

# Veiling

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## Abstract

Veiling among Muslim women is modelled as a form of *cultural resistance* which inhibits the transmission of secular values. Individuals care about opinions of their community members and use veiling to influence these opinions. Our theory predicts that veiling is highest when individuals from highly religious communities interact in highly secular environments. This accounts for puzzling features of the new veiling movement since the 1970s. Though veiling helps retain religious values, we show that bans on veiling aimed at assimilation can be counterproductive. By inducing religious types to segregate in local communities, bans on veiling can lead to *increased* religiosity.

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*One recent phenomenon incomprehensible to many observers of the Egyptian scene today is the visible presence of a new Egyptian woman: the young urban college student on her way to or from the university campus – carrying her books, wearing eye glasses, alone or in the chatting company of other college women, and completely “veiled” – face and body.*

(El Guindi 1981)

## 1 Introduction

The issue of veiling by Muslim women has become a focal point for debate about religion and multiculturalism. By veiling we mean the various types of headcovering and modest forms of dress worn by Muslim women. Why is the way that women clothe themselves the subject of such intense political interest? Various bans on veiling have been imposed at times in Turkey, Iran, Indonesia and Tunisia. In 2004, France introduced bans on the Muslim headscarf in public schools. At present, there are political moves to further restrict veiling in France, the Netherlands, Belgium, Italy, Switzerland and Egypt (e.g. Bremner 2010). A 2006 Pew Poll on the veil in Europe reveals considerable support for banning headscarves in France (78%), Germany (54%), the Netherlands (51%) and Spain (43%) (Morin & Horowitz 2006). Despite the political interest, there is no coherent theoretical framework for making sense of why women veil, let alone understanding the implications of bans on veiling. In this paper, we provide what is, to the best of our knowledge, the first formal theory of veiling.

There has been a dramatic surge in veiling among Muslim women around the world since the 1970s. This new veiling movement is part of the broader rise in religious commitment among Muslims known as the Islamic revival.<sup>1</sup> Muslims had begun abandoning the veil as a sign of backwardness and oppression from the start of the twentieth century (Shaarawi & Badran 1987, Hoodfar 1991, Stillman 2003). By 1969, Janet Abu-Lughod (1971) writes of Cairo, “Almost no women are veiled” [p. 239]. A visitor to the city in 2000 would have encountered a very different scene: “a staggering majority of over 80 percent” of Cairene women wear some form of veil (Bayat 2007). Similarly, in Turkey, the religious headcovering was a rare sight in major cities until the 1970s. Today, around 45 percent of Turkish women wear the headscarf in public (Rheault 2008). This pattern has been repeated in countries such as Indonesia (Smith-Hefner 2007), Pakistan (Afzal-Khan 2007) and Tunisia (Waltz 1986), as well as among Muslim minorities in Europe and the United

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<sup>1</sup>See Hunter (1988), Esposito (1999), Lapidus (2002), Bayat (2007) and Carvalho (2009).

States. Moreover, the ‘new veiling’ movement in places such as Egypt, Turkey, Indonesia, the United States and Europe appears to be largely a *voluntary* phenomenon.<sup>2</sup> Many young Muslim women have begun to veil against the wishes of their parents and husbands, and in many cases their mothers do not veil (e.g. El Guindi 1981, Brenner 1996, Ali 2005).

We call attention to two features of contemporary veiling which require explanation. Firstly, there appear to be strong *peer effects* on veiling with the opinions of friends, family and community members influencing the decision to veil (Brenner 1996, Smith-Hefner 2007, Omkar 2007). Secondly, the new veiling movement is primarily associated with *urban, educated, working, middle-class* women (e.g. El Guindi 1981, Hoodfar 1991, Mule & Barthel 1992, Smith-Hefner 2007). Yet it is these women who we would expect to bear the largest costs from veiling.

Veiling is an important economic decision. Even in predominantly Muslim societies, such as Egypt, Turkey, Lebanon and Indonesia, veiled women are routinely screened out by foreign firms and employers in lucrative fields such as televised media, hospitality and tourism (Mule & Barthel 1992, Brenner 1996, Blaydes & Linzer 2008). In France, they forego access to public schools. In Turkey, veiled women are prohibited from entering government institutions, including public universities. In non-Muslim societies, veiled women are the subject of verbal/physical harassment, especially after 9/11 (e.g. Ali 2005, Read & Bartkowski 2000, Omkar 2007). As a voluntary sacrifice, veiling requires some explanation.

Modern behavioural economics and game theory have economists well placed to study issues of identity, such as veiling. We develop a model in which agents acquire secular or religious values via cultural transmission.<sup>3</sup> An agent who acquires religious values engages in religiously approved behaviour. An agent who acquires secular values engages in religiously prohibited behaviour. We introduce the notion that veiling serves as a form of *cultural resistance* to acquiring secular values. This can work in several ways. A central idea in the theory of identity developed by Akerlof & Kranton (2000, 2002, 2005) is that agents suffer dissonance/anxiety when deviating from the ‘ideal’ behaviour associated with their social identity.<sup>4</sup> Thus adopting an Islamic identity (e.g. veiling)

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<sup>2</sup>See El Guindi (1981), Hoodfar (1991), Brenner (1996), Read & Bartkowski (2000) and Ali (2005).

<sup>3</sup>For related work on cultural transmission in evolutionary anthropology and economics, see Cavalli-Sforza & Feldman (1981), Boyd & Richerson (1985, 2005) and Bisin & Verdier (2000, 2001).

<sup>4</sup>For example, Smith-Hefner (2007) reports that “those who decide to veil are told that after doing so, they should be “consistent and responsible in their behavior,” and “wear it continuously” – that is, not put it on one day and take it off the next. In light of these expectations, most young women think long and hard before donning the veil. Those who do not veil describe themselves as “not yet ready” to commit to the weighty ethical standards and behavioral restrictions of veiling” [p. 400].

might serve to reduce the likelihood of acquiring secular values by imposing behavioural prescriptions that make indulgence in religiously prohibited behaviour psychologically costly (e.g. Brenner 1996). Veiling also serves as a constant physical reminder of religious prescriptions for behaviour (Smith-Hefner 2007, Droogsma 2007). Secondly, veiling might *segregate* agents from secular values/behaviour even while they integrate into mainstream society by studying and working outside their local community.

To capture peer effects we introduce a novel formulation in which an individual's behaviour is judged by her community, and agents care about the opinions of members of their community, even when these opinions proceed from different values to their own. The higher the proportion of religious types in the community, the more heavily religious values weigh in social judgements, and the greater the pressure to veil in order to resist religiously prohibited behaviour. Thus, cultural resistance is not only motivated by personal, but also reputational concerns.

Specifically, there are three reasons in our framework why individuals might resist acquiring secular values. Firstly, religious agents anticipate the personal cost to them of later acquiring secular values and indulging in religiously prohibited behaviour. They can reduce the probability of this occurring by veiling. We call this is the *personal commitment* motivation for veiling. Secular agents have no such motivation to veil. Secondly, when behaviour is observable by an agent's community, a member of a more religious community might veil to avoid violating the religious standards prevalent in the community. We call this the *social commitment* motivation for veiling. Thirdly, when an agent's behaviour is hidden, veiling can be used to signal that an agent has religious values and is thereby less likely to acquire secular values, for any given degree of veiling. We call this the *social signalling* motivation for veiling.

We demonstrate that when the proportion of religious types in the community  $q$  is low, there exists an equilibrium in which both secular and religious types refrain from veiling. When  $q$  is intermediate, both secular and religious types adopt veiling as a social commitment. However, religious types choose a higher degree of veiling, due to their added personal commitment motivation for veiling. When  $q$  is sufficiently large, being identified as an agent with religious values becomes especially attractive. Religious types have to further increase veiling to signal their existing values and avoid being mimicked by secular types.

This leads to a unified theory of veiling in predominantly Muslim and non-Muslim societies. The main testable prediction of our theory is that veiling should be highest among

women from highly religious communities who interact in highly secular environments. In contrast, an increasing-returns/tipping-point model of veiling (Schelling 1978*a*, Kuran 1995, 1998), in which agents veil to keep up with veiling by their peers, would predict lower veiling in more secular environments. We attribute the rise of the new veiling movement to the influx of women from highly religious communities into formal education and employment, which has led to the breakdown in customary segregation of the sexes and increased exposure to Western culture (e.g. television content, movies, magazines). Hence our model explains why the new veiling movement is primarily associated with urban, educated, working, middle-class women, especially those from traditional rural backgrounds (MacLeod 1991). Veiling enables them to resist the secular values and opportunities for religious behaviour with which they come into contact, and which meet with disapproval in their communities.

The full dynamic version of our model is used to analyze the implications of bans on veiling. The view of veiling as a resistance to acquiring secular values makes it unsurprising that groups favouring the cultural assimilation of religious minorities seek to prohibit veiling. However, we demonstrate that bans on veiling aimed at cultural assimilation can be self defeating when women choose whether to segregate by interacting only in their community or integrate by taking up study/work outside the community, in a more secular environment. If the return to integration is low (e.g. low wages, low returns to education, high discrimination) relative to the personal and reputational costs of de veiling, then a ban on veiling induces agents to segregate in their local community as a (costly) substitute for veiling. Hence, if segregation further reduces exposure to secular values, then a ban on veiling *inhibits* the transmission of secular values. Of course, the right policy on veiling is a broader matter of justice, well beyond the scope of this paper. But our framework does suggest that a ban on veiling aimed at cultural assimilation could be counterproductive.

Before proceeding, let us point to some related research. In Akerlof and Kranton's (2000, 2002, 2005) theory of identity, agents choose to adopt a marker, such as the veil, to place themselves in a particular social category. Belonging to a social category imposes certain behavioural prescriptions, and agents bear a cost when deviating from the ideal behaviour associated with their social category. As we have already mentioned, our main assumption – that adopting a religious identity (i.e. veiling) reduces the probability of engaging in religiously prohibited behaviour – accords perfectly with this notion. The main difference in our approaches is that agents in Akerlof and Kranton's theory do not care about the opinions of others, and hence do not tailor their social identity to

the ‘audience’ they face. Thus applying their theory to veiling would leave peer effects unexplained.

Austen-Smith & Fryer (2005) develop a two-audience signalling model of “acting white” in which agents choosing education tradeoff increased earnings in the labour market with peer group rejection. Our model can be given a similar interpretation: agents bear a cost from veiling, in terms of labour market and social discrimination, in order to avoid disapproval by their community. This tradeoff is not the focus of our analysis, however. Instead, we open up the ‘black box’ of the peer group by introducing a model in which agents are judged by members of their community. This enables us to examine how the religious composition of a community and an agent’s exposure to secular values shape veiling choices.

The remainder of the paper is structured as follows. In section 2, we briefly review the historical origins of veiling, identify patterns of contemporary veiling that require explanation and discuss why we believe existing theories do not account for these facts. In section 3, we introduce our model of veiling and in section 4 we analyze the veiling norms that emerge when agents care about how they are judged by their community. In section 5, we conduct the comparative statics analysis, which leads to an account of the factors behind the new veiling movement. In section 6, the consequences of veiling bans are studied in light of our theory. Section 7 concludes.

## 2 Veiling

### 2.1 Origins of Veiling

The veil is defined by the Oxford Dictionary of Islam as, “The traditional Muslim women’s head, face, or body covering, of numerous varieties across time and space” (Esposito 2004). The various forms of veiling adopted by Muslims today include the *chador* which is the semi-circle of fabric Iranian women wear wrapped around their heads and bodies in public spaces, the *jilbab* which is a concealing coat, the *khimar* which is a sheer headscarf or wrap, the *niqab* which is the face veil commonly worn in the Persian Gulf states, and the *burqa* associated with Afghanistan which covers the entire head and body, usually with an area of mesh around the eyes. While the term *hijab* is often used in reference to one of the many ways a scarf or cloth can be used to cover the hair,<sup>5</sup> we shall adopt the

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<sup>5</sup>The word used to refer specifically to a headcovering in the Qur’an is *khimar*.

broader notion of the terms “*hijab*” and “veiling” in this paper, as an overall standard of dress which symbolizes “modesty, privacy, and morality” (Esposito 2004).

The tradition of veiling practiced by contemporary Muslims predates Islam (Sherif 1987, El Guindi 1999, Esposito 2004). The oldest known law pertaining to veiling is from the Middle Assyrian period (c. 1300 BCE). The law required married women and unmarried women under the protection of their fathers to cover their heads in public. Prostitutes and female slaves were forbidden from covering their heads (Goto 2004). The practice of veiling was appropriated by Muslims from elite women of the Byzantine and Persian empires, during the Arab conquests (El Guindi 1999, Esposito 2004). In these empires, veiling was a luxury; it symbolized high status by indicating that a woman could be supported by her husband, without her being required to work.

The Quar’an instructs Muslims to “be modest in thy bearing” (verse 31; 19). The main scriptural injunction used to motivate veiling as a religious duty comes in Surah an-Nur ayah 31 of the Quar’an:

And say to the believing women that they cast down their looks and guard their private parts and do not display their ornaments except what appears thereof, and let them wear their head-coverings (*khimar*) over their bosoms, and not display their ornaments. . . and let them not strike their feet so that what they hide of their ornaments may be known; and turn to Allah all of you, O believers! so that you may be successful.

In further Quar’anic passages, Muslims are instructed, “Tell your wives and daughters and the believing women that they should cast their outer garments (*jilbab*) over themselves, that is more convenient that they be known and not molested,” while men are required to speak to the wives of the prophet from behind a screen (*hijab*) to ensure “greater purity for your hearts and for them” (Sherif 1987, p. 155).

The etymology of veiling terminology in different Islamic traditions points to the veil as an extension of the home, a portable *barrier* which ensures the modesty and privacy of women in public spaces. *Chador* in Farsi means ‘tent,’ *hijab* is used in the Quar’an to refer to a curtain or screen which provides privacy, while the Indo-Pakistani word *purdah*, from *pardeh* which also means curtain, refers to the seclusion of women from the sight of men, achieved either by confinement to the home or by wearing concealing garments when leaving the home (Sherif 1987). In this paper, we suggest that veiling is not only a physical screen from the gaze of strangers, but also a cultural barrier which guards against the acquisition of secular values.

## 2.2 Contemporary Veiling

Despite the static nature of scriptural injunctions to veil, norms of veiling have been subject to substantial change over the twentieth century. In this section, we describe the contemporary rise in veiling among Muslim women and identify several features of this new veiling movement that a theory of veiling needs to explain. To our knowledge, there do not exist any hard statistical data on patterns of veiling among Muslim women. Therefore, we proceed on the basis of extant historical, ethnographic and survey-based studies of veiling.

### 2.2.1 The New Veiling Movement

The first half of the twentieth century witnessed a retreat from traditional religious practices in many Muslim societies. By the 1930s, the educated elite had begun to adopt Western modes of lifestyle and behaviour incompatible with *sharia*; prayers and fasting were less frequently observed, and the consumption of alcohol was rising (Hourani 2005, p. 345-6). The veil was also vanishing. Veiling was first abandoned by non-Muslim minorities in the Middle East during the 19th century. In Beirut, Christian women had ceased veiling by 1890 (Stillman 2003). Muslim women began this process later and more gradually. Modest standards of European dress were first adopted, including European-style face veils, as a transition from traditional norms of dress to Western fashion (Stillman 2003).

In 1923, an upper-class Egyptian woman named Huda Shaarawi publicly removed her face veil, upon returning from an international meeting of feminists (Shaarawi & Badran 1987). This initiated a deveiling movement, featuring organized marches by unveiled women in the streets of Cairo.<sup>6</sup> It culminated in the almost universal adoption of Western modes of dress by Egyptian women of the middle and upper classes. By 1971, most Cairene women wore:

a straight, dark gabardine skirt ending just below the knee and over it a shirt in a floral or geometric pattern with an open collar and sleeves just above the elbow. (Soueif 2001)

Indeed, Janet Abu-Lughod (1971) writes of Cairo at that time: “One rarely sees *jalabiyyah* (plural of *jilbab*)... Almost no women are veiled” [p. 239]. Since the 1970s, however, there has been a dramatic revival in veiling among Muslim women, both in predominantly

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<sup>6</sup>Unlike in Iran, Turkey and Indonesia, the movement was led by women activists and without resort to the state apparatus (Hoodfar 1991).



Muslim societies and in immigrant communities in Europe and the United States. In Egypt, veiling resumed among university students in the early 1970s, and had by the end of the decade become a widespread movement among the lower middle classes, especially women employed in white-collar positions in the state sector (Hoodfar 1991). By 2001, a visitor to Cairo would have noticed:

the straight gabardine skirt is now just above the ankles, the patterned shirt is longer, and now has long sleeves. The head is covered with a scarf folded into a large, concealing triangle. This has become the “default” dress. (Soueif 2001)

Conducting a set of informal surveys in 2000, Bayat (2007) claims that veiled women in Cairo constitute “a staggering majority of over 80 percent.” This is a far cry from the Cairo of 1969 in which “almost no women are veiled.”

Similarly, veiling was rarely seen in many parts of Turkey during the 1970s (see Breu & Marchese 2000), where the religious headcovering had been prohibited in public universities and Turkish government institutions since 1924. Yet, prior to the repeal of the prohibition in 2008, 45 percent of Turkish women surveyed in a Gallup Poll reported wearing the headscarf in public (Rheault 2008). In Indonesia, Smith-Hefner (2007) estimates that the percentage of the Muslim female student population wearing an Islamic headcovering on campus in the nation’s oldest and second-largest university rose from less than three percent in the late 1970s to more than 60 percent by 2002.<sup>7</sup>

The rise in veiling in the United States and Europe seems to have begun in the 1990s among second and third generation Muslim immigrants (e.g. Alvi et al. 2003, Ali 2005). In a survey of Muslim women in the mid-1980s, Haddad & Lummis (1987) report that “few if any Muslims born in the U.S. wear *hijab* (headcovering) or *jilbab*, and most migrants who came wearing such conservative clothing gradually change to more typical American style clothing” [p. 132]. In contrast, 36 percent of American Muslims surveyed in a 2002 poll wear a religious headcovering daily; only half of respondents never wear a form of headcovering (Hamilton College 2002). A 2006 Pew Global Attitudes Poll reports that 53 percent of female Muslim respondents in Great Britain, 45 percent in Spain, 44 percent in Germany and 13 percent in France wear a headscarf every day (Morin & Horowitz 2006). Only in France do a majority of Muslim women (73%) report never wearing any form of veil. A resurgence in veiling is evidenced by inter-generational differences in attitudes among Muslims. In a 2006 survey of 1,003 Muslims conducted by Populus, the largest inter-generational difference between British Muslims centres on veiling: 74 percent of

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<sup>7</sup>In Java, we cannot speak of a ‘revival’ in veiling, since veiling in many parts of Java was until recently quite limited (Brenner 1996).

respondents aged 16-26 prefer Muslim women to wear the Islamic headcovering, compared to only 28 percent of British Muslims over 55 years old (Mirza et al. 2007).

Veiling among Muslim women is often attributed to coercion by fathers and husbands, aimed at increasing their status and control within the family by limiting the outside options of their daughters and wives. There is substantial evidence however that the role of coercion has been overstated and the ‘new veiling’ movement is largely a voluntary phenomenon (e.g. El Guindi 1981, Hoodfar 1991, Brenner 1996, Read & Bartkowski 2000, Ali 2005).<sup>8</sup> Interviews with Muslim women are replete with accounts of careful deliberation prior to adopting the veil. Many young Muslim women have begun to veil against the wishes of their parents, husbands, teachers and other authority figures; in many cases their mothers do not veil (El Guindi 1981, Brenner 1996, Ali 2005, Omkar 2007, e.g.). In the debate leading up to the French bans on veiling in state schools in 2004, Muslim women demonstrated in the streets of Paris, Lille, Marseille and other French cities, shouting: “Not our fathers, not our husbands, we chose the headscarf” (Abu-Rabia 2006, p. 100).

### 2.2.2 Patterns of Veiling

We shall now set out two features of the new veiling movement which should be part of any explanation.

I. *Peer Effects*. While often voluntary, the veiling decision appears to be significantly influenced by the opinions of family, friends and other community members (e.g. Brenner 1996, p. 675; Smith-Hefner 2007, p. 400-401; Omkar 2007, p. 54). Indeed the new veiling movement is coincident with the broader rise in religious participation and values among Muslims known as the Islamic revival (see Hunter 1988, Lapidus 2002, Carvalho 2009). To illustrate the role of peer effects on veiling, consider, for example, the case of the Royal Atheneum, which was one of only three schools in Antwerp that did not ban Muslim headcoverings after 9/11. Between 2006 and 2008, its Muslim population rose from half to 80 percent, as many students from conservative Muslim families transferred to the school. This change in school composition had visible effects on the original students. Those who did not wear a headcovering expressed being uncomfortable at school without one. Many adopted the headscarf, and others who already veiled, began wearing longer

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<sup>8</sup>A 2005 Gallup World Poll involving more than 8,000 face-to-face interviews with women from eight predominantly Muslim countries (including Saudi Arabia) reveals that Muslim women do not view themselves as being oppressed (Mogahed 2006). When asked what they resented most about their own societies, the *hijab*, *niqab*, *burqa* and other forms of veiling were never mentioned.

headscarves (The Economist 2009).

II. *Education and Labour Force Participation*. Among the most prominent participants in the new veiling movement are urban, educated, middle-class women who work outside the home (e.g. El Guindi 1981, Hoodfar 1991, Mule & Barthel 1992, Smith-Hefner 2007). For example, in Egypt, the movement began in universities and is pronounced among women occupying (lower-level) white-collar public sector jobs. MacLeod (1991) writes: “Voluntary support of the new veiling, by educated, working women, part of the modernizing middle classes, presents a paradox, for why would women who are already on the path to modernized life choose to resurrect a symbol which seems to portray and encourage their subordination?” [p. 4].

According to our theory, the new veiling movement is a product of modernization rather than a return to traditional modes of dress. Accordingly, Hoodfar (1991) writes, “The modern veil is a style of dress very different from clothing worn by more traditional *balady* (urban lower classes) or *felaheen* (peasant) women” [p. 112]. It can be described as a new standard of dress, which incorporates only certain elements of older, regionally distinct styles (Stillman 2003). Stillman (2003) proposes that modern *hijab* has become “a sort of pan-Islamic uniform, in much the same way that blue jeans became an international uniform of modern youth” [p. 158]. Thus, contemporary veiling is not a longstanding custom, but a large-scale innovation which requires explanation.

## 2.3 Theories of Veiling

We shall now review two alternative theories of veiling. Marriage market motivations for veiling are discussed in section 5.2, in light of our model. Four other theories are surveyed in Appendix A. Each of the theories, we argue, either fails to explain an important fact about contemporary patterns of veiling or is incompletely specified in an important way.

1. *Religious Duty*. Numerous studies of veiled women identify religious duty as the primary motivation for veiling (e.g. Sherif 1987, Brenner 1996, Read & Bartkowski 2000, Ali 2005, Omkar 2007). The following statement is typical, “I realized that it was *fard* (religious duty) and I wanted to obey Allah’s commands” (Ali 2005, p. 517). The religious duty hypothesis, however, fails to account for the observed peer effects on veiling and also the changing nature of what is deemed to be a religious obligation. In 1937, the *Fatwa* Committee of Al-Azhar, the premier institution of Sunni Islamic higher learning, declared that veiling was not a religious obligation. This seems to be a codification of the informal

norms of women's dress which had emerged by that time (Stillman 2003, p. 156).

2. *Increasing Returns/Tipping Points*. Schelling (1978a) popularized the notion that in many social settings the payoff from an action is increasing in the number/proportion of agents adopting that action. In this tradition, Kuran (1998) develops a model in which the pressure to engage in ethnically significant activities (such as veiling), increases with the degree of community participation in these activities. This generates peer effects consistent with the evidence on veiling (see also Kuran 1995, p. 8-9, 16), and leads to an illuminating account of ethnic identification and conflict in general. However, such a (conformity-based) peer effect does not explain the adoption of veiling by women choosing to study and work in secular environments, where they are exposed to representations/norms that are inconsonant with their decision to veil. In addition, educational and labour force participation subject an agent to greater reliance on secular groups (e.g. employers) who tend to discriminate against veiled women (e.g. Mule & Barthel 1992, Brenner 1996, Blaydes & Linzer 2008). We can explain why veiling is adopted by educated, working, middle-class women, by recognizing that interaction outside the home exposes an agent to secular values, which can be resisted through veiling.

### 3 A Model of Veiling

We develop a model in which veiling acts as a form of *cultural resistance* by reducing the probability that an agent acquires secular values and violates religious standards of behaviour. As this is the main assumption of our paper, we shall take some time to motivate it, before proceeding to the formal analysis.

How does veiling work to reduce the likelihood that an agent acquires secular values and engages in religiously prohibited behaviour? We propose three mechanisms, though one may think of others. The first two work to 'immunize' an agent against secular values, so that exposure is less likely to lead to indulgence. The third mechanism relies on 'segregation' from contact with secular values and opportunities for indulging in religiously prohibited behaviour.

*Cognitive Dissonance*. The notion that people attempt to avoid cognitive dissonance arising from inconsistent attitudes/behaviours is well established in the psychology literature (e.g. Festinger 1957, Aronson 1969). A central idea in Akerlof and Kranton's (2000, 2002, 2005) theory of identity, is that identification with a social category imposes certain behavioural prescriptions. Veiling is no exception. Smith-Hefner (2007) provides a list of

religiously prohibited behaviours that veiled women are expected to avoid:

[T]he ethical standards and behavioral restrictions associated with veiling are weighty, and most Muslims regard the decision to adopt the veil as something of a great behavioral divide. It is widely held, for example, that veiled women should not be loud or boisterous; hold hands with a member of the opposite sex (even if he is her fiancé); go out in public after evening prayers; patronize cafes or clubs; wear makeup or fingernail polish; smoke, dance, swim, or wear tight clothing; or ride on the back of a motorcycle holding on to an unrelated male driver. [p. 399]

Akerlof and Kranton propose that agents suffer dissonance/anxiety when deviating from the ‘ideal’ behaviour associated with their social identity. Adopting an Islamic identity (e.g. veiling) and indulging in religiously prohibited behaviour are inconsistent. Thus, cognitive dissonance might induce an agent who adopts a higher degree of veiling to avoid religiously prohibited behaviour.<sup>9</sup> This finds clear support in Brenner’s (1996) work on veiling in Indonesia:

Consequently, women who wear Islamic clothing tend to be very careful of their behaviour, along with their dress. Some feel that they must refrain from going to movies, gossiping, or engaging in any other frivolous activities; veiled women are especially cautious about their interactions with men lest they be accused of flirtatiousness or, worse, sexual impropriety... One student said, “When I started wearing *jilbab* [headscarf in Indonesia] my behaviour changed. I kept wondering, ‘Is this a sin or not? Is this wrong or not?’ I always felt afraid.” [p. 688]

*Cognitive Control.* Indulgence by religious types in our model can be viewed as a problem of self-control. Religious types would prefer not to indulge, but are exposed to secular values which induce them to do so. Veiling might serve as a countervailing cue which evokes religious standards of behaviour [see Laibson (2001) for a cue-based theory of consumption]. For example, Baldwin et al. (1990) find that after reading a passage representing “fairly permissive attitude toward sexuality,” Catholic subjects primed through exposure to the disapproving face of the Pope produced lower self-ratings on a variety of dimensions (e.g. tense vs at ease, immoral vs moral) than subjects shown a blank card. As an external representation of religious modesty, veiling might also trigger cognitive mechanisms which override automatic mental processes susceptible to temptation (Benhabib & Bisin 2005). These notions find support in interviews with veiled women. For example, Smith-Hefner (2007) reports that for many women in Indonesia veiling is “a constant physical reminder, one that helps keep them from overstepping the bounds of moral propriety” [p. 401-402]. Droogsma (2007) suggests that veiling “functions as a

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<sup>9</sup>As well internal sanctions such as dissonance/anxiety, there is evidence that veiled women are more severely sanctioned by other Muslims when engaging in religiously prohibited behaviour. For example, Smith-Hefner (2007) reports that, “The militants would approach the women and berate them with claims that the women were ‘besmirching the name of the *jilbab* [headscarf]’ ” [p. 414].

reminder to the women to guard their behavior so that their lives please God” [p. 304].

*Segregation.* Veiling might segregate agents from secular individuals and activities, even while they integrate into mainstream society by studying and working outside the home. For example, incongruence between veiling and norms of dress in locations where religiously prohibited behaviour is concentrated (e.g. bars and nightclubs) could mean that contact with secular values and opportunities for indulgence present themselves less frequently to veiled women. One respondent in Read and Bartkowski’s (2000) study of veiled women in Austin, Texas, claims that, “The veil keeps us [Muslim women] from getting mixed up in American culture” [p. 407]. Droogsma (2007) reports the following response in her interviews, “For me to think of myself going into a bar as a [woman who wears *hijab*], it just doesn’t seem right, so it kind of helps you stay away from places you’re not supposed to be” [p. 304]. Another respondent who wears a headscarf reveals, “Nobody’s ever offered me drugs... nobody offered me a drink once I became Muslim... So [veiling is] a protection. I don’t have to have the strength to say ‘No,’ it’s just for the most part, the opportunities are not presented to me” [p. 304].

These immunization and segregation effects of veiling are captured by the simple assumption that a higher degree of veiling reduces the probability that an agent acquires secular values and thereby engages in religiously prohibited behaviour.

### 3.1 The Model

Let us now turn to the formal model of veiling. We shall introduce and analyze the stage game before proceeding to the dynamic analysis in section 6.

*Types.* Consider an agent  $i$  drawn from community  $I$ , which is a continuum of agents with unit mass. The agent is endowed with cultural values, where  $i = r$  denotes religious values and  $i = s$  denotes secular values. The *proportion of agents in the community with religious values* at the beginning of the period is  $q \in (0, 1)$ . An agent’s type is private information, but the proportion of religious types  $q$  is common knowledge.

Social interactions take place over four dates:

*Identity.* At date 0, agent  $i$  observes her type and chooses a degree of veiling. Rather than analysing the choice between discrete forms of headcovering (headscarf, *chador*, *niqab* etc.), we model veiling as a continuous variable  $v_i \in [0, 1]$  which reflects the overall modesty of a woman’s appearance (Esposito 2004). Empirically, there is gradation in headcoverings and overall dress (see El Guindi 1981, p.474-5).

*Cultural Transmission.* At date 1, agent  $i$  enters a *cultural transmission phase* with probability  $\alpha \in (0, 1)$ . If this occurs, she acquires secular values with probability  $pg(v)$  and religious values with complementary probability  $1 - pg(v)$ , where  $g$  is strictly decreasing in  $v$  (our main assumption) and  $p$  is a constant between zero and one. If she does not enter a cultural transmission phase, then she retains her date-0 type. We assume that  $g$  is a convex function of  $v$ ,  $g(v) \in [0, 1]$  and  $g'$  is bounded from below. For example, the affine function  $(1 - v)$  satisfies all of these conditions.

*Behaviour.* At date 2, agent  $i$  observes her updated type and chooses an action denoted by  $x \in \{r, s\}$ . A religious type chooses action  $r$  and a secular type chooses action  $s$  (i.e. types and actions are synonymous). Action  $s$  is interpreted as a greater level of ‘indulgence’ in behaviour which is religiously prohibited (e.g. mixing with opposite sex, drinking, attending nightclubs).

*Social Judgements.* At date 3, an agent’s behaviour is judged by her community, in a manner to be specified below in section 3.4.

The structure of the game is common knowledge.

## 3.2 Interpretations

Before proceeding to specify payoffs, let us discuss several compatible interpretations of the model. The *immunization* interpretation of the cultural transmission formulation, which accords with the literature on cultural evolution (see Cavalli-Sforza & Feldman 1981, Boyd & Richerson 1985, Bisin & Verdier 2001) and evolutionary game theory (Schlag 1998), is that  $p$  is the proportion of secular types in the broader society.<sup>10</sup> In a cultural transmission phase, agent  $i$  is exposed to a ‘model’ drawn at random from society. If the model is a secular type, which occurs with probability  $p$ , agent  $i$  acquires the model’s type with probability  $g(v)$  (which is decreasing in veiling). More generally,  $p$  could be the probability of contact with secular values, which is an increasing function of the proportion of agents in society with secular values. For example, the actual proportion could be amplified by media bias toward portraying secular lifestyles. In general, we refer to  $p$  as the *degree to which the environment is secular*.

The *segregation* interpretation is that, during a cultural transmission phase, an opportunity for indulgence arrives with probability  $pg(v)$ , so that the ‘base’ arrival rate  $p$  is

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<sup>10</sup>Note that under this interpretation, cultural transmission is unidirectional in the sense that agents from the broader society transmit their values to members of the community, but not *vice versa*.

reduced in line with an agent’s degree of veiling. For example, veiled women may receive fewer offers to visit bars and fewer approaches by men. The parameter  $p$  here can be viewed as a measure of the degree of temptation to indulge, which is a property of the environment.

Finally, choice in our model can be given a planner-doer interpretation which is familiar in behavioural economics (Schelling 1978*b*, Thaler & Shefrin 1981): veiling at date 0 is chosen by a (farsighted) planner, while behaviour at date 2 is chosen by a (myopic) doer. There is no reason why these two selves need to reside in the same individual. For example, the veiling decision at date 0 could be made by parents attempting to shape their child’s values and choice of behaviour at date 2. Veiling could hence be viewed as a form of cultural resistance by parents, seeking to minimize the likelihood that their children acquire secular values. For expositional ease, we shall not emphasize this alternative interpretation in the paper. But the reader may keep in mind that our model encompasses both voluntary veiling and veiling imposed by the household.

### 3.3 Personal Payoffs

Let us begin by characterizing payoffs in the absence of social judgements about an agent’s behaviour. We shall refer to these as *personal payoffs*. Denote the payoff to a type- $i$  agent who takes action  $k$  by  $z_{ik}$ . By the definition of types, it follows that  $z_{ii} > z_{ik}$  for  $i \neq k$ .

In addition, agents bear a cost of veiling denoted by  $c(v)$ , which reflects concerns such as discomfort and discrimination. In predominantly Muslim societies, such as Egypt, Turkey, Lebanon and Indonesia, veiled women are routinely screened out by foreign firms and employers in lucrative fields such as televised media, hospitality and tourism (Mule & Barthel 1992, Brenner 1996, Blaydes & Linzer 2008). In non-Muslim societies, veiled women are increasingly the subject of verbal/physical harassment (e.g. Ali 2005, Read & Bartkowski 2000, Omkar 2007). We assume that  $c$  is strictly increasing and strictly convex in  $v$ .<sup>11</sup> In addition, to ensure interior veiling equilibria, we assume  $c'(0) = 0$  and  $\lim_{v \rightarrow 1} c'(v) = \lim_{v \rightarrow 1} c(v) = \infty$ .

We are concerned in this paper with an agent’s choice of veiling, which occurs at date 0. We assume that a date-0 agent has “imperfect empathy” toward her date-2 self (see for e.g. Bisin & Verdier 2001). Specifically, an agent evaluates her date-2 action from the

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<sup>11</sup>We could assume that  $c$  is decreasing in  $v$  up to some point, so that agents have a *taste* for a positive degree of veiling. However, we choose to abstract from taste-based motives of veiling, which do not in themselves generate peer effects, to focus on our cultural resistance motivation.



perspective of her date-0 values. Hence an agent who acquires new values via cultural transmission at date 1 experiences a loss, because she will *disapprove* of her action at date 2 from the perspective of her date-0 values.

Consider an agent who begins the period as type  $i$ . When she chooses her degree of veiling  $v$  at date 0, her expected payoff is:

$$u_i(v) = \alpha pg(v)z_{is} + \alpha(1 - pg(v))z_{ir} + (1 - \alpha)z_{ii} - c(v). \quad (1)$$

For an agent who begins the period as religious  $i = r$ , the payoff in (1) can be expressed as:

$$\begin{aligned} u_r(v) &= z_{rr} - \alpha pg(v)[z_{rr} - z_{rs}] - c(v) \\ &\equiv z_{rr} - \alpha pg(v)\lambda_r - c(v), \end{aligned} \quad (2)$$

where we have defined  $z_{rr} - z_{rs} \equiv \lambda_r > 0$  as the ‘cost’ of indulgence to a religious type. We shall henceforth refer to  $\lambda_r$  as the *intensity of disapproval by religious types*. Thus, religious types experience an expected loss of  $\alpha pg(v)\lambda_r$  from acquiring secular values and indulging in religiously prohibited behaviour. As  $g(v)$  is strictly decreasing in  $v$ , veiling serves to mitigate this expected loss by reducing the probability that a religious agent acquires secular values.

For a secular agent  $i = s$ , we have:

$$\begin{aligned} u_s(v) &= z_{ss} - \alpha(1 - pg(v))[z_{ss} - z_{sr}] - c(v) \\ &\equiv z_{ss} - \alpha(1 - pg(v))\lambda_s - c(v), \end{aligned} \quad (3)$$

where we have defined  $z_{ss} - z_{sr} \equiv \lambda_s > 0$  as the ‘cost’ of not indulging to a secular type. We shall refer to  $\lambda_s$  as the *intensity of disapproval by secular types*. Here secular types experience an expected loss of  $\alpha(1 - pg(v))\lambda_s$  from acquiring religious values and refraining from indulgence. Veiling serves to inflate this expected loss by increasing the probability that a secular agent acquires religious values.

These observations lead to the following proposition.

**Proposition 1** *Restricting attention to personal payoffs, there exists a unique optimal degree of veiling  $v_i$  for each type.*

- (i) A religious agent chooses a positive degree of veiling,  $v_r$ , which is increasing in:
  - (a) the degree to which the environment is secular,  $p$ ,
  - (b) the intensity of disapproval by religious types,  $\lambda_r$ .
- (ii) A secular agent chooses not to veil  $v_s = 0$ .

The proof is trivial and follows by taking first-order conditions and imposing the assumptions we have made on  $g$  and  $c$ .

Therefore, religious types adopt veiling as a form of cultural resistance, to prevent themselves from contracting secular values and indulging in religiously prohibited behaviour. As we have not yet introduced social payoffs, we call this the *personal commitment* motivation for veiling. Accordingly, there is greater incentive to veil in a more secular environment (i.e. high  $p$ ) and when secular behaviour evokes greater disapproval by a religious type (high  $\lambda_r$ ). This motivation for veiling does not, however, generate peer effects, in the sense that veiling is independent of  $q$ .

In addition, we find that secular types will never veil based on personal payoffs alone. Some form of social payoffs is required to induce dissimulation among secular types, as well as peer effects.

### 3.4 Social Payoffs

In the context of our model, the personal payoff given by (1) is the payoff received by an agent who has no concern for how she is judged by her community, i.e. an agent who ‘has no shame.’ Social judgements, however, appear to be a central concern for women who take up veiling. Bayat (2007) identifies an active interest in the conduct of others as a key feature of the contemporary Islamic movement in Egypt: “Unlike the passively pious who remained indifferent about other people’s religiosity, the actively pious began to judge others for what and how they believed” [p. 150].

In our model, agents care about what other members of their community think of them, even though these opinions may proceed from different values to their own. We shall now introduce a formulation for *social payoffs* which captures this concern in a simple and intuitive way. In the same way that agent  $i$  judges her (date-2) behaviour by her values at date 0, agent  $i$ ’s choice of behaviour  $x$  is judged by agent  $k$  based upon  $k$ ’s values. Precisely, the evaluation of  $i$ ’s action  $j$  by agent  $k \in \{r, s\}$  is  $z_{kj}$ . *Inter alia*  $z_{rr} > z_{rs}$ , so

that agents indulging in religiously prohibited behaviour are subject to disapproval from religious types in their community.

Agent  $i$  is judged in this manner by each member of her community at the end of the period.<sup>12</sup> Let  $\beta$  be the (endogenous) probability that all players  $k \in I \setminus i$  assign to agent  $i$  having religious values at date 0 upon observing  $i$ 's choice of veiling  $v$ . Agent  $k$ 's evaluation of  $i$ 's expected behavior is:

$$\begin{aligned} S_k(v, \beta) &= \alpha pg(v)z_{ks} + \alpha(1 - pg(v))z_{kr} + (1 - \alpha)[\beta z_{kr} + (1 - \beta)z_{ks}] \\ &= [\alpha pg(v) + (1 - \alpha)(1 - \beta)]z_{ks} + [\alpha(1 - pg(v)) + (1 - \alpha)\beta]z_{kr} \\ &\equiv h(v, \beta)z_{ks} + (1 - h(v, \beta))z_{kr}. \end{aligned} \quad (4)$$

Recall that the proportion of religious types in community  $I$  (a continuum of agents with unit mass) is  $q$ . Therefore, social judgements integrated over all  $k \in I \setminus i$  amount to the social payoff:

$$S(v, \beta) = qS_r(v, \beta) + (1 - q)S_s(v, \beta). \quad (5)$$

An agent's total payoff is the sum of her expected personal and social payoffs. We write the expected total payoff for agent  $i$  when choosing veiling  $v$ , under the belief  $\beta$  regarding her initial type as:

$$U_i(v, \beta) = u_i(v) + S(v, \beta). \quad (6)$$

## 4 Veiling Norms

In this section, we analyze equilibrium veiling when agents are subject to social judgements by their community.

### 4.1 Social Commitment

Firstly, let us begin with a benchmark case in which agent  $i$ 's behaviour  $x$  is *observable* by her community. This would be a reasonable approximation when behaviour takes place at locations frequented by members of the community.

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<sup>12</sup>Equivalently, each agent  $i$  may simply care about the 'honour' of their parents which could in turn reflect how  $i$  is judged by members of the community.

Given that an agent's behaviour  $x$  is observable, she does not veil for informational reasons to influence her community's inference about  $x$  by signalling religious values. Hence there is no strategic interaction in this case.<sup>13</sup> Nevertheless, agent  $i$  is still concerned with how her behaviour is judged by members of her community.

When the community is highly religious (high  $q$ ), religious values weigh heavily in social judgements. Hence agents are inclined to veil in order to resist acquiring/retaining secular values and being the subject of disapproval in their community. We call this the *social commitment* motivation for veiling.

**Proposition 2** *Given social payoffs and observable behaviour, there exists a unique optimal degree of veiling  $\bar{v}_i$  for each type.*

(i) *A religious agent chooses a positive degree of veiling  $\bar{v}_r$  if and only if  $q > \underline{q} \equiv \frac{\lambda_s - \lambda_r}{\lambda_r + \lambda_s}$ ,*

(ii) *A secular agent chooses a positive degree of veiling  $\bar{v}_s$  if and only if  $q > \bar{q} \equiv \frac{2\lambda_s}{\lambda_r + \lambda_s}$ .*

*In addition, whenever  $\bar{v}_r > 0$ ,  $\bar{v}_r > \bar{v}_s$ .*

All proofs are contained in Appendix C. The intuition behind Proposition 2 is straightforward. Recall that religious agents benefit from the *personal* commitment effect of veiling, whereas secular agents bear a cost from increasing the likelihood that they acquire religious values. This is why veiling is higher for religious types, even though social payoffs are the same for both types.<sup>14</sup> When there is a large proportion of religious types in the community (i.e.  $q > \bar{q}$ ), so that agents are judged by more religious standards, even secular agents find it beneficial to veil. Conversely, when  $q$  is sufficiently low (i.e.  $q \leq \underline{q}$ ), so that secular behaviour is highly valued in the community, even religious agents quit resisting the transmission of secular values through veiling.

Our results can be partly summarized by Figure 1, which depicts how optimal veiling  $\bar{v}_i$  depends on  $q$ , when disapproval by religious types is (a) less intense than disapproval by secular types, and (b) more intense than disapproval by secular types.<sup>15</sup> We see that veiling by religious types with social payoffs  $\bar{v}_r$  is less than under personal payoffs alone,

<sup>13</sup>Members of the community mechanically form a judgement. The only form of strategic interaction arises when behaviour is unobservable and agents use their veiling choice to influence the community's inference about their hidden behaviour.

<sup>14</sup>This is also why the threshold for positive veiling by religious types,  $\underline{q} \equiv \frac{\lambda_s - \lambda_r}{\lambda_r + \lambda_s}$ , is lower than the threshold for preferring to be identified as a religious type  $\tilde{q} \equiv \frac{\lambda_s}{\lambda_r + \lambda_s}$ , and *vice versa* for secular types.

<sup>15</sup>The formal comparative static results are provided in section 5.1.

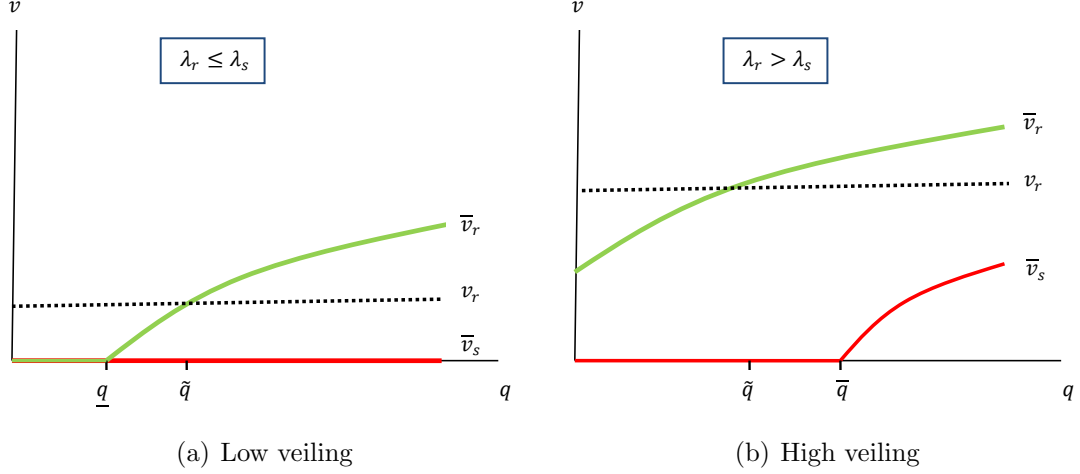


Figure 1: *Social Commitment*. Veiling  $v$ , when behaviour is observable, as a function of the proportion of religious types  $q$  in the community, for secular types (*dark*) and religious types (*light*). The dotted line represents veiling by religious types under personal payoffs only.

when the proportion of religious types in the community is less than some threshold  $\tilde{q}$  (to be defined in the next section), and *vice versa*.

## 4.2 Social Signalling

In many situations, an agent's behaviour is unobservable to her community. In this section, we analyze the case in which an agent interacts outside her community (e.g. university, work). The details of how she conducts herself at this location are unobservable, but her choice of veiling (which is more easily measured and monitored) can be observed by her community.

Even though an agent's behaviour is unobservable, community members can still make an inference regarding agent  $i$ 's behaviour from her choice of veiling when forming social judgements. Now, however, there is an important source of information asymmetry. An agent knows her date-0 values, but her community does not. Because an agent who does not enter a cultural transmission phase retains her initial values, an agent who begins the period with religious values is more likely to end the period with religious values. In addition, religious agents derive a greater personal benefit from veiling. Thus, a religious type can communicate that her behaviour is more likely to conform to religious standards at the end of the period, by further increasing veiling to *signal* her existing religious values. We call this the *social signalling* motivation for veiling.

Veiling may be an especially important signal of religious values for Muslim women, because unlike men who participate in communal prayer in the mosque, they tend to pray in the privacy of the home (e.g. MacLeod 1991, p. 39). Based upon interviews with veiled women in London, Omkar (2007) proposes that high degrees of veiling signal deep religious values. For example, one of his respondents suggests that “I am a religious person... that shows in my actions, in the way I dress. As soon as you see me, you can tell that I’m a Muslim” [p. 67]. In our model, an agent signals religious values to influence her community’s inference about her (unobservable) behaviour.

The equilibrium concept we employ is Perfect Bayesian equilibrium [PBE].<sup>16</sup> In a PBE, beliefs are consistent with the equilibrium, and actions are optimal given beliefs. Out-of-equilibrium beliefs, however, are arbitrary. Following Austen-Smith & Fryer (2005), we use the D1 refinement introduced by Cho & Kreps (1987) to restrict these beliefs. Now denote the probability assigned to an agent being a religious type by  $\beta(v)$ , so that the belief is explicitly a function of veiling. Suppose that when secular types are weakly better off deviating to  $v$  from their equilibrium identity choice, religious types are *strictly* better off deviating to  $v$ . Then according to D1, the probability assigned to an agent choosing veiling degree  $v$  being a religious type is  $\beta(v) = 1$ . A formal statement of the D1 criterion adapted to our context is contained in Appendix B. This standard criterion guarantees that religious types adopt a (weakly) higher degree of veiling than secular types in equilibrium.

In existing social signalling models (e.g. Bernheim 1994, Levine 1998, Austen-Smith & Fryer 2005), there is a universally superior type with whom every player would like to be identified (e.g. high ability). In our model, the values an agent would like to signal depend upon the composition of her ‘audience.’ We can determine whether an agent would like to be identified by their community as a religious or secular type by differentiating the social payoff in (5) with respect to  $\beta$ :

$$\frac{\partial U_i(v, \beta)}{\partial \beta} = (1 - \alpha)[q\lambda_r - (1 - q)\lambda_s]. \quad (7)$$

For both types, this expression is positive if and only if  $q > \tilde{q} \equiv \frac{\lambda_s}{\lambda_r + \lambda_s} \in (0, 1)$ . Therefore, when the proportion of religious types in the community is sufficiently large, both religious and secular agents would like to be identified as religious, and *vice versa*. Thus, unlike standard signalling models (e.g. Spence 1973), the veiling equilibria in our model depend upon the distribution of types in the population  $q$ .

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<sup>16</sup>See Fudenberg & Tirole (1991, p. 331-3) for a formal definition.

One additional feature of our approach is that we have not directly imposed the single-crossing condition for veiling – the marginal cost of veiling is the same for both types. Instead, the single-crossing condition emerges from the fact that religious agents bear a larger personal loss from acquiring secular values and indulging in religiously prohibited behaviour.

Define  $\sigma$  as a mixed strategy in which the agent puts weight  $\sigma(v)$  on veiling  $v$ . Let  $v_r^*$  be the solution to  $U_s(v_r^*, 1) = U_s(\bar{v}_s, 0)$ , if one exists, and zero otherwise (i.e.  $v_r^*$  defines the minimal separating equilibrium).<sup>17</sup> We can now state the following proposition.

**Proposition 3** *Given social payoffs and unobservable behaviour, for each  $q \in (0, 1)$  there exists a unique PBE that satisfies the D1 criterion, as follows:*

(i) *Equilibrium veiling for a secular agent is  $\sigma_s^*(\bar{v}_s) = 1$  for all  $q \in (0, 1)$ .*

(ii) *Equilibrium veiling for a religious agent is:*

$$\begin{aligned} \sigma_r^*(0) &= 1 && \text{for } q \leq q_1, \\ \sigma_r^*(0) &= b \text{ and } \sigma_r^*(\bar{v}_r) = 1 - b && \text{for } q_1 < q < q_2, \\ \sigma_r^*(\max\{\bar{v}_r, v_r^*\}) &= 1 && \text{for } q \geq q_2, \end{aligned}$$

where  $b$  decreases continuously from 1 to zero as  $q$  goes from  $q_1$  to  $q_2$ .

Therefore, for each  $q$  there is a unique D1 PBE. The beliefs that are part of the equilibria are stated in Appendix C. The equilibria can be conveniently represented by Figure 2.

In the low-veiling regime ( $\lambda_r \leq \lambda_s$ ), signalling concerns induce a zero-veiling pooling equilibrium for  $q \in [0, q_1]$ . As  $q_1 > \underline{q}$ , this is a larger interval than the zero-veiling region under observable behaviour,  $[0, \underline{q}]$ . For  $q_1 < q < q_2$ , the unique equilibrium that satisfies the D1 criterion is a hybrid equilibrium in which secular types choose  $\bar{v}_s = 0$  with probability one, and religious types choose  $\bar{v}_s = 0$  with probability  $b$  and  $\bar{v}_r > 0$  with complementary probability. At this level of  $q$ , both types want to be identified as secular (for reputational reasons), but religious types want to veil (for personal commitment reasons). If a religious type pools on zero veiling with secular types, she is believed to be secular with probability  $(1 - q)$ . At  $q_1$ , this inference is no longer attractive enough to stop her from veiling. But then if a separating equilibrium is proposed, a religious agent is believed to be secular with probability one if she deviates to  $v = 0$ . This inference is attractive enough to stop her veiling, as long as  $q < q_2$ . Therefore, the unique D1

<sup>17</sup>A solution to this equation always exists when agents prefer to be identified as a religious type, i.e.  $q \geq \tilde{q}$ .

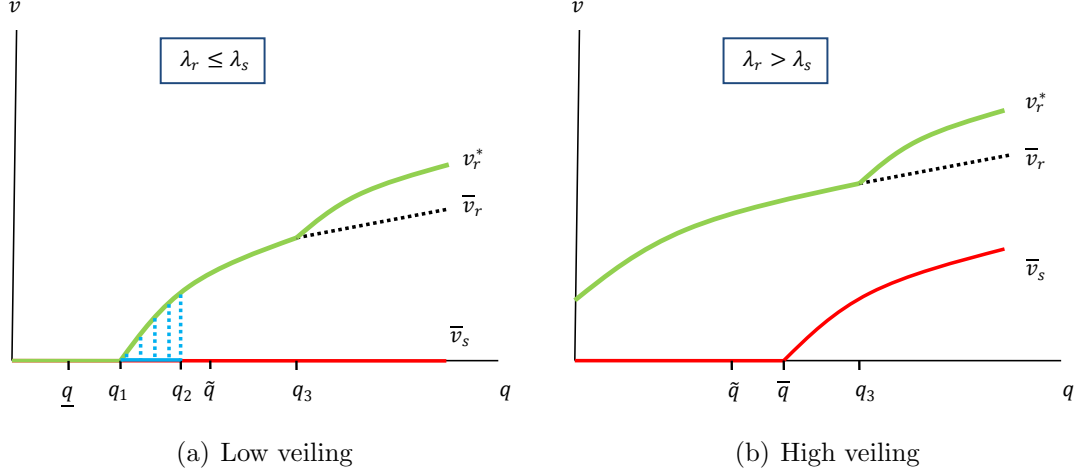


Figure 2: *Social Signalling*. Veiling  $v$ , when behaviour is unobservable, as a function of the proportion of religious types  $q$  in the community, for secular types (*dark*) and religious types (*light*). The vertical dotted lines represent mixing by religious types between  $\bar{v}_r$  and zero. The oblique dotted line represents veiling by religious types under observable behaviour.

equilibrium is a hybrid equilibrium in which religious types mix between their optimal degree of veiling under observable behaviour and pooling with secular types on zero veiling.

If the proportion of religious types in the community is sufficiently large, then the unique D1 equilibrium is the Pareto-dominant separating equilibrium. Figure 2 is drawn for the case in which there exists a threshold  $q_3$  such that for all  $q > q_3$ , religious types have to increase their veiling above their full information optimum  $\bar{v}_r$  to avoid being mimicked by secular types.

The only differences in the high-veiling regime ( $\lambda_r > \lambda_s$ ), is that religious types always choose a positive degree of veiling, and secular types choose a positive degree of veiling when  $q$  is sufficiently high.

## 5 Cultural Resistance & the New Veiling Movement

The view of veiling as a form of cultural resistance yields several comparative statics results and testable predictions. In this section, we conduct the comparative statics analysis, and develop an account of the factors behind the new veiling movement.



## 5.1 Comparative Statics & Testable Predictions

The comparative statics results are as follows.

**Proposition 4** *Whenever positive,  $\bar{v}_r$  and  $\bar{v}_s$  are:*

- (i) strictly increasing in the degree to which the community is religious,  $q$ ,*
- (ii) strictly increasing in the degree to which the environment is secular,  $p$ ,*
- (iii) strictly increasing in the intensity of disapproval by religious types,  $\lambda_r$ ,*
- (iv) strictly decreasing in the intensity of disapproval by secular types,  $\lambda_s$ .*

*The only difference for  $v_r^*$  is that  $v_r^*$  is strictly increasing in  $p$  if and only if  $q > \bar{q}$ .*

The intuition behind parts (i), (iii) and (iv) is that agents are judged based upon stricter religious standards when there is a higher proportion of religious types in the community and disapproval by religious types is intense relative to disapproval by secular types. Hence both secular and religious types increase veiling under these conditions to resist acquiring secular values. According to part (ii) of the Proposition, when positive, the degree of veiling by agents under observable behaviour is increasing in the risk of acquiring secular values  $p$ . Religious and secular types veil only when acquiring secular values is costly to them. In this case, the greater the risk of acquiring secular values  $p$ , the greater the need for veiling to reduce the expected cost of acquiring secular values. The only difference for the degree of veiling under unobservable behaviour occurs when religious types need to increase veiling beyond  $\bar{v}_r$  to separate from secular types and signal religious values. In this case,  $v_r^*$  is strictly increasing in  $p$  if and only if  $q > \bar{q}$ . Thus, we can still say that in highly religious communities, veiling is increasing in the degree to which the environment in which agents interact is secular.

The main *testable implication* of our theory is that veiling should be highest among women who come from highly religious communities and operate in highly secular environments. For example, in a non-Muslim majority society, a random assignment of individuals from a single local community to different schools should lead to higher veiling among individuals allocated to schools with fewer Muslim pupils.<sup>18</sup> A possible test in Muslim societies could be whether veiling rose at the neighbourhood level with the introduction

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<sup>18</sup>Of course, the analysis would need to be restricted to schools that do not regulate (i.e. either mandate or ban) veiling.

of television.<sup>19</sup> On the basis of our results, we would expect this effect to be pronounced in more religious neighborhoods. In contrast, an increasing-returns/tipping-point model of veiling (Schelling 1978*a*, Kuran 1995, 1998), in which agents veil to keep up with veiling by their peers, would predict lower veiling in more secular environments.

Our theory also leads to an account of the rise in veiling since the 1970s. For the remainder of this section, we shall attribute the new veiling movement to the increased exposure of women from highly religious communities to secular lifestyles and ideals.

## 5.2 Secular Environments, Religious Communities

Veiling in our model is highest when women from highly religious communities interact in highly secular environments. Formal education and employment can expose individuals from conservative backgrounds to more frequent contact with secular values and opportunities for religiously prohibited behavior. In the context of our model, this can be represented by a higher  $p$ . Therefore, the prominence of educated, middle-class women in the new veiling movement is not surprising, when veiling is viewed as a form of cultural resistance. The rise in veiling in countries such as Egypt can hence be attributed to the massive influx of women into higher education and formal employment since the 1970s, especially women from traditional rural backgrounds (e.g MacLeod 1991). According to El Guindi (1981):

[A] more balanced proportion of men and women on university campuses means that for nine months of the year young women are out in overcrowded streets, and on public transportation and campuses, with men. These are the same women who are socialized to stay apart from men, protect their virginity and honor, and remain controlled by their male relatives until marriage. So on the one hand there is a tradition to keep the sexes apart, and on the other a social reality which does not.

On the one hand, education and employment provide substantial economic benefits and are often the only assurance of a middle-class lifestyle (e.g MacLeod 1991). On the other, they undermine the customary segregation of the sexes by placing men and women side-by-side in educational institutions, workplaces and public spaces (e.g. streets and buses). A content analysis conducted by Mernissi (1987) of 402 letters to a religious counselling service on Moroccan state television reveals a preoccupation with issues of sexuality arising from mixing of the sexes. For example, women asked whether swimming unveiled

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<sup>19</sup>In section 5.2 we shall argue that veiling may be partly a response to exposure to secular lifestyles and ideals represented in Western cultural products, such as television shows, movies and magazines.

on a mixed-sex beach or kissing a man outside of marriage is acceptable. Bayat (2007) suggests that, “Affluent Muslim women, in comparison with men, the poor, and non-Muslims, showed a greater inclination to piety because their class position and lifestyle were more closely associated with “sin” and therefore caused guilt” [p. 158]. Accordingly, Mule & Barthel (1992, p. 324) write of educated women who take up formal employment, “It was not simply a case of their having the world to gain, as they claimed individual rights and autonomy, and freed themselves from patriarchy. They also had a world to lose: the world of traditional societal esteem” [p. 324]. As in Mule and Barthel’s (1992) work, veiling in our model is a strategy for taking advantage of opportunities outside the community, while maintaining esteem within the community.

Furthermore, the rise in veiling since the 1970s may also be attributable to increased exposure to secular lifestyles and ideals in Western culture, which can also be represented in our model by a rise in  $p$ . This might explain high rates of veiling observed among Muslim immigrants in the West, even relative to their country of origin. While cultural changes associated with the sexual revolution in the West would have been felt directly by Muslim minorities in the United States and Europe, more liberal ideals in terms of sexual behaviour and male-female interaction were culturally transmitted to Muslim societies via imported cultural products (e.g. movies, television, magazines, etc.).<sup>20</sup> For example, Mule & Barthel (1992) propose that, “Exposure to secularized Western culture has presented a traditionally Islamic country [Egypt] with new gender ideologies and an image of the New Woman: a Western-style woman whose life is free of the *chador* and, supposedly, of social constraints” [p. 327]. Hoffman (1995) claims that “American television shows ... are perceived as truly representative of American life. They depict a society dominated by crass materialism, excessive individualism, and sexual immorality, and are seen as undermining the Muslim family by introducing aspirations toward materialism and sexual liberation” [p. 218]. Thus, the rise in veiling since the 1970s may be motivated in part by the desire to resist the transmission of secular values ‘embedded’ in Western cultural representations of secular lifestyles and religiously prohibited behaviour.

One reason why women might be keen to resist secular values/behaviour is to improve their *marriage market* prospects. Blaydes & Linzer (2008) claim, “A common feature

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<sup>20</sup>Rohde (2008) surveys a controversial debate over female sexuality and social norms played out in the Iraqi print media in the late 1960s and early 1970s. A German film depicting a woman ‘searching for sexual freedom’ was shown in Baghdad in 1971, with the explicit aim of changing attitudes toward sexuality. A series of articles calling for sexual liberalization, free mixing of the sexes and gender equality were printed in state newspapers. Rohde (2008) concludes that “during the late 1960s and early 1970s a general mood of departure from established social norms existed in Iraq that bore connotations of sexual freedom” [p. 145].

across the contemporary Muslim world is the premium placed on conformity to conservative norms and perceived piousness for women seeking marriage” [p. 584]. According to Rugh (1984), “A girl wearing Islamic dress announces herself to be one of the moral types men like to marry and maybe attracts a man’s attention on campus as a result” [p. 232]. Our model explains both why veiling is a credible signal of religious values and how stable marriage market concerns may be part of an explanation for the rise in veiling since the 1970s. In particular, our theory suggests that increased exposure to secular values may have made women who actively resist such values even more attractive on the marriage market, especially in highly religious communities. Hence, our model can be viewed as representing marriage market concerns in reduced form, while also taking into account that individuals may have other reasons to care about the opinions of community members.

## 6 Dynamics & Policy

The stage game analyzed so far can be embedded in a recurrent game in which each agent in time period  $t$  (which is composed of four dates as above) gives birth to one agent at the beginning of  $t + 1$ , who inherits their parent’s type. Choice is myopic: agents simply maximize current period payoffs in the stage game.<sup>21</sup> In this section, we derive the stationary distribution of types in the recurrent game and study the effects of veiling prohibitions on the religious composition of communities in the long run.

### 6.1 Equilibrium Religiosity

Denote the proportion of religious types in the population at the beginning of period  $t$  by  $q^t$ . A stationary distribution, denoted by  $\hat{q}$ , has the following property: if  $q^t = \hat{q}$ , then  $q^{t+k} = \hat{q}$  for all  $k > 0$ . We shall refer to such a distribution as a *religious equilibrium*. The following proposition characterizes the equilibria of the recurrent game:

**Proposition 5** *A religious equilibrium solves:*

$$q = \hat{q} \equiv \frac{1 - pg(\bar{v}_s)}{p[\sigma_r^*(0)g(0) + (1 - \sigma_r^*(0))g(\max\{\bar{v}_r, v_r^*\})] + (1 - pg(\bar{v}_s))}. \quad (8)$$

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<sup>21</sup>If our model is interpreted as a parent choosing a degree of veiling for their child, then this myopic choice assumption translates to a parent only caring directly about their child’s welfare, and not about their child’s child’s welfare and so forth.

- (i) *There exists at least one religious equilibrium,*
- (ii) *Denote the set of equilibria by  $\widehat{Q}$ . Every equilibrium  $q \in \widehat{Q}$  is interior,*
- (iii) *If the process  $q^t$  begins in a state other than an equilibrium, then  $q^t$  converges to an equilibrium.*

Therefore, at least one stable religious equilibrium exists, but we cannot rule out multiple equilibria. Notice that the right-hand side of (8) is independent of  $q$  when veiling for both types is set to zero, so that there is only one equilibrium  $\widehat{q}$  in this case. Hence it is veiling that generates multiple religious equilibria. In addition, we have shown that in all religious equilibria (including unstable ones) religious and secular types coexist, and that the community ends up in an equilibrium from any initial state.

These results can be used to assess the implications of veiling bans on levels of religiosity. We shall show that, under certain conditions, a ban on veiling aimed at cultural assimilation can be self defeating by *increasing* the equilibrium proportion of religious types in a community.

## 6.2 Bans on Veiling

When veiling is viewed as a form of cultural resistance, it is not surprising that bans on veiling are supported by those favoring secularization and cultural assimilation by immigrants. By inhibiting the transmission of secular values, veiling increases the equilibrium proportion of religious types in the community. However, we shall proceed to show that this is not necessarily the case when agents can choose whether to *segregate* by interacting only in their community or *integrate* by taking up study/work outside the community, in a more secular environment. In the formulation of the model analyzed so far, we have implicitly assumed that all agents integrate.

Let us continue with the case of unobservable behaviour. Denote the integration decision by  $\ell \in \{0, 1\}$ , where  $\ell = 0$  is segregation and  $\ell = 1$  is integration. Now community members' beliefs, denoted by  $\beta(v, \ell)$ , can be conditioned upon an agent's veiling choice and integration decision. Suppose that the (additive) return to integration is  $y$ , which might reflect higher wages, superior leisure opportunities, etc. As before, assume that an agent who integrates enters a cultural transmission phase with probability  $\alpha$  and acquires secular values with probability  $pg(v)$ .

Let the only difference for an agent who segregates be that, in a cultural transmission phase, she acquires secular values with probability  $p\delta g(1)$ , where  $\delta$  is a positive parameter reflecting the effectiveness of segregation in resisting secular values relative to full veiling ( $v = 1$ ). The idea here is that an agent who segregates in her local community has less exposure to secular values and opportunities for indulgence in religiously prohibited behaviour, regardless of their degree of veiling. Thus segregation serves as a *substitute* for veiling. In fact, veiling plays no role in cultural transmission when an agent segregates. This highlights the role of veiling in our model as a strategy for integration. If segregation means confinement to the home, then a woman who segregates may not veil at all. Nevertheless, we can allow agents who segregate to choose any degree of veiling, for reasons outside of the model. Let the (additive) net benefit of this (exogenous) veiling be  $\nu$ . The *personal* payoff to an agent who segregates is denoted by:

$$\tilde{u}_i = \alpha\delta pg(1)z_{is} + \alpha(1 - \delta pg(1))z_{ir} + (1 - \alpha)z_{ii} + \nu. \quad (9)$$

Now suppose that a ban on veiling in public spaces (e.g. schools, universities) is introduced. When integrating a woman must choose veiling  $v = 0$ . Hence the payoff to an agent who integrates is  $y + U_i(0, \beta(0, 1))$ . As veiling is exogenous when an agent segregates, we write beliefs in this case as  $\beta(., 0)$  and the *total* payoff to segregation as  $\tilde{U}_i(\beta(., 0))$ .

The following proposition characterizes the effect of a ban on veiling on the religious composition of communities:

**Proposition 6** *Let  $q^0$  be a religious equilibrium under unrestricted veiling in which both types integrate and at least one type chooses a positive degree of veiling with probability one. Introduce a ban on veiling during period 1.*

*If the return to integration  $y$  and  $\delta$  are sufficiently small, then  $q^t > q^1$  for all  $t > 1$ . That is, religiosity in the community is higher in every period after the ban is introduced.*

The proposition begins by supposing that both types integrate and at least one type chooses a positive degree of veiling. This is the relevant case for policy analysis.<sup>22</sup> Proceeding from such a state, we have shown that if the returns to integration are not high

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<sup>22</sup>If no type veiled, then a ban on veiling would be moot. If only secular types integrated, then a ban on veiling would not effect religious types who adopt higher degrees of veiling and transmit religious values.

(e.g. low wages, low returns to education, high discrimination), then a ban on veiling can lead to a *higher* level of religiosity in the community. This works as follows. If the return to integration is low (low  $y$ ), then a ban on veiling induces agents to segregate in their local community as a costly substitute for veiling. Hence, if segregation further reduces exposure to secular values (low  $\delta$ ), then a ban on veiling *inhibits* the transmission of secular values.

We remark that this result holds even when some agents continue to integrate after the ban is introduced. A ban reduces veiling by those who continue to integrate and thus increases their likelihood of acquiring secular values. On the other hand, veiling can induce women (especially those with religious values) to segregate if the returns to integration are low, relative to the personal and reputational costs of interacting in a secular environment without veiling. When segregation is highly effective at reducing exposure to secular values (low  $\delta$ ), the second effect dominates.

In our theory, veiling is a strategy to integrate into mainstream society while maintaining esteem within the community. Removing the option to veil can lead agents to adopt more costly substitutes for veiling such as segregation. Ultimately, the right veiling policy is a broader matter of justice which is well beyond the scope of this paper. However, our theory does suggest that on the same grounds that bans on veiling are often advocated, they may turn out to be counterproductive by inhibiting the spread of secular values in highly religious communities.

## 7 Conclusion

We believe that viewing veiling as a form of cultural resistance provides a useful framework for understanding contemporary patterns of veiling in both predominantly Muslim and non-Muslim societies. Nevertheless, veiling is a highly complex phenomenon; we do not pretend to understand it completely, nor do we suggest that other motivations play no role in veiling. In this paper, we have developed an account of the rise of the new veiling movement based on our theory of cultural resistance and shown how it explains veiling among educated, working, middle-class women. The main testable prediction of our theory is that veiling should be highest among women from highly religious communities who interact in highly secular environments. Finally, our theory suggests that bans on veiling aimed at secularization can be self defeating, by encouraging agents with religious values to segregate in local communities.

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## Appendix A. Alternative Theories

In this Appendix, we review four alternative theories of veiling.

1. *Protection*. Veiling can be a strategy adopted by women to regulate interactions with men and expand their autonomy in a patriarchal society (see MacLeod 1991, Mule & Barthel 1992). Public spaces such as streets, cafes and buses are viewed in many Muslim societies as the domain of men (El Guindi 1981, Mernissi 1987). Women who intrude into the public domain are often subject to verbal and physical harassment. According to Smith-Hefner (2007), veiling “offers a significant symbolic defense against unwelcome male advances while nonetheless allowing young women to enjoy their freedom of movement” [p. 401].<sup>23</sup> The new veiling movement, however, extends to Muslim minorities in Europe and the United States, where veiling can invite, not deter, physical and verbal harassment when moving around in mainstream society. Our aim is to provide a unified theory of veiling in Muslim and non-Muslim societies.

2. *Cultural Expression*. Veiling is commonly viewed as an *expression* of opposition to what many Muslims perceive to be morally corrupting cultural influences from the West (El Guindi 1981, Rugh 1984, Mule & Barthel 1992, Droogsma 2007). Rather than viewing themselves as subjugated, veiled women often lament the conformity of western women to sexualized gender roles preferred by men.<sup>24</sup> In their analysis of World Values Survey data, Norris & Inglehart (2004) conclude that “the basic cultural fault line between the West and Islam does not concern democracy – it involves issues of gender equality and sexual liberalization” [p. 155]. If veiling is motivated by purely expressive concerns, however, it is unclear how peer effects might arise. In our model, agents communicate opposition to secular values and behaviour in order to enhance esteem in their community, by (publicly) resisting the acquisition of secular values through veiling.

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<sup>23</sup>This protection function of the veil is illustrated in interviews by Read & Bartkowski (2000): “There was a boy who attended my university. He was very rude to all of the girls, always whistling and staring at them. One day, I found myself alone in the hallway with him. I was very nervous because I had to walk by him. But because I was wearing the *hijab*, he looked down when I walked past. He did not show that respect to the unveiled girls” [p. 405].

<sup>24</sup>In a 2005 Gallup World Poll, a majority of women interviewed in each of eight predominantly Muslim countries cites “attachment to spiritual and moral values” as the best aspect of their own society (Mogahed 2006). Moral decay, promiscuity and pornography were reported to be the least admired aspects of the West.

3. *Religious Club Goods*. The club goods theory introduced by Iannaccone (1992) proposes that religious groups impose behavioural restrictions to provide for more efficient provision of religious club goods. Behavioural restrictions ameliorate the free-rider problem in collective production by stigmatizing members in the society at large. This induces existing members to shift resources away from secular activity and screens out uncommitted members.<sup>25</sup> The religious club goods theory seems to be at odds with the educational and labour market participation of veiled women. Today, veiled women are a familiar sight in public spaces in Muslim and non-Muslim societies. Rather than limiting the overall secular activity of religious group members, we propose that veiling is a targeted commitment to refrain from indulgence in religiously prohibited behaviour, which enables a woman to interact outside the monitoring range of her community while maintaining a reputation for virtue.<sup>26</sup> Religious groups might provide veiled women access to club goods not to encourage efficient group production, but to reward behaviour that upholds religious standards in a secular environment.

4. *Oppositional Identity*. Bisin et al. (2010) develop a model in which members of an ethnic/religious minority bear a psychological cost from interacting with members of the majority group. They propose that individuals can better cope with this cost of interethnic contact by differentiating themselves further through ethnic identification. Bisin et al. (2010) provide empirical evidence supporting this cultural distinction hypothesis. In particular, self-reported measures of ethnic identity are higher in mixed than segregated neighborhoods. While coping with negative social interactions through oppositional ethnic identity may contribute to an explanation of ethnic identification among Muslim immigrants, we believe that our theory of cultural resistance has greater explanatory power when it comes to veiling in particular. Cultural distinction motives should apply to men and women alike. However, veiling is far more prevalent among Muslim women than equivalent forms of identification among men (e.g. beard, traditional robe). Clearly, veiling has something to do with the way moral standards are applied to women, in practice.<sup>27</sup>

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<sup>25</sup>This theoretical framework has not been specifically applied to veiling. For an application of the club goods theory to communal Quar'an study and Islamic school attendance, see Chen (2008). Berman (2000) applies the religious club goods model to explain patterns of behaviour among Ultra-Orthodox Jews.

<sup>26</sup>For example, one of Omkar's (2007) respondents recounts how their parents "were fine with my going to uni because they know that dressed like this I can't get into trouble. It's not like I'll go clubbing or drinking with men" [p. 79].

<sup>27</sup>Bayat (2007) claims that men "are not subject to the same standards of sin and guilt as women": "While both Muslim men and women might appear half-naked on beaches, only the women would be considered immoral. Only a woman's uncovered hair, not a man's, provokes moral pressure" [p. 158].

## Appendix B. D1 Criterion

In this Appendix, we restate the D1 criterion for our context. Cho & Kreps (1987) developed the D1 criterion for the case in which the player moving second chooses an action based upon their belief about the first mover's type. In our model, the second movers (agents in the community  $I$ ) simply form a belief about the first-mover's type. The first-mover's payoff depends *directly* upon this belief, because agents care about how they are judged by members of their community. The restatement is as follows:

**D1 Criterion.** Consider a PBE in which type  $i$  chooses veiling  $\tilde{v}$  and the equilibrium belief is  $\beta(\tilde{v})$ . Define the set of out-of-equilibrium beliefs at which  $i$  has a profitable deviation to  $v$  as:

$$B_i(v) = \{\beta(v) \in [0, 1] : U_i(v, \beta(v)) > U_i(\tilde{v}, \beta(\tilde{v}))\}. \quad (10)$$

Similarly, define:

$$\tilde{B}_i(v) = \{\beta(v) \in [0, 1] : U_i(v, \beta(v)) = U_i(\tilde{v}, \beta(\tilde{v}))\}. \quad (11)$$

According to the D1 criterion, if  $B_s(v) \cup \tilde{B}_s(v) \subseteq B_r(v)$ , then  $(s, v)$  can be pruned from the game, so that  $\beta(v) = 1$  as long as  $B_r(v) \neq \emptyset$ . If  $B_r(v) \cup \tilde{B}_r(v) \subseteq B_s(v)$ , then  $(r, v)$  can be pruned from the game, so that  $\beta(v) = 0$  as long as  $B_s(v) \neq \emptyset$ .

## Appendix C. Proofs

In this Appendix, we set out the proofs of Propositions 2-6.

**Proof of Proposition 2.** (i) The expected total payoff to a religious type is:

$$U_r(v) = (\alpha pg(v)) [z_{rs} + qz_{rs} + (1-q)z_{ss}] + (\alpha(1-pg(v)) + (1-\alpha)) [z_{rr} + qz_{rr} + (1-q)z_{sr}] - c(v). \quad (12)$$

For an interior solution, the first-order condition with respect to  $v$  is:

$$-\alpha pg'(v) [(1+q)\lambda_r - (1-q)\lambda_s] = c'(v), \quad (13)$$

where  $\lambda_r \equiv \frac{\lambda_s - \lambda_r}{\lambda_r + \lambda_s}$  and  $\lambda_s \equiv \frac{2\lambda_s}{\lambda_r + \lambda_s}$ . As the LHS of (13) is positive for  $v > 0$ , the right-hand side must also be positive at an interior solution (otherwise the marginal utility of veiling would be negative for all  $v$ ). This implies that:

$$(1+q)\lambda_r > (1-q)\lambda_s, \quad (14)$$

which is satisfied if and only if  $q > \underline{q} \equiv \frac{\lambda_s - \lambda_r}{\lambda_r + \lambda_s}$ . Notice that this inequality holds for all  $q > 0$  if  $\lambda_r > \lambda_s$ .

Suppose  $q > \underline{q}$ . To establish that a unique solution exists to the first-order condition (13) in this case, recognize that the LHS is positive (as  $g'(v) < 0$ ), bounded from above (as  $g'$  is bounded from below) and decreasing in  $v$  (as  $g$  is convex). The RHS is strictly increasing (as  $c$  is convex) and by assumption goes through the positive real line as  $v$  goes through the unit interval. Therefore, there is a unique value of  $v$  that satisfies the first-order condition and the second-order condition for a maximum. We denote this value by  $\bar{v}_r$ .

Conversely, when  $q \leq \underline{q}$ , the RHS of (13) is negative for all  $v$  which implies that the marginal utility of veiling is negative for all  $v \in [0, 1]$ . Hence the optimal degree of veiling is  $\bar{v}_r = 0$  in this case.

(ii) The expected total payoff to a secular type is:

$$U_s(v) = (\alpha p g(v) + (1 - \alpha)) [z_{sr} + q z_{rr} + (1 - q) z_{sr}] + (\alpha (1 - p g(v))) [z_{rr} + q z_{sr} + (1 - q) z_{sr}] - c(v). \quad (15)$$

For an interior solution, the first-order condition with respect to  $v$  is:

$$-\alpha p g'(v) [q \lambda_r - (2 - q) \lambda_s] = c'(v). \quad (16)$$

Again, as the LHS of (16) is positive for  $v > 0$ , the right-hand side must also be positive at an interior solution. Therefore:

$$q \lambda_r > (2 - q) \lambda_s, \quad (17)$$

which is satisfied if and only if  $q > \bar{q} \equiv \frac{2\lambda_s}{\lambda_r + \lambda_s}$ . Notice that this inequality cannot hold when  $\lambda_s > \lambda_r$ , as  $q < 1$ .

In the same way that we established part (i), it is straightforward to show that if  $q > \bar{q}$  then a unique interior solution exists to the first-order condition (16), which we denote by  $\bar{v}_s$ . Conversely, if  $q \leq \bar{q}$  then the optimal degree of veiling is  $\bar{v}_s = 0$ .

Finally, we claim that if  $\bar{v}_r > 0$ , then  $\bar{v}_r > \bar{v}_s$ . This holds if the marginal return to veiling is strictly higher for religious types for all  $v$ . We can establish this by subtracting the LHS of (16) from the LHS of (13) to get  $-p g'(v) [\lambda_r + \lambda_s]$ , which is indeed positive for all  $v$ .  $\square$

For the remaining analysis, we consider the case with social payoffs and unobservable behaviour.



**Proof of Proposition 3.** The Proposition follows immediately from Lemmas 1-4 below.

**Lemma 1** *For each  $q \in (0, 1)$ , there exists a unique equilibrium that satisfies the D1 criterion.*

*Proof.* Cho & Sobel (1990) demonstrate that a unique D1 equilibrium exists under the following conditions:<sup>28</sup>

- (i) If  $\beta'' > \beta'$ , then all types prefer  $\beta''$  to  $\beta'$ ,
- (ii) A player's utility function is differentiable and satisfies the Spence-Mirrlees sorting condition:  $(\partial U_r / \partial v)(\partial U_r / \partial \beta) > (\partial U_s / \partial v)(\partial U_s / \partial \beta)$ .

*Case 1:  $q > \tilde{q}$ .* Recall that:

$$\frac{\partial U_i(v, \beta)}{\partial \beta} = (1 - \alpha)[q\lambda_r - (1 - q)\lambda_s]. \quad (18)$$

For both types, this expression is positive if and only if  $q > \tilde{q} \equiv \frac{\lambda_s}{\lambda_r + \lambda_s} \in (0, 1)$ . Therefore condition (i) is satisfied in our setting.

In addition, given that  $\partial U_r / \partial \beta = \partial U_s / \partial \beta > 0$  for  $q > \tilde{q}$ , condition (ii) holds if and only if  $\partial U_r / \partial v > \partial U_s / \partial v$ , which we have verified in the proof of Proposition 2. Therefore, there exists a unique D1 equilibrium in this case.

*Case 2:  $q < \tilde{q}$ .* We can relabel types and responses, or equivalently switch the inequalities in conditions (i)-(ii). By (18), if  $\beta'' < \beta'$ , then all types prefer  $\beta'$  to  $\beta$ , for  $q < \tilde{q}$ . Hence (the relabelled) condition (i) is satisfied.

In addition,  $\partial U_r / \partial \beta = \partial U_s / \partial \beta < 0$  for  $q < \tilde{q}$ . Therefore,  $(\partial U_r / \partial v)(\partial U_r / \partial \beta) < (\partial U_s / \partial v)(\partial U_s / \partial \beta)$  [i.e. condition (ii) relabelled] holds if and only if  $\partial U_r / \partial v > \partial U_s / \partial v$ , which we have established holds. Therefore, there exists a unique D1 equilibrium in this case.

*Case 3:  $q = \tilde{q}$ .* In this case, (18) equals zero, so that payoffs are invariant to  $\beta$ . This is fully equivalent to the case of observable behaviour, as we can set  $\beta(v) = 0$  for all  $v$  for secular types and  $\beta(v) = 1$  for all  $v$  for religious types, without affecting payoffs. Therefore, agents choose their unique perfect-information degree of veiling  $\bar{v}_i$ , which are distinct for each type by Proposition 2.

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<sup>28</sup>The original conditions, as stated by Fudenberg & Tirole (1991, p.458), have been translated into our framework. An additional condition requiring the responder to react more favourably to the sender when she believes the sender is a 'higher type' is trivially satisfied in our setting, because the community responds by simply producing a belief  $\beta$  regarding the sender's type.

This establishes the Lemma.  $\square$

**Lemma 2** *There exists a threshold  $q_1 \in (\underline{q}, \tilde{q})$  such that a pooling D1 equilibrium exists in which  $\sigma_s^*(0) = \sigma_r^*(0) = 1$  if  $q \leq q_1$ . The beliefs that support the equilibrium are  $\beta(0) = q$  and  $\beta(v) = 1$  for all  $v > 0$ .*

*Proof.* Nothing is learned about types in a pooling equilibrium, so that  $\beta(0) = q$  is the only belief consistent with the equilibrium. D1 implies that  $\beta(v) = 1$  for all  $v > 0$  (see Fudenberg & Tirole 1991, p. 459).

Because religious types gain more from an upward deviation, we only need to check that the incentive-compatibility condition for religious types holds. The only source of asymmetric information in the model is an agent's date-0 type. It is straightforward to show that the optimal degree of veiling under perfect information on an agent's date-0 type is the same as under observable behaviour, i.e.  $\bar{v}_i$ . Therefore, the most profitable deviation for a religious type is  $\bar{v}_r$ . Under the specified beliefs, the incentive-comparability condition is:

$$U_r(0, q) \geq U_r(\bar{v}_r, 1). \quad (19)$$

This can be reexpressed as:

$$U_r(0, 1) + S(0, q) - S(0, 1) \geq U_r(\bar{v}_r, 1), \quad (20)$$

or:

$$S(0, q) - S(0, 1) \geq U_r(\bar{v}_r, 1) - U_r(0, 1). \quad (21)$$

Expanding the LHS of this expression:

$$(1 - \alpha)(1 - q)[(1 - q)\lambda_s - q\lambda_r] \geq U_r(\bar{v}_r, 1) - U_r(0, 1). \quad (22)$$

At  $q = \underline{q} \equiv \frac{\lambda_s - \lambda_r}{\lambda_s + \lambda_r}$ , the LHS of (22) is positive and the RHS is zero because  $\bar{v}_r = 0$  by Proposition 2(i). At  $q = \tilde{q} \equiv \frac{\lambda_s}{\lambda_s + \lambda_r}$ , the LHS is zero and the RHS is positive because  $\bar{v}_r > 0$  by Proposition 2(i) and  $\bar{v}_r = \operatorname{argmax}_{v \in [0, 1]} U_r(v, 1)$ . Therefore, all that remains to show that there exists a number  $q_1 \in (\underline{q}, \tilde{q})$  such that the putative pooling equilibrium is incentive-compatible for religious types for all  $q \leq q_1$ , is that the LHS of (22) is strictly decreasing in  $q$  and the RHS is increasing in  $q$ .

By differentiation this holds for the LHS for  $q \leq \tilde{q}$ . For the RHS, we can calculate:

$$\begin{aligned}
\frac{d}{dq} [U_r(\bar{v}_r, 1) - U_r(0, 1)] &= \frac{dU_r(\bar{v}_r, 1)}{dq} - \frac{dU_r(0, 1)}{dq} \\
&= \frac{\partial U_r(\bar{v}_r, 1)}{\partial q} - \frac{\partial U_r(0, 1)}{\partial q} \\
&= \frac{\partial}{\partial q} [U_r(\bar{v}_r, 1) - U_r(0, 1)] \\
&= \frac{\partial}{\partial q} \left( \alpha p [g(0) - g(\bar{v}_r)] \{ (1+q)\lambda_r - (1-q)\lambda_s \} - [c(\bar{v}_r) - c(0)] \right) > 0.
\end{aligned} \tag{23}$$

The second line of (23) follows immediately when  $\bar{v}_r = 0$  and by the envelope theorem otherwise.

This establishes the Lemma.  $\square$

**Lemma 3** *There exists a threshold  $q_2 \in (q_1, \tilde{q})$  such that for each  $q \in (q_1, q_2)$  a hybrid D1 equilibrium exists in which  $\sigma_s^*(0) = 1$  and  $\sigma_r^*(0) = b$  and  $\sigma_r^*(\bar{v}_r) = 1 - b$ . Beliefs are  $\beta(0) = \frac{b}{1-q(1-b)}$  and  $\beta(v) = 1$  for all  $v > 0$ .*

*In addition,  $b$  is continuous and strictly decreasing in  $q$  for all  $q \in [q_1, q_2]$ .*

*Proof.* The belief  $\beta(0) = \frac{b}{1-q(1-b)}$  follows from the equilibrium and the application of Bayes rule. Once again, D1 implies  $\beta(v) = 1$  for all  $v > 0$ .

Firstly, we claim that there exists a unique value  $q_2 \in (q_1, \tilde{q})$  such that  $U_r(\bar{v}_r, 1) = U_r(0, 0)$  for  $q = q_2$  and  $U_r(\bar{v}_r, 1) < U_r(0, 0)$  if and only if  $q < q_2$ . Let us establish this claim.

By definition  $q_1$ , at  $q = q_1$ ,  $U_r(\bar{v}_r, 1) = U_r(0, q)$ . As  $U_r(0, \beta)$  is decreasing in  $\beta$  for all  $q < \tilde{q}$  and  $q_1 < \tilde{q}$ ,  $U_r(0, 0) > U_r(0, q) = U_r(\bar{v}_r, 1)$  at  $q = q_1$ .

At  $q = \tilde{q}$ , agents are indifferent between being identified as a secular or religious type, so that  $U_r(0, 0) = U_r(0, 1)$  which is less than  $U_r(\bar{v}_r, 1) = \max_{v \in [0, 1]} U_r(v, 1)$  [as  $\bar{v}_r > 0$ , because  $\tilde{q} > \underline{q}$ ].

In sum  $U_r(0, 0) > U_r(\bar{v}_r, 1)$  at  $q = q_1$  and  $U_r(0, 0) < U_r(\bar{v}_r, 1)$  at  $q = \tilde{q}$ . To establish the

claim then, it is sufficient that  $U_r(\bar{v}_r, 1) - U_r(0, 0)$  is strictly increasing in  $q$ . Differentiating:

$$\begin{aligned}
\frac{d}{dq} [U_r(\bar{v}_r, 1) - U_r(0, 0)] &= \frac{dU_r(\bar{v}_r, 1)}{dq} - \frac{dU_r(0, 0)}{dq} \\
&= \frac{\partial U_r(\bar{v}_r, 1)}{\partial q} - \frac{\partial U_r(0, 0)}{\partial q} \\
&= \frac{\partial S(\bar{v}_r, 1)}{\partial q} - \frac{\partial S(0, 0)}{\partial q} \\
&= \frac{\partial}{\partial q} [S(\bar{v}_r, 1) - S(0, 0)] \\
&= \frac{\partial}{\partial q} \left( [\alpha(g(0) - g(\bar{v}_r)) + (1 - \alpha)] \{q\lambda_r - (1 - q)\lambda_s\} \right) > 0.
\end{aligned} \tag{24}$$

Where we have used the envelope theorem in the second line. This establishes the claim.

We shall now demonstrate the existence of the proposed hybrid equilibrium.

A secular type can do no better than by playing her part in the equilibrium, as  $\bar{v}_s = 0$  and  $U_s(v, 1) < U_s(v, 0) < U_s(\bar{v}_s, 0)$  for all  $v > 0$  when  $q < \tilde{q}$ . If a religious type chooses  $v > 0$ , she reveals her type and hence will never choose a positive degree of veiling other than  $\bar{v}_r = \operatorname{argmax}_{v \in [0, 1]} U_r(v, 1)$ . Define  $\beta^* \equiv \frac{b}{1 - q(1 - b)}$ . For a religious type to mix in the proposed way, there needs to be a value  $b \in (0, 1)$  such that:

$$\begin{aligned}
U_r(\bar{v}_r, 1) &= U_r(0, \beta^*) \\
\iff U_r(\bar{v}_r, 1) &= U_r(0, 1) + S(0, \beta^*) - S(0, 1) \\
\iff U_r(\bar{v}_r, 1) - U_r(0, 1) &= S(0, \beta^*) - S(0, 1) \\
\iff \alpha p [g(0) - g(\bar{v}_r)] \left( (1 - q)\lambda_s - (1 + q)\lambda_r \right) - [c(\bar{v}_r) - c(0)] & \\
&= \frac{(1 - q)(1 - b)}{1 - q(1 - b)} (1 - \alpha) \left( (1 - q)\lambda_s - q\lambda_r \right).
\end{aligned} \tag{25}$$

When  $b = 0$  we have already established that the LHS of the last line of (25) is less than the RHS [i.e.  $U_r(\bar{v}_r, 1) < U_r(0, 0)$ ]. When  $b = 1$ , the RHS is zero which is less than the LHS which is positive, since  $U_r(\bar{v}_r, 1) > U_r(0, 1)$  by the definition of  $\bar{v}_r$ , for  $q > \underline{q}$ .

In addition, the LHS is independent of  $b$  by inspection. The RHS is strictly decreasing in  $b$ . Taken together, this implies that there exists a unique  $b \in (0, 1)$  such that a religious type is indifferent between choosing  $v = 0$  and  $v = \bar{v}_r$ , and is therefore willing to mix between the two actions with weight  $b$  on  $v = 0$ .

We shall now show that  $b$  is strictly decreasing in  $q$ . Firstly, write the LHS of (25) as  $F(\bar{v}_r, q)$  and the RHS as  $G(b, q)$ . Implicitly differentiating equation (25) with respect to

$q$  yields:

$$\frac{\partial F}{\partial q} + \frac{\partial F}{\partial \bar{v}_r} \frac{d\bar{v}_r}{dq} = \frac{\partial G}{\partial q} + \frac{\partial G}{\partial b} \frac{db}{dq}. \quad (26)$$

Let us sign each term in (26). Firstly, recall that  $F(\bar{v}_r, q) = U_r(\bar{v}_r, 1) - U_r(0, 1)$ . By the same reasoning as in (24),  $\frac{\partial F}{\partial q} = \frac{\partial}{\partial q}([\alpha(g(0) - g(\bar{v}_r))]\{(1 - q)\lambda_s - q\lambda_r\}) > 0$ , because  $(1 - q)\lambda_s > q\lambda_r$  for  $q < \tilde{q}$ . Therefore, the first term on the LHS of (26) is positive.

Secondly,  $\frac{\partial F}{\partial \bar{v}_r} = \frac{\partial U_r(v, 1)}{\partial v}|_{v=\bar{v}_r} = 0$ . Hence the second term on the LHS of is zero.

Thirdly:

$$\frac{\partial G}{\partial q} = -\frac{b(1 - b)}{(1 - q(1 - b))^2}(1 - \alpha)((1 - q)\lambda_s - q\lambda_r) - \frac{(1 - q)(1 - b)}{1 - q(1 - b)}(1 - \alpha)(\lambda_s + \lambda_r) < 0. \quad (27)$$

Fourthly:

$$\frac{\partial G}{\partial b} = -\frac{1 - q}{(1 - q(1 - b))^2}(1 - \alpha)((1 - q)\lambda_s - q\lambda_r) < 0. \quad (28)$$

Taken together, these results imply that  $db/dq < 0$  for  $q \in (q_1, q_2)$ .

Finally,  $U_r(\bar{v}_r, 1) = U_r(0, q)$  when  $q = q_1$ , so that  $b = 1$ . When  $q = q_2$ ,  $U_r(\bar{v}_r, 1) = U_r(0, 0)$  so that  $b = 0$ . Therefore,  $b$  decreases continuously from 1 to zero as  $q$  goes from  $q_1$  to  $q_2$ .  $\square$

**Lemma 4** *Suppose  $q \geq q_2$ . Let  $v_r^*$  be the solution to  $U_s(\bar{v}_s, 0) = U_s(v_r^*, 1)$ , if one exists. The unique D1 equilibrium is the Pareto-dominant separating equilibrium in which  $\sigma_s^*(\bar{v}_s) = 1$  and  $\sigma_r^*(\max\{\bar{v}_r, v_r^*\}) = 1$ .*

*Proof.* The only form of pooling in a D1 equilibrium is either on  $v = 0$  or  $v = 1$  (Cho & Sobel 1990, p. 395). There is no pooling on  $v = 0$  here, because  $U_r(\bar{v}_r, 1) \geq U_r(0, 0)$  for all  $q \geq q_2$ . In addition, there is no pooling on  $v = 1$ . Otherwise, both types would have a profitable deviation to  $v = 0$  as  $U_i(0, 0)$  is a finite constant, whereas  $\lim_{v \rightarrow 1} U_i(v, 0) = -\infty$  because  $\lim_{v \rightarrow 1} c(v) = \infty$  by assumption.

In this case, Cho & Sobel (1990, p. 399) show that D1 selects the Pareto-dominant separating equilibrium, which is determined here as follows.

*Case 1:*  $q_2 \leq q < \tilde{q}$ . In a separating equilibrium, each type can do no better than by choosing their perfect information optimum,  $\bar{v}_i$ , with probability one. As  $q < \tilde{q}$ , a secular type is ‘envied’ and when choosing  $\bar{v}_s$  can do no better than her equilibrium payoff, under any beliefs. This means that there does not exist a value  $v_r^* \in [0, 1]$  which solves  $U_s(\bar{v}_s, 0) = U_s(v_r^*, 1)$ , so we set  $v_r^* = 0$  by convention. It also implies that we only need to

check incentive compatibility for religious types. As  $q \geq q_2$ , incentive compatibility holds because  $U_r(\bar{v}_r, 1) > U_r(0, 0)$  in this case. Therefore, strategies are indeed  $\sigma_s^*(\bar{v}_s) = 1$  and  $\sigma_r^*(\bar{v}_r) = 1$  in the unique D1 equilibrium.

*Case 2:  $q \geq \tilde{q}$ .* For this case, we only need to check incentive compatibility for secular types. If  $U_s(\bar{v}_s, 0) > U_s(\bar{v}_r, 1)$ , then the unique D1 equilibrium once again involves  $\sigma_s^*(\bar{v}_s) = 1$  and  $\sigma_r^*(\bar{v}_r) = 1$ .

If  $U_s(\bar{v}_s, 0) < U_s(\bar{v}_r, 1)$ , then the Pareto-dominant separating equilibrium involves religious types increasing veiling to  $v_r^* > \bar{v}_r$ , which is the value which makes secular types indifferent between choosing  $\bar{v}_s$  and mimicking religious types.

All that remains is to show that there exists a unique such value  $v_r^*$ . We can rewrite  $U_s(\bar{v}_s, 0) = U_s(v_r^*, 1)$  as:

$$U_s(\bar{v}_s, 0) - U_s(v_r^*, 0) = S(v_r^*, 1) - S(v_r^*, 0). \quad (29)$$

First consider the case in which  $q = \tilde{q}$ . Then  $S(v_r^*, 1) = S(v_r^*, 0)$ , so that the RHS of (29) is zero. Therefore,  $v_r^* = \bar{v}_s = 0$ .

For  $q > \tilde{q}$ , the right-hand side of (29) is positive. The left-hand side equals zero at  $v_r^* = \bar{v}_s$ . As  $v \rightarrow 1$ ,  $U_s(v, 1) \rightarrow -\infty$ , because  $c(v) \rightarrow \infty$ . Therefore, the left-hand side goes to infinity as  $v_r^* \rightarrow 1$ . We claim that  $U_s(v, 0)$  is strictly decreasing in  $v$  for all  $v > \bar{v}_s$ . Therefore, for each  $q > \tilde{q}$ , there exists a unique value  $v_r^* \in (\bar{v}_s, 1)$  that solves  $U_s(\bar{v}_s, 0) = U_s(v_r^*, 1)$ . We shall now establish the claim.

Recall that  $U_s(v, 1)$  is strictly decreasing in  $v$  for all  $v$  when  $q < \bar{q}$  (see proof of Proposition 2(ii)). In addition,  $\bar{v}_s = \operatorname{argmax}_{v \in [0,1]} U_s(v, 0)$ , and by differentiation  $U_s(v, 0)$  is strictly concave in  $v$  if  $q \geq \bar{q}$ . Therefore,  $U_s(v, 1)$  is strictly decreasing in  $v$  for all  $v > \bar{v}_s$ .

This establishes the claim and indeed the Lemma.  $\square$

**Proof of Proposition 4.** Suppose  $\bar{v}_r > 0$  and  $\bar{v}_s > 0$ . Let us first derive the comparative statics results for  $\bar{v}_r$  and  $\bar{v}_s$  by computing the cross-partial derivatives of (6), when  $x$  is observable, as follows:

Recall that  $g(v) < 0$  for all  $v$ , by assumption. It is straightforward to sign the derivatives in Table 1 by inspection, except for those associated with  $p$ . From the third row of Table 1,  $\frac{\partial U_r}{\partial v \partial p} > 0$  if and only if  $(1+q)\lambda_r - (1-q)\lambda_s > 0$ , which implies  $q > \frac{\lambda_s - \lambda_r}{\lambda_r + \lambda_s}$ . By Proposition 2(i), this holds if  $\bar{v}_r > 0$ . Therefore, when positive,  $\bar{v}_r$  is strictly increasing in  $p$ .

Table 1: Cross-partial derivatives under observable behaviour

	$i = r$	$i = s$
$\frac{\partial U_i}{\partial v \partial q}$	$-\alpha p g'(v) [\lambda_r + \lambda_s]$	$-\alpha p g'(v) [\lambda_r + \lambda_s]$
$\frac{\partial U_i}{\partial v \partial p}$	$-\alpha g'(v) [(1+q)\lambda_r - (1-q)\lambda_s]$	$-\alpha g'(v) [q\lambda_r - (2-q)\lambda_s]$
$\frac{\partial U_i}{\partial v \partial \lambda_r}$	$-\alpha p g'(v)(1+q)$	$-\alpha p g'(v)q$
$\frac{\partial U_i}{\partial v \partial \lambda_s}$	$\alpha p g'(v)(1-q)$	$\alpha p g'(v)(2-q)$

In addition,  $\frac{\partial U_s}{\partial v \partial p} > 0$  if and only if  $q\lambda_r - (2-q)\lambda_s > 0$ , which implies  $q > \frac{2\lambda_s}{\lambda_r + \lambda_s}$ . By Proposition 2(ii), this holds if  $\bar{v}_s > 0$ . Therefore, when positive,  $\bar{v}_s$  is also strictly increasing in  $p$ .

We can now derive the comparative statics results for  $v_r^*$ , when  $v_r^* > 0$ . Recall that in this case  $v_r^*$  is defined as the solution to:

$$\begin{aligned}
U_s(\bar{v}_s, 0) &= U_s(v_r^*, 1) \\
\iff U_s(\bar{v}_s, 0) - U_s(v_r^*, 0) &= S(\bar{v}_s, 1) - S(\bar{v}_s, 0) \\
\iff \alpha p [g(\bar{v}_s) - g(v_r^*)] ((2-q)\lambda_s - q\lambda_r) &+ [c(v_r^*) - c(\bar{v}_s)] = (1-\alpha)(q\lambda_r - (1-q)\lambda_s).
\end{aligned} \tag{30}$$

Define  $K \equiv -dU_s(v, 0)/dv|_{v=v_r^*}$ . We claim that  $U_s(v, 0)$  is strictly decreasing in  $v$  for  $v > \bar{v}_s$ , so that  $K > 0$ . To establish the claim first recall that when  $q < \bar{q}$ ,  $U_s(v, 0)$  is strictly decreasing in  $v$  (see proof of Proposition 2(ii)). When  $q \geq \bar{q}$ ,  $U_s(v, 0)$  is strictly concave in  $v$  (by differentiation). Together with the fact that  $\bar{v}_s = \operatorname{argmax}_{v \in [0,1]} U_s(v, 0)$ , this implies  $U_s(v, 0)$  is strictly decreasing in  $v$  for all  $v > \bar{v}_s$ . Therefore,  $K > 0$ .

By implicit differentiation of (30), we can derive the results in table 2.

Table 2: Comparative Statics under unobservable behavior

$\frac{dv_r^*}{dq}$	$K^{-1} \{ (1-\alpha) + \alpha p [g(\bar{v}_s) - g(v_r^*)] \} (\lambda_r + \lambda_s)$
$\frac{dv_r^*}{dp}$	$K^{-1} \alpha [g(\bar{v}_s) - g(v_r^*)] (q\lambda_r - (2-q)\lambda_s)$
$\frac{dv_r^*}{d\lambda_r}$	$K^{-1} q \{ (1-\alpha) + \alpha p [g(\bar{v}_s) - g(v_r^*)] \}$
$\frac{dv_r^*}{d\lambda_s}$	$-K^{-1} \{ (1-\alpha)(1-q) + \alpha p [g(\bar{v}_s) - g(v_r^*)] (2-q) \}$

By inspection, the first and third entries are positive and the fourth entry is negative. The second entry is positive if and only if  $q > \bar{q} = \frac{2\lambda_s}{\lambda_r + \lambda_s}$ . This establishes the Proposition.

□

**Proof of Proposition 5.** The ‘inflow’ at time  $t$  to the pool of religious types is  $(1 - q^t)\alpha[1 - pg(\bar{v}_s)]$ , i.e. the proportion of secular types in the community times the probability that a secular type becomes a religious type during the period. Similarly, the outflow from the pool of religious types is  $q^t\alpha p[\sigma_r^*(0)g(0) + (1 - \sigma_r^*(0))g(\max\{\bar{v}_r, v_r^*\})]$ . Therefore:

$$q^{t+1} = h(q^t) \equiv q^t + (1 - q^t)\alpha[1 - pg(\bar{v}_s)] - q^t\alpha p[\sigma_r^*(0)g(0) + (1 - \sigma_r^*(0))g(\max\{\bar{v}_r, v_r^*\})], \quad (31)$$

where  $h$  is a real-valued function of  $q^t$ .

In an equilibrium,  $q^{t+1} = q^t$ . This implies:

$$q^t = \frac{1 - pg(\bar{v}_s)}{p[\sigma_r^*(0)g(0) + (1 - \sigma_r^*(0))g(\max\{\bar{v}_r, v_r^*\})] + (1 - pg(\bar{v}_s))}. \quad (32)$$

(i)-(ii) We shall now show that at least one such equilibrium exists. Recall that  $p \in (0, 1)$  and  $g(v) \in (0, 1)$  by assumption. Therefore,  $h(q^t) \in (0, 1)$  for all  $q^t$ . Hence  $q^t = 0 < h(0)$  and  $q^t = 1 > h(1)$ , so that all equilibria are interior. In addition,  $h(q^t)$  is continuous in  $q^t$ , because  $\sigma_r^*(0)$ ,  $\bar{v}_s$ ,  $\bar{v}_r$  and  $v_r^*$  are continuous in  $q$  [by Lemma 4 and Proposition 4]. Taken together this implies that there exists at least one  $q^t$  such that  $q^t = h(q^t)$  and where  $h(q^t)$  cuts the 45° line from above (and hence is Lyapunov stable).

(iii) We shall now demonstrate that the process converges to an equilibrium from every initial state. First we shall establish that  $h$  is strictly increasing. By (31), differentiating  $h(q)$  with respect to  $q$ , we have:

$$\begin{aligned} \frac{dh(q)}{dq} = & 1 - \alpha[1 - pg(\bar{v}_s)] - \alpha p[\sigma_r^*(0)g(0) + (1 - \sigma_r^*(0))g(\max\{\bar{v}_r, v_r^*\})] \\ & - (1 - q^t)\alpha p g'(\bar{v}_s) \frac{d\bar{v}_s}{dq} - q^t \alpha p (1 - \sigma_r^*(0)) g'(\max\{\bar{v}_r, v_r^*\}) \frac{d \max\{\bar{v}_r, v_r^*\}}{dq} \\ & - q^t \alpha p \frac{d\sigma_r^*(0)}{dq} [g(0) - g(\max\{\bar{v}_r, v_r^*\})]. \end{aligned} \quad (33)$$

The sum of the first two terms on the RHS of (33) is:

$$\begin{aligned} & 1 - \alpha[1 - pg(\bar{v}_s)] - \alpha p[\sigma_r^*(0)g(0) + (1 - \sigma_r^*(0))g(\max\{\bar{v}_r, v_r^*\})] \\ & = 1 - \alpha + \alpha p[g(\bar{v}_s) - \sigma_r^*(0)g(0) - (1 - \sigma_r^*(0))g(\max\{\bar{v}_r, v_r^*\})], \end{aligned} \quad (34)$$

which is positive since  $\alpha < 1$ ,  $g(\bar{v}_s) \geq g(\bar{v}_r)$  (because  $g'(v) < 0$  and  $\bar{v}_r \geq \bar{v}_s$ ) and  $\sigma_r^*(0) > 0$  only if  $\bar{v}_s = 0$  by Lemma 4.

The third and fourth terms are positive since  $g'(v) < 0$ ,  $\frac{d\bar{v}_s}{dq} > 0$  and  $\frac{d\bar{v}_i}{dq} > 0$  for  $i = r, s$  by Proposition 4. Except in a hybrid equilibrium,  $\sigma^*$  does not depend on  $q$ ,



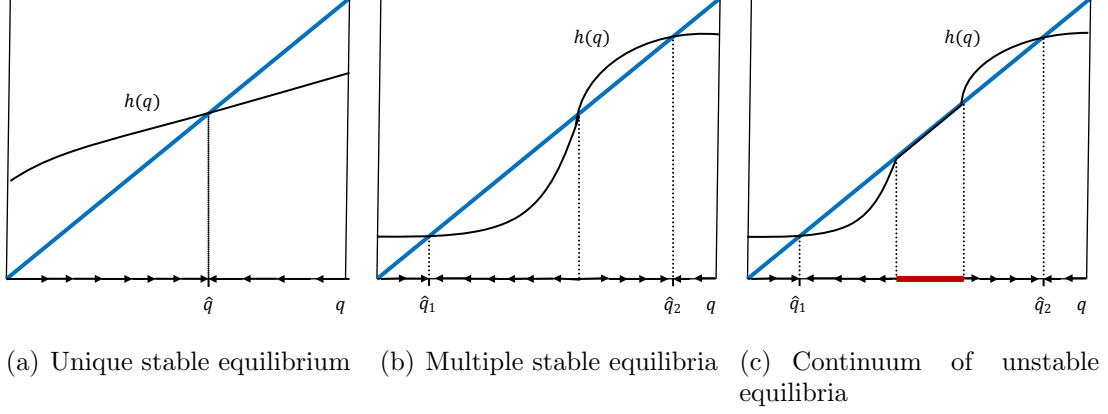


Figure 3: Direction of motion of  $q^t$ .

so the final term is zero in this case. In a hybrid equilibrium, the final term equals  $-q^t \alpha p \frac{db}{dq} [g(0) - g(\bar{v}_r)]$ . This is positive, since  $db/dq < 0$  by Lemma 4, and  $\bar{v}_r > 0$  in a hybrid equilibrium, so that  $g(0) > g(\bar{v}_r)$ .

This establishes that  $h$  is strictly increasing. Now we can depict the direction of motion of the process, as in Figure 3. Whenever  $h(q^t)$  lies above the  $45^\circ$  line,  $q^{t+1} = h(q^t) > q^t$ , and *vice versa*.

To prove convergence, consider an initial state  $q^0$  in which  $q^0 < h(q^0)$ , without loss of generality. Therefore,  $q^0 < h(q^0) \equiv q^1$ . As  $h$  is strictly increasing,  $q^1 \equiv h(q^0) < h(q^1) \equiv q^2$ . Iterating this argument,  $q^{t+1} > q^t$  for all  $t \geq 0$ . Every monotonic sequence on a compact set has a limit. Therefore,  $q^t \rightarrow \hat{q}$ . As  $h$  is continuous, this implies  $h(q^t) \rightarrow h(\hat{q})$ . Note that  $h(q^t) \equiv q^{t+1} \rightarrow \hat{q}$ . Therefore,  $\hat{q} = h(\hat{q})$ , which is a religious equilibrium.  $\square$

**Proof of Proposition 6.** Let the process begin in a religious equilibrium under unrestricted veiling denoted by  $q^0$ . By hypothesis, both types integrate and religious types choose a positive degree of veiling with probability one. Denote equilibrium veiling for each type by  $\hat{v}_r$  and  $\hat{v}_s$ , respectively.

As both types integrate, community members learn nothing about an agent's type from her integration decision. The equilibrium beliefs at  $t = 0$ , denoted by  $\beta^0(\hat{v}_r, 1) = 1$  and  $\beta^0(\hat{v}_s, 1) = 0$ , then follow from Proposition 3 for the case  $q \geq q_2$  (this is the case in which religious types choose positive veiling with probability one).

Set  $\delta$  such that the probability that each agent acquires secular values in a cultural transmission phase if they segregate is lower than if they integrate, i.e.  $p\delta g(1) < p\delta(\widehat{v}_r)$  [Notice that  $\delta \leq 1$  is sufficient]. This means that segregation acts as an increase in veiling so that religious types benefit more than secular types from segregation. Therefore, community members assign belief  $\beta^0(., 0) = 1$  upon observing segregation.

As religious types integrate in the initial state at  $t = 0$ , their equilibrium payoff must be higher than the payoff from segregation:

$$y + U_r(\widehat{v}_r, 1) \geq \widetilde{U}_r(1). \quad (35)$$

Now introduce a ban on veiling during  $t = 1$ , so that agents who integrate are restricted to zero veiling. It is straightforward to show that for each  $q$  there exists a unique D1 equilibrium, in this case. We shall demonstrate here that given  $q^1$  there exists a value  $y$  such that the equilibrium involves secular types continuing to integrate with probability one and religious types segregating with probability one. In this case, equilibrium beliefs at  $t = 1$  are  $\beta^1(0, 1) = 0$  and  $\beta^1(., 0) = 1$ . Religious types segregate if  $y$  is sufficiently low as follows:

$$y + U_r(0, 0) < \widetilde{U}_r(1). \quad (36)$$

Therefore, religious types switch from integration to segregation if:

$$\widetilde{U}_r(1) - U_r(\widehat{v}_r, 1) \leq y < \widetilde{U}_r(1) - U_r(0, 0). \quad (37)$$

There exists such a  $y$  if:

$$U_r(\widehat{v}_r, 1) > U_r(0, 0). \quad (38)$$

Suppose (38) does not hold. Then religious types would have a profitable deviation to  $U_r(0, 0)$  at  $t = 0$  [It is straightforward to show that  $\beta^0(0, 1) = 0$ ]. By hypothesis, however,  $(v, \ell) = (\widehat{v}_r, 1)$  is the *equilibrium* strategy for religious types at  $t = 0$ , a contradiction. Therefore, there exists a  $y$  such that religious types switch from integration to segregation.

In addition, because religious types benefit more from segregation than secular types, we can choose  $y$  such that secular types continue to integrate.

The inflow to the pool of religious types during  $t = 1$  is then  $(1 - q^1)\alpha(1 - pg(0))$  and the outflow is  $q^1\alpha p\delta g(1)$ . Therefore,

$$q^2 = \widetilde{h}(q^1) \equiv q^1 + (1 - q^1)\alpha(1 - pg(0)) - q^1\alpha p\delta g(1), \quad (39)$$

where  $\widetilde{h}$  is strictly increasing [ $\widetilde{h}'(q^1) = 1 - \alpha + \alpha p(g(0) - \delta g(1)) > 0$ ].

We claim that  $q^2 > q^1$ . From (39), this occurs if:

$$(1 - q^1)\alpha(1 - pg(0)) > q^1\alpha p\delta g(1), \quad (40)$$

or:

$$q^1 < \frac{1 - pg(0)}{p\delta g(1) + (1 - pg(0))}. \quad (41)$$

To establish that (41) holds, recall that, as  $q_1$  is a religious equilibrium (i.e.  $q^1 = q^0$ ), in which  $\sigma_r^*(\hat{v}_r) = 1$ , (32) implies:

$$q^1 = \frac{1 - pg(\bar{v}_s)}{pg(\hat{v}_r) + (1 - pg(\bar{v}_s))}. \quad (42)$$

Therefore, we require the RHS of (41) to be greater than the RHS of (42). As  $\delta \rightarrow 0$ , the RHS of (41) goes to one, which is greater than  $q^1$  (all religious equilibria are interior by Proposition 5). Therefore,  $q^2 > q^1$  for  $\delta$  sufficiently small.

Now consider play during  $t = 2$ .

*Case 1: Secular types integrate with probability one.* We claim that religious types continue to segregate. To establish this claim, it is sufficient to show that the difference between the payoff from segregation and integration is increasing in  $q$  for both types. This can be demonstrated as follows:

$$\begin{aligned} \frac{d}{dq}[\tilde{U}_i(1) - U_i(0,0)] &= \alpha p\delta g(1)(z_{rs} - z_{ss}) + [(1 - \alpha) + \alpha(1 - \delta pg(1))](z_{rr} - z_{sr}) \\ &\quad - [(1 - \alpha) + \alpha pg(0)](z_{rs} - z_{ss}) - \alpha(1 - pg(0))(z_{rr} - z_{sr}), \end{aligned} \quad (43)$$

which is positive if:

$$\alpha p[g(0) - \delta g(1)](\lambda_r + \lambda_s) > -(1 - \alpha)(\lambda_r + \lambda_s). \quad (44)$$

This holds because  $g(0) > \delta g(1)$  by construction, so that the LHS is positive. Therefore, if religious types segregated in period 1, they continue to segregate in period 2, when secular types integrate.

Hence,  $q^3 = \tilde{h}(q^2) > \tilde{h}(q^1) = q^2 > q^1$  because  $\tilde{h}$  is strictly increasing.

*Case 2: Secular types segregate with positive probability.* If secular types weakly prefer segregating to integrating, then religious types are strictly better off segregating. Let secular types segregate with probability  $d$ . Then:

$$q^3 = q^2 + (1 - q^2)\alpha[d(1 - p\delta g(1))(1 - d)(1 - pg(0))] - q^2\alpha p\delta g(1), \quad (45)$$

which is greater than  $\tilde{h}(q^2)$  [because  $\delta g(1) < g(0)$ ], which we have shown is greater than  $q^1$ .

Therefore, in both cases  $q^3 > q^1$ .

Recall that the difference in the payoffs from segregating and integrating is increasing in  $q$  for both types by (43). Hence if secular types choose to segregate with probability  $d$  in period  $t$  and  $q^{t+1} > q^t$ , then they segregate with probability at least  $d$  in period  $t + 1$ .

Therefore, for periods  $t > 2$ , we can iterate the reasoning used for  $t = 2$  to demonstrate that  $q^t > q^1$  for all  $t > 1$ .  $\square$