Taboos and Identity:

Considering the Unthinkable

Tuesday, December 08, 2009

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Abstract: A taboo is an "unthinkable" action. Even the thought of violating a taboo triggers a punishment. We consider a simple model in which taboos are part of the definition of one's identity. Deliberating over breaking the taboo changes the individual's choice set and provides information on possible private benefits but is costly because it contradicts one's identity. The strength of the taboo is endogenously determined by the number of individuals that obey it. We analyze the relationship between social heterogeneity and the strength as well as effectiveness of taboos. We then examine societies in which individuals may choose among several identities characterized by different taboos. Having such a choice defines a dynamic process with respect to social identity: Some identities disappear while others flourish. We examine the characterization and the conditions giving rise to a multi-identity society.

1. Introduction

Human behavior is not governed only by rational decision making. Societies often have shared values and standards of acceptable behavior that members of the society are encouraged to follow. A culture or a society guides the behavior and the thoughts of their members by agreed upon expectations and rules. The list of behavioral guidelines is typically referred to as social norms and taboos. These norms and taboos have a huge effect on our life. The way we behave, dress, eat, drive and our sex life are all governed by the norms and taboos of the societies we belong to. While there is an extensive literature on social norms, taboos were mainly discussed by anthropologists that have documented and analyzed taboos in different societies.[1]

The term taboo is of Polynesian origin (the words 'tabu' or 'tapu' in the Tongan language) and was introduced to the English language only in the 18th century. The original Polynesian term has a specific religious association - see also the famous book "Totem and Taboo" (Freud, 1913).[2] According to Encyclopedia Britannica (2009) taboo is defined as "the prohibition of an action based on the belief that such behaviour is either too sacred and consecrated or too dangerous and accursed for ordinary individual to undertake".

Taboos may include restrictions on sexual activities like incest, animal-human sex, necrophilia and adult-child sex. Other taboos relate to dietary restrictions like Halal and Kosher diets for Muslims and Jews, eating beef by Hindus or cannibalism in most societies.[3] Taboos can be repugnant and appalling actions or behavior which includes the display of some bodily functions.[4] Almost all these taboos are not universal and according to Freud, incest is one of the only universal taboos. Another important set of taboos involves "taboo tradeoffs" that can entail putting a monetary value on "sacred" values like life, friendship, religion, etc. For example being asked to estimate the monetary worth of one's children, of one's loyalty to his friends or country is considered

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[1] See for example Ullmann-Margalit (1977), Akerlof (1980), Elster (1989), Cole, Mailath and Postlewaite (1992, 1998), Hechter and Opp (2001), Bicchieri (2006) and Young (2006).
[2] When Freud first introduce the term 'taboo' in Section II of the book he claims that its meaning is identical to the term 'Sacer' by Romans and 'Kadesh' by Hebrews (Jews).
[3] For a more detailed list see the value "Taboo" in Wikipedia.
[4] Some of the repugnance and appalling actions are culturally specific and may change over time. For many examples and discussion see Haidt, Rozin, McCauley and Imada (1997) and Roth (2007).

by most people morally offensive and as a violation of a taboo (see Fiske and Tetlock (1997) and Tetlock, Kristel, Elson, Green and Lerner (2000)).

The list of taboos and their importance may change over time. Some taboos may weaken or even disappear, while others may become stronger and more dominant.[5] For example child insurance and life insurance were for a long time taboos and then became acceptable (see Zelizer 1978, 1981). Trades of human organs are still a taboo in most societies but some forms of trade become acceptable (see Roth (2007)). There are even claims that that the famous incest taboos are disappearing in complex societies (see Cohen (1978) and Spain (1988)).

There are various explanations for the origin of taboos. The typical anthropological argument is that the origin of taboos is cultural experience. The alternative explanation is psychoanalytical emphasizing the strong subconscious prohibitions that pass through generations (see Freud (1913)). But what is the difference between taboos and social norms? One interpretation is that taboos are strong social norms; norms which are sufficiently strong that may be viewed as sacred. Every time an individual's behavior diverges from a norm, this act impacts on the other members of society, who then punish the deviant individual (see for example Akerlof (1976, 1980), Cole, Mailath and Postlewaite (1998) and Young (2006)). Taboos can therefore be viewed as strong social norms that are supported by severe social sanctions.[6]

But there is an additional aspect of taboos that may distinguish it from social norms. Taboos are sometimes referred to as doing the "unthinkable". Even thinking about violating a taboo is problematic. The sanctions associated pertain not just to the behavior that contradicts the taboo but also merely thinking or considering such a behavior. Under this interpretation a taboo is a form of "thought police" that governs not just human behavior but also their thoughts.[7] Thinking or considering incest, necrophilia or cannibalism is a violation of the relevant taboos. Tetlock, Kristel, Elson, Green and Lerner (2000) considered taboo tradeoffs in terms of "*The Psychology of the*

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[5] See also Chambers (1960).
[6] Our analysis focuses on social enforcement. However some of the taboos that we mentioned are also illegal in some countries.
[7] In some cases considering an action requires also an action. For example the action of cheating on one's spouse. The action itself is viewed by some as a violation of a norm or a taboo and therefore punishable. Considering such an action may be the involved registering to a dating service or checking other options. Typically such an act, even without the cheating itself, would be viewed by some as punishable.

Unthinkable". The concept of taboos tradeoffs focuses indeed on the mental exercise or thinking and not on the action itself. "*People rejects certain comparisons because they feel that seriously considering the relevant tradeoffs would undercut their self image and social identities as moral beings*" (see also Fiske and Tetlock (1997, p.256)). The emphasis in taboo-tradeoffs is about considering the tradeoffs between sacred values and monetary gains and not about carrying out these tradeoffs.

The economic consequence of not being able to consider an act is that a taboo is a constraint on one's choice set. One needs to consider an act in order to determine the exact costs and benefits of the act. Considering an act is viewed under this interpretation as acquiring the option of carrying out this act. When there are no constraints about thoughts these options are costless. But when there are taboos that prohibit and penalize certain considerations, acquiring an option for certain actions becomes costly (see Benabou and Tirole (2006) for a similar interpretation of taboos)[8].

Some taboos activities are prohibited under the law and transgressions may lead to severe punishment, some taboos are regulated by religious practices while others are enforced only by social punishment. The most familiar social punishment involves the attitudes and reactions of other society's members.[9] For such social punishment to be effective, behavior must be observable. But if taboos are also with respect to thoughts, how can someone be punished for having "dirty" thoughts? Thoughts are not observable. But social punishment can be also self-inflicted. When talking about taboos-tradeoffs Raz (1986, p. 22) claims that "*It diminish one's potentiality as a human being to put a value on one's friendship in terms of improved living conditions*". Similarly Fiske and Tetlock (1997, p.256) claim that "*to attach a monetary value to one's friendships of one's children or one's loyalty to one's country, is to disqualify one from certain social roles. People feel that making such an evaluation demonstrates that one is not a true friend, or parent, or*

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[8] If an act is unthinkable it is not necessarily the case that the act of thinking about the act is itself unthinkable. For example, suppose the reader found out his friend was considering committing incest. The reader might recognize this to be disgusting. However, the reader is not disgusting for having come to such recognition, even though the reader has thought about the act of thinking about incest. In fact, it seems the permissibility of meta-thinking is a necessary component for the functioning of taboos. How else would we be able to sanction others for thinking about the unthinkable? How else could we educate our children what taboos our society upholds?

[9] Sometimes the social punishment itself is costly and in order to enforce it punishing becomes also a social norm implying that individuals who are not punishing for certain behavior would be punishment themselves for violation of the social norm (see Akerlof 1976).

citizen". Taboos are an important part of any social identity[10]. Adopting an identity implies accepting the taboos and the social norms associated with this identity. The desire to maintain an identity and to view oneself as a moral person as defined by one's identity is an important consideration that defines the self-inflicted cost of thinking about violating a taboo. As Haidt et al. (1997) and Fessler and Navarrete (2003) argue, these costs may involve negative emotions such as fear or disgust.

What is the advantage of using taboos rather than social norms to regulate a certain behavior? In order to answer this question consider for example a situation that occurs only with a very small probability but at this situation a certain behavior or an action entails high private benefit. Assume now that society wishes to curb such a behavior. Social norms penalizing the actions only may be ineffective as deterrence as they require harsh punishments. The high private benefits should be balanced with severe social sanctions in order to deter such a behavior. But social sanctions have a limit (see Cole, Mailath and Postlewaite (1998)).[11] On the other hand, taboos that penalize for merely considering a deviation may impose a much lower penalty that is nonetheless sufficient to deter individuals from thinking about the option to deviate. To illustrate this structure, consider the taboo against cannibalism. When someone is starving, the private benefit of deviating from this taboo may be large. Thus the only way to deter such a behavior is to impose a taboo prohibiting individuals even to consider such an act.

What advantage may society obtain from taboos? One explanation is that sometimes thoughts per se create negative externalities. Taboos-tradeoffs provide examples for such externalities. Making the tradeoff evaluations undermine the meaning of friendship, loyalty, family ties etc. But taboos may provide other type of public benefit to a society. For example a taboo against cannibalism would guarantee safety and the function of the society in case of a severe famine. A dietary taboo, like Kosher restrictions for Jews, has facilitated isolation and survival of the group culture (see Slezkine (2004). A taboo prohibiting a direct payment for human organs for transplanting may benefit a society by eliminating incentives of exploiting people and violent harvesting of human organs.

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[10] see Akerlof and Kranton (2000) for a discussion on social identity.
[11] In addition it is not clear that we enjoy leaving in a society that prescribes many harsh sanctions and penalties.

Taboos have an important aspect of social interaction. The strength of a taboo is affected by the percentages of individuals who deviate or think about deviating from the taboo (see Fessler and Navarrete (2003); for a similar argument with respect to social customs see Akerlof (1980) and Romer (1984)). We do not specify the underlying social interaction process that establishes this relationship. It is possible that with some probability individuals' thoughts are transparent.[12] Or that the strength of the taboo is determined by social interaction among individuals that may express their opinions and those that consider deviating from a taboo contribute to its weakening. Consequently, the strength of the taboo affects an individual's incentives to deviate from it or to consider such a deviation and on the other hand the percentage of individuals who deviate or consider deviation from the taboo affects its strength.

In this paper we present a simple model that formalizes the role of taboos in societies and the way they affect behavior, thoughts and the choice of identity. We start by considering a society in which there is one taboo. Behaving in a manner that violates the taboo or considering such a deviation is costly. The severity of the punishment is positively related to the strength of the taboo. Individuals may differ with respect to their social concerns and the severity that they associate with social punishment (for evidence on individual variations in susceptibility to emotional of fear and disgust in reaction to taboo stimuli see Fessler and Navarrete (2003)). We assume that there are stochastically distributed potential private benefits from deviating from the taboo. Considering such a deviation is a learning process by which an individual becomes aware of his/her own private benefit. Deviation from a taboo is possible only after an individual has completed this learning process. The strength of the taboo is determined by the percentage of individuals that follow it. We assume that the public benefit from a taboo and the severity of the social punishment depends on the taboo's strength. We thus have a model in which individuals' behavior depend on the strength of the taboo and on the other hand the strength of the taboo is determined by individuals' choices. We define a stable taboo and investigate its properties. We demonstrate the possibility of a non-continuous adjustment process by which a relatively small increase in private benefits destroys the taboo.

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[12] In some cases considering an act may require engaging in an actual search, which is not simply a mental task, but involve fact finding which is partly observable.

Societies may differ in their level of social heterogeneity. One aspect of such heterogeneity is the distribution of attitudes towards social norms and social punishment among individuals. Another aspect is the range of different identities and taboos and the possible coexistence of multiple identities. We first consider heterogeneity with respect to social preferences. We introduce a measure of heterogeneity that reflects the distribution of individual concerns regarding social punishment. We show that when the potential private benefits from deviation are relatively small, then increasing the level of homogeneity implies a weaker stable taboo with more people considering deviation. Alternatively, when the potential private benefits from deviation are relatively large, a higher degree of homogeneity leads to a stronger stable taboo, with a smaller percentage of the population considering deviation from the taboo.

We then consider a society in which there are (potentially) two identities. Each identity is characterized by only one taboo. Individuals need first to choose which identity to adopt and then whether they are going to follow the taboo prescribed by this identity. Allowing individuals to choose identities defines an evolutionary process with respect to identities. Some identities may disappear while others may flourish when more individuals choose to adopt them. We specify the conditions that give rise to a multiple-identity society and investigate its structure.

2. Taboos and Identities

We start our analysis by considering a society, or an identity, with one taboo. The strength of the taboo determines the severity of the social punishment imposed on people that deviate from the taboo and it is endogenously determined by the behavior of people in the society.

The first part of our analysis studies the properties of stable taboos. We then extend our analysis and allow individuals to decide which identity to adopt and if they are going to violate the prescribed taboo of the chosen identity. We therefore endogenize the concept of identity letting people choose their identity given the taboos each identity prescribes and the strength of these taboos.[13] The stable system of identities and taboos is

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[13] We ignore social norms and identify a society only by the list of taboos it imposes. Clearly a more extended analysis should include both norms and taboos.

jointly determined as individuals that adopt a particular identity may choose to deviate from the prescribed taboos and thus weaken them.

2.1 Stable Taboos

Consider a society with one taboo. We normalize the size of the population to 1 and assume that individuals are heterogeneous with respect to their social concerns. We denote the individual's type as ϕ, letting the distribution of ϕ be $G(\phi)$; $\phi \in [\bar{\phi}, \underline{\phi}]$. An individual of type $\phi = 0$ is concerned with neither his identity nor the social implications of his actions. A higher ϕ implies higher social concerns.

Not all the taboos are of the same strength. The strength of a taboo is denoted by T and we assume that T is commonly accepted and known by all members of the society. We assume that there is a social cost of deviating, or just considering a deviation, from a taboo. These costs are increasing with the strength of the taboo and the individual's type, ϕ. Specifically, let

- $C(\phi,T)$ - be the cost associated with considering a deviation from the taboo

- $D(\phi,T)$ - be the cost associated with deviating from the taboo.

Where $C(\phi,T)$ and $D(\phi,T)$ are increasing in both arguments.

A taboo has meaning only if there are private benefits attached to deviating from it. There is no taboo against eating sand but there is a taboo against eating beef or pork or seafood or human flesh. The private benefits may materialize only in some special events. A starving person may benefit from eating a certain type of food against which there is a taboo. We therefore assume that people may sometimes obtain private benefits from deviating from the taboo. However, these benefits are not apparent without individuals first considering the deviation. This consideration process is also a learning process in which the private benefits of deviation are revealed.

An individual who considers deviation from a taboo will observe the realization of his own private benefits from such a deviation. The private benefit, denoted by *b*, is privately observed whenever an individual is considering a deviation from the taboo. The distribution of *b* is given by *F(b)*, and is commonly known. We assume for convenience that all individuals have the same distribution of private benefits.

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After observing the realization of private benefits an individual may decide whether he/she wishes to deviate from the taboo. But this deviation is costly; therefore, deviation from the taboo will occur only when the realized benefits are greater than the costs of deviation, i.e., whenever $b \geq D(\phi, T)$.

Considering deviation from a taboo is similar to buying an option, that is, the option to deviate from a taboo whenever such a deviation is beneficial. In order to obtain such an option, the individual pays the consideration costs $C(\phi, T)$. The individual then observes a realization of the random benefit b and, given his/her type, he/she decides whether to deviate or not. The value of such an option for an individual of type ϕ is denoted by $V(F(b), \phi, T)$. An individual will consider deviating from the taboo only when the value of this option is greater than the cost of acquiring it, which is the cost of considering violation of the taboo, i.e., whenever $V(F(b), \phi, T) \geq C(\phi, T)$ [14].

Clearly, some individuals who deviate from a taboo regret doing so. When an individual decides on deviation, the cost of considering a deviation, $C(\phi, T)$, is a sunk cost. Thus, whenever $C(\phi, T) + D(\phi, T) > b > D(\phi, T)$, the individual will deviate from the taboo but regret the fact that deviation was even considered.

We assume that the strength of the taboo is endogenously determined by the percentage of people that follow it.[15] When people deviate from a taboo or when they consider such a deviation they indirectly weaken the taboo. We do not model the underlying social interaction process but we simply assume that the strength of a taboo is a decreasing function of the percentage of individuals that violate it. Letting

N_c - be the percentage of people that consider deviating from the taboo.

N_d - be the percentage of people that actually deviate from the taboo.

We denote the strength of the taboo as $T(N_c, N_d)$ where $T(\cdot, \cdot)$ is declining in both arguments.

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[14] The fact that individuals are able to costlessly calculate whether or not it is worth buying this option rests on the assumption that it is permissible to think about thinking about a taboo. Likewise, this assumption is necessary for us to permit punishment, of oneself or another, without violating the taboo. See footnote 3 for a discussion of this assumption.

[15] For an Anthropological aspect of this property see also Fessler and Navarrete (2003).

Individuals in this society benefit from having a taboo. The taboo may be viewed as a public good that all individuals enjoy. We denote these benefits as $E(T)$ and assume that it is increasing with the strength of the taboo and that all the individuals in the society enjoy it regardless of their own behavior. For example the benefits can be some biological advantages from different restrictions of sexual behavior.[16]

As an example consider the taboo of eating kosher food which is part of the Jewish identity. The strength of this taboo changed over time as there are more individuals that have a Jewish identity but do not obey this taboo. What are the benefits of breaking this taboo?[17] The benefits from deviating from this taboo has nothing to do with the type of food one's eat but with the possibility to socialize with people that has other identities and do not obey the Kosher dietary restrictions.[18] In a period in which socialization is important aspect of life and may provide high private benefits, there is no surprise that more Jewish people deviate from this taboo. Such a behavior of course weakens the taboo. The restriction on socialization with individuals outside the group is also part of the public benefits entailed by the taboo. The restriction on socialization with individuals outside the group had helped to support the Jewish identity without assimilation into other groups (see Slezkine, 2004).

Given our framework a taboo is characterized by the triple $\{T^*,\ N_C^*, N_D^*\}$ such that

(T1) - $T^* = T(N_C^*, N_D^*)$ is the strength of the taboo as defined by the number of individuals that do not violate it.

(T2) - $N_C^* = \# \{\phi \mid V(F(b), \phi, T^*) \geq C(\phi, T^*)\}$ is the expected percentage of individuals for whom the value of the option of deviating from the taboo is greater

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[16] Another example is the taboo against cannibalism that guarantees to members of the society that in dire times when there is a famine they will enjoy some level of security that may guarantee that the society will continue to function.

[17] We are not going to express any position regarding the taste of Kosher food.

[18] Note that obeying Kosher dietary does not just restrict the type of food that ones can eat but also the places that he can eat. One cannot be invited to a dinner at a house of a friend or a colleague that does not follow the Kosher dietary restrictions (unless he/she comes and does not eat –which may be viewed as impolite). One cannot go for a drink with friends or have dinner in a restaurant unless it is a Kosher restaurant.

than the cost of considering such a deviation given that the strength of the taboo is T^*.

(T3) - $N_D^* = \int\limits_{\{\phi|V(F(b),\phi,T^*)\geq C(\phi,T^*)\}} (1\text{-}F(D(\phi,T^*)))\, g(\phi)\, d\phi$ is the expected

percentage of individuals that actually deviate from the taboo. These individuals have considered deviation and realized a private benefit that is above their cost of deviation, i.e., $b \geq D(\phi,T^*)$.

Dynamic adjustment process: In order to consider the stability of a taboo, we define a dynamic adjustment process as follows: Starting from any (N_C^1, N_D^1), the corresponding strength of the taboo is $T^1 \equiv T(N_C^1, N_D^1)$. Given T^1, we can find the number of individuals that consider deviation from the taboo, $N_c(T^1)$, and those who actually deviate, $N_D(T^1)$. The starting point in the second iteration would be $(N_C^2, N_D^2) \equiv (N_C(T^1), N_D(T^1))$. We can now define $T^2 = T(N_C^2, N_D^2)$ as the taboo's strength at the second iteration. For this T^* we can define the number of individuals that violate the taboo. We can proceed in the same manner to define the dynamic adjustment sequence $\{T^k(N_C^{k-1}, N_D^{k-1}); (N_C^k(T^{k-1}), N_D^k(T^{k-1}))\}$.

Definition 1: A **stable taboo** is a taboo that is characterized by $\{T^*, N_C^*, N_D^*\}$ which satisfies (T1) - (T3) and has the following property: For every (N_C, N_D) in the ε - neighborhood of (N_C^*, N_D^*), the dynamic adjustment process converges to (N_C^*, N_D^*).

Maintaining a taboo implies that people will not take certain actions that may benefit them. The social cost of a taboo, denoted as SC(T), is the expected unexploited benefits for the types of individuals who do not consider deviation plus the sum of positive benefits foregone by those who consider deviation but do not deviate whenever the benefits from deviation are smaller than the cost. Hence,

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$$SC(T) = (1 - N_c)\int_0^\infty bf(b)db + \int_{\{\phi|V(F(b),\phi,T^*)\geq C(\phi,T^*)\}} g(\phi)\, F(D(\phi,T)) \int_0^{D(\phi,T)} bf(b)\; db d\phi \quad .$$

Thus in evaluating the overall benefit of a taboo one need to compare the public benefits $E(T)$ with the social costs $SC(T)$.

2.2 The choice of Identity

Choosing an identity is not a simple process. There are different aspects of the identity that cannot be changed at all and they are determined upon birth or at a young age.[19] But people have a choice at least on some aspect of their identity. People leave their society, immigrate, change faith or gender or adopt different sets of values. We assume that people choose their identity and there are no switching costs. Individuals of different types compare the expected benefits from each identity given the different taboos and their strength.

Consider a set $\{I_1,...,I_n\}$ of n possible identities. Each identity is characterized by a different set of taboos with possibly different strength and public benefits. Each identity j has k_j taboos and we let $T_j = (T_{1,j}, ..., T_{kj,j})$ be a vector of taboos strength in identity j and let $T \equiv (T_1,...T_n)$. Let $E_{i,j}(T_{i,j})$ be the public benefit for people of identity j from having their i'th taboo at strength level $T_{i,j}$. We let $E_j(T_j) = (E_{1,j}(T_{1,j}),...,E_{kj,j}(T_{kj,j}))$ and $E(T) = (E_1(T_1),..., E_n(T_n))$. The costs of violating a taboo, considering such a violation and the stochastic private benefit from such a violation are as described in Section 2.1. When an individual chooses an identity I_j he gets the public benefit $\sum_i E_{i,j}(T_{i,j})$ and then he needs to decide whether he is going to consider violating some of the taboos.

Definition 2: A **Stable Identity system** with respect to $\{I_1,...,I_n\}$ is
- T^* - A full specification of taboos' strength.
- $A^*(\phi|T^*): [\bar{\phi},\underline{\phi}] \rightarrow \{I_1,...,I_n\}$ is an assignment of individuals to different identities given their type ϕ and the taboos' strength T^*.
- $N^*_c(i,j|\ T_{i,j}^*)$ and $N^*_d(i,j\ |\ T_{i,j}^*)$ are the percentage of individuals of identity j that consider a deviation and (respectively) actually deviate from taboo i.

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[19] Gender, caste, family, sometimes nationality - are all examples of elements of the identity that are not chosen and cannot be changed easily.

Such that

(i) $T_{i,j}{}^* = T(N^*_c(i,j| T_{i,j}{}^*), N^*_d(i,j | T_{i,j}{}^*))$ - the strength of each taboo is determined by the percentage of individuals that consider violating it and those that actually choose to violate it.

(ii) No individual would like to switch his identity; the assignment function $A^*(\phi|T^*)$ describe the optimal identity choice of all types of individuals.

(iii) $N^*_c(i,j| T_{i,j}{}^*)$ and $N^*_d(i,j | T_{i,j}{}^*)$ is consistent with optimal behavior of individuals as specified in Section 2.1.

Remark: Our setup assumes a free mobility between identities without any restriction. We also assume a complete seperability between taboos; the strength of each taboo and the public benefits from it do not depend on other taboos. But in reality it is possible that some of the taboos are shared by different identities and the behavior of the members of all these identities affect the strength of these taboos. Another possible effect that we ignore is the possible interdependence between taboos. That is, it is possible that the strength of one taboo is affected by the strength of other taboos that are part of the same identity. In particular the cost of deviating from one taboo may depends on the other strength of other taboos.[20]

3. Stable Taboos and Private Benefits

3.1 A Simple Setup

Consider a simple version of the above model.

- $C(\phi,T) = \lambda T\phi$ is the cost of considering deviation from a taboo.

- $D(\phi,T) = \delta T\phi$ is the cost of deviating from a taboo; $\delta > \lambda > 0$.

- $T(N_c, N_d) = \alpha_c(1-N_c) + \alpha_d(1-N_d)$ is the strength of the taboo, where $\alpha_d > \alpha_c$.

- $G(\phi) =$ the distribution of types in the population, assumed to be uniformly distributed on [0,1],

- The benefits from deviating from the taboo is b with probability q and 0 otherwise.

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[20] When an identity is defined by a long list of taboos then it is possible that the cost of deviating from one of them is not that high as the deviator maintains most of the characteristics of his/her identity.

- The public benefits of deviation are $E(T) = ET$.

3.2 Stable Taboos

Consider the behavior of an individual of type ϕ who belongs to a society that maintains a taboo of strength T. If the individual has already considered violating the taboo, he will violate it whenever the benefit from doing so is greater than $D(\phi,T)$, i.e., whenever $b \geq \delta T \phi$. The cost of considering deviation is $\lambda T \phi$; if an individual does not plan to deviate from the taboo upon obtaining a positive realization of his/her private benefits, there is no reason for him/her to consider such an option. Thus, the value of the option to deviate from the taboo is $V(F(b), \phi, T) = q[b - \delta T \phi]$. An individual will consider deviating from the taboo only when the value of the option $V(F(b), \phi, T)$ is greater than the cost of deviation, i.e., whenever

$$(1) \qquad q[b - \delta T \phi] \geq \lambda T \phi$$

Since the cost of considering a deviation as well as the cost of deviation itself are increasing in ϕ, there is a threshold $\phi_c(T,b,q)$ such that only individuals of type $\phi \leq \phi_c(T,b,q)$ will consider deviating. Using (1), ϕ_c is defined as follows:

$$(2) \qquad \phi_c(T,b,q) \equiv Min\left\{\frac{qb}{(\lambda + q\delta)T}, 1\right\}.$$

The strength of the taboo is endogenously determined by the proportion of the population that considers breaking it and those that actually break it. Letting ϕ_c be the proportion of individuals that consider breaking the taboo, then $q\phi_c$ will be the proportion of individuals that actually break it.[21] $T(\phi_c)$, the strength of the taboo, is therefore given by:

$$(3) \qquad T(\phi_c) = \alpha_c(1-\phi_c) + \alpha_d(1-q\phi_c) = (\alpha_c + \alpha_d) - (\alpha_c + q\alpha_d)\phi_c \;.$$

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[21] Since proportion q of the individuals that consider deviating actually deviate (after observing a positive private benefit realization), we get that $N_d = q\phi_c$.

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An individual of type $\phi=0$ will always consider deviating from the taboo as such an individual does not suffer from any costs associated with violating (or considering violating) of the taboo. The presence of individuals of this type implies a setting in which there is always some proportion of the population that violates the taboo.[22]

Our definition of a taboo is therefore a couple (T, ϕ_c) that satisfies equations (2) and (3). We depict these two conditions in a $(T \times \phi_c)$ space (see Figure 1). Condition (2) describes the percentage of individuals who consider deviation as a function of T (the taboo's strength) while condition (3) describes the strength of the taboo as a function of the percentage of people that consider deviation, ϕ_c. Condition (2) is a convex declining curve while condition (3) is a linearly declining line.
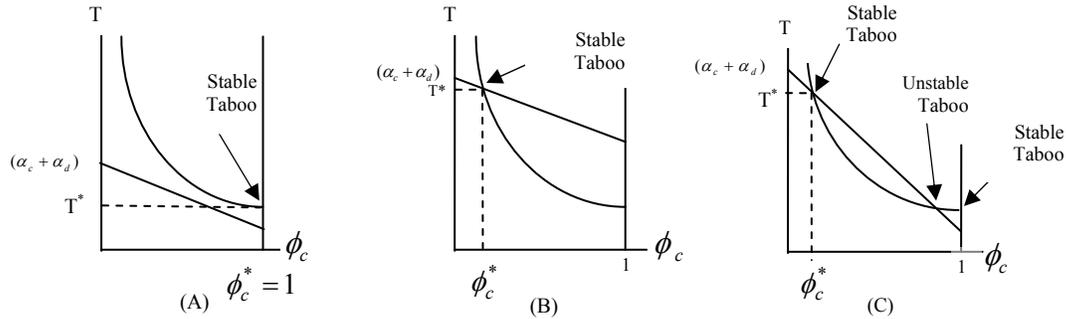

Figure 1: Stable and unstable taboos in the simple setting.

Three possible scenarios are depicted in Figure 1:

Case (A): When there is no intersection between conditions (2) and (3), the only solution is no taboo ($\phi_c^*=1$), i.e., all individuals consider deviation. This is a stable situation. If there are some individuals who do not consider deviating from the taboo, the dynamic adjustment process will converge back to $\phi_c^*=1$ since the strength of the taboo is sufficiently low to induce these individuals to change their behavior and consider violating the taboo after all.

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[22] Whenever there are fixed costs of deviation (independent of the type) or when the distribution of ϕ is such that $\phi > \phi_{\min} > 0$, we may obtain stable taboos that no one considers violating.

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Case (B): There is only one intersection between conditions (2) and (3). This point, denoted as (T^*, ϕ_c^*), is a stable taboo.[23] In terms of the dynamic adjustment process, the curved line describes the adjustment function $\phi_c^t(T^{t-1})$ while the straight line describes $T^t(\phi_c^{t-1})$, i.e., the strength of the taboo at period t as a function of the percentage of people that consider deviating in the previous period. Suppose that at period t, $\phi_c^t > \phi_c^*$. Using the dynamic adjustment process we can define $T^{t+1}(\phi_c^t)$ and to obtain that $\phi_c^{t+2}(T^{t+1}(\phi_c^t)) < \phi_c^t$, with the adjustment process converging to (T^*, ϕ_c^*).

Case (C): There are two intersections between conditions (2) and (3). The intersection on the left has the same properties as the intersection in case (B) and therefore defines a stable taboo, the second intersection is not a stable taboo. The point $\phi_c = 1$ has the same properties as described in case (A) and defines a second stable taboo.

Note that the social cost of the taboo is defined by the private benefits that are foregone from maintaining such a taboo, i.e.,

$$(4) \qquad SC(T) = (1 - \phi_c(T))qb \ .$$

3.3 The Effect of Greater Private Benefits on Taboos

Taboos change over time; some become stronger while others disappear. Part of this process is clearly a result of social and demographic changes. But taboos may also change as a result of variations in the distribution of private benefits. New inventions and ideas as well as new opportunities may imply changes in the distribution of private benefits. Having a higher *b* affects the incentives available to individuals should they deviate from the taboo or even just consider such a deviation. Greater private benefits therefore lead to more deviations and a weaker taboo, which in turn encourages further deviations. Such positive feedback implies that the process of weakening the taboo is not necessarily continuous.

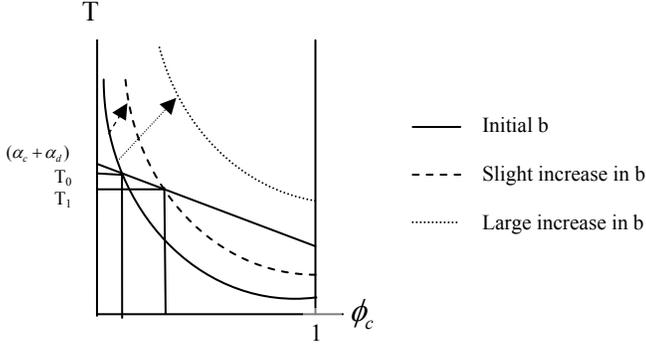[23] Observe that the point $\phi_c = 1$ is not a stable taboo.

Figure 2: Effect of increasing b on stable taboos.

The effect of a higher b is described in Figure 2. Changing b does not affect condition (3) as it describes the strength of the taboo as a function of individual behavior. Condition (2) describes the incentives to deviate as a function of the taboo's strength. These incentives increase with the private benefits gained from deviation. When b increases, the intersection points between the two curves shift to the right, which implies a weaker taboo as more people consider deviation.

Weakening the taboo is not necessarily a continuous process. There is a critical level of b, denoted as $\hat{b}$, such that whenever $b > \hat{b}$, condition (2) will be above condition (3). The critical $\hat{b}$ is given by

$$(5) \quad \hat{b} \equiv \frac{(\alpha_c + \alpha_d)^2 (\lambda + q\delta)}{4q(\alpha_c + q\alpha_d)}.$$

This point also defines the weakest taboo that may still hold:

$$(6) \quad T^* = \frac{\alpha_c + \alpha_d}{2}; \phi_c^* = \frac{\alpha_c + \alpha_d}{2(\alpha_c + q\alpha_d)}$$

Clearly, the necessary condition for such discontinuity is that $\phi_c^* < 1$, which will be satisfied whenever $q > \dfrac{\alpha_d - \alpha_c}{2\alpha_d}$. When q is below this level, the adjustment of the taboo's strength is continuous until the taboo slowly disappears. Only when b is sufficiently large is the process discontinuous. We conclude the following:

Proposition 1: A higher b (potential private benefit) implies an erosion of the taboo's strength, i.e., a lower T^*, with more people considering deviating (a higher ϕ_c). The process of taboo erosion is not necessarily continuous. When $q > (\alpha_d - \alpha_c)/2\alpha_d$, a small increase of b above $\hat{b}$ eradicates the taboo and induces all members of society to consider deviation.

Proof: See Appendix 1.

Note that temporary changes in the private benefits may cause permanent changes in the taboo's strength. Suppose that the starting point is case (c) (Figure 1), with the stable taboo at the point on the left that represents a sufficiently strong taboo so that a proportion of the population does not consider deviation. Suppose now that the private benefit b rises sufficiently such that the curved line is above the straight line (case (a), Figure 1). The stable taboo has reached the point $\phi_c = 1$ and all individuals consider deviation. Now suppose that b falls back to its original level – so we are back to case (c). According to the dynamic adjustment process specified in Section 1, in such circumstances the taboo remains at point $\phi_c = 1$ and does not converge to its original value.

To illustrate, think about the case in which kidney transplants become easy and the private value of trade in kidneys becomes sufficiently high so that many people deviate from the taboo of trading in kidneys and consider this possibility. Suppose now that due to some technological breakthrough it becomes easy to transplant artificial kidneys. The private benefit from trading in kidneys will then decline although we do not expect that the taboo against such trade will return to its original level of strength.

4. Social Heterogeneity and Taboos

Does the effectiveness of taboos depend on social homogeneity? Some societies are characterized by a homogenous population while others have a more diverse population with a more heterogeneous preference distribution. Heterogeneity can be with respect to the distribution of private benefits or in the effectiveness of social costs and punishment. The question is whether it is easier to maintain a stronger taboo in

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homogeneous or in heterogeneous societies? Clearly, the answer depends on the type of preferences individuals have in the society. In one homogeneous society individuals may not care about social costs while in another everyone is very much concerned with social costs. Thus, in order to examine the relationship between the strength of taboos and the homogeneity of society, we vary the degree of homogeneity without changing the average type of individual.

Let's consider our benchmark model but now assume that the type ϕ is uniformly distributed over $[\mu, 1-\mu]$, with $0 \leq \mu \leq 1/2$. Changing μ does not change the average type in the society but a higher μ implies a more homogeneous society. We can thus interpret μ as the degree of population heterogeneity. When $\mu=0$ we are back with our benchmark case; when $\mu=1/2$ we have a homogeneous society in which all individuals are of the same type.

In order to examine the effect of μ on the taboo's strength, let us first examine the two equilibrium conditions, (2) and (3). Condition (2) is derived from the individual's cost-benefit considerations, which depend on his type but not on the distribution of types. Therefore:

$$(2') \qquad \phi_c = \min\{\max\{\frac{qb}{(\lambda + q\delta)T}, \mu\}, 1-\mu\} \quad .$$

Condition (3) defines the strength of the taboo as a function of the percentage of people that maintain it; it thus depends on N_c and N_d, which are given now by:

$$N_c = \frac{\phi_c - \mu}{1 - 2\mu}; N_d = q\frac{\phi_c - \mu}{1 - 2\mu}.$$

Inserting these terms into (4) we derive the new condition as follows:

$$(3') \qquad \begin{aligned} T(\phi_c) &= \alpha_c(1 - \frac{\phi_c - \mu}{1 - 2\mu}) + \alpha_d(1 - q \cdot \frac{\phi_c - \mu}{1 - 2\mu}) = \\ &= [\alpha_c + \alpha_d + \frac{\mu(\alpha_c + q\alpha_d)}{1 - 2\mu}] - \frac{1}{1 - 2\mu}(\alpha_c + q\alpha_d)\phi_c \end{aligned}$$

We can now illustrate these two conditions (Figure 3). Note that as μ increases, condition (3') has a steeper slope and a higher intercept.
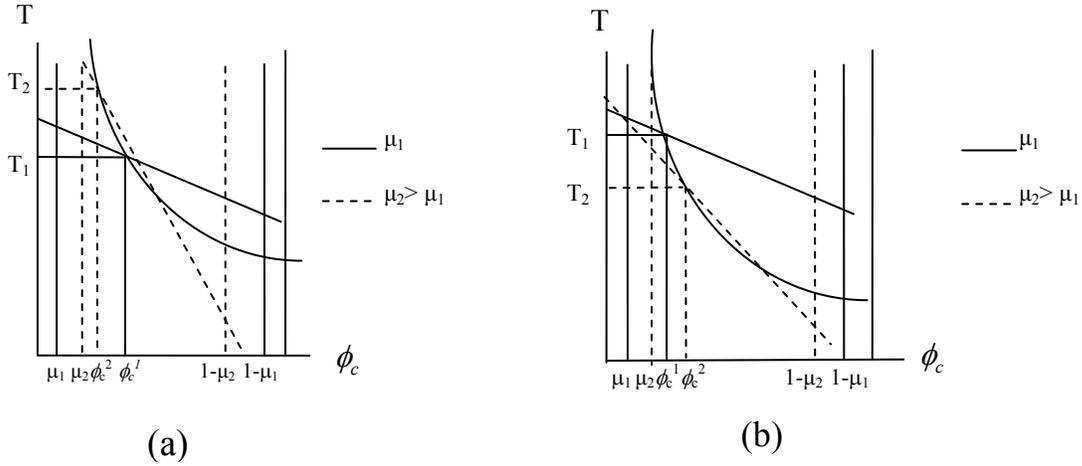
Figure 3: The effect of population homogeneity on a stable taboo.

Figure 3 illustrates two possible scenarios. In both cases we compare the stable taboo in two societies, letting $\mu_2 > \mu_1$, thus assuming that the second society, with μ_2, is more homogeneous than the first society, μ_1. In Figure 3a we describe a homogeneous society, where the stable taboo is stronger as there are fewer people who consider deviation from the taboo. But this is not necessarily the only outcome of a homogeneous society: In Figure 3b we demonstrate the opposite possibility. In this case, the second society is even more homogeneous but there are also more people who consider deviating from the taboo that, as a result, is weaker than in the less homogeneous society.

Proposition 2: (i) For low levels of b, increasing the level of homogeneity will cause the stable taboo to weaken, with more people considering deviation, while for high levels of b, more homogeneity causes the stable taboo to strengthen, with a smaller percentage of the population considering deviation from the taboo.

(ii) The weakest taboo that can be supported in a society is stronger in a more-homogeneous society (given a higher μ).

Proof: See Appendix 2. ∎

We prove Proposition 2 by solving the two conditions (2') and (3') and analyzing the effect of μ on the stable taboo. In the Appendix we show that there are two critical

levels of private benefits, $\bar{b}$ and $\tilde{b}$, where $\bar{b} < \tilde{b}$, such that in case A (Figure 1), where the only stable situation is a weak (or no) taboo in which everyone considers deviating from the taboo, then:

  (i) Whenever $b \geq \tilde{b}$, increasing μ and having a more homogeneous society may induce taboo formation.

  (ii) Whenever $b < \tilde{b}$, decreasing μ and having a more heterogeneous society may induce taboo formation.

  If, however, we have case B or C (Figure 1), such that there is an effective stable taboo (i.e., $\mu \leq \phi_c \leq 1 - \mu$), then:

  (i) Whenever $b \geq \bar{b}$, increasing μ and having a more homogeneous society results in a stronger taboo with less deviation (i.e., for $b \geq \bar{b}$ we have $\dfrac{\partial \phi_{c_1}}{\partial \mu} < 0$).

  (ii) Whenever $b < \bar{b}$, increasing μ and having a more homogenous society results in a weaker taboo with more deviation (i.e., for $b < \bar{b}$ we have $\dfrac{\partial \phi_{c_1}}{\partial \mu} \geq 0$).

  Proposition 2 implies that in more-homogeneous societies, a taboo that is associated with low private benefits provides less temptation to deviate and is weaker than the same taboo in a more heterogeneous society. Alternatively, a taboo that is associated with high private benefits is stronger. This property may have an effect on how different societies adjust to changes in potential private benefits. Returning to our example of organ transplants, if a new invention implies higher benefits for deviating from this taboo, we should expect more resistance to such changes in the more homogeneous society in which the taboo would still be stronger than would the same taboo in a heterogeneous society.

5. Choosing an Identity: The Coexistence of Multiple Identities

  People may choose their identity. Clearly there are aspects of our identity which are beyond our control and determined upon birth into a specific family, tribe, religion, nationality or gender. But there are other aspects of identity which people choose. This

choice of identity defines a dynamic process by which some identities can become more widespread, as more individuals adopt them, while others disappear. Each identity comes with a list of taboos (and social norms) but individual, even when they choose an identity, do not have to follow all the taboos and the norms that this identity prescribes. This creates a setup in which we can endogenize the concept of identity. Some identities do not survive the competition with other identities and will disappear.

We consider a simple scenario that would clarify and demonstrate the endogenous shaping of identities. In this setup, there are two competing identities denoted as A and B.[24] Each identity has only one taboo. The strength of a taboo is endogenously determined in each identity by the percentage of individuals that deviate or consider deviation from that taboo. Hence, there is no influence across identities regarding the strength of the taboos. Each individual needs to choose the identity to belong to and then whether he/she would consider deviating from the taboo and suffering the associated penalty.

We further assume that the taboo's externality function is identical in the two identities, $E_A(T_A) = E_B(T_B)$; hence, the public benefits from the taboos are only a function of the strength of the taboo.[25] Thus, the two identities and taboos are identical ex-ante. One of the questions to be explored is whether population dynamics may result in ex-post asymmetric identities.

A stable identity system with two identities has been defined as (see Def. 2) (T_A^*, T_B^*), an assignment function $A^*(\phi \mid T_A^*, T_B^*)$ that assign individuals depending on their type to the different identities and $\{N_c^*(T_A^*), N_c^*(T_B^*); N_d^*(T_A^*), N_d^*(T_B^*)\}$ which are the percentage of individuals from each identity that consider a deviation and (resp.) actually deviate from each of the taboos. Such that: (i) the strength of each taboo is determined by the percentage of individuals that consider violating it and those that actually choose to violate it, (ii) Given (T_A^*, T_B^*), no individual would like to switch his identity; (iii) the

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[24] As we prove later, in our framework it is impossible to have a stable taboo system with more than two identities.

[25] Clearly in a more general setup we may assume different externality functions but since the externality function is totally exogenous to our model we assume that it is identical in both societies, in order to have a setup in which the choice of individuals will be determined solely on their type and on the behavior of other people in the two groups.

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number of individuals that consider a deviation and actually deviate from each taboo is consistent with optimal behavior of individuals as specified in Section 2.1.

Since we assume that the two taboos are associated with the same externality function, one possible stable identity system is when the distribution of types in each identity would be the same. In this case there is no difference between the two identities. The strength of the taboos is identical and individuals are indifferent between the two identities. The question is if, despite the assumed symmetry, it is possible to have two different types of identities with different distribution of types and different strength of taboos.

An individual of type ϕ who adopts an identity k in which the strength of the taboo is T_k has the option of not considering violating the taboo or to consider such an act and to deviate when there are good realizations. The utility of such an individual from adopting identity k is:

$$(7) \quad U_k(T_k,\phi) \equiv Max\{E(T_k); E(T_k) + qb - (\lambda + q\delta)T_k\phi\} \quad k=A,B.$$

Individuals of type ϕ will choose identity A if and only if $U_A(T_A, \phi) \geq U_B(T_B, \phi)$. Assume now, w.l.o.g., that $T_B > T_A$. Since the two taboos have the same externality function, $T_B > T_A$ implies that $E(T_B) > E(T_A)$. Note that an individual of type $\phi = 0$ is unaffected by social punishment and therefore will choose identity B and consider deviating from its taboo.

The possibility of choosing an identity implies that all the individuals who choose identity A would consider deviating from its taboo. To see this consider an individual who chose an identity A but without considering deviating from its taboo. This individual does not suffer any social punishment but does enjoy the externality associated with the taboo. Since $E(T_B) > E(T_A)$, this individual would be better off belonging to identity B. Thus, all the individuals belonging to the identity A would consider deviating from its taboo.[26]

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[26]This result is sensitive to our specific setup. If we change the externality function or the other primitives, the model can generate a multi-identity society in which there is a mixture of individuals who follow or deviate from the taboo in both identities.

In Figure 4 we show the utilities arising from choosing identities A and B as a function of type ϕ. The horizontal part of the graph presents the choice of obeying the taboo and enjoying the benefits ET_k, whereas the declining part is the utility enjoyed by individuals who adopt the identity but also consider deviating from the taboo. Note that because $T_B > T_A$, U_B is steeper than U_A since $ET_B + qb - (\lambda + q\delta)T_B\phi$ declines faster with ϕ than does $ET_A + qb - (\lambda + q\delta)T_A\phi$.
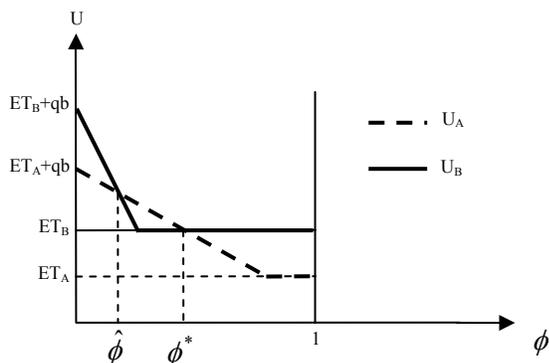

Figure 4: Utilities in a two-identity society.

Figure 4 illustrates the type equilibria that can emerge in this society. When T_A is sufficiently low such that U_A lies fully below U_B, then all individuals prefer identity B, which will become the only identity in the society. Otherwise a two-identity society will emerge, to be characterized by two parameters, $\hat{\phi}$ and ϕ^*. Identity B will consists of types $\phi < \hat{\phi}$, who choose identity B but also consider deviating from its taboo, and types $\phi > \phi^*$, who choose identity B but without considering deviation from the taboo. Identity A would consist of types $\hat{\phi} \leq \phi \leq \phi^*$, who all consider deviation from its taboo.

The two identity society thus has the following interesting structure: There is one relatively homogeneous group that adopts the identity with the weaker taboo. These individuals have moderate social concerns and they all consider deviating from the taboo. The second group is heterogeneous with respect to their social concerns. Although they adopt the identity with the strong taboo, they consist of two sub-groups. One sub-group is comprised of individuals with low social concerns who consider deviating from the taboo

while the other sub-group consists of individuals with strong social concerns who indeed adopt the strong taboo without considering deviating from it.

Assume now that we have three identities $\{A,B,C\}$ such that $T_A^* < T_B^* < T_C^*$. We can repeat our previous analysis to claim that in identity A, all individuals consider deviation from the taboo. If some do not consider deviation, then they are better off belonging to identities B or C. We can repeat the same argument with respect to the individuals that belong to identity B: If they do not consider deviation from the taboo, they are better off belonging to identity C. Hence, identities A and B consist only of individuals that consider deviation. In consequence, the taboo has the same strength in both groups, i.e., $T_A^* = T_B^*$, and the identities do not differ from one another. We can thus conclude the following:

Proposition 3: When there is only one taboo and identities differ only in the strength associated with this taboo then,

(i)   A two-identity society is stable. A multi-identity society with more than two identities is not stable.

(ii)   In a society with two identities, the individuals who adopt the identity with the weaker taboo will always consider deviating from it. The identity with the stronger taboo is more heterogeneous and is adopted by two subgroups of individuals. Individuals of type $\phi < \hat{\phi}$ consider deviating from the taboo and individuals of type $\phi > \phi^*$ do not consider such a deviation.

Proposition 3 considers the individuals' choice of identity when the taboos' strength are exogenously given. The next step is to relate the strength of the taboos to the individuals' choices as well as to identify the conditions under which we may have a stable society with two competing identities.

When $\phi^* \geq 1$, all individuals consider deviation from both identities, which implies that the taboos are of the same strength. Thus, a two-identity society may exist only if $\phi^* < 1$. The critical level ϕ^* can be derived from the indifference of an individual of

type ϕ^* between belonging to identity A and considering deviating from its taboo and belonging to identity B without considering such a deviation. Thus, the first condition is:

$$(8) \quad \phi^* = \frac{ET_A - ET_B + qb}{(\lambda + q\delta)T_A} < 1 \ ,$$

which implies the following restrictions on the parameters:

$$(9) \quad qb < ET_B - ET_A + (\lambda + q\delta)T_A .$$

The second condition is that the line $U_A(T_A, \phi)$ will not lie entirely below $U_B(T_B, \phi)$. In other words, there exists a type ϕ for which $U_A(T_A, \phi) > U_B(T_B, \phi)$. This condition will be satisfied when $U_A(T_A, \hat{\phi}) > ET_B$.

To identify type $\hat{\phi}$, note that this type is indifferent between identities A and B and that no matter what his/her choice is, he/she would consider deviating from the taboo. The type $\hat{\phi}$ indifference condition is:

$$(10) \quad ET_A + qb - (\lambda + q\delta)T_A\hat{\phi} = ET_B + qb - (\lambda + q\delta)T_B\hat{\phi},$$

which yields:

$$(11) \quad \hat{\phi} = \frac{ET_B - ET_A}{(\lambda + q\delta)[T_B - T_A]} = \frac{E}{(\lambda + q\delta)} .$$

Inserting this value into $U_A(T_A, \hat{\phi})$ implies that $U_A(T_A, \hat{\phi}) = qb$; hence, the second requirement for having a stable identity society with two different identities is that $qb > ET_B$. Consequently, the necessary condition for a stable two-identity society is, then,

$$(12) \quad ET_B < qb < ET_B - ET_A + (\lambda + q\delta)T_A .$$

A necessary condition for (12) is that $\lambda + q\delta > E$, which holds when public benefits are not too high and the expected punishment from deviation is not too low. But note that T_A and T_B are endogenously determined, so the question is: Is there a range of parameters for which condition (12) is satisfied, with T_A and T_B consistent with the individuals' behavior and $T_B > T_A$?

Proposition 4: A necessary condition for having a two-identity society is that $\lambda + q\delta > E$. If this condition is satisfied, then for every q there is a range of private

rewards b such that $T_B > T_A$, condition (12) is satisfied and T_A as well as T_B are consistent with the individuals' behavior.

Proof: See Appendix 3.

Remark: The Interaction between identities may not be constrained to competition over the "hearts and minds" of individuals. It is possible that the behavior of the individuals who adopt one identity shapes the taboos (and norms) associated with another identity. For example, in our setting the taboo's strength is determined by the percentage of people who obey the taboo's rules without considering any deviation from them. When a taboo is common to different identities, deviation by members of one identity may affect the strength of the taboo in the other identity. In this case, interactions between the identities may occur via the joint reference group that holds the taboo in common and thus jointly determines the strength of the taboos in both identities.

Concluding Remarks

Economics is mostly about actions. Our actions determine our wealth, our consumption, education etc. Thoughts are not part of the standard economics setting. We may be affected by actions of other individuals but we are not affected by their thoughts. One exception is the bounded cognitive abilities literature that considers the relationship between cognitive bounds, including a bound on the complexity of our thinking abilities, and the actions that we choose. A second exception is the literature on psychological games which assume that intentions matters and player's emotions like surprise or disappointment affect his payoffs (see Geanakoplos et al. (1989) and Rabin (1993)).

But thoughts are very important to us. We enjoy certain thoughts. We are afraid from other thoughts and try to suppress them. We care about the thoughts and the beliefs of our friends and colleagues. Sometimes thoughts are more important than actions. Incorporating thoughts into the standard models is not a simple task. Thoughts are not necessarily observable and more importantly we have a limited control on our thoughts.

Talking about taboos is talking about the unthinkable. Using rational terminology to discuss the possibility of thinking about eating human flash is not a simple task and

may repel some of the readers. In our society one does not need to justify or explain the taboo of not eating (or thinking about eating) human flesh. It suppose to be obvious – as part of our characterization as human beings. These taboos may be obvious under regular circumstances. But a society needs to ask itself what will happened also in special (small probability) circumstances in which the dilemma of violating a taboo is real and practical. It seams that our possible behavior in these special circumstances is part of the definition of whom we are and what is our identity.

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Appendix 1: Proof of Proposition 1

The conditions that give rise to the three cases: Equations (2) and (3) yield a quadratic equation:

$$(\alpha_c + q\alpha_d)(\lambda + q\delta)\phi_c^2 - (\alpha_c + \alpha_d)(\lambda + q\delta)\phi_c + qb = 0$$

We define $\Delta \equiv (\alpha_c + \alpha_d)^2(\lambda + q\delta)^2 - 4(\alpha_c + q\alpha_d)(\lambda + q\delta)qb$

When $\Delta < 0$, we are in case (A).

When $\Delta = 0$, condition (3) is tangent to condition (4).

When $\Delta > 0$, cases (B) and (C) arise:

There are two solutions for the quadratic equation –

$$\phi_{c1,2} = \frac{(\alpha_c + \alpha_d)(\lambda + q\delta) \pm \sqrt{\Delta}}{2(\alpha_c + q\alpha_d)(\lambda + q\delta)}$$

where $\phi_{c_2} > \phi_{c_1}$

When $\phi_{c_2} > 1$ we are in case (B).

When $\phi_{c_2} < 1$ we are in case (C).

Using an upper bound for Δ, it is possible to show that $\phi_{c_1} > 0$, $\phi_{c_2} < \dfrac{\alpha_c + \alpha_d}{\alpha_c + q\alpha_d}$.

Conditions on the parameters: We define $\hat{b} \equiv \dfrac{(\alpha_c + \alpha_d)^2(\lambda + q\delta)}{4q(\alpha_c + q\alpha_d)}$

therefore $b = \hat{b} \Rightarrow \Delta = 0$. Thus, for $b > \hat{b}$, we have case (A), and for $b < \hat{b}$ we are in case (B) or (C). A distinction between cases (B) and (C) is achieved by looking at the value of ϕ_{c_2}, as stated above. A sufficient condition could be derived: We are in case (B) when

$\phi_{c_2} > 1$, which is ensured by: $\dfrac{\alpha_c + \alpha_d}{2(\alpha_c + q\alpha_d)} > 1 \iff (1 - 2q)\alpha_d > \alpha_c$,

Since $\alpha_d > \alpha_c$, we can see that for small values of q, we have one stable taboo (case B).

∎

Appendix 2: Proof of Proposition 2 (Heterogeneity of Types):

Equations (2') and (3') yield the following quadratic equation:

$$(\alpha_c + q\alpha_d)(\lambda + q\delta)\phi_c^2 - (\lambda + q\delta)[(\alpha_c + \alpha_d)(1 - 2\mu) + \mu(\alpha_c + q\alpha_d)]\phi_c + qb(1 - 2\mu) = 0 .$$

Define:

$$\Delta' \equiv (\lambda + q\delta)^2 [(\alpha_c + \alpha_d)(1 - 2\mu) + \mu(\alpha_c + q\alpha_d)]^2 - 4(\alpha_c + q\alpha_d)(\lambda + q\delta)qb(1 - 2\mu).$$

$$\tilde{\Delta} \equiv \Delta' / (\lambda + q\delta) = (\lambda + q\delta)[(\alpha_c + \alpha_d)(1 - 2\mu) + \mu(\alpha_c + q\alpha_d)]^2 - 4(\alpha_c + q\alpha_d)qb(1 - 2\mu)$$

$$M \equiv (\lambda + q\delta)[(\alpha_c + \alpha_d)(1 - 2\mu) + \mu(\alpha_c + q\alpha_d)] \quad .$$

Solving the above quadratic equation yields that:

$$\phi_{c_{1,2}} = \frac{(\lambda + q\delta)[(\alpha_c + \alpha_d)(1 - 2\mu) + \mu(\alpha_c + q\alpha_d)] \pm \sqrt{\Delta'}}{2(\alpha_c + q\alpha_d)(\lambda + q\delta)} = \frac{M \pm \sqrt{\Delta'}}{2(\alpha_c + q\alpha_d)(\lambda + q\delta)} \quad .$$

To examine how changes in μ affect the taboo, we examine the following derivatives:

$$\frac{\partial M}{\partial \mu} = -(\lambda + q\delta)[\alpha_c + (2 - q)\alpha_d] < 0 \quad ,$$

and

$$\frac{\partial \tilde{\Delta}}{\partial \mu} = 2(\lambda + q\delta)[(\alpha_c + \alpha_d)^2(4\mu - 2) + (\alpha_c + \alpha_d)(\alpha_c + q\alpha_d)(1 - 4\mu) + \mu(\alpha_c + q\alpha_d)^2] + 8qb(\alpha_c + q\alpha_d)$$

Define:

$$\tilde{b} \equiv \frac{(\lambda + q\delta)[(\alpha_c + \alpha_d)^2(2 - 4\mu) + (\alpha_c + \alpha_d)(\alpha_c + q\alpha_d)(4\mu - 1) - \mu(\alpha_c + q\alpha_d)^2]}{4q(\alpha_c + q\alpha_d)} \quad .$$

$$b > \tilde{b} \Rightarrow \frac{\partial \tilde{\Delta}}{\partial \mu} > 0$$

$$b = \tilde{b} \Rightarrow \frac{\partial \tilde{\Delta}}{\partial \mu} = 0$$

$$b < \tilde{b} \Rightarrow \frac{\partial \tilde{\Delta}}{\partial \mu} < 0$$

We now examine the effects of changes in the degree of homogeneity μ on the percentage of deviation from the taboo:

$$\frac{\partial \phi_{c_1}}{\partial \mu} = \frac{1}{2(\alpha_c + q\alpha_d)(\lambda + q\delta)} \{\frac{\partial M}{\partial \mu} - \frac{(\lambda + q\delta)\frac{\partial \tilde{\Delta}}{\partial \mu}}{2\sqrt{\Delta'}}\} =$$

$$= \frac{-\sqrt{\Delta'}[\alpha_c + (2 - q)\alpha_d] + (\lambda + q\delta)[(\alpha_c + \alpha_d)^2(2 - 4\mu) + (\alpha_c + \alpha_d)(\alpha_c + q\alpha_d)(4\mu - 1) - \mu(\alpha_c + q\alpha_d)^2] - 4qb(\alpha_c + q\alpha_d)}{2(\alpha_c + q\alpha_d)\sqrt{\Delta'}}$$

Define:

$$\bar{b} = \frac{(\lambda + q\delta)[(\alpha_c + \alpha_d)^2(2 - 4\mu) + (\alpha_c + \alpha_d)(\alpha_c + q\alpha_d)(4\mu - 1) - \mu(\alpha_c + q\alpha_d)^2] - \sqrt{\Delta'}[\alpha_c + (2 - q)\alpha_d]}{4q(\alpha_c + q\alpha_d)}$$

We see that for:

$$b < \bar{b} \Rightarrow \frac{\partial \phi_{c_1}}{\partial \mu} > 0$$

$$b = \bar{b} \Rightarrow \frac{\partial \phi_{c_1}}{\partial \mu} = 0$$

$$b > \bar{b} \Rightarrow \frac{\partial \phi_{c_1}}{\partial \mu} < 0$$

Thus, for a small level of b, raising the degree of homogeneity μ will cause the stable taboo to be weaker, with more people considering deviation. For high levels of b, more homogeneity causes the stable taboo to be stronger, with a smaller percent of the population considering deviation from the taboo.

Note also that $\bar{b} < \tilde{b}$. We thus have several possible domains with respect to the value of *b* and the initial state of the taboo:

Start with case A (in Figure 1) such that in effect there is no taboo:

(i). $b > \tilde{b}$: Increasing μ could induce taboo formation.

(ii). $\bar{b} < b < \tilde{b}$: Increasing μ will never create a taboo. On the other hand, lowering μ could induce taboo formation. If a taboo is formed in this domain, further lowering μ would weaken this taboo.

(iii). $b < \bar{b}$: Increasing μ will never create a taboo. Lowering μ could induce taboo formation. If a taboo is formed, lowering μ further would strengthen this taboo.

Now assume that we are in case B or C (Figure 1), in which there is an effective taboo:

(i). $b > \tilde{b}$: Increasing μ strengthens the taboo.

(ii). $\bar{b} < b < \tilde{b}$: Increasing μ strengthens the taboo but can also induce a switch to case A.

(iii). $b < \bar{b}$: Increasing μ weakens the taboo and could also induce a switch to case A. Lowering μ strengthens the taboo but does not induce a switch to case A.

Next, find the weakest taboo that still holds as a function of the degree of population homogeneity:

$$\tilde{\Delta} = 0 \Leftrightarrow \hat{b}_\mu = \frac{(\lambda + q\delta)[(\alpha_c + \alpha_d)(1 - 2\mu) + \mu(\alpha_c + q\alpha_d)]^2}{4q(\alpha_c + q\alpha_d)(1 - 2\mu)} \quad .$$

$$\tilde{\Delta} = 0 \Leftrightarrow \Delta' = 0 \implies \phi^*_{c_\mu} = \frac{\alpha_c + \alpha_d}{2(\alpha_c + q\alpha_d)} - \mu[\frac{\alpha_c + \alpha_d}{(\alpha_c + q\alpha_d)} - \tfrac{1}{2}] \quad .$$

We can now derive the weakest taboo as a function of population homogeneity:

$$T^*_\mu = [\alpha_c + \alpha_d + \frac{\mu(\alpha_c + q\alpha_d)}{1 - 2\mu}] - \frac{1}{1 - 2\mu}(\alpha_c + q\alpha_d)[\frac{\alpha_c + \alpha_d}{2(\alpha_c + q\alpha_d)} - \mu(\frac{\alpha_c + \alpha_d}{\alpha_c + q\alpha_d} - \tfrac{1}{2})] =$$

$$= \frac{\alpha_c + \alpha_d}{2} + \frac{\mu(\alpha_c + q\alpha_d)}{2(1 - 2\mu)}$$

thus: $\mu > 0 \implies \phi^*_{c_\mu} < \phi^*_c$ and $T^*_\mu > T^*$.

For higher levels of homogeneity, we need a stronger threshold taboo.

We now derive conditions on μ, q that ensure $\phi^*_{c_\mu} \in [\mu, \ 1 - \mu]$:

$$\mu \le \phi^*_{c_\mu} \le 1 - \mu \Leftrightarrow \mu \le \frac{\alpha_c + \alpha_d}{2(\alpha_c + q\alpha_d)} - \mu[\frac{\alpha_c + \alpha_d}{(\alpha_c + q\alpha_d)} - \tfrac{1}{2}] \le 1 - \mu$$

$$\frac{(1 - 2q)\alpha_d - \alpha_c}{\alpha_d(2 - 3q) - \alpha_c} \le \mu \le \frac{\alpha_c + \alpha_d}{2(\alpha_c + \alpha_d) + (\alpha_c + q\alpha_d)} \quad .$$

Similarly,

$$\frac{(1 - 2\mu)\alpha_d - (1 - \mu)\alpha_c}{\alpha_d(2 - 3\mu)} \le q \le \frac{(1 - 3\mu)\alpha_c + (1 - 2\mu)\alpha_d}{\mu\alpha_d} \quad . \quad \blacksquare$$

Appendix 3: Proof of Proposition 4.

Eq. (12) states the necessary condition for a two-identity society. This condition requires that

$$(A1) \qquad ET_B < qb < ET_B - ET_A + (\lambda + q\delta)T_A$$

A necessary condition for (A1) to be satisfied is that $\lambda + q\delta > E$.

Yet, a taboo's strength in our model is endogenously determined by the percentage of people who consider deviation from the respective taboo.

First let us find T_A. Since all individuals in group A consider deviating from the taboo, $N_c^A = 1$, which implies that $N_d^A = qN_c^A = q$ and therefore:

$$T_A = \alpha_c(1 - N_c^A) + \alpha_d(1 - N_d^A) = \alpha_d(1 - q).$$

The percentage of individuals who consider deviating from the taboo in group B is:

$$\text{(A2)} \quad N_c^B = \frac{\hat{\phi}}{1 - \phi^* + \hat{\phi}} = \frac{ET_A}{(\lambda + q\delta)T_A - qb + ET_B}.$$

The strength of the taboo is defined by

$$\text{(A3)} \quad T_B = (\alpha_c + \alpha_d) - (\alpha_c + q\alpha_d)N_c^B.$$

Substituting for N_c^B, we derive a quadratic equation, which we can solve for T_B.

We now need to establish that $T_B > T_A$. Using the above terms, this requires that $\alpha_c + \alpha_d - (\alpha_c + q\alpha_d)N_c^B > \alpha_d - q\alpha_d$; collecting terms, this condition is equivalent to requiring that $(\alpha_c + q\alpha_d)(1 - N_c^B) > 0$. This condition is satisfied only when $N_c^B < 1$, which is guaranteed by condition (A1). But condition (A1) does not hold for all combinations of q and b. Solving for T_B and inserting in (A1) yields the following condition:

$$\frac{(\alpha_c + \alpha_d)E + qb - \alpha_d(1-q)(\lambda + q\delta) + \sqrt{\Delta}}{2} < qb < \alpha_d(1-q)(\lambda + q\delta - E) + \frac{(\alpha_c + \alpha_d)E + qb - \alpha_d(1-q)(\lambda + q\delta) + \sqrt{\Delta}}{2}$$

Note that whenever $\lambda + q\delta > E$, the right hand side of this inequality is greater than the left-hand side. Thus, for every q that satisfies $\lambda + q\delta > E$, we can find a range of values of b for which condition (A1) is satisfied and we obtain a non-redundant two identity society. ∎