2016	37	0,07	0,80	-0,71	1,52
SZ	Q3/2016	36	0,36	1,28	-0,57	1,86
BILD	Q2/2015	12	0,79	1,65	-0,42	2,07
BILD	Q3/2015	79	0,29	1,41	-0,81	2,22
BILD	Q4/2015	19	0,17	1,22	-1,00	2,22
BILD	Q1/2016	29	0,07	1,34	-1,29	2,63
BILD	Q2/2016	13	-0,61	0,58	-2,01	2,59
BILD	Q3/2016	48	-0,46	0,42	-1,21	1,62
FAZ	Q2/2015	12	-0,23	0,83	-0,99	1,82
FAZ	Q3/2015	46	-0,32	0,75	-1,40	2,15
FAZ	Q4/2015	45	-0,43	0,57	-1,30	1,87
FAZ	Q1/2016	19	-0,45	1,14	-1,38	2,52
FAZ	Q2/2016	9	-0,73	0,10	-1,14	1,24
FAZ	Q3/2016	20	-0,42	0,34	-1,36	1,70
WELT	Q2/2015	19	0,13	1,05	-0,69	1,73
WELT	Q3/2015	63	-0,07	1,02	-0,93	1,96
WELT	Q4/2015	37	0,00	1,12	-0,96	2,08
WELT	Q1/2016	48	0,37	1,26	-0,86	2,12
WELT	Q2/2016	22	0,00	0,75	-1,07	1,82
WELT	Q3/2016	18	-0,12	0,82	-1,31	2,13
JF	Q2/2015	5	-0,71	0,97	-1,83	2,80
JF	Q3/2015	21	-1,01	-0,28	-1,80	1,52
JF	Q4/2015	9	-0,89	0,20	-1,76	1,96
JF	Q1/2016	15	-0,42	0,74	-1,44	2,18
JF	Q2/2016	9	-0,05	0,79	-1,10	1,90
JF	Q3/2016	10	-1,29	-0,52	-2,06	1,54

C.2 Details for the Forsa survey

We present the original screens that subjects were shown in the Forsa survey experiment as follow. For each screen, we also provide an English translation. Our survey experiment began as follows.

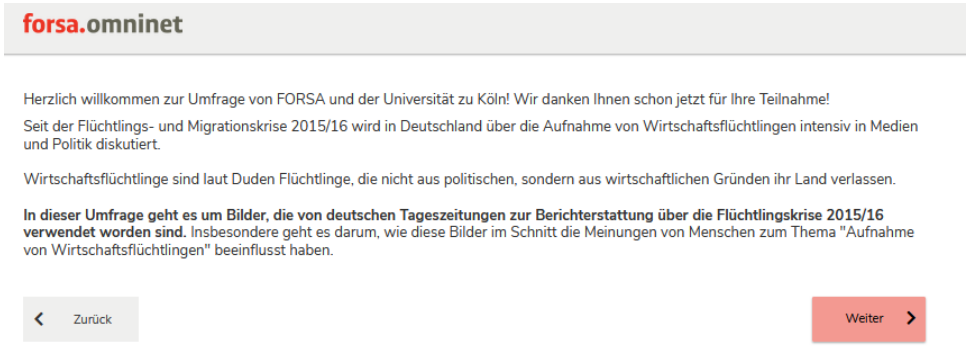

Figure C.2. Screen 1

Welcome to the survey conducted by FORSA and the University of Cologne! We thank you in advance for your participation!

Since the refugee and migration crisis in 2015/16, the admission of economic refugees has been the subject of intense debate in the media and politics in Germany.

According to the dictionary, economic refugees are refugees who leave their country not for political but for economic reasons.

This survey is about pictures that have been used by German daily newspapers to cover the migration crisis in 2015/16. In particular, it looks at how these pictures on average influenced people's opinions on the topic of admitting economic refugees.

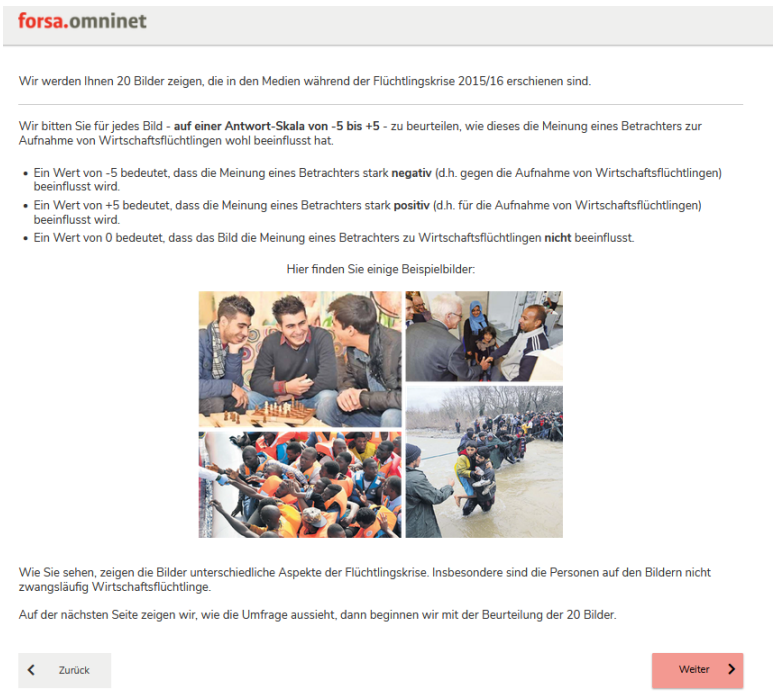

Figure C.3. Screen 2

We will show you 20 pictures that appeared in the news media during the migration crisis 2015/16.

For each picture, we ask you to rate how it affects probably a viewer's opinion of accepting economic refugees, on a scale of -5 to +5.

A value of -5 means that a viewer's opinion is strongly negatively influenced (i.e., against admitting economic refugees).
A value of +5 means that a viewer's opinion is strongly positively influenced (i.e., in favor of admitting economic refugees).
A value of 0 means that the picture does not influence a viewer's opinion on economic migrants.

Here you can find some sample images: [FOUR EXAMPLE PICTURES]

As you can see, the images show different aspects of the refugee crisis. In particular, the people in the pictures are not necessarily economic refugees.

On the next page we will show what the survey looks like, then we will start rating the 20 pictures.

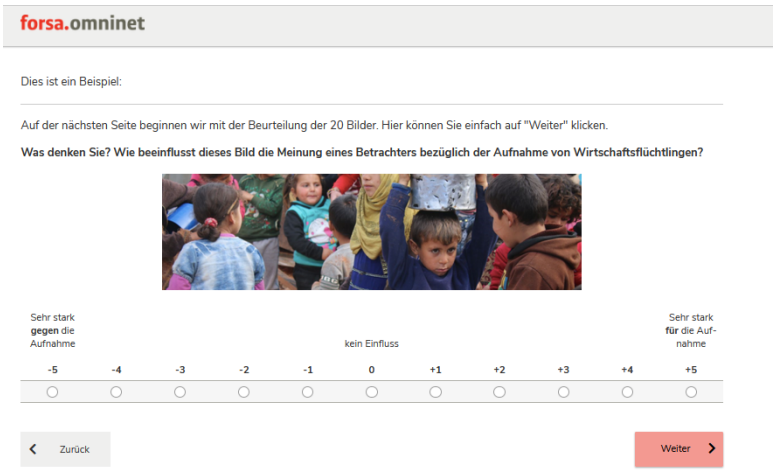

Figure C.4. Screen 3

This is an example.

On the next page we will start with the rating of 20 pictures. Here you can simply press the "next" button.

What do you think? How does this picture influence a viewer's opinion regarding the admission of economic refugees?

-5 (Very negative/ Strongly against the admission of economic refugees)... 0 (No influence)... +5 (Very positive/ Strongly in favor of the admission accepting of economic refugees)

Each subject in the Forsa survey experiment was asked to rate 20 pictures. We present three examples of this rating process in the following three screens.

Example 1

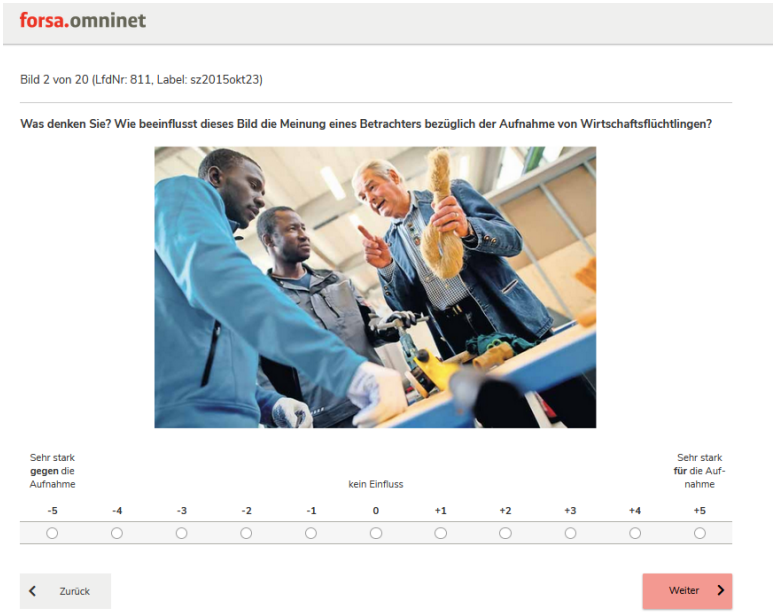

Figure C.5. Screen 4

What do you think? How does this picture influence a viewer's opinion regarding the admission of economic refugees?

-5 (Very negative/ Strongly against the admission of economic refugees)... 0 (No influence)... +5 (Very positive/ Strongly in favor of the admission accepting of economic refugees)

Example 2

Figure C.6. Screen 5

What do you think? How does this picture influence a viewer's opinion regarding the admission of economic refugees?

-5 (Very negative/ Strongly against the admission of economic refugees)... 0 (No influence)... +5 (Very positive/ Strongly in favor of the admission accepting of economic refugees)

Example 3

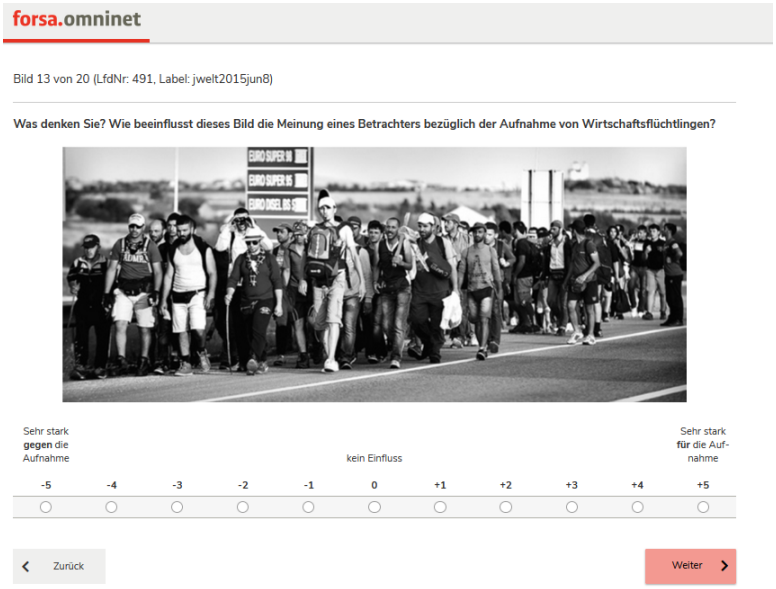

Figure C.7. Screen 6

What do you think? How does this picture influence a viewer's opinion regarding the admission of economic refugees?

-5 (Very negative/ Strongly against the admission of economic refugees)... 0 (No influence)... +5 (Very positive/ Strongly in favor of the admission accepting of economic refugees)

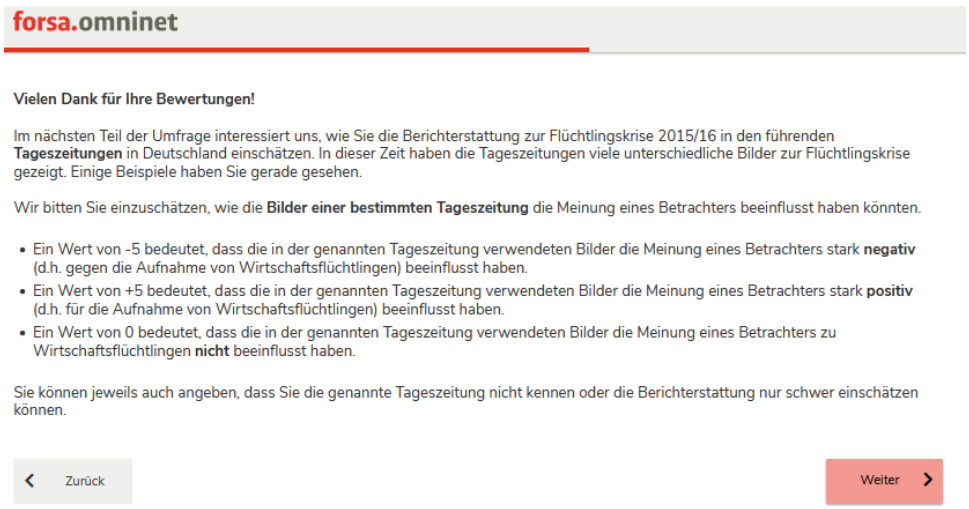

Figure C.8. Screen 24

Thank you for your ratings!

In the next part of the survey, we are interested in how you rate the coverage of the 2015/16 migration crisis in the leading daily newspapers in Germany. During this time, the dailies have shown many different news pictures on the migration crisis. You have seen some these pictures in the first part of the survey.
Now we ask you to rate how the pictures of a certain newspaper might have influenced a viewer's opinion.

A value of -5 means that the pictures used in the respective daily newspaper had a strongly negative influence on a viewer's opinion (i.e., against admitting economic refugees).
A value of +5 means that the pictures used in the respective daily newspaper had a strongly positive influence on a viewer's opinion (i.e., in favor of admitting economic refugees).
A value of 0 means that the pictures used in the respective daily newspaper did not influence a viewer's opinion of economic refugees.

In each case, you can also state that you do not know the daily newspaper mentioned or that it is

difficult for you to rate the coverage.

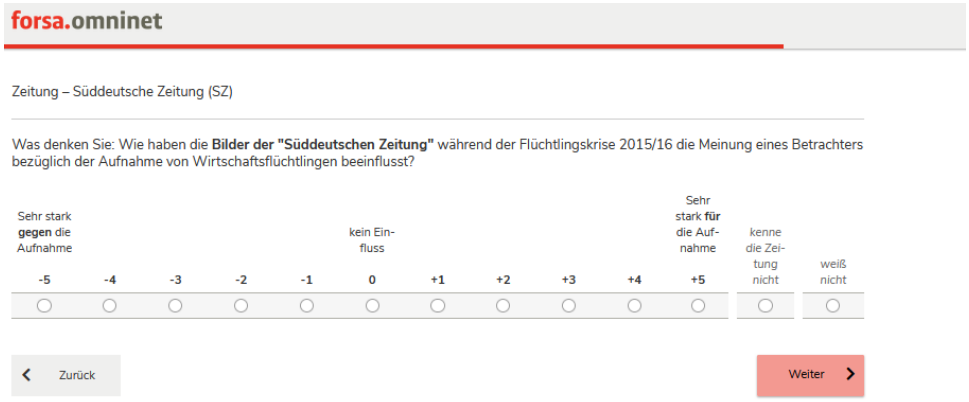

Figure C.9. Screen 25

Newspaper – Sueddeutsche Zeitung (SZ)

What do you think? How did the pictures of the "Sueddeutsche Zeitung" during the 2015/16 migration crisis influence a viewer's opinion regarding the admission of economic refugees?

-5 (Very negative/ Strongly against the admission of economic refugees)... 0 (No influence)... +5 (Very positive/ Strongly in favor of the admission accepting of economic refugees)... don't know...don't know the newspaper

Identically, we asked subjects to rate the remaining daily newspapers.

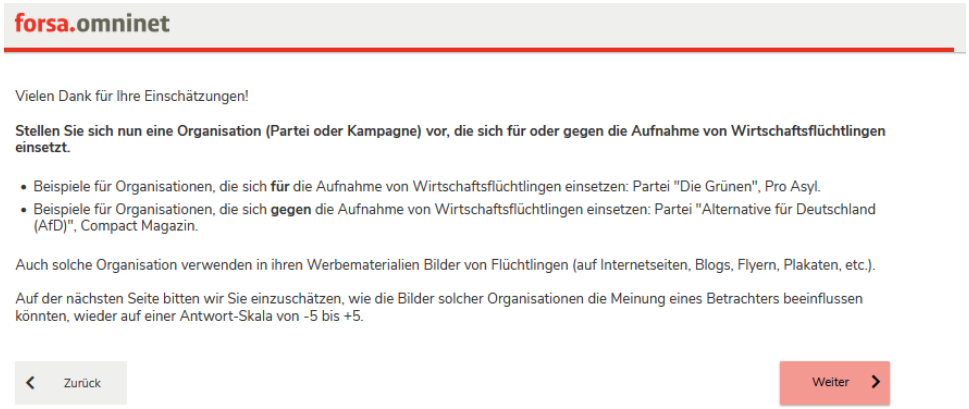

Figure C.10. Screen 32

Thank you very much for your evaluations!

Now imagine an organization (party or campaign) that advocates for or against admitting economic refugees.

Examples of organizations that support the admission of economic refugees: Party "Die Grünen", Pro Asyl.
Examples of organizations that oppose the admission of economic refugees: Alternative für Deutschland (AfD), Compact Magazin.

Such organization also use pictures of refugees in their promotional materials (on websites, blogs, flyers, posters, etc.).

On the next page, we ask you to rate how the pictures of such organizations might influence a viewer's opinion, again on a response scale of -5 to +5.

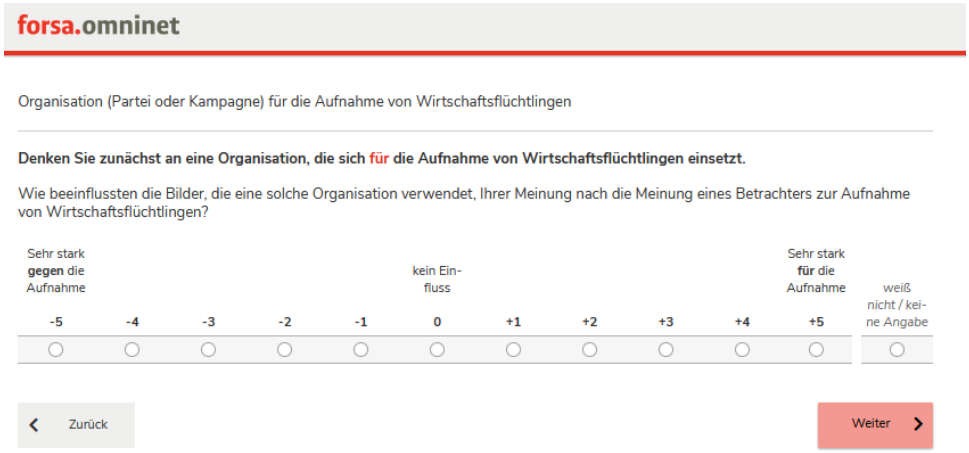

Figure C.11. Screen 33

Organization (Party and Campaign) that support the admission of economic refugees

First, think of an organization that advocates for the admission of economic refugees.

How do you think the pictures used by an organization like this influenced a viewer's opinion of admitting economic refugees?

-5 (Strongly against the admission of economic refugees)... 0 (No influence)... +5 (Strongly in favor of the admission accepting of economic refugees)...don't know/don't know the newspaper

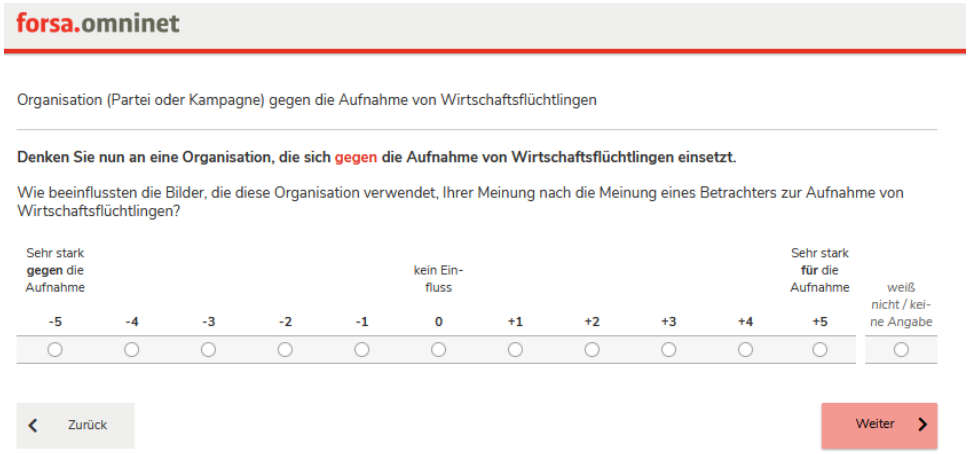

Figure C.12. Screen 34

Organization (Party and Campaign) that oppose the admission of economic refugees

First, think of an organization that advocates against the admission of economic refugees.

How do you think the pictures used by an organization like this influenced a viewer's opinion of admitting economic refugees?

-5 (Strongly against the admission of economic refugees)... 0 (No influence)... +5 (Strongly in favor of the admission accepting of economic refugees)...don't know/don't know the newspaper

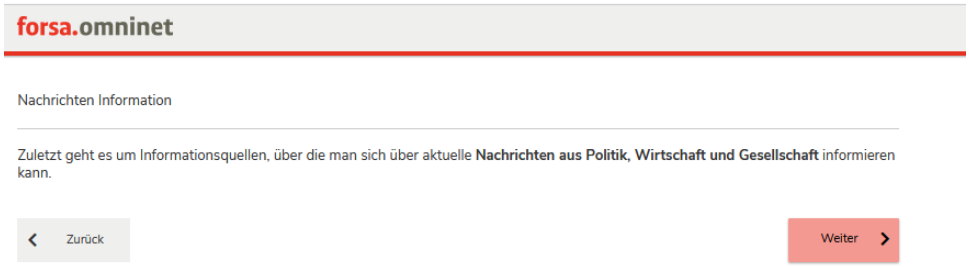

Figure C.13. Screen 35

News information

This last part relates to the sources of information that can be used to inform yourself about the latest news from politics, business, and society.

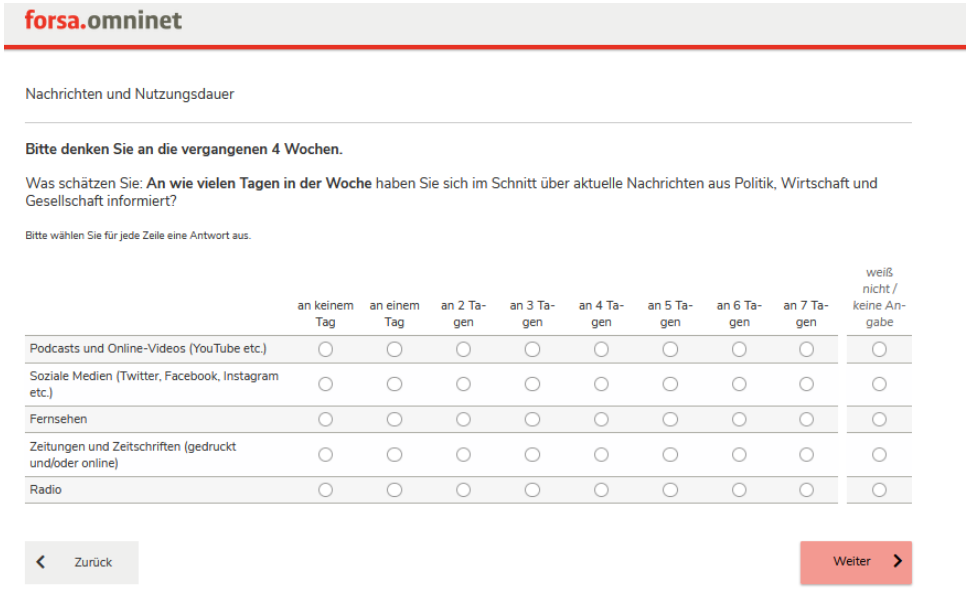

Figure C.14. Screen 36

News consumption

Please remember the past 4 weeks.

What do you estimate: on how many days a week, on average, did you inform yourself on the latest news from politics, business, and society?

Please select for each of the following lines your answer.

Newspapers and magazines (printed and/or online)

Television

Radio

Social media (Twitter, Facebook, Instagram, etc.)

Podcasts and online videos (YouTube, etc.)

Scale: none – in 1 day – 2 days – 3 days – 4 days – 5 days – 6 days – 7 days – don't know/no response

Filter: If newspapers/magazines are used on at least one day of the week according to the previous question in Screen C.14.

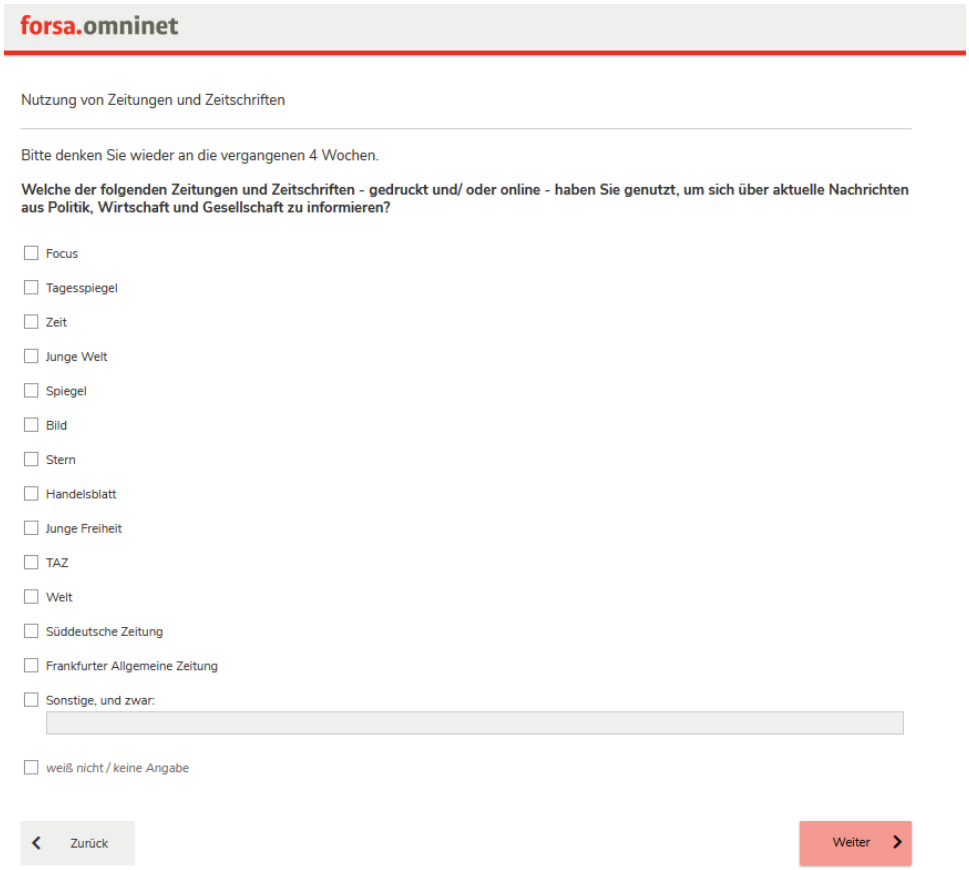

Figure C.15. Screen 37

News consumption of newspapers and magazines

Please consider again the past 4 weeks.

Which of the following newspapers and magazines – printed and/or online – have you used to inform yourself about current news from politics, business, and society?

Focus

Tagesspiegel

Zeit

Junge Welt

Spiegel

Bild

Stern

Handelsblatt

Junge Freiheit

TAZ

Welt

Sueddeutsche Zeitung

Frankfurter Allgemeine Zeitung

Others, which are:

don't know/no response

Filter: If TV is used on at least one day of the week according to the previous question in Screen C.14.

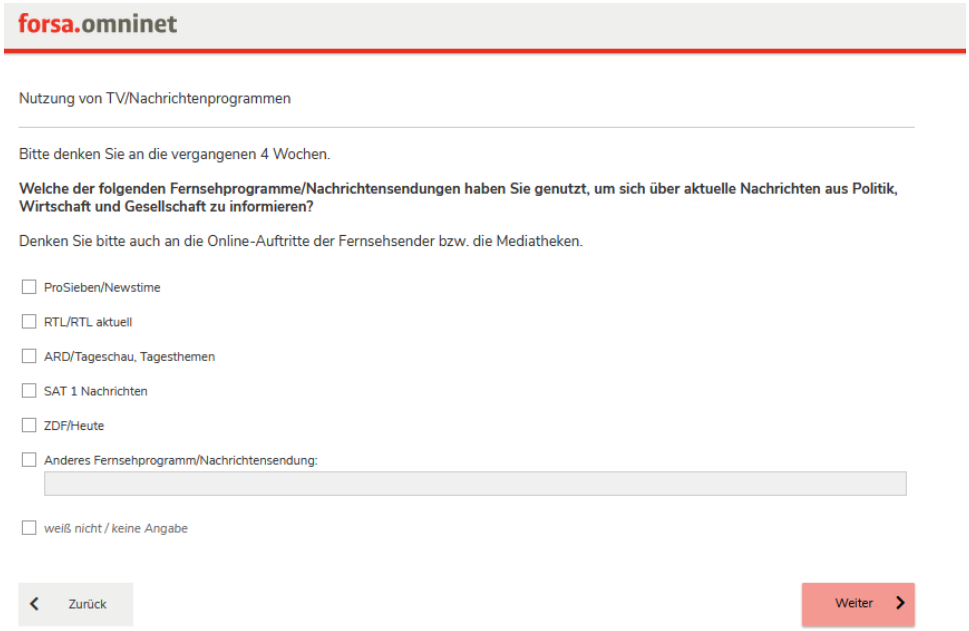

Figure C.16. Screen 38

News consumption of TV programs /news broadcast

Please consider the past 4 weeks.

Which of the following TV programs/news broadcasts have you used to inform about current news from politics, business, and society? Please also consider the online presences of the TV broadcasters (e.g., online live streams) or the media libraries.

ProSieben/Newstime

RTL/RTL aktuell

ARD/Tageschau, Tagesthemen

SAT 1 Nachrichten

ZDF/Heute

Other TV program/news program:

don't know/no response

Filter: If radio is used on at least one day of the week according to the previous question in Screen C.14.

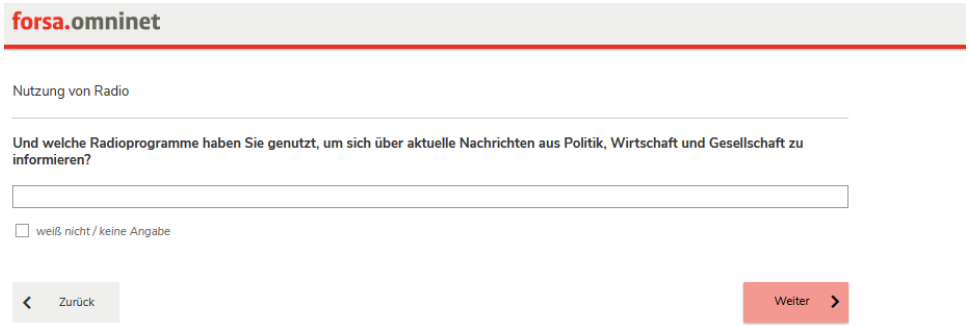

Figure C.17. Screen 39

Consumption of radio

And which radio programs did you use to inform about the latest news from politics, business, and society?

Filter: If social media is used on at least one day of the week according to the previous question in Screen C.14.

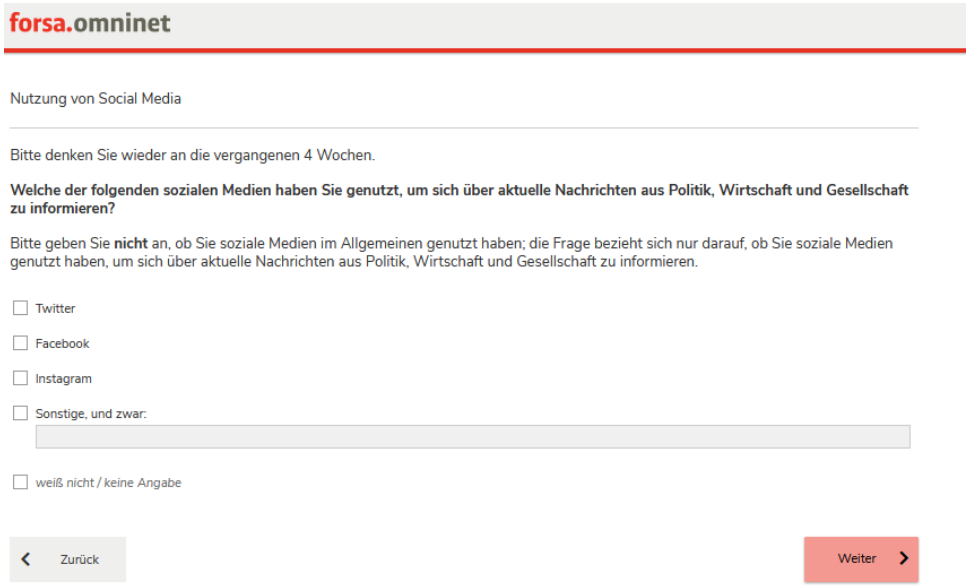

Figure C.18. Screen 40

Please think back to the past 4 weeks.

Which of the following social media did you use to keep up with the latest news from politics, business, and society?

Please do not indicate whether you have used social media in general; the question only refers to whether you have used social media to inform yourself about current news from politics, business, and society.

Twitter
Facebook
Instagram
Others, which are:

don’t know/no response

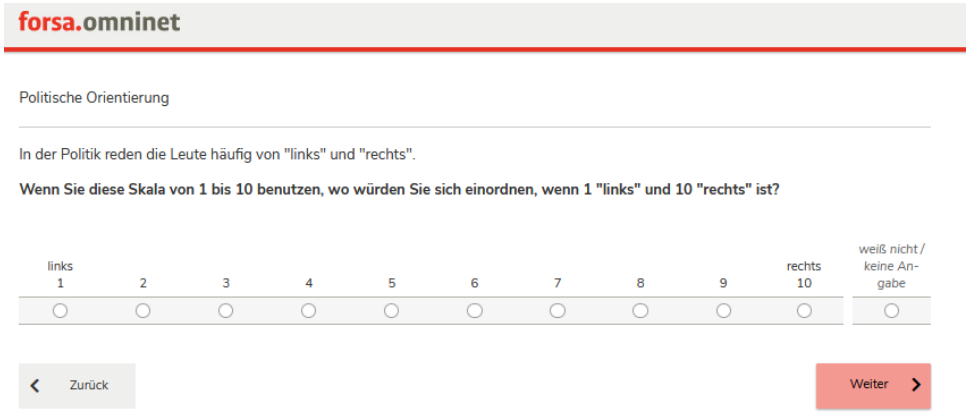

Figure C.19. Screen 41

Political orientation

In politics, people often talk about “left” and “right”.

If you use this scale from 1 to 10, where would you place yourself if 1 is “left” and 10 is “right”?

Scale: 1 (left) – ...– 5 –... – 10 (right) – don’t know/no response

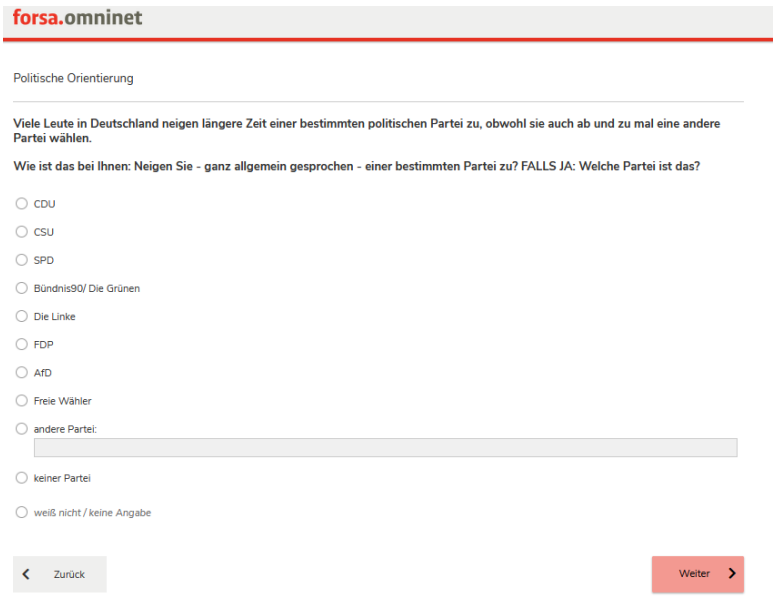

Figure C.20. Screen 42

Political orientation

Many people in Germany lean towards a particular political party for a long time, although they also vote for another party from time to time.

What about you: Do you - generally speaking - lean towards a particular party? IF YES: Which party is that?

CDU

CSU

SPD

Buendnis90/ Die Gruenen

Die Linke

FDP

AfD

Freie Waehler

another party:

no party

don't know/no response

Bibliography

Alesina, Alberto, Armando Miano, and Stefanie Stantcheva (2018) "Immigration and Redistribution," *NBER Working Paper No. 24733*.

Andreoni, James (2007) "Giving gifts to groups: How altruism depends on the number of recipients," *Journal of Public Economics*, **91** (9), 1731–1749.

Andreoni, James, Nikos Nikiforakis, and Jan Stoop (2017) "Are the Rich More Selfish than the Poor, or Do They Just Have More Money? A Natural Field Experiment," NBER Working Paper No. 23229.

Arnott, Richard, Bruce Greenwald, and Joseph E. Stiglitz (1994) "Information and Economic Efficiency," *Information Economics and Policy*, **6** (1), 77–82.

Ash, Elliott, Ruben Durante, Mariia Grebenshchikova, and Carlo Schwarz (2021) "Visual Representation and Stereotypes in News Media," URL: `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3934858`.

Atkeson, Andrew, Christian Hellwig, and Guillermo Ordonez (2015) "Optimal Regulation in the Presence of Reputation Concerns," *Quarterly Journal of Economics*, **130** (1), 415–464.

Balafoutas, Loukas, Adrian Beck, Rudolf Kerschbamer, and Matthias Sutter (2013) "What Drives Taxi Drivers? A Field Experiment on Fraud in a Market for Credence Goods," *Review of Economic Studies*, **80** (3), 876–891.

Balafoutas, Loukas and Rudolf Kerschbamer (2020) "Credence goods in the literature: What the past fifteen years have taught us about fraud, incentives, and the role of institutions," *Journal of Behavioral and Experimental Finance*.

Bansak, Kirk, Jens Hainmueller, and Dominik Hangartner (2016) "How economic, humanitarian, andreligious concerns shape Europeanattitudes toward asylum seekers," *Science*, **354** (6309), 217–222.

Baron, David P. (2006) "Persistent media bias," *Journal of Public Economics*, **90** (1), 1–36, URL: https://www.sciencedirect.com/science/article/pii/S0047272705000216.

Barrera, Oscar, Sergei Guriev, Emeric Henry, and Ekaterina Zhuravskaya (2020) "Facts, alternative facts, and fact checking in times of post-truth politics," *Journal of Public Economics*, **182**, 104–123.

Barrett, Andrew W. and Lowell W. Barrington (2005) "Bias in Newspaper Photograph Selection," *Political Research Quarterly*, **58** (4), 609–618, URL: http://www.jstor.org/stable/3595646.

Bartling, Björn, Vanessa Valero, and Roberto A. Weber (2019) "The Causal Effect of Income Growth on Consumer Social Responsibility," Working Paper.

Becker, D. Vaughn, Douglas T. Kenrick, Steven L. Neuberg, K. C. Blackwell, and Dylan M. Smith (2007) "The Confounded Nature of Angry Men and Happy Women," *Journal of Personality and Social Psychology*, **92** (2), 179–190.

Bersani, Bianca E. (2014) "An Examination of First and Second Generation Immigrant Offending Trajectories," *Justice Quarterly*, **31** (2), 315–343, URL: https://doi.org/10.1080/07418825.2012.659200.

Bester, Helmut and Matthias Dahm (2018) "Credence Goods, Costly Diagnosis and Subjective Evaluation," *Economic Journal*, **128** (611), 1367–1394.

Bloom, Pazit Ben-Nun, Gizem Arikan, and Gallya Lahav (2015) "The effect of perceived cultural and material threats on ethnic preferences in immigration attitudes," *Ethnic and Racial Studies*, **38** (10), 1760–1778, URL: https://doi.org/10.1080/01419870.2015.1015581.

Borjas, George J. (1999) "The Economic Analysis of Immigration," *Handbook of Labor Economics*.

Cappelen, Alexander W., Ranveig Falch, and Bertil Tungodden (2019) "The Boy Crisis: Experimental Evidence on the Acceptance of Males Falling Behind," *NHH Dept. of Economics Discussion Paper No. 06/2019*.

Carpenter, Jeffrey, Eric Verhoogen, and Stephen Burks (2005) "The Effect of Stakes in Distribution Experiments," *Economics Letters*, **86** (3), 393–398.

Chowdhury, Subhasish M and Joo Young Jeon (2014) "Impure altruism or inequality aversion?: An experimental investigation based on income effects," *Journal of Public Economics*, **118**, 143–150.

Dallmann, Alexander, Florian Lemmerich, Daniel Zoller, and Andreas Hotho (2015) "Media bias in german online newspapers," in *Proceedings of the 26th ACM Conference on Hypertext & Social Media*, 133–137, ACM.

Darby, Michael R. and Edi Karni (1973) "Free Competition and the Optimal Amount of Fraud," *Journal of Law and Economics*, **16** (1), 67–88.

DellaVigna, Stefano and Eliana La Ferrara (2015) "Economic and social impacts of the media," *Handbook of media economics*, **1**, 723–768.

Dewenter, Ralf, Uwe Dulleck, and Tobias Thomas (2016) *Does the 4th estate deliver? Towards a more direct measure of political media bias*: DICE Discussion Paper.

Dixit, Avinash, Gene Grossman, and Elhanan Helpman (1997) "Common Agency and Coordination: General Theory and Application to Government Policy Making," *Journal of Political Economy*, **105** (4), 752–769.

Djankov, Simeon, Rafael La Porta, Florencio Lopez de Silanes, and Andrei Shleifer (2002) "The Regulation of Entry," *Quarterly Journal of Economics*, **117** (1), 1–37.

Dulleck, Uwe and Rudolf Kerschbamer (2006) "On Doctors, Mechanics, and Computer Specialists: The Economics of Credence Goods," *Journal of Economic Literature*, **44** (1), 5–42.

Dulleck, Uwe, Rudolf Kerschbamer, and Matthias Sutter (2011) "The Economics of Credence Goods: An Experiment on the Role of Liability, Verifiability, Reputation, and Competition," *American Economic Review*, **101** (2), 526–55.

Dustmann, Christian, Kristine Vasiljeva, and Anna Piil Damm (2018) "Refugee Migration and Electoral Outcomes," *The Review of Economic Studies*, **86** (5), 2035–2091, URL: https://doi.org/10.1093/restud/rdy047.

Ellsberg, Daniel (1961) "Risk, Ambiguity, and the Savage Axioms," *Quarterly Journal of Economics*, **75** (4), 643–669.

Emons, Winand (1997) "Credence goods and fraudulent experts," *RAND Journal of Economics*, 107–119.

Engel, Christoph (2011) "Dictator games: A meta study," *Experimental Economics*, **14** (4), 583–610.

Englmaier, Florian and Achim Wambach (2010) "Optimal incentive contracts under inequity aversion," *Games and Economic Behavior*, **69** (2), 312–328.

European Economic and Social Committee (2014) "The State of Liberal Professions Concerning their Functions and Relevance to European Civil Society," European Union.

Farris, Emily M. and Heather Silber Mohamed (2018) "Picturing immigration: how the media criminalizes immigrants," *Politics, Groups, and Identities*, **6** (4), 814–824, URL: https://doi.org/10.1080/21565503.2018.1484375.

Fitzgerald, Jennifer, K. Amber Curtis, and Catherine L. Corliss (2012) "Anxious Publics: Worries About Crime and Immigration," *Comparative Political Studies*, **45** (4), 477–506, URL: https://doi.org/10.1177/0010414011421768.

Freitag, Julian, Anna Kerkhof, and Johannes Münster (2021) "Selective sharing of news items and the political position of news outlets," *Information Economics and Policy*, **56**, 100926, URL: https://www.sciencedirect.com/science/article/pii/S0167624521000147.

Frey, Bruno S., David A. Savage, and Benno Torgler (2010) "Behavior under Extreme Conditions: The Titanic Disaster," *Journal of Economic Perspective*, **24** (4), 1–14.

Friebel, Guido and Matthias Heinz (2014) "Media slant against foreign owners: Downsizing," *Journal of Public Economics*, **120**, 97–106, URL: https://www.sciencedirect.com/science/article/pii/S0047272714001947.

Garz, Marcel, Jil Sörensen, and Daniel F Stone (2020) "Partisan selective engagement: Evidence from Facebook," *Journal of Economic Behavior & Organization*, **177**, 91–108.

Gentzkow, Matthew and Jesse M. Shapiro (2010) "What Drives Media Slant? Evidence From U.S. Daily Newspapers," *Econometrica*, **78** (1), 35–71.

Gentzkow, Matthew, Jesse Shapiro, and Daniel Stone (2016) "Media bias in the marketplace: Theory," in *Handbook of Media Economics*, **1**: Elsevier, 623–645.

Gottschalk, Felix, Wanda Mimra, and Christian Waibel (2018) "Health services as credence goods: A field experiment," *Available at SSRN 3036573*.

Graber, Doris A. (1990) "Seeing Is Remembering: How Visuals Contribute to Learning from Television News," *Journal of Communication*, **40** (3), 134–156, URL: https://doi.org/10.1111/j.1460-2466.1990.tb02275.x.

Groeling, Tim (2013) "Media Bias by the Numbers: Challenges and Opportunities in the Empirical Study of Partisan News," *Annual Review of Political Science*, **16** (1), 129–151, URL: https://doi.org/10.1146/annurev-polisci-040811-115123.

Groseclose, Tim and Jeffrey Milyo (2005) "A Measure of Media Bias," *The Quarterly Journal of Economics*, **120** (4), 1191–1237, URL: https://doi.org/10.1162/003355305775097542.

Hainmueller, Jens and Daniel J. Hopkins (2014) "Public Attitudes Toward Immigration," *Annual Review of Political Science*, **17**, 225–49.

Halla, Martin, Alexander Wagner, and Josef Zweimüller (2017) "Immigration and Voting for the Far Right," *Journal of the European Economic Association*, **15** (6), 1341–1385.

Hamilton, James T. (2006) "All the News That's Fit to Sell: How the Market Transforms Information into News," *Princeton, NJ: Princeton University Press.*

Hehman, Eric, Elana Graber, Lindsay Hoffman, and Samuel Gaertner (2012) "Warmth and competence: A content analysis of photographs depicting American presidents.," *Psychology of Popular Media Culture*, **1**, 46–52.

Hestermann, Thomas and Elisa Hoven (2020) "Crime in Germany as Portrayed by the Alternative for Germany (AfD)," *German Law Journal*, **21** (4), 721–738.

Hovden, Jan Fredrik, Hilmar Mjelde, and Jostein Gripsrud (2018) "The Syrian refugee crisis in Scandinavian newspapers," *Communications*, **43** (3), 325–356, URL: https://doi.org/10.1515/commun-2018-0013.

Huddy, Leonie and Anna H. Gunnthorsdottir (2000) "The Persuasive Effects of Emotive Visual Imagery: Superficial Manipulation or the Product of Passionate Reason?" *Political Psychology*, **21** (4), 745–778, URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/0162-895X.00215.

Kerkhof, Anna and Johannes Münster (2021) "Detecting coverage bias in user-generated content," *Journal of Media Economics*, **32** (3-4), 99–130, URL: https://doi.org/10.1080/08997764.2021.1903168.

Kerschbamer, Rudolf, Matthias Sutter, and Uwe Dulleck (2017) "How Social Preferences Shape Incentives in (Experimental) Markets for Credence Goods," *Economic Journal*, **127** (600), 393–416.

Kleiner, Morris M. and Alan B. Krueger (2013) "Analyzing the Extent and Influence of Occupational Licensing on the Labor Market," *Journal of Labor Economics*, **31** (2), 173–202.

Kogut, Tehila and Ilana Ritov (2005) "The "identified victim" effect: an identified group, or just a single individual?" *Journal of Behavioral Decision Making*, **18**, 157–167.

Korenok, Oleg, Edward L Millner, and Laura Razzolini (2012) "Are Dictators Averse to Inequality?" *Journal of Economic Behavior & Organization*, **82** (2-3), 543–547.

Kőszegi, Botond (2014) "Behavioral Contract Theory," *Journal of Economic Literature*, **52** (4), 1075–1118.

List, John A. (2011) "The Market for Charitable Giving," *Journal of Economic Perspectives*, **25** (2), 157–180.

Mimra, Wanda, Alexander Rasch, and Christian Waibel (2016) "Price competition and reputation in credence goods markets: Experimental evidence," *Games and Economic Behavior*, **100**, 337–352.

Mullainathan, Sendhil and Andrei Shleifer (2005) "The Market for News," *American Economic Review*, **95** (4), 1031–1053, URL: https://www.aeaweb.org/articles?id=10.1257/0002828054825619.

Navarrete, Carlos David, Andreas Olsson, Arnold K. Ho, Wendy Berry Mendes, Lotte Thomsen, and James Sidanius (2009) "Fear Extinction to an Out-Group Face: The Role of Target Gender," *Psychological Science*, **20** (2), 155–158.

Paris, Valérie, Marion Devaux, and Lihan Wei (2010) "Health Systems Institutional Characteristics: A Survey of 29 OECD Countries," OECD Health Working Papers No. 50.

Peng, Yilang (2018) "Same Candidates, Different Faces: Uncovering Media Bias in Visual Portrayals of Presidential Candidates with Computer Vision," *Journal of Communication*, **68**.

Pesendorfer, Wolfgang and Asher Wolinsky (2003) "Second Opinions and Price Competition: Inefficiency in the Market for Expert Advice," *Review of Economic Studies*, **70** (2), 417–437.

Pitchik, Carolyn and Andrew Schotter (1987) "Honesty in a Model of Strategic Information Transmission," *American Economic Review*, **77** (5), 1032–1036.

Prescott, Edward C. and Robert M. Townsend (1984) "Pareto Optima and Competitive Equilibria with Adverse Selection and Moral Hazard," *Econometrica*, **52** (1), 21–46.

Puglisi, Riccardo and James M. Snyder (2015) "Chapter 15 - Empirical Studies of Media Bias," in Simon P. Anderson, Joel Waldfogel, and David Strömberg eds. *Handbook of Media Economics*, **1** of Handbook of Media Economics: North-Holland, 647–667, URL: https://www.sciencedirect.com/science/article/pii/B9780444636850000152.

Rasch, Alexander and Christian Waibel (2018) "What Drives Fraud in a Credence Goods Market?–Evidence from a Field Study," *Oxford Bulletin of Economics and Statistics*, **80** (3), 605–624.

Schneider, Henry (2012) "Agency Problems and Reputation in Expert Services: Evidence from Auto Repair," *Journal of Industrial Economics*, **60** (3), 406–433.

Schumacher, Heiner, Iris Kesternich, Michael Kosfeld, and Joachim Winter (2017) "One, Two, Many – Insensitivity to Group Size in Games with Concentrated Benefits and Dispersed Costs," *Review of Economic Studies*, **84** (3), 1346–1377.

Slovic, Paul (2007) ""If I look at the mass I will never act": Psychic numbing and genocide," *Judgment and Decision Making*, **2** (2), 79–95.

Smeets, Paul, Rob Bauer, and Uri Gneezy (2015) "Giving behavior of millionaires," *Proceedings of the National Academy of Sciences*, **112** (34), 10641–10644.

Smith, Vincent H, Michael R Kehoe, and Mary E Cremer (1995) "The private provision of public goods: Altruism and voluntary giving," *Journal of Public Economics*, **58** (1), 107–126.

Statista (2021) "Überregionale Tageszeitungen," *Statstia-Dossier*, URL: https://de.statista.com/statistik/studie/id/25727/dokument/ueberregionale-tageszeitungen-statista-dossier/.

Steinmayr, Andreas (2021) "Contact versus Exposure: Refugee Presence and Voting for the Far Right," *The Review of Economics and Statistics*, **103** (2), 310–327, URL: https://doi.org/10.1162/rest_a_00922.

Tabellini, Marco (2020) "Gifts of the Immigrants, Woes of the Natives: Lessons from the Age of Mass Migration," *The Review of Economic Studies*, **87** (1), 454–486, URL: https://doi.org/10.1093/restud/rdz027.

The Guardian (2020) "Don't be fooled by the myth of a 'migrant invasion'," URL: https://www.theguardian.com/commentisfree/2020/aug/11/myth-migrant-invasion-government-asylum-seekers-britain.

UNHCR (2015) "Monthly Arrivals by Nationality to Greece, Italy and Spain - Jan-Dec 2015," *United Nations High Commissioner for Refugees (UNHCR)*, URL: https://reliefweb.int/sites/reliefweb.int/files/resources/MonthlyTrendsofNationalities-ArrivalstoGreeceItalyandSpain-31December2015.pdf.

Veneti, Anastasia, Daniel Jackson, and Darren G. Lilleker (2019) *Visual Political Communication*: Palgrave Macmillan, Cham.

Walker, Jeffery T. and Sean Maddan (2011) *Understanding Statistics for the Social Sciences, Criminal Justice, and Criminology*: Jones & Bartlett Learning.

Wiepking, Pamala and René Bekkers (2012) "Who gives? A literature review of predictors of charitable giving. Part Two: Gender, family composition and income," *Voluntary Sector Review*, **3** (2), 217–245.

Wolinsky, Asher (1993) "Competition in a market for informed experts' services," *RAND Journal of Economics*, 380–398.

Zhang, Xu and Lea Hellmueller (2017) "Visual framing of the European refugee crisis in Der Spiegel and CNN International : Global journalism in news photographs," *International Communication Gazette*, **79**, 174804851668813.