

DO MARKETS OVERCOME REPUGNANCE?  
MUSLIM TRADE RESPONSE TO ANTI-MUHAMMAD CARTOONS

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**Abstract** What is the effect of religious beliefs on economic choices? And in light of this effect, what is the cost of free speech? After Danish newspapers published Anti-Muhammad cartoons, the religious status of trade with Denmark changed exogenously in Muslim countries. Exports from Denmark to Muslim countries decreased by 23%, while close substitute countries like Finland gained export share. Final goods were more affected than intermediate goods as were more religious Muslim countries. Denmark did not shift exports to other countries, but trade quantity rebounded in 20 months. Notably, Muslim exports to Denmark were unaffected, consistent with money overcoming repugnance.

**JEL Codes:** K0, Z1

**Keywords:** Free speech, trust, conflict, backlash, markets, trade, culture

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## 1 Introduction

Proponents of the *doux commerce* thesis have argued that a competitive market, with its disruptive effect on geographical and tribal isolation, will increase our care for and understanding of others—“wherever there is commerce, manners are gentle,” wrote Montesquieu (1749), and “commerce operates to cordialize mankind,” according to Paine (1792). Consistent with this view, theoretical models have formalized the dynamics of market integration and preference evolution (Olivier et al. 2008) and cultural convergence (Maystre et al. 2014).<sup>1</sup> In particular, the causation runs in both ways: war causes trust and trade to plummet; conversely, low trust and scant inter-ethnic trade increase the probability of future wars (by decreasing the cost of war) (Rohner et al. 2013b).

Empirically, the proportion of trade between countries is a correlate of conflict (Martin et al. 2008) and variation in the intensity of fighting suggests a causal effect of civil conflict on trust and social capital (Rohner et al. 2013a).<sup>2</sup> I examine the causal channel in the short- and medium-term, namely, the effect of the publication of anti-Muhammad cartoons by the Danish Newspaper *Jyllands-Posten* on September 30th, 2005. In most Islamic traditions, the act of making a picture of Muhammad is considered blasphemy. Thus, the publication of those cartoons was religiously significant from an Islamic perspective, but not from other people’s perspective. Furthermore, the Danish government was also implicated, when it refused a request by eleven ambassadors from Muslim-majority countries to punish the publishers of the cartoons. I compare the reaction to these cartoons by Muslim and non-Muslim countries in their economic interactions with Denmark. The difference in this reaction is only due to an Islamic view of blasphemy, and therefore allows me to measure the effect that a shift in Islamic beliefs has on economic choice. The economic interaction of focal interest is international trade. I use monthly product-level data on trade of the 28 members of the

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<sup>1</sup>Using World Value Survey data, the authors observe significant time variation in bilateral cultural distances over their sample period but with a general pattern towards convergence. These time variations in bilateral cultural distances are correlated with variations in bilateral trade flows, which is consistent with the model.

<sup>2</sup>Rohner et al. (2013a) separately identifies the causal impacts of trade on conflict and impacts of conflict on trade through lag specifications.

European Union with the rest of the world.

The idea that religious beliefs have economic consequences is associated with Max Weber's (1905) classic work. However, identifying the effect of religion on economic choices has turned out to be rather difficult. In an ideal experimental setting, one would like to exogenously change people's religion, and look at the effect that such a change has on their economic choices. This paper looks at the context of Islam's effect on economic choices. In 1910, 13% of world population was Muslim. A century later, in 2010, the share of Muslims in world population has increased to 23%, or about 1.6 billion people.<sup>3</sup> In light of the spread of Islam in the past century, understanding its effect on economic choices is of independent interest. To investigate the effect of Islam on economic choices, the paper focuses on an act that was only prohibited by Islam, and investigates how this act affects Muslims' economic interactions, as opposed to non-Muslims'. The difference in the reaction of Muslims and non-Muslims to the same act is only due to way Islam views the act, and therefore allows me to investigate and analyze the effect of Islam on at least one set of economic choices.

In regards to the link between religion and economic choices more broadly, some have tried to address this question by looking across countries (Grier 1997; La Porta et al. 1997; Inglehart and Abramson 1999; Stulz and Williamson 2003; Barro et al. 2003). The problem with this approach, naturally, is that the impact of religion is confounded with that of other institutional and cultural factors that vary across countries. Others have used an instrumental variables approach to overcome this issue (Becker and Woessmann 2009). Still others have attempted to overcome this problem by looking within countries at the relationship between intensity of religious beliefs and economic attitudes (Guiso et al. 2003). This paper is also related to Michaels and Zhi (2010), who analyze consumer reactions to U.S.–France tensions over the Iraq invasion in 2003, Fuchs and Klann (2013), who examine whether political compliance is a precondition for healthy trade relations with China,

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<sup>3</sup>Notably, the two other most populous world religions, Christianity and Hinduism, have not increased their share of world population during this century (Christianity holds around 33%, and Hinduism around 13%, of world population).

Campante and Yanagizawa-Drott (2015), who examine the impact of Ramadan fasting on economic outcomes, Heilmann (2016), who examine the short-term effects of a number of consumer boycotts including the Danish cartoon crisis, and Chen and Yeh (2016), who examine the causal effects of free speech rights in the U.S. In contrast, this paper examines the economic effects of a speech act, particularly speech that is offensive to Muslims, with a long-term and heterogeneous effects perspective for studying mechanisms. In particular, I note the willingness of Islamic countries to accept money despite the boycott.

To highlight the results, after Danish newspapers published Anti-Muhammad cartoons—on the intensive margin—exports from Danish countries to Muslim countries decreased by 23% for 20 months but rebounded by 24% thereafter. More secular Muslim countries were less affected by the controversy. Final goods (food, transport, and manufactured goods) were more affected, while intermediate goods (crude materials and commodities exports) were unaffected. The rebound virtually eliminated Muslim backlash. Interestingly, Islamic exports to Denmark were unaffected (Danish money was acceptable) throughout this time period. On the extensive margin—the number of product categories trading did not rebound. The extensive margin effects provide some evidence of fixed costs to trade (Melitz 2003).

The remainder of the paper is organized as follows. Section 2 describes the context, data, and specifications. Section 3 presents the results. Section 4 examines heterogeneity. Section 5 concludes.

## 2 Setting, Data, and Empirical Strategy

**2.1 The Danish Cartoons** On September 30th, 2005, the Danish newspaper Jyllands-Posten published 12 editorial cartoons, most of which depicted the prophet Muhammad. In the following days, the cartoons received significant attention in other Danish press outlets.

Following petitions from Danish imams, on October 12th, 2005, eleven ambassadors from Muslim-majority countries (Turkey, Saudi Arabia, Iran, Pakistan, Egypt, Indonesia, Algeria, Bosnia and Herzegovina, Libya, Morocco), and the Head of the Palestinian General Delegation, asked for a meeting with Danish Prime Minister, Anders Fogh Rasmussen. Their letter

noted an “on-going smearing campaign in Danish public circles and media against Islam and Muslims,” and asked for the Danish Government “to take all those responsible to task under law of the land in the interest of inter-faith harmony, better integration and Denmark’s overall relations with the Muslim world.”

The Danish Prime Minister answered with a letter, without addressing the request for a meeting. He noted that “The freedom of expression has a wide scope and the Danish government has no means of influencing the press. However, Danish legislation prohibits acts or expressions of blasphemous or discriminatory nature. The offended party may bring such acts or expressions to court, and it is for the courts to decide in individual cases.”

The Organization of Islamic Cooperation (OIC) and Arab League also wrote a joint letter to the Prime Minister expressing alarm about the cartoons. Turkish Prime Minister Recep Tayyip Erdoğan visited Copenhagen in November, and clashed with Rasmussen over the cartoons. Egyptian foreign minister Ahmed Aboul Gheit and the secretary-generals of the OIC and the Arab League sent letters to the OSCE, OECD, and EU foreign policy coordinator complaining about Danish inaction.

In December 2005, a group of Danish Muslim clerics decided to gain support and leverage outside of Denmark by meeting directly with religious and political leaders in the Middle East. They prepared a 43 page document which was circulated on visits to Egypt, Syria and Lebanon in early December 2005. The dossier was also distributed informally on 7–8 December 2005 at the OIC summit in Mecca, with many heads of state in attendance. Violent demonstrations and riots occurred in January and February 2006.

A 2006 Pew Global Attitudes survey found that most people in Muslim countries had heard of the cartoon (Egypt 98%, Jordan 99%, Pakistan 87%, Turkey 89%). Most placed sole blame on Western nations’ disrespect for Islamic religion (Egypt 87%, Jordan 90%, Turkey 84%). In contrast, many individuals in non-Muslim countries blamed Muslims’ intolerance to different points of view (Germany 62%, France, 67%, US 60%). Media and word-of-mouth played key role in information transmission.

The appendix provides a model whose theoretical effects are ex ante ambiguous as to whether there will be a transient or permanent response of trade to Anti-Muhammad cartoons.

**2.2 Data and Raw Visualizations** I investigate the effect that the publication of the Danish cartoons had on international trade. To do so, I use Eurostat monthly data on the trade of the 28 members of the European Union with the rest of the world. The data uses the Standard International Trade Classification (SITC), and allows for three levels of data aggregation (total exports, exports by 1-digit SITC code, and exports by 2-digits SITC code). Additionally, I use country-level Religion Adherence Data (McCleary and Barro 2006a,b).

I begin with visual displays of the raw data. In Figure 1, I present the exports of Denmark, Sweden, and Finland to Muslim and non-Muslim countries. Time zero on the x-axis represents September 2005, the month in which the cartoons were published. As one can see on the left panel of Figure 1, relative to Swedish and Finnish exports to Muslim countries, Danish exports to Muslim countries collapsed after the publication of the cartoons, and picked up again around 20 months after the publication. These findings are especially clear when one compares the left panel in Figure 1 to the right panel, which presents data on exports to non-Muslim countries. In the right panel, there is no effect of the publication of cartoons on Danish exports to non-Muslim countries relative to Swedish and Finnish exports.

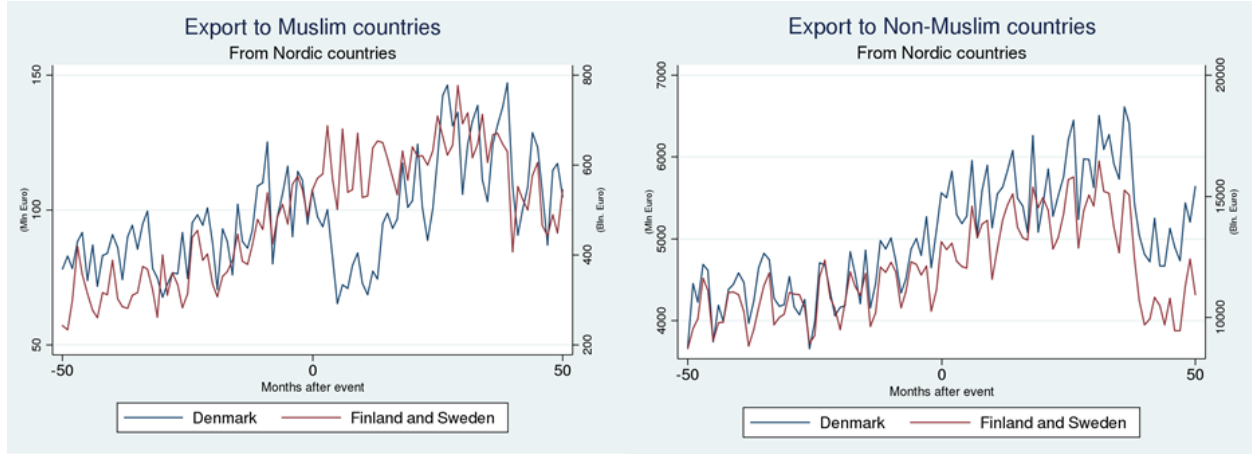


Figure 1: Export to Muslim and Non-Muslim Countries by Denmark vs. Finland and Sweden

In Figure 2, I present data on export of Denmark versus the rest of the European Union, to Muslim and non-Muslim countries. Again, one can see on the left panel of Figure 2 that, relative to the export by European Union countries to Muslim countries, Danish exports to Muslim countries collapsed after the publication of the cartoons, and picked up again around 20 months after the publication. These findings are also especially clear when one compares them to the right panel of Figure 2, which presents data on exports to non-Muslim countries. In the right panel, there is no effect of the publication of cartoons on Danish exports to non-Muslim countries, relative to European Union exports.

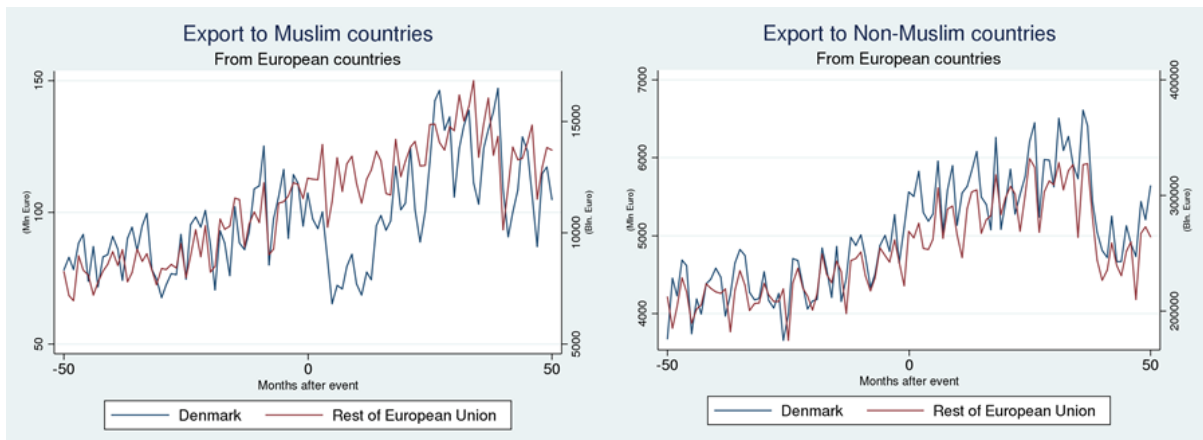


Figure 2: Export to Muslim and Non-Muslim Countries by Denmark vs. the rest of the EU

These figures motivate the inclusion of a dummy indicator for the first 20 months after the

publication of the cartoons, and another one for the following period, to capture the drop and rebound, respectively. Raw group means are presented in Figure 3, which verify the significant drop and rebound. Recall Figure 1 showed no pre-trend before the event, which was in any event unexpected.

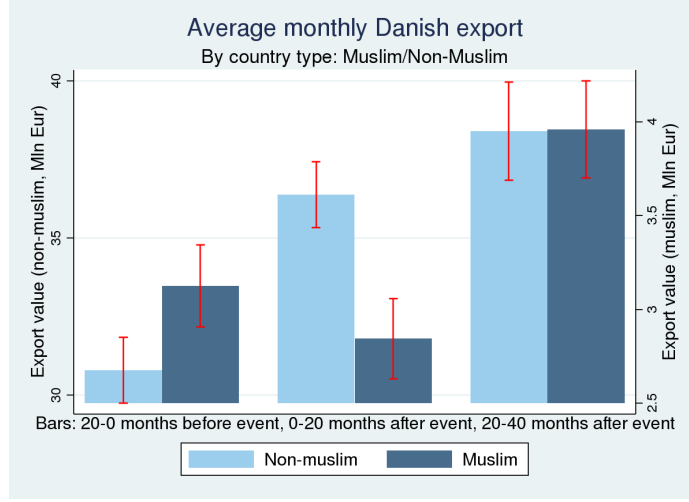


Figure 3: Export to Muslim and non-Muslim countries (monthly average)

**2.3 Empirical Strategy** The empirical strategy follows a differences-in-differences research design. The specification is:

$$Y_{ictp} = \alpha + \beta \times PostCartoon_t \times Denmark_i \times Muslim_c + \beta \times PostBlowback_t \times Denmark_i \times Muslim_c + \gamma_{icp} + \delta_{it} +$$

The dependent variable,  $Y_{ict}$ , is a measure of exports from country  $i$  to country  $c$ , at time  $t$ , for product  $p$ .  $PostCartoon_t$  is a dummy indicator that assumes the value one after the publication of the cartoons,  $PostBlowback_t$  is a dummy indicator that assumes the value one after the blowback,  $Denmark_i$  is a dummy indicator that assumes the value one when the exporting country is Denmark, and  $Muslim_c$  is a dummy indicator that assumes the value one when the importing country is Muslim, which is defined as a country in which at least 80% of the population is Muslim. Some specifications include  $\gamma_{icp}$ , which represents



fixed effects for country  $i$ , country  $c$ , and product  $p$ . Their inclusion means that identification comes from comparing exports for product  $p$  within country-pairs  $i$  and  $c$  before and after the cartoon publication. Some specifications include  $\delta_{it}$ , which represents month fixed effects for exporting country  $i$  at time  $t$ . I cluster standard errors at the exporting country level to address serial correlation of  $\varepsilon_{ict}$ . The sample that only includes Scandinavian (“North”) countries will cluster standard errors at the exporting country-importing country level.

I also consider absolute measures of exports and log exports to interpret the effects in percentage terms. Outcomes on the intensive, extensive, and total margin are examined. Missing values are treated as 0. Binary outcomes are analyzed using linear probability following Angrist and Pischke (2008). Some specifications restrict to Scandinavian countries to keep the set of countries serving as “control” closer to Denmark. The number of trading partners is 184, the number of months is 168, and the number of product categories is 1, 10, or 100 depending on the level of aggregation. I present analyses at three levels of data aggregation - (i) total exports, (ii) exports by 1-digit SITC code, and (iii) exports by 2-digits SITC code. Differences emerge when examining the data at the extensive margin (more granular analyses would have more 0s) even at the 1-digit SITC code. Results are presented at the 2-digit level because heterogeneity analyses employ 2-digit level product classifications. Finally, each table presents regressions with varying controls or sub-samples.

### 3 Results

#### 3.1 Main model

##### 3.1.1. *Intensive margin*

In Table I, the dependent variable is total exports. Columns (1) and (2) use the entire sample while Columns (3) and (4) use the Scandinavian sample. To interpret the results, Column (1) indicates that Danish exports to Muslim countries decreased by 23% along the intensive margin in the first 20 months following the publication, and following those months exports increased by 24%. This finding holds in Column (2) controlling for exporter-specific time trends. Comparing with other Scandinavian countries, Danish exports dropped by 48%

the first 20 months following the publication, and following those months exports increased by 47%. The coefficients are statistically significant, but the sum of the coefficients is not. This means that the rebound in trade, 20 months after the publication of the cartoons, is approximately equal to the decrease in trade following the publication.

TABLE I  
INTENSIVE MARGIN (TOTAL EXPORTS LEVEL)

Intensive margin model estimated on the total exports level. Odd-numbered columns present the base specification, and even-numbered columns control for exporter-specific time trends. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                              | (1)                   | (2)                   | (3)                 | (4)                 |
|------------------------------|-----------------------|-----------------------|---------------------|---------------------|
|                              | Export (log)          | Export (log)          | Export (log)        | Export (log)        |
| Denmark X Muslim X Month>0   | -0.233***<br>(0.0361) | -0.240***<br>(0.0354) | -0.476*<br>(0.141)  | -0.479*<br>(0.140)  |
| Denmark X Muslim X Month>20  | 0.237***<br>(0.0366)  | 0.238***<br>(0.0365)  | 0.373**<br>(0.0739) | 0.370**<br>(0.0734) |
| N                            | 691286                | 691286                | 85477               | 85477               |
| P-value (Month>0)            | 0.000000679           | 0.000000279           | 0.0778              | 0.0760              |
| P-value (Month>0 + Month>20) | 0.917                 | 0.963                 | 0.265               | 0.245               |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

The dependent variable in Table II is exports by 1-digit SITC code and in Table III is exports by 2-digit SITC code. Columns (1) and (3) use the baseline specification with the entire sample and with the Scandinavian sample. Columns (2) and (4) include fixed effects for every combination of Reporter X Partner X Product. This means that these columns present estimates whose identification comes from comparing exports for product  $p$  within country-pairs  $i$  and  $c$  before and after the cartoon publication.

All specifications show a drop in exports following the cartoon publication, which is then followed by a subsequent rebound. The magnitudes are comparable to those presented in Table I. Furthermore, the drop and subsequent rebound in the Scandinavian sample is also larger than for the entire EU sample. Interestingly, including Reporter X Partner X Product fixed effects (instead of only Reporter X Partner fixed effects) affect the interpretation of the rebound. In some specifications, the rebound is such that the net effect is not significantly different from 0, while in others, the net drop that is statistically significant remains. In Table III, the rebound, while individually statistically significant, is a bit smaller relative to

the original drop.

TABLE II  
INTENSIVE MARGIN (1-DIGIT LEVEL)

Intensive margin model estimated on the 1-digit level. Odd-numbered columns include fixed effects for Reporter X Partner pairs, and even-numbered columns add fixed effects for Reporter X Partner X Product. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                              | (1)                   | (2)                   | (3)                  | (4)                  |
|------------------------------|-----------------------|-----------------------|----------------------|----------------------|
|                              | Export (log)          | Export (log)          | Export (log)         | Export (log)         |
| Denmark X Muslim X Month>0   | -0.229***<br>(0.0306) | -0.252***<br>(0.0264) | -0.409**<br>(0.0763) | -0.458**<br>(0.0743) |
| Denmark X Muslim X Month>20  | 0.309***<br>(0.0181)  | 0.254***<br>(0.0170)  | 0.348**<br>(0.0526)  | 0.238***<br>(0.0155) |
| N                            | 4051490               | 4051490               | 470912               | 470912               |
| P-value (Month>0)            | 4.59e-08              | 3.90e-10              | 0.0331               | 0.0253               |
| P-value (Month>0 + Month>20) | 0.0197                | 0.953                 | 0.682                | 0.0644               |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

TABLE III  
INTENSIVE MARGIN (2-DIGIT LEVEL)

Intensive margin model estimated on the 2-digit level. Odd-numbered columns include fixed effects for Reporter X Partner pairs, and even-numbered columns add fixed effects for Reporter X Partner X Product. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                              | (1)                   | (2)                   | (3)                    | (4)                   |
|------------------------------|-----------------------|-----------------------|------------------------|-----------------------|
|                              | Export (log)          | Export (log)          | Export (log)           | Export (log)          |
| Denmark X Muslim X Month>0   | -0.337***<br>(0.0181) | -0.290***<br>(0.0205) | -0.472***<br>(0.00874) | -0.377***<br>(0.0258) |
| Denmark X Muslim X Month>20  | 0.309***<br>(0.0180)  | 0.197***<br>(0.0164)  | 0.398***<br>(0.0340)   | 0.264***<br>(0.0235)  |
| N                            | 18635328              | 18635328              | 2056871                | 2056871               |
| P-value (Month>0)            | 5.90e-17              | 5.03e-14              | 0.000342               | 0.00463               |
| P-value (Month>0 + Month>20) | 0.260                 | 0.00220               | 0.0988                 | 0.000409              |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 3.1.2. Extensive margin

Table IV reports an analysis of the impact on the extensive margin. Columns (1) and (2) use the entire sample while Columns (3) and (4) use the Scandinavian sample. To interpret the results, Column (1) indicates that Danish exports to Muslim countries decreased by 4% along the extensive margin in the first 20 months following the publication, and following those months, exports increased by 1%. This finding holds in Column (2) controlling for exporter-specific time trends. The results for the Scandinavian sample is not statistically significant in either the drop or rebound, but the magnitudes are comparable with the entire sample.

TABLE IV  
EXTENSIVE MARGIN (TOTAL EXPORTS LEVEL)

Extensive margin model estimated on the total exports level. Odd-numbered columns present the base specification, and even-numbered columns control for exporter-specific time trends. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                              | (1)                     | (2)                     | (3)                   | (4)                   |
|------------------------------|-------------------------|-------------------------|-----------------------|-----------------------|
|                              | Ext. margin             | Ext. margin             | Ext. margin           | Ext. margin           |
| Denmark X Muslim X Month>0   | -0.0383***<br>(0.00839) | -0.0383***<br>(0.00839) | -0.0266*<br>(0.00782) | -0.0266*<br>(0.00782) |
| Denmark X Muslim X Month>20  | 0.00911**<br>(0.00431)  | 0.00911**<br>(0.00431)  | -0.00423<br>(0.00625) | -0.00423<br>(0.00625) |
| N                            | 860832                  | 860832                  | 92232                 | 92232                 |
| P-value (Month>0)            | 0.0000987               | 0.0000987               | 0.0764                | 0.0764                |
| P-value (Month>0 + Month>20) | 0.00184                 | 0.00184                 | 0.159                 | 0.159                 |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table V examines exports by 1-digit SITC code on the extensive margin. Columns (1) and (2) use the entire sample as control for Danish exports. Notably, these results show no rebound. The drop in exports remains statistically significantly negative throughout the time frame. A 1% drop in the relative number of Danish products exported is followed by another 1% decline.

TABLE V

## EXTENSIVE MARGIN (1-DIGIT LEVEL)

Extensive margin model estimated on the 1-digit level. Odd-numbered columns include fixed effects for Reporter X Partner pairs, and even-numbered columns add fixed effects for Reporter X Partner X Product. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                              | (1)                      | (2)                      | (3)                    | (4)                    |
|------------------------------|--------------------------|--------------------------|------------------------|------------------------|
|                              | Ext. margin              | Ext. margin              | Ext. margin            | Ext. margin            |
| Denmark X Muslim X Month>0   | -0.00974***<br>(0.00342) | -0.00974***<br>(0.00342) | -0.0191*<br>(0.00655)  | -0.0191*<br>(0.00655)  |
| Denmark X Muslim X Month>20  | -0.00776***<br>(0.00278) | -0.00776***<br>(0.00278) | -0.00930*<br>(0.00285) | -0.00930*<br>(0.00285) |
| N                            | 8608320                  | 8608320                  | 922320                 | 922320                 |
| P-value (Month>0)            | 0.00833                  | 0.00833                  | 0.1000                 | 0.1000                 |
| P-value (Month>0 + Month>20) | 0.000411                 | 0.000411                 | 0.0942                 | 0.0942                 |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

In Table VI, the dependent variable is number of exports by 2-digit SITC code. The results confirm the previous result that as trade is examined more granularly, the picture changes from a rebound that eliminates the initial decline to one where the decline is persistent (and the initial decline—at least in terms of number of products—is not statistically significant).

TABLE VI

## EXTENSIVE MARGIN (2-DIGIT LEVEL)

Extensive margin model estimated on the 2-digit level. Odd-numbered columns include fixed effects for Reporter X Partner pairs, and even-numbered columns add fixed effects for Reporter X Partner X Product. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                              | (1)                    | (2)                    | (3)                   | (4)                   |
|------------------------------|------------------------|------------------------|-----------------------|-----------------------|
|                              | Ext. margin            | Ext. margin            | Ext. margin           | Ext. margin           |
| Denmark X Muslim X Month>0   | -0.00259<br>(0.00211)  | -0.00259<br>(0.00211)  | -0.00460<br>(0.00179) | -0.00460<br>(0.00179) |
| Denmark X Muslim X Month>20  | -0.00348*<br>(0.00181) | -0.00348*<br>(0.00181) | -0.00187<br>(0.00383) | -0.00187<br>(0.00383) |
| N                            | 61119072               | 61119072               | 6548472               | 6548472               |
| P-value (Month>0)            | 0.230                  | 0.230                  | 0.124                 | 0.124                 |
| P-value (Month>0 + Month>20) | 0.0532                 | 0.0532                 | 0.0866                | 0.0866                |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 3.1.3. *Overall margin*

The last set of analyses probe the effects on overall trade, which combines both the intensive and the extensive margins. Mechanically, this means that the trade data is calculated as a log of 1+ the underlying value, and missing values are set to 0 (whereas they would have been dropped in the intensive margin analysis). This renders an increase of 20% in sample size even at the total exports level (and a 70% increase in sample size for the 2-digit level). The results are presented in Tables VII, VIII, and IX.

The level of aggregation renders significant differences in the magnitude of the impact, but not in the qualitative interpretation. For example, Table VII shows that exports declined by 61% (or 74%) relative to the control group, and the rebound did not redress the initial decline. The long-term effect remains significantly negative for the total exports level and for the 1-digit level, and is negative but not significantly so for the 2-digit level. At the 2-digit level, the measured decline in exports is 9% (or 15%) relative to the control group. As the change in sample size suggests, part of the reason the results differ so much from the intensive margin analysis is that there are many product categories without trade. Accounting for this fact renders a different picture of a rebound that redresses the decline.

TABLE VII  
OVERALL MARGIN (TOTAL EXPORTS LEVEL)

Overall margin model estimated on the total exports level. Odd-numbered columns present the base specification, and even-numbered columns control for exporter-specific time trends. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                              | (1)                   | (2)                   | (3)                   | (4)                   |
|------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                              | Tot. margin           | Tot. margin           | Tot. margin           | Tot. margin           |
| Denmark X Muslim X Month>0   | -0.614***<br>(0.0886) | -0.614***<br>(0.0886) | -0.746***<br>(0.0447) | -0.746***<br>(0.0447) |
| Denmark X Muslim X Month>20  | 0.317***<br>(0.0633)  | 0.317***<br>(0.0633)  | 0.322<br>(0.113)      | 0.322<br>(0.113)      |
| N                            | 860832                | 860832                | 92232                 | 92232                 |
| P-value (Month>0)            | 0.000000189           | 0.000000189           | 0.00357               | 0.00357               |
| P-value (Month>0 + Month>20) | 0.00684               | 0.00684               | 0.0250                | 0.0250                |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

TABLE VIII  
OVERALL MARGIN (1-DIGIT LEVEL)

Overall margin model estimated on the 1-digit level. Odd-numbered columns include fixed effects for Reporter X Partner pairs, and even-numbered columns add fixed effects for Reporter X Partner X Product. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                              | (1)                   | (2)                   | (3)                   | (4)                   |
|------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                              | Tot. margin           | Tot. margin           | Tot. margin           | Tot. margin           |
| Denmark X Muslim X Month>0   | -0.198***<br>(0.0318) | -0.198***<br>(0.0318) | -0.386***<br>(0.0339) | -0.386***<br>(0.0339) |
| Denmark X Muslim X Month>20  | 0.0678**<br>(0.0302)  | 0.0678**<br>(0.0302)  | 0.0562<br>(0.0235)    | 0.0562<br>(0.0235)    |
| N                            | 8608320               | 8608320               | 922320                | 922320                |
| P-value (Month>0)            | 0.00000116            | 0.00000116            | 0.00766               | 0.00766               |
| P-value (Month>0 + Month>20) | 0.00409               | 0.00409               | 0.0291                | 0.0291                |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$



TABLE IX  
OVERALL MARGIN (2-DIGIT LEVEL)

Overall margin model estimated on the 2-digit level. Odd-numbered columns include fixed effects for Reporter X Partner pairs, and even-numbered columns add fixed effects for Reporter X Partner X Product. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                              | (1)                    | (2)                    | (3)                   | (4)                   |
|------------------------------|------------------------|------------------------|-----------------------|-----------------------|
|                              | Tot. margin            | Tot. margin            | Tot. margin           | Tot. margin           |
| Denmark X Muslim X Month>0   | -0.0891***<br>(0.0244) | -0.0891***<br>(0.0244) | -0.146***<br>(0.0121) | -0.146***<br>(0.0121) |
| Denmark X Muslim X Month>20  | 0.0546***<br>(0.0165)  | 0.0546***<br>(0.0165)  | 0.0823<br>(0.0376)    | 0.0823<br>(0.0376)    |
| N                            | 61119072               | 61119072               | 6548472               | 6548472               |
| P-value (Month>0)            | 0.00112                | 0.00112                | 0.00680               | 0.00680               |
| P-value (Month>0 + Month>20) | 0.283                  | 0.283                  | 0.130                 | 0.130                 |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**3.2 Muslim population shares** The basic specification used a dummy indicator for Muslim countries, defining a country as Muslim if at least 80% of its population is Muslim. Instead, Table X uses the population share of Muslim (and revisits the intensive margin). The original results of a decline in exports following the publication of the cartoons followed by a rebound remains.

TABLE X

INTERACTION WITH MUSLIM POPULATION SHARE

Intensive margin model estimated on the total exports level. Odd-numbered columns present the base specification, and even-numbered columns control for exporter-specific time trends. Columns 1-2 present the entire sample, while Columns 3-4 present the Scandinavian sample. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of a dummy for Danish exports and the population share of the partner country that is Muslim. Standard errors are clustered on Reporter (exporting country) level for the whole sample and country-product level for the Scandinavian ("North") subsample.

|                                   | (1)                   | (2)                   | (3)                 | (4)                  |
|-----------------------------------|-----------------------|-----------------------|---------------------|----------------------|
|                                   | Export (log)          | Export (log)          | Export (log)        | Export (log)         |
| Denmark X Muslim Share X Month>0  | -0.310***<br>(0.0399) | -0.320***<br>(0.0391) | -0.581**<br>(0.101) | -0.583**<br>(0.0995) |
| Denmark X Muslim Share X Month>20 | 0.253***<br>(0.0411)  | 0.254***<br>(0.0415)  | 0.400**<br>(0.0706) | 0.398**<br>(0.0697)  |
| N                                 | 691286                | 691286                | 85477               | 85477                |
| P-value (Month>0)                 | 2.31e-08              | 9.01e-09              | 0.0288              | 0.0279               |
| P-value (Month>0 + Month>20)      | 0.158                 | 0.123                 | 0.0270              | 0.0248               |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 4 Heterogeneity Across Products

Thus far, the results show that—along the intensive margin—a drop and rebound that virtually eliminated Muslim backlash to the obscenity deemed blasphemous from an Islamic perspective. However, on the extensive margin—the number of product categories trading did not rebound. Together, these results present a subtle picture on the costs of free speech. In particular, they highlight the possible fixed costs of trade, whereby product categories that cease to trade cannot easily be re-opened for trade.

This section introduces further nuances. Final goods (food, transport, and manufactured

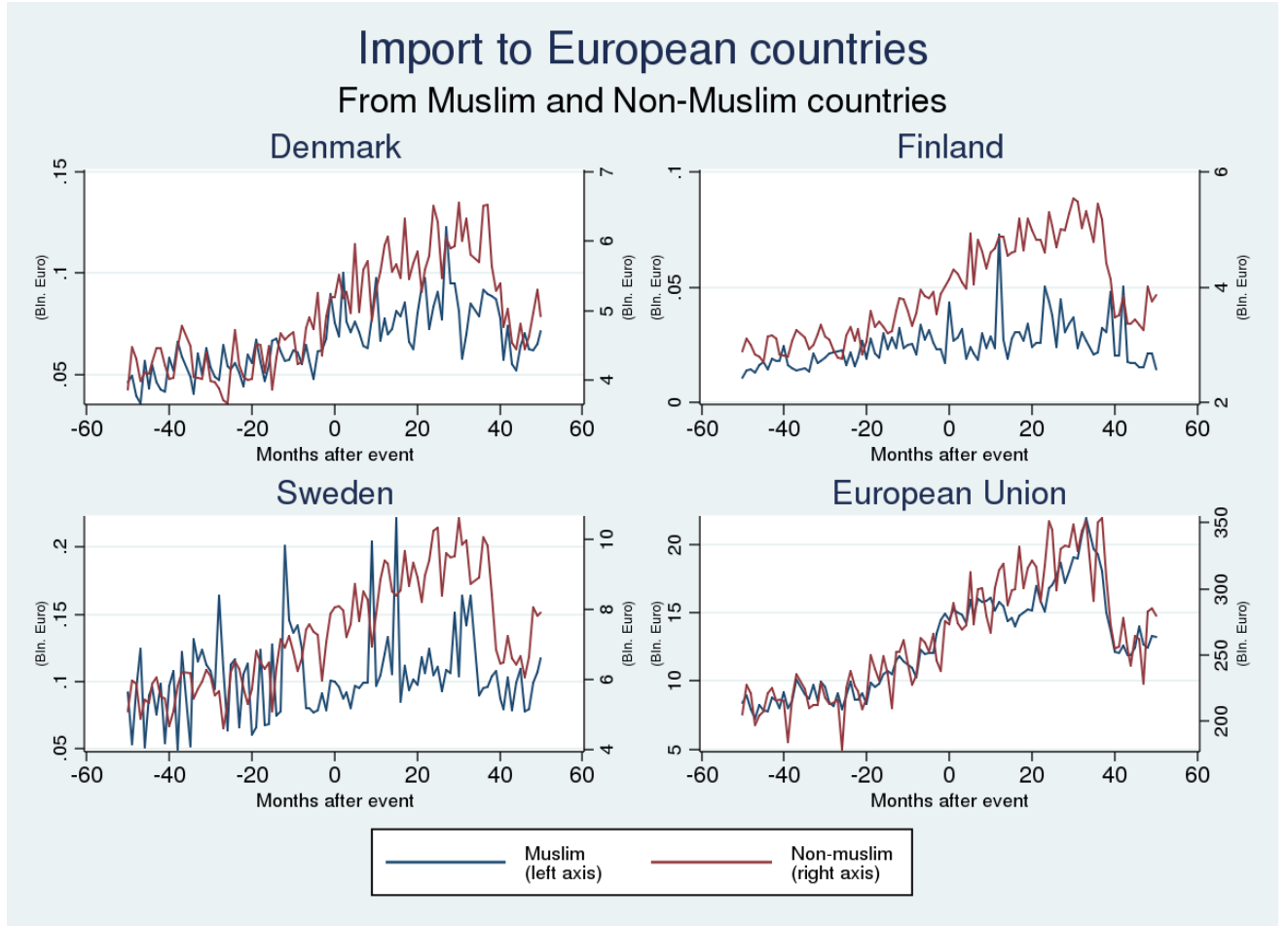


Figure 4: Import from Muslim and Non-Muslim Countries by Denmark vs. the rest of the EU

goods) were more affected, while intermediate goods (crude materials and commodities exports) were unaffected. Islamic exports to Denmark were unaffected (Danish money—a product—was acceptable) throughout this time period (relative to the controls) (Figure 4).

Figure 5 shows more salient effects for final products like food, animal, and machinery. The other products are displayed in Figure 6 and they exhibit less salient effects.

Tables XI, XII, and XIII present regression analyses where an index is used to categorize product types: Broda Weinstein elasticities (Broda and Weinstein 2006) and the Rauch Classification Index (Rauch 1999). The Rauch classification is also translated to numeric values, where 1 = non-homogenous good, 2 = partially homogenous, 3 = homogenous, and it shows that the higher the homogeneity, the higher the drop and then the rebound. This

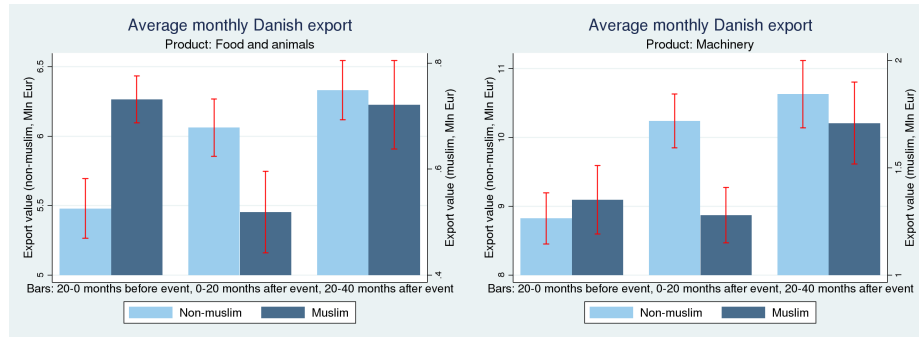


Figure 5: Heterogeneity by product category

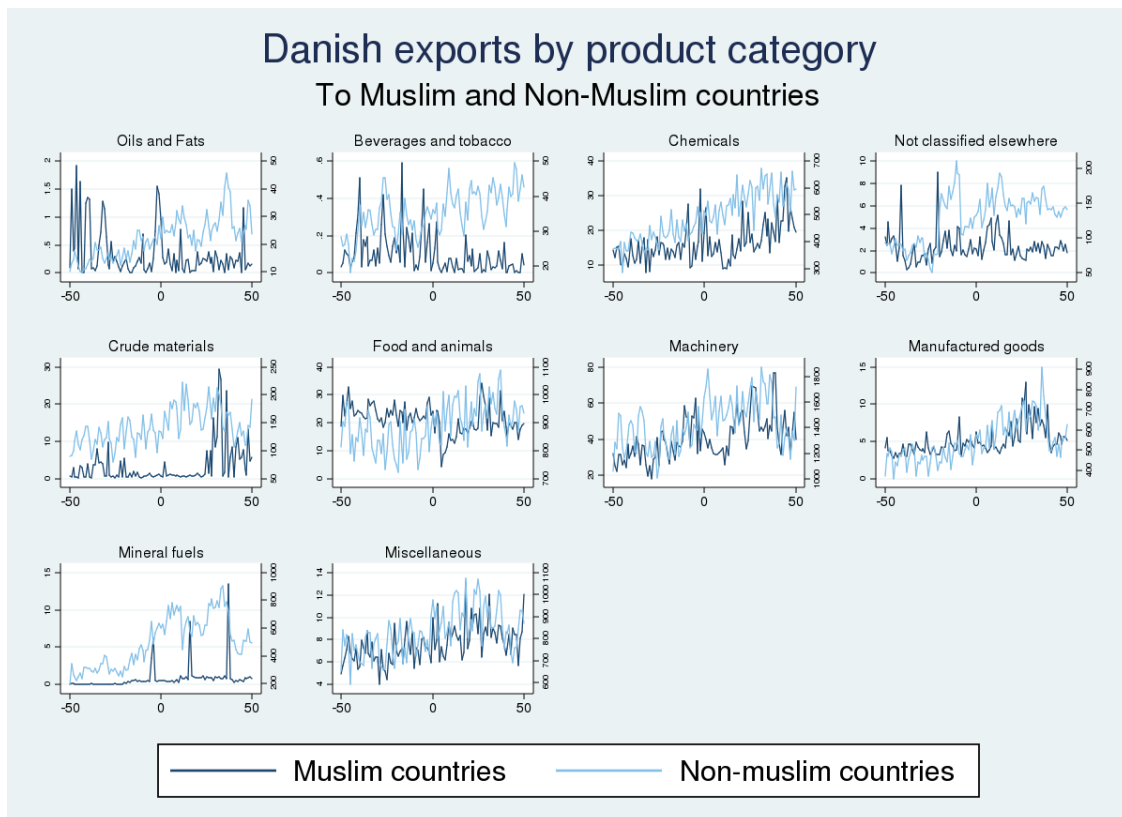


Figure 6: Export to Muslim and Non-Muslim Countries by Denmark for different product categories

interpretation is consistent with an interpretation of greater substitutability rendering larger effects.

Table XI shows no significant differences by Broda Weinstein elasticities for only the intensive margin, but significant differences by Broda Weinstein elasticities for the extensive margin (Table XII) and overall margin (Table XIII). In all three analyses, the Rauch Classification Index indicate significant differences. Note that the previous results (the extensive and overall margins have significant and persistent declines) are apparent for the Rauch Classification Index but not for the Broda Weinstein elasticities, which show a rebound.

TABLE XI

## HETEROGENEITY ANALYSIS: INTERACTION WITH RAUCH PRODUCT CATEGORY (INTENSIVE MARGIN)

Intensive margin model estimated on the 2-digit level. Each 2-digit SITC product category was assigned to its average Rauch Classification Index, where 1 indicates differentiated products, 2 indicates partially homogeneous products, and 3 indicates homogeneous goods. Columns 1-2 use a continuous Rauch measure. Columns 3-4 round the measure into a dummy indicator for ease of interpretation and the omitted interaction is differentiated products. Odd-numbered columns include fixed effects for Reporter X Partner pairs, and even-numbered columns add fixed effects for Reporter X Partner X Product. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level.

|                                    | (1)          | (2)          | (3)          | (4)          |
|------------------------------------|--------------|--------------|--------------|--------------|
|                                    | Export (log) | Export (log) | Export (log) | Export (log) |
| DK X Muslim X Month>0              | 0.0780*      | 0.131***     | -0.225***    | -0.179***    |
|                                    | (0.0446)     | (0.0376)     | (0.0231)     | (0.0234)     |
| DK X Muslim X Month>20             | -0.231***    | -0.0516      | 0.202***     | 0.151***     |
|                                    | (0.0486)     | (0.0451)     | (0.0247)     | (0.0222)     |
| DK X Muslim X Month>0 X Rauch      | -0.276***    | -0.281***    |              |              |
|                                    | (0.0237)     | (0.0191)     |              |              |
| DK X Muslim X Month>20 X Rauch     | 0.371***     | 0.170***     |              |              |
|                                    | (0.0274)     | (0.0251)     |              |              |
| DK X Muslim X Month>0 X (Rauch=1)  |              |              | 0            | 0            |
|                                    |              |              | (.)          | (.)          |
| DK X Muslim X Month>0 X (Rauch=2)  |              |              | -0.244***    | -0.237***    |
|                                    |              |              | (0.0224)     | (0.0214)     |
| DK X Muslim X Month>0 X (Rauch=3)  |              |              | -0.428***    | -0.463***    |
|                                    |              |              | (0.0557)     | (0.0390)     |
| DK X Muslim X Month>20 X (Rauch=1) |              |              | 0            | 0            |
|                                    |              |              | (.)          | (.)          |
| DK X Muslim X Month>20 X (Rauch=2) |              |              | 0.331***     | 0.146***     |
|                                    |              |              | (0.0330)     | (0.0273)     |
| DK X Muslim X Month>20 X (Rauch=3) |              |              | 0.215***     | 0.0373       |
|                                    |              |              | (0.0529)     | (0.0459)     |
| N                                  | 18381177     | 18381177     | 18381177     | 18381177     |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table XII: Heterogeneity analysis: Interaction with Rauch product category (extensive margin)

Extensive margin model estimated on the 2-digit level. Each 2-digit SITC product category was assigned to its average Broda-Weinstein import elasticity and its average Rauch Classification Index, where 1 indicates differentiated products, 2 indicates partially homogeneous products, and 3 indicates homogeneous goods. Columns 1-2 use Broda-Weinstein elasticities. Columns 3-4 use a continuous Rauch measure. Columns 5-6 round the measure into a dummy indicator for ease of interpretation and the omitted interaction is differentiated products. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level.

|                                    | (1)                       |  | (2)                       |  | (3)                     |  | (4)                     |  | (5)                     |  | (6)                     |  |
|------------------------------------|---------------------------|--|---------------------------|--|-------------------------|--|-------------------------|--|-------------------------|--|-------------------------|--|
|                                    | Ext. margin               |  | Ext. margin               |  | Ext. margin             |  | Ext. margin             |  | Ext. margin             |  | Ext. margin             |  |
| DK X Muslim X Month>0              | 0.000976<br>(0.00239)     |  | 0.000976<br>(0.00239)     |  | 0.0471***<br>(0.00402)  |  | 0.0471***<br>(0.00402)  |  | 0.0176***<br>(0.00263)  |  | 0.0176***<br>(0.00263)  |  |
| DK X Muslim X Month>0 X Sigma      | -0.00121***<br>(0.000177) |  | -0.00121***<br>(0.000177) |  |                         |  |                         |  |                         |  |                         |  |
| DK X Muslim X Month>20             | -0.00981***<br>(0.00202)  |  | -0.00981***<br>(0.00202)  |  | -0.00365<br>(0.00547)   |  | -0.00365<br>(0.00547)   |  | -0.00806**<br>(0.00304) |  | -0.00806**<br>(0.00304) |  |
| DK X Muslim X Month>20 X Sigma     | 0.00111***<br>(0.000138)  |  | 0.00111***<br>(0.000138)  |  |                         |  |                         |  |                         |  |                         |  |
| DK X Muslim X Month>0 X Rauch      |                           |  |                           |  | -0.0289***<br>(0.00157) |  | -0.0289***<br>(0.00157) |  |                         |  |                         |  |
| DK X Muslim X Month>20 X Rauch     |                           |  |                           |  | -0.000810<br>(0.00244)  |  | -0.000810<br>(0.00244)  |  |                         |  |                         |  |
| DK X Muslim X Month>0 X (Rauch=2)  |                           |  |                           |  |                         |  |                         |  | -0.0343***<br>(0.00197) |  | -0.0343***<br>(0.00197) |  |
| DK X Muslim X Month>0 X (Rauch=3)  |                           |  |                           |  |                         |  |                         |  | -0.0416***<br>(0.00272) |  | -0.0416***<br>(0.00272) |  |
| DK X Muslim X Month>20 X (Rauch=2) |                           |  |                           |  |                         |  |                         |  | 0.00881***<br>(0.00270) |  | 0.00881***<br>(0.00270) |  |
| DK X Muslim X Month>20 X (Rauch=3) |                           |  |                           |  |                         |  |                         |  | -0.00518<br>(0.00399)   |  | -0.00518<br>(0.00399)   |  |
| N                                  | 53371584                  |  | 53371584                  |  | 55954080                |  | 55954080                |  | 55954080                |  | 55954080                |  |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table XIII: Heterogeneity analysis: Interaction with Rauch product category (overall margin)

Overall margin model estimated on the 2-digit level. Each 2-digit SITC product category was assigned to its average Broda-Weinstein import elasticity and its average Rauch Classification Index, where 1 indicates differentiated products, 2 indicates partially homogeneous products, and 3 indicates homogeneous goods. Columns 1-2 use Broda-Weinstein elasticities. Columns 3-4 use a continuous Rauch measure. Columns 5-6 round the measure into a dummy indicator for ease of interpretation and the omitted interaction is differentiated products. Month>0 and Month>20 are dummies indicating the period after September 2005 (when cartoons were published) and May 2007 (20 months after publication), respectively. Denmark X Muslim represents the interaction of the dummies for Danish exports to Muslim countries. Standard errors are clustered on Reporter (exporting country) level.

|                                    | (1)                     | (2)                     | (3)                   | (4)                   | (5)                   | (6)                   |
|------------------------------------|-------------------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                    | Tot. margin             | Tot. margin             | Tot. margin           | Tot. margin           | Tot. margin           | Tot. margin           |
| DK X Muslim X Month>0              | -0.0440<br>(0.0281)     | -0.0440<br>(0.0281)     | 0.371***<br>(0.0504)  | 0.371***<br>(0.0504)  | 0.0981***<br>(0.0331) | 0.0981***<br>(0.0331) |
| DK X Muslim X Month>0 X Sigma      | -0.0136***<br>(0.00206) | -0.0136***<br>(0.00206) |                       |                       |                       |                       |
| DK X Muslim X Month>20             | -0.00363<br>(0.0196)    | -0.00363<br>(0.0196)    | 0.0259<br>(0.0516)    | 0.0259<br>(0.0516)    | 0.0195<br>(0.0279)    | 0.0195<br>(0.0279)    |
| DK X Muslim X Month>20 X Sigma     | 0.0133***<br>(0.00155)  | 0.0133***<br>(0.00155)  |                       |                       |                       |                       |
| DK X Muslim X Month>0 X Rauch      |                         |                         | -0.266***<br>(0.0184) | -0.266***<br>(0.0184) |                       |                       |
| DK X Muslim X Month>20 X Rauch     |                         |                         | 0.0134<br>(0.0242)    | 0.0134<br>(0.0242)    |                       |                       |
| DK X Muslim X Month>0 X (Rauch=2)  |                         |                         |                       |                       | -0.305***<br>(0.0206) | -0.305***<br>(0.0206) |
| DK X Muslim X Month>0 X (Rauch=3)  |                         |                         |                       |                       | -0.393***<br>(0.0332) | -0.393***<br>(0.0332) |
| DK X Muslim X Month>20 X (Rauch=2) |                         |                         |                       |                       | 0.0798***<br>(0.0270) | 0.0798***<br>(0.0270) |
| DK X Muslim X Month>20 X (Rauch=3) |                         |                         |                       |                       | -0.0296<br>(0.0407)   | -0.0296<br>(0.0407)   |
| N                                  | 53371584                | 53371584                | 55954080              | 55954080              | 55954080              | 55954080              |

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$



## 5 Conclusion

This paper examines the a shock on moral attitudes and the subsequent dynamic market response. Danish publication of Jyllands-Posten Muhammad cartoons led to a substantial decrease in Danish exports to Muslim countries on the intensive margin. In addition, a larger response and rebound was observed for countries with greater Muslim share of population. However, the extensive and overall margin showed a more permanent effect. More substitutable products showed greater effect. But money (the most substitutable of all)—despite professed repugnance—showed no effect: there was no decrease in Danish imports from Muslim countries.

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## A Conceptual Framework

This appendix outlines a recent model of trade, trust, and conflict (Rohner et al. 2013b). In this model, business relations are key to preserving stable peace, and trade and trust are promising ways to overcome group conflict. Cooperation is risky, and young agents acquire beliefs about the other group based on conflict history. The incidence of conflict can be reduced by policies abating cultural barriers and fostering inter-ethnic trade. Inter-group conflict—and peace—can be persistent and information traps can arise.

Consider an economy with 2 groups: A and B. Group A can wage a war against Group B; if no war is waged, agents from different groups are randomly paired to trade.

Inter-group trade is modeled as a stag hunt game. Payoffs from trades consist of two parts: (1) material payoffs, which obtain the highest if both cooperate; (2) psychological payoffs from cooperation, which differ from agents to agents. The payoff matrix is shown below where  $c > d > d - l$

|     | $C$                                    | $D$                        |
|-----|--|----------------------------|
| $C$ | $c + \mathcal{P}_i, c + \mathcal{P}_j$ | $d - l + \mathcal{P}_i, d$ |
| $D$ | $d, d - l + \mathcal{P}_j$             | $d, d$                     |

$\mathcal{P}$  is the psychological payoff independently drawn from group-specific distributions. Define p.d.f. for  $\mathcal{L} \equiv l - \mathcal{P}$ ,  $f^J : \mathbb{R} \rightarrow \mathbb{R}^+$ ,  $J \in \{A, B\}$ . Accordingly c.d.f. is  $F^J : \mathbb{R} \rightarrow [0, 1]$ ,  $J \in \{A, B\}$ . Group A can be one of the two types  $F^A \in \{F^+, F^-\}$  with  $F^+$  first-order stochastically dominating  $F^-$ . Label the term  $F^+$  *civic* and  $F^-$  *uncivic*. Group B has only one realization  $F^B$ .<sup>4</sup>

Group A's benefit from war  $\mathcal{V}$  is a discrete random variable. The support of  $\mathcal{V}$  is  $\{V_L, V, V_H\}$  with probabilities  $\lambda_P, 1 - \lambda_W - \lambda_P, \lambda_W$ . They are respectively called *peace shock*, *business as usual* (BAU henceforth), and *war shock*.

Information is asymmetric: the realization of  $\mathcal{V}$  and  $k \in \{+, -\}$  are only observed by Group A. Everything else is common knowledge.

The rest consists of 2 parts. The first part considers general  $f$  and  $F$ . The second part assumes a uniform distribution, which makes the analysis much easier. Most notations and the equilibrium characterization are built up in the first part.

Consider a dynamic economy with overlapping generations of 2-period lived agents. The timing of the game is summarized below:

**Period  $t$ :** Agents from Group B acquire common prior  $r_{t-1}$  based on war history.

**Period  $t + 1$ :**

---

<sup>4</sup>Rohner et al. (2013b) (henceforth called RTZ) defines p.d.f. and c.d.f. on  $\mathcal{P}_i$  and changes to  $f$  and  $F$  in Notation 1. The former is more intuitive but is in fact mathematically equivalent to the latter. For succinctness, I only define the latter. The definition for  $\mathcal{P}$  can be found on p.1120.

1. Agents from Group A decide if to wage a war;
2. Agents from Group B update their belief from  $r_{t-1}$  to  $r_t$ ;
3. If no war is waged, agents can trade.

The equilibrium concept is *Dynamic Stochastic Equilibrium* (DSE) which consists of a sequence of *Perfect Bayesian Equilibria* (PBE) with an associated sequence of beliefs such that, given an initial  $r_0$ , the posterior belief at  $t - 1$  is the prior belief at  $t$ .

A strategy profile for agent  $i$  from A at  $t$  consists of a *war action* for each  $k \in \{+, -\}$ ,  $\mathcal{V} \in \{V_L, V, V_H\}$  conditional on beliefs, and of a *trade action* for each  $\mathcal{P}_i$ . A strategy profile for agent  $j$  from B at  $t$  consists of a *trade action* for each  $\mathcal{P}_j$  conditional on beliefs. A DSE consists of a sequence of strategy profiles, beliefs, and triplets  $(n_A^+, n_A^-, n^B) \in [0, 1]^3$  (denoting the proportion of cooperators in equilibrium) such that (i) in the trade continuation game all agents choose their *trade actions* to maximize their expected payoffs conditional on posterior  $r_t^P$ ; (ii) for  $k \in \{+, -\}$ , Group A wages a war with probability  $1 - \sigma^k$  to maximize total expected payoffs conditional on  $\mathcal{V}$  and  $r_t^P$ ; (iii) beliefs are updated according to Bayes' rule whenever possible.

$r_t^P$  denotes the posterior belief at  $t$  if no war is waged;  $r_t^W$  denotes the posterior if a war is wage. For simplicity, beliefs are also defined on likelihood ratios, that is  $r \equiv \frac{\pi}{1-\pi} \in [0, \infty]$  where  $\pi \in [0, 1]$  is the subjective belief, held by Group B, of Group A being civic. Parameters  $r$  and  $\pi$  are used interchangeably.

Due to sequential rationality, group A's war decision rests on the tradeoff between  $\mathcal{V}$  and endogenous aggregate trade surplus  $S^k$  with  $k \in \{+, -\}$ .

Next, solve for  $S^k$  from the trade game and the PSE for the whole game with backward induction for an arbitrary  $t$ .

## B Trade Game

Consider an agent from Group A: he will cooperate for higher expected payoff, that is

$$n_B \times (c + \mathcal{P}_i) + (1 - n_B) \times (d - l + \mathcal{P}_i) \geq d$$

Rewrite it with  $\mathcal{L}_i$

$$n_B \times (c + l - \mathcal{L}_i) + (1 - n_B) \times (d - \mathcal{L}_i) \geq d$$

Rearrange

$$\mathcal{L}_i \leq n_B(c + l - d) \equiv n_B z$$

Similarly, an agent from Group B will cooperate if

$$\begin{aligned} & \frac{r_t^P}{1+r_t^P} [n_A^+ \times (c+l-\mathcal{L}_j) + (1-n_A^+) \times (d-\mathcal{L}_j)] \\ & + \frac{1}{1+r_t^P} [n_A^- \times (c+l-\mathcal{L}_j) + (1-n_A^-) \times (d-\mathcal{L}_j)] \geq d \end{aligned}$$

Rearrange

$$\mathcal{L}_j \leq \frac{r_t^P}{1+r_t^P} n_A^+ z + \frac{1}{1+r_t^P} n_A^- z$$

Invoke fixed-point argument to find equilibrium proportion of cooperators

$$(4) \quad \{n_A^+, n_A^-, n_B\} = \left\{ F^+(n_B z), F^-(n_B z), F^B \left( \frac{r_t^P}{1+r_t^P} F^+(n_B z) z + \frac{1}{1+r_t^P} F^-(n_B z) z \right) \right\}$$

The aggregate trade surplus to Group A is given by

$$\begin{aligned} (5) \quad S^k &= \underbrace{\int_{-\infty}^{n_B z} n_B \times (c+l-\mathcal{L}_i) dF^k(\mathcal{L}_i)}_{\text{Both A and B choose } C} + \underbrace{\int_{-\infty}^{n_B z} (1-n_B) \times (d-\mathcal{L}_i) dF^k(\mathcal{L}_i)}_{\text{A chooses } C \text{ but B chooses } D} + \underbrace{\int_{n_B z}^{+\infty} d dF^k(\mathcal{L}_i)}_{\text{A chooses } D} \\ &= d + n_B z F^k(n_B z) - \int_{-\infty}^{n_B z} \mathcal{L}_i dF^k(\mathcal{L}_i) \\ &= d + \int_{-\infty}^{n_B z} F^k(\mathcal{L}_i) d\mathcal{L}_i \quad (\text{Integral by parts}) \end{aligned}$$

## C War Decision

*Assumption*

$$V_L < S^{\min} < V < S^{\max} < V_H.$$

Under this assumption, the optimal (equilibrium) choice  $\sigma_t^k$  is given by

$$(8) \quad \sigma_t^k = \begin{cases} 0 & S^k(r_t^P(r_{t-1})) < V \\ \in [0, 1] & S^k(r_t^P(r_{t-1})) = V \\ 1 & S^k(r_t^P(r_{t-1})) > V \end{cases}$$

$S^k$  is a function of the posterior belief after peace, which is defined in (6).

Given their common prior  $r_{t-1}$  and the optimal  $\sigma^k$ , agents from Group B update beliefs according to Bayes' rule. Note that different war decisions lead Group B to different information sets, thus updates must

be conditioned on war decisions. If no war is waged

$$\pi_t^P = \frac{\pi_{t-1}[\sigma_t^+(1 - \lambda_W - \lambda_P) + \lambda_P]}{\pi_{t-1}[\sigma_t^+(1 - \lambda_W - \lambda_P) + \lambda_P] + (1 - \pi_{t-1})[\sigma_t^-(1 - \lambda_W - \lambda_P) + \lambda_P]}$$

rewrite it with likelihood ratio

$$(6) \quad \ln r_t^P = \ln r_{t-1} + \ln \frac{\sigma_t^+(1 - \lambda_W - \lambda_P) + \lambda_P}{\sigma_t^-(1 - \lambda_W - \lambda_P) + \lambda_P}$$

On the other hand, if a war is waged

$$\pi_t^W = \frac{\pi_{t-1}[(1 - \sigma_t^+)(1 - \lambda_W - \lambda_P) + \lambda_W]}{\pi_{t-1}[(1 - \sigma_t^+)(1 - \lambda_W - \lambda_P) + \lambda_W] + (1 - \pi_{t-1})[(1 - \sigma_t^-)(1 - \lambda_W - \lambda_P) + \lambda_P]}$$

rewrite it with likelihood ratio

$$(7) \quad \ln r_t^W = \ln r_{t-1} - \ln \frac{1 - \lambda_P - \sigma_t^-(1 - \lambda_W - \lambda_P)}{1 - \lambda_P - \sigma_t^+(1 - \lambda_W - \lambda_P)}$$

#### Proposition

A PBE exists and is fully characterized by (4), (5), (6), (7), and (8), given a  $r_0 \in [0, +\infty]$ .

### D Intertemporal Dynamics

Intertemporal dynamics is described by mappings from priors to posteriors; agents update their beliefs with new history/information. But there are some interesting cases where they don't: when both types act in the same way (professionally employ the same strategy). RTZ call these situations *information traps* and distinguish between *war traps* and *peace traps*.

#### Definitions

A *war trap* is a set of states  $\Omega_{TRAP} \subset \mathbb{R}^+$  such that  $\forall r_t \in \Omega_{TRAP}, \sigma^+(r_t) = \sigma^-(r_t) = 0$ .

#### Definition

A *peace trap* is a set of states  $\Pi_{TRAP} \subset \mathbb{R}^+$  such that  $\forall r_t \in \Pi_{TRAP}, \sigma^+(r_t) = \sigma^-(r_t) = 1$ .

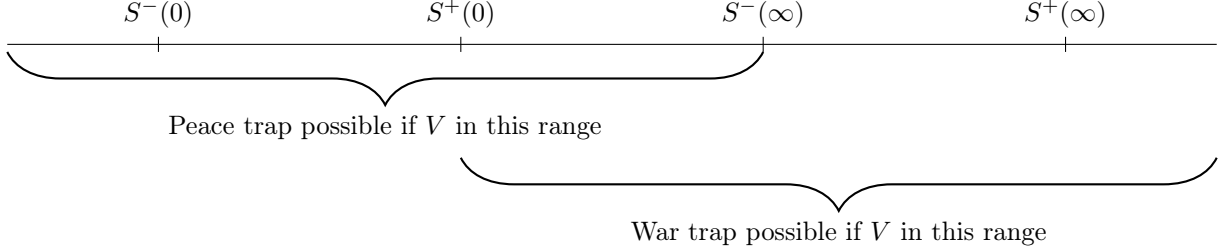
#### Definition

An *information trap* is a set of states  $\Omega_{TRAP} \cup \Pi_{TRAP} \subset \mathbb{R}^+$  such that  $\forall r_t \in \Pi_{TRAP}, \sigma^+(r_t) = \sigma^-(r_t)$ .

To investigate the conditions under which *information traps* might arise, recall two properties of  $S^k$ . First,  $n_B$  is an increasing function of  $r_t^P$  from FOSD and (4). Since  $S^k$  is an increasing function of  $n_B$ , it is also

an increasing of  $r_t^P$ . Second,  $S^+(r_t) \geq S^-(r_t)$  for any  $r_t^P$  by FOSD.

From (8), it is clear that  $V \geq S^+(0)$  is necessary for war traps (actually for  $\sigma^+ = 1$ ). Similarly,  $V \leq S^-(\infty)$  is necessary for peace traps (actually for  $\sigma^- = 0$ ). Picking up the assumption  $S^+(0) < S^+(\infty)$ ,<sup>5</sup> we obtain the following figure



Denote  $\underline{r}$  and  $\bar{r}$  such that  $S^+(r_t^P(\underline{r})) = S^-(r_t^P(\bar{r})) = V$ . They represent the thresholds for (extremely low/high) priors under/above which the economy enters *war/peace trap* regardless A's type

$$\begin{cases} \forall r_{t-1} < \underline{r} : & \sigma^+(r_{t-1}) = \sigma^-(r_{t-1}) = 0 \\ \forall r_{t-1} > \bar{r} : & \sigma^-(r_{t-1}) = \sigma^+(r_{t-1}) = 1 \end{cases}$$

Define  $r^* \equiv \frac{1-\lambda_W}{\lambda_P} r$ .<sup>6</sup> From  $1 - \lambda_P - \lambda_W > 0$  and the monotone relation of  $r_{t-1}$  and  $S^k$

$$\underline{r} < \underline{r}^* < \bar{r} < \bar{r}^*$$

RTZ fully characterize the DSE in different parameter ranges. The next part considers a simplification of the model and discusses the conditions and probabilities for *information traps*.

## E Toy Model

Assume uniform distributions for  $\mathcal{P}$  in this part to allow for explicit solutions. To further streamline the analysis, assume that whenever they are indifferent, the civic always keep peace whereas the uncivic wage a war.<sup>7</sup> In particular

$$\textbf{Group A: } \mathcal{P}_i^+ \sim U[0, 2l] \Rightarrow \mathcal{L}_i^+ \sim U[-l, l]$$

$$\mathcal{P}_i^- \sim U[-l, l] \Rightarrow \mathcal{L}_i^- \sim U[0, 2l]$$

$$\textbf{Group B: } \mathcal{P}_j \sim U[0, l] \Rightarrow \mathcal{L}_j \sim U[0, l]$$

<sup>5</sup>While partial separation ( $S^+(0) < S^+(\infty)$ ) seems to be more reasonable, full separation ( $S^+(0) < S^-(\infty)$ ) cannot be ruled out by the model. However, under full separation, *information traps* are rarer.

<sup>6</sup>Instead RTZ use  $S^+(\bar{r}^*) = S^-(\bar{r}) = V$ .

<sup>7</sup>RTZ adopt a different selection criterion: they assume that agents always select the most informative equilibrium. This criterion selects the mixed-strategy equilibrium, which complicates the analysis. Besides this criterion is not naturally justified by Pareto arguments as it lowers the payoffs of a uncivic group.



Under this specification, civic A is the most trusting and cooperative while uncivic A is the least; B is in the middle. The following table of conditional probabilities illustrates the idea

|                            | civic A       | uncivic A                        | B |
|----------------------------|---------------|----------------------------------|---|
| [-1.5ex] $\mathbb{P}(C C)$ | 1             | $\frac{l+d-c}{2l} < \frac{1}{2}$ | 1 |
| [.5ex] $\mathbb{P}(C D)$   | $\frac{1}{2}$ | 0                                | 0 |

Solving (4)

$$\{n_A^+, n_A^-, n_B\} = \left\{ \frac{n_B z + l}{2l}, \frac{n_B z}{2l}, \frac{n_B}{2} + \frac{r_t^P}{2(1+r_t^P)} \right\}$$

we obtain  $n_B = \frac{r_t^P}{1+r_t^P} = \pi_t^P$ .  $n_B$  is indeed an increasing function of  $r_t^P$ , consistent with the intuition that the more optimistic B is the more cooperative B becomes.

From now on, consider  $\pi$  instead of  $r$ . Solving (5) respectively for the two types

$$S^+(\pi_t^P) = d + \int_{-l}^{n_B z} \frac{\mathcal{L}_i + l}{2l} d\mathcal{L}_i = d + \frac{(\pi_t^P z + l)^2}{4l}$$

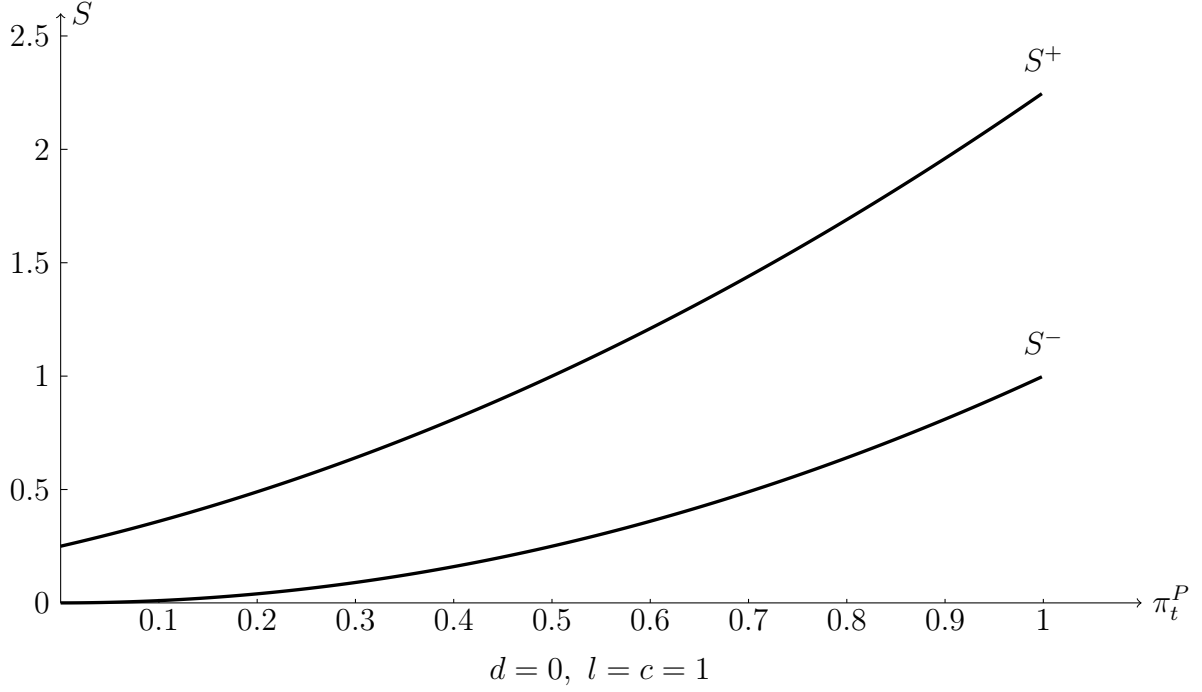
$$S^-(\pi_t^P) = d + \int_0^{n_B z} \frac{\mathcal{L}_i}{2l} d\mathcal{L}_i = d + \frac{(\pi_t^P z)^2}{4l}$$

Again it becomes clearer that  $\forall \pi_t^P \in [0, 1]$ ,  $S^+(\pi_t^P) \geq S^-(\pi_t^P)$ . Moreover, both  $S^+$  and  $S^-$  are monotonically increasing in  $\pi_t^P \in [0, 1]$  with lower and upper bounds

$$\begin{cases} S^+(0) = d + \frac{l}{4} \\ S^+(1) = d + \frac{(z+l)^2}{4l} \end{cases} \quad \begin{cases} S^-(0) = d \\ S^-(1) = d + \frac{z^2}{4l} \end{cases}$$

where  $S^-(0) < S^+(0) < S^-(1) < S^+(1)$ .

Belief updates still follow (6) and (7), and the posterior threshold can be explicitly solved under/above



which the economy enters a *war/peace trap*

$$V = S^+(\underline{\pi}^*) = d + \frac{(\underline{\pi}^* z + l)^2}{4l} \Rightarrow \underline{\pi}^* = \begin{cases} [0, 1] & V > S^+(1) \\ \frac{2\sqrt{(V-d)l-l}}{z} & S^+(0) \leq V \leq S^+(1) \\ \emptyset & \text{else} \end{cases}$$

$$V = S^-(\bar{\pi}^*) = d + \frac{(\bar{\pi}^* z)^2}{4l} \Rightarrow \bar{\pi}^* = \begin{cases} [0, 1] & V < S^-(0) \\ \frac{2\sqrt{(V-d)l}}{z} & S^-(0) \leq V \leq S^-(1) \\ \emptyset & \text{else} \end{cases}$$

The corresponding priors,  $\underline{\pi}$  and  $\bar{\pi}$ , are given by

$$\pi = \frac{\pi^* \Lambda}{1 - \pi^* + \Lambda \pi^*} = \frac{\pi^* \lambda_P}{1 - \lambda_W - \pi^* (1 - \lambda_P - \lambda_W)}$$

Thus, if the value of war  $V$  is exceptionally high/low, the economy enters a *war/peace trap* on the outset, given any prior  $\pi_0 \in [0, 1]$ . There is no dynamics of beliefs ever after.

*High value of war*  $S^-(1) < V \leq S^+(1)$

Within this range, *peace traps* are out of the question. The economy starts in the *war trap* for  $\pi_0 < \underline{\pi}$ .

For  $\pi_0 \geq \underline{\pi}$  and A being uncivic, the economy enters the *war trap* with probability 1. Suppose not, then

after infinite observations, belief updates must stop at  $\pi_\infty \rightarrow 1$ . However this mistaken belief cannot support an equilibrium since  $S^-(1) < V \leq S^+(1)$ .

For  $\pi_0 \geq \underline{\pi}$  and A being civic, the economy enters the *war trap* with probability  $\mathbb{P}_{TRAP}^H \in (0, 1)$ . And there is a strictly positive probability  $1 - \mathbb{P}_{TRAP}^H$  that B will learn the true type of A.

The following table summarizes the probabilities of entering an *information trap*

|                          |                                  | civic                 | uncivic |
|--------------------------|----------------------------------|-----------------------|---------|
| [-2ex] <i>peace trap</i> | $\pi_0 \in [0, 1]$               | 0                     | 0       |
| [.5ex] <i>war trap</i>   | $\pi_0 \in [0, \underline{\pi})$ | 1                     | 1       |
|                          | $\pi_0 \in [\underline{\pi}, 1]$ | $\mathbb{P}_{TRAP}^H$ | 1       |

where  $\mathbb{P}_{TRAP}^H$  satisfies

$$\begin{aligned} \pi_0 = & \mathbb{P}_{TRAP}^H \times \mathbb{E} \left\{ \pi_\infty | \pi_\infty \in \Omega_{TRAP} = \left( \frac{\lambda_P}{1 - \lambda_W} \frac{\underline{\pi}}{1 - \underline{\pi}}, \underline{\pi} \right) \right\} \\ & + (1 - \mathbb{P}_{TRAP}^H) \times \mathbb{E} \{ \pi_\infty = 1 \} \end{aligned}$$

with the following transitional probability matrix

$$\left( \mathbb{P} \left( \frac{1 - \lambda_W}{\lambda_P} \frac{\pi_{t-1}}{1 - \pi_{t-1}} | \pi_{t-1} \right) \quad \mathbb{P} \left( \frac{\lambda_W}{1 - \lambda_P} \frac{\pi_{t-1}}{1 - \pi_{t-1}} | \pi_{t-1} \right) \right) = \begin{pmatrix} 1 - \lambda_W & \lambda_W \end{pmatrix}$$

*Low value of war*  $S^+(0) \leq V \leq S^-(1)$

Within this range, both *peace traps* and *war traps* are possible. The economy starts in the *war trap* for  $\pi_0 < \underline{\pi}$  and in the *peace trap* for  $\pi_0 > \bar{\pi}$ .

For  $\pi_0 \in [\underline{\pi}, \bar{\pi}]$ , perfect learning is not possible. That is B will never learn the true type of A, whatever it might be.  $\bar{\pi}$  and  $\underline{\pi}$  are absorbing states.  $\pi_\infty \rightarrow 1$  is not possible in that once  $\pi_t$  grows to  $\bar{\pi}$ , the economy enters a *peace trap* and update stops;  $\pi_\infty \rightarrow 0$  is not possible in that once  $\pi_t$  decreases to  $\underline{\pi}$ , the economy enters a *war trap* and update stops. Put differently, the economy enters an *information trap* with probability 1.

The probability of ending up in a *war trap* is  $\mathbb{P}_{TRAP}^L \in (0, 1)$  which depends  $\pi_0$  and  $V$  (for the distance between the initial state and either absorbing state and the step length) as well as on  $\lambda_P$  and  $\lambda_W$  (for the transitional probability matrix, which is type-specific). The following table summarizes the probabilities of entering an *information trap*

|                          |  | civic                        | uncivic                      |
|--------------------------|--|------------------------------|------------------------------|
| [-2ex] <i>peace trap</i> | $\pi_0 \in (\bar{\pi}, 1]$               | 1                            | 1                            |
| [.5ex]                   | $\pi_0 \in [0, \underline{\pi})$         | 0                            | 0                            |
| [.5ex]                   | $\pi_0 \in [\underline{\pi}, \bar{\pi}]$ | $1 - \mathbb{P}_{TRAP}^{L+}$ | $1 - \mathbb{P}_{TRAP}^{L-}$ |
| [.5ex] <i>war trap</i>   | $\pi_0 \in (\bar{\pi}, 1]$               | 0                            | 0                            |
|                          | $\pi_0 \in [0, \underline{\pi})$         | 1                            | 1                            |
| [.5ex]                   | $\pi_0 \in [\underline{\pi}, \bar{\pi}]$ | $\mathbb{P}_{TRAP}^{L+}$     | $\mathbb{P}_{TRAP}^{L-}$     |
| [.5ex]                   |  |                              |                              |

where  $\mathbb{P}_{TRAP}^L$  satisfies

$$\begin{aligned}
(24') \quad \pi_0 = & \mathbb{P}_{TRAP}^{Lk} \times \mathbb{E} \left\{ \pi_\infty \middle| \pi_\infty \in \Omega_{TRAP} = \left( \frac{\lambda_P}{1 - \lambda_W} \frac{\underline{\pi}}{1 - \underline{\pi}}, \underline{\pi} \right) \right\} \\
& + (1 - \mathbb{P}_{TRAP}^{Lk}) \times \mathbb{E} \left\{ \pi_\infty \middle| \pi_\infty \in \Pi_{TRAP} = \left( \frac{\lambda_P}{1 - \lambda_W} \frac{\bar{\pi}}{1 - \bar{\pi}}, \bar{\pi} \right) \right\}
\end{aligned}$$

with the following transitional probability matrix if  $k = +$

$$\left( \mathbb{P} \left( \frac{1 - \lambda_W}{\lambda_P} \frac{\pi_{t-1}}{1 - \pi_{t-1}} \middle| \pi_{t-1} \right) \quad \mathbb{P} \left( \frac{\lambda_W}{1 - \lambda_P} \frac{\pi_{t-1}}{1 - \pi_{t-1}} \middle| \pi_{t-1} \right) \right) = \begin{pmatrix} 1 - \lambda_W & \lambda_W \end{pmatrix}$$

if  $k = -$

$$\left( \mathbb{P} \left( \frac{1 - \lambda_W}{\lambda_P} \frac{\pi_{t-1}}{1 - \pi_{t-1}} \middle| \pi_{t-1} \right) \quad \mathbb{P} \left( \frac{\lambda_W}{1 - \lambda_P} \frac{\pi_{t-1}}{1 - \pi_{t-1}} \middle| \pi_{t-1} \right) \right) = \begin{pmatrix} \lambda_P & 1 - \lambda_P \end{pmatrix}$$