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Ben Lockwood (Head of the Department of Economics, University of Warwick) and Michael Ward (Head of the Department of Economics, Monash University)

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Miss Congeniality in Crisis: a theoretical model of gender, cooperation and leadership

Jeanne Yi-Ern Cheong*

Abstract

Why do female leaders do better in crisis situations than their male counterparts as a stylised fact? We integrate intrinsic preference into a Leader – Expert coordination game to model the impact of dominant strategies on the effectiveness of crisis management outcomes. We show that given the Leader has intrinsic preference for cooperative (competitive) behaviour, the Expert will reciprocate in kind which results in the highest (lowest) social outcome. Using cultural transmission theory to develop the theoretical micro-foundation of this preference, we find socialisation inefficiencies arising from two-parent socialisation result in the persistence of cooperative traits in women and competitive traits in men, thereby providing a mechanism for more effective crisis management by female leaders. Drawing upon feminist and leadership theory to inform our assumptions, we suggest that collective ability to deal with crisis will be improved if male leaders are more cooperative.

JEL classifications: J16, B52, B54, C71

Keywords: gender; crisis management; cultural transmission; leadership

*Contact jeanne.ycheong@gmail.com | Access Appendix | I would like to first thank my supervisor Weijia Li for his encouragement, enthusiasm and guidance in the course of this research; I also thank Taminka Hanscamp, Robert Gao, Emad Iqbal, Vinod Mishra, Lucy Chan and Vai-Lam Mui for their valuable comments, and extend my appreciation to Gérard Roland for his generosity in sharing additional resources.

1 Introduction

The success of female leaders has garnered much attention over the course of the SARS-CoV-2[1] pandemic in both popular media and academia as nations struggle to manage the global health crisis (see Garikipati and Kambhampati (2021); Wittenberg-Cox (2020); Taub (2020)). Women leaders appear to be carrying not just their own countries through crisis with lower death and case rates, but providing an enviable paradigm of effective crisis management globally based on science, compassion and honesty (Abras et.al (2021); Sergent and Stajkovic (2020)). But this shining public recognition of female leaders jars with the experiences of many women in private and political spaces as entrenched gender inequality continues to manifest in a variety of ways in even the most progressive nations. For example, domestic violence (Aizer (2010)), sexual harassment (Batabyal and Beladi (2020)), the gender wage gap (Oostendorp (2009)) and the 'double bind' constraining women in power (Teele et.al (2018)) are but some of the social and economic challenges faced by women around the world. In this paper, we investigate the stylised observation that female leaders manage crisis situations more effectively than their male counterparts as contextualised within this reality. We identify cooperation as a key mechanism for this difference. We develop a two part model based upon three key assumptions. Firstly, effective crisis management is determined by a leader's ability to cooperate. This is because collaborating with an expert specifically allows the leader to access technical information vital for management of the crisis situation. This conception of leadership success is consistent with the work of Benjamin Hermalin (1998) who argues that access to special information is what distinguishes a leader from their followers. Secondly, to compete is a learned behaviour. Influential psychologists Tomasello and Vaish (2013) confirm that while cooperation is an instinctive response in infants, eventually socially conditioned behaviours emerge and influence behavioural preferences. Indeed, this natural view of cooperation is found within a vast array of disciplines including linguistics (Grice (1991)), philosophy (Tuomela (2000)) and evolutionary biology (Leigh (1971)). Despite the centrality of cooperation to human experience, *homo economicus*[2] is still a persistent tradition within Economics though increasingly challenged by emerging fields within the discipline itself (Thaler (2000)). Finally and most crucially, cooperative behaviour among women is so persistent due to the strong inertia of gender related traits - not necessarily because they are naturally more congenial. In our paper, we identify the particular stickiness of gender related traits resulting from inefficiencies of two parent transmission. Simply, once a gender norm has been established it is very difficult to change thereby explaining its persistence in even socially 'progressive' nations (Tungodden and Willén (2021)). This

[1] More commonly known as *COVID-19* or *novel coronavirus*

[2] Persky (1995) traces the history of 'Economic man' noting Mill's early conception that he 'has four distinct interests: accumulation, leisure, luxury and procreation' (pg. 223). The result of this view is that the significance of activity and actors that fall outside of these categories are often simplified away.

is because parents of the same type socialise their children most effectively however with two parent transmission, parents may be of different types and cannot directly socialise their child at all. The effect of this is self-reinforcing transmission of the established dominant behaviour type which is where men compete and women cooperate. This inefficiency, coupled with the ubiquity of both hostile and benevolent[3] sexism, explains the persistence of gender biased preference for cooperation and competition in even the most gender equal nations. That a particular trait can get stuck and further embed itself through the very process of its own transmission emphasises the self-perpetuating nature of gender inequality and provides evidence for popular rallying cries such as 'you can't be what you can't see.' The impact of this preferential difference for cooperation or competition becomes particularly apparent in times of crisis.

Surveying the existing literature reveals interest in gendered cooperation across a variety of research disciplines. Economic analysis has been largely concerned with quantifying the differences in male and female cooperation through experimental studies to understand how cooperation is influenced by group behaviour (Frey and Meier (2004)), gender difference in economic pro-sociality (Eckel and Grossman (1998)), the gendered behaviour differentials in high competition situations (Dato and Nieken (2014)) and the effect of community structure on expectations about cooperative behaviour (Gneezy et.al (2009)). Such research is necessary to quantify the effects of gender inequality however, often has less to say about how and why these patterns initially emerge (Booth (2009)). Although non-experimental empirical research can still reveal macro-level insights into the patterns of gendered cooperative behaviour when the dataset is sufficiently large (Dube and Harish (2020)), economic approaches often delegate the explanation of drivers of these behaviours to other disciplines that integrate social, psychological and cultural considerations. Consequently, unravelling the origins of cooperative behaviour and its implications for labour organisation and leadership has been largely left to sociology, psychology and feminist theory. Scholarship in this domain is diverse and often interdisciplinary but carries a common theme of how private conceptions of femininity - often characterised by cooperative attitudes, spill over into the public sphere to affect social status (Gerber (2009)) and burden of care work (Folbre and Nelson (2000)) among other concerns. In this kind of scholarship, written argument over formalised modelling is more commonly employed. In some respects 'feminist theory' has become a catchall to refer to research that distinguishes 'male' as a gender in itself through the distinction of a male and female experience. But the explicit reference to gender in economic research is important as its omission can suggest a homogeneity of conclusions even though its inclusion would reveal richer insight. Our research seeks to uncover some of this nuance by bridging this gap between theoretical argument and formal modelling approaches. Drawing on the seminal cultural transmission model of Bisin and Verdier (2001), we integrate micro-founded intrinsic preference for cooperation in women with a simple Leader - Expert game to identify a mechanism for more effective crisis management leadership in women compared to men.

[3]Research has shown that *benevolent* sexism also exists. Glick and Fiske (1996) describes the former as 'a set of interrelated attitudes toward women that are sexist in terms of viewing women stereotypically and in restricted roles but that are subjectively positive in feeling tone (for the perceiver) and also tend to elicit behaviors typically categorized as prosocial (e.g., helping) or intimacy seeking (e.g., self-disclosure)' (pg. 491). Though categorised as 'benevolent' such sexism is still underpinned by conceptions of 'masculine dominance' (pg. 492).

Due to this examination of personal behaviour alongside public outcomes, our research is close to Kashwan (2016) who explores the impact of individual power on cooperation at institutional levels. We distinguish our research by paying particular attention to the role of gender and power as relating to facilitating cooperative behaviour in particular. Our work is then similar to Breen and Cooke (2005) who also use a game theoretic approach to conceptualise gendered behavioural choices. However, rather than empirically test our findings, we utilise cultural transmission theory to model the persistence of intrinsic preference for cooperation in women and competition in men. In order to incorporate gender into our model, we employ two rather than single parent transmission as discussed in Bisin et.al (2004) and Hiller and Baudin (2016).

It not a question of whether crisis will occur, rather when and where. The potential for political, environmental and biological crises looms but is tempered by technological and medical advances that can both predict and manage such situations. Evidently we are not completely defenceless in the face of uncertainty yet despite possessing crisis mitigating information, responses are still largely reactive rather than proactive. We find that this is because leaders and experts must actively work together to access, understand and execute these preventative measures. We show this by developing a simple game where a Leader[4] and Expert decide whether to *compete* or *cooperate* with one another. We find this game takes on a coordination structure such that players prefer to reciprocate the strategy of their partner in order to either both *cooperate* or *compete.* However, by holding the Expert neutral in preference, we show that when the Leader has an intrinsic preference for a *cooperation* (*competition*), a single dominant strategy equilibrium emerges and they will always *cooperate* (*compete*) regardless of what the Expert selects. Realistically, the payoff from a *cooperative* equilibrium is larger than in a *competitive* equilibrium when players do not work together. As found in the cultural transmission section of the model, women are more likely to cooperate while men are more likely to compete thereby identifying a mechanism for more effective crisis management outcomes from female leaders. This model of intrinsic preference, although shows the difficulty of changing behaviours, inadvertently presents a solution for improved crisis management outcomes. We suggest that institutional focus should be on ameliorating social norms that encourages cooperation in men, rather than those that increase competitive behaviour in women.

2 The Leader - Expert Game

The first part of our model is a simple simultaneous game we developed by simplifying a potential interaction between a leader and advisor such a subject matter specialist. There are two players: the Leader who as the name suggests, is responsible for governing a polity, and the Expert who possesses interpretive skill and access to the technical information itself. A crisis situation requiring policy choices provides the context for interaction between players. In

[4]We distinguish discussion of leaders and experts from players in the Leader - Expert game by capitalising the latter i.e. 'Leader' and 'Expert'. Similarly, we italicise *cooperation/cooperate* and *competition/compete* to denote particular strategies in the Leader - Expert game

times of crisis, access to technical information facilitates effective governing decisions. However, it is only the Leader who has the legal jurisdiction and authority to act on this expert information.

Individuals have asymmetric preferences and therefore payoffs between players differ for a given strategy. Payoffs may be influenced by personal aptitude or ability associated with specific activity. In this section of our paper we consider how intrinsic preference for particular strategies, affect the equilibrium outcome.

2.1 Setup of the Model: Intrinsic Preference for Cooperation

We begin by presenting the case when the Leader has an intrinsic preference for cooperation in Figure 1.

		Expert	
		Cooperate	**Compete**
Leader	**Cooperate**	$D-c+p+\Delta V^{ii}$, $D-c+p$	$\frac{1}{2}D-c+\Delta V^{ii}$, $\frac{1}{2}D$
	Compete	$\frac{1}{2}D$, $\frac{1}{2}D-c$	p , p

Figure 1. Normal form of the game where the Leader has an intrinsic preference for cooperation

The Leader satisfies an intrinsic preference if they choose to *cooperate* as represented by ΔV^{ii}. The significance of this notation is found in the next section of our model. We can presently interpret this term as analogous to a single letter. Players make the choice to *cooperate* or *compete* in order to maximise their own utility as denoted by V_r .

Before analysing the base game we note the assumptions of the model

The Players. Suppose that only the Leader has intrinsic preference for cooperation while the Expert remains generalised with no preference for a particular strategy. Neither player has additional characteristics or motivations outside of the direct payoffs noted in the game.

Assumption 1 (Utility function)**.** The Leader's complete utility function is $V_L = \frac{1}{2}D_L - c + \frac{1}{2}D_E + p \cdot t + \Delta V^{ii} \cdot u$. Because we assume the Expert has no preference, their utility is $V_E = \frac{1}{2}D_E - c + \frac{1}{2}D_L + p \cdot t$. If a player chooses to *cooperate* they gain benefit D, however this benefit will be equally divided between both players regardless of whether the other also chooses to *cooperate*. It then follows that if both players *cooperate*, each will receive total benefit D. *Cooperation* requires effort and as such incurs cost c. Because each strategy is a discrete choice of *cooperate* or *compete*, $D_L = D_E = D$. Additionally, $t = 1$ when players choose the same strategy and is otherwise $t = 0$. If the *(cooperate, cooperate)* outcome eventuates, p represents the benefit realised from the increased effectiveness of players working together. Alternatively in the *(compete, compete)* outcome, p represents a 'saving face' reserve payoff. Note that $u = 1$ only if the Leader chooses to cooperate and thereby gains additional utility from their intrinsic preference. If the Leader chooses to compete $u = 0$. Note that D can represent a different benefit for each player which may be tangible and intangible. For example, personal or public support from the public, personal or public support from

peers, both of which can impact the collective behaviour of the public. It may also represnt an individual's satisfaction and resolve to achieve a particular outcome.

Assumption 2 (Cooperation cost)**.** While the strategy of *cooperate* is costly, it is sufficiently small such that $\frac{1}{2}D > c$. This transaction cost may be attributed to the practical time requirements, interpersonal effort or administrative processes necessary for working with another player (see Bianco and Bates (1990); Taylor and Singleton (1993)).

Assumption 3 (Magnitude of p)**.** The value of p is sufficiently large such that $p > \frac{1}{2}D - c$ for both the 'productive bonus' and 'saving face' reserve applications of p.

Assumption 4 (Payoff beneficiaries)**.** The combined payoffs obtained by each player are analogous to the overall social benefit obtained to the community.

Assumption 5 (Magnitude of intrinsic utility)**.** Intrinsic utility is denoted by ΔV^{ii} but interpreted as a single exogenous term. discuss this further in the cultural transmission part of our model.

2.2 Analysis of the Game with Intrinsic Preference for Cooperation

We identify the resulting outcome and any equilibria by examining the payoffs from this game. The Leader only chooses to *cooperate* when the Expert is also *cooperating* if $D - c + p + \Delta V^{ii} > \frac{1}{2}D$. This easily holds given our assumptions of p and c. If the Leader has an intrinsic preference for cooperation, the Leader will choose to *cooperate* when the Expert is *competing* if and only if

$$\frac{1}{2}D - c + \Delta V^{ii} > p. \tag{1}$$

Proposition 1 (Dominant cooperative strategy)**.** When ΔV^{ii} is sufficiently large the Leader with intrinsic preference for cooperation always chooses to *cooperate* regardless of the strategy the Expert chooses to play as their payoff from *cooperation* is larger in both scenarios.

Explicitly, when the Expert *cooperates* and *competes*, the Leader's payoff conditions are $D - c + p + \Delta V^{ii} > \frac{1}{2}D$ and $\frac{1}{2}D - c + \Delta V^{ii} > p$ respectively.

Proposition 2 (Reciprocal cooperation)**.** The Expert is aware that the Leader has intrinsic preference for cooperation and as such also chooses to *cooperate*.

The Expert will never *compete* when the Leader *cooperates* as $\frac{1}{2}D < D - c + p$.

Remarks. A special case occurs when $\Delta V^{ii} = 0$. More simply, when the Leader has no intrinsic preference for cooperation, the game structure yields two equilibria thus no dominant strategy for either player exists. Moving simultaneously, each player prefers to match the other's strategy regardless of whether it is a (*compete, compete*) or (*cooperate, cooperate*) outcome. Examining the payoffs of each situation we observe that this is a coordination game where players have Pareto compatible preference. Given our assumptions about p and c it follows that the combined

payoff for the *cooperative* equilibrium is larger than the *competitive* equilibrium.

2.3 Setup of the Model: Intrinsic Preference for Competition

We now model the case where the Leader has intrinsic preference for competition. This game is almost identical to the game above however, the Leader's intrinsic preference is now attached to the payoffs of their *competitive* strategies. The game is illustrated in normal form in Figure 2.

		Expert	
		Cooperate	**Compete**
Leader	**Cooperate**	$D-c+p$, $D-c+p$	$\frac{1}{2}D-c$, $\frac{1}{2}D$
	Compete	$\frac{1}{2}D+\Delta V^{jj}$, $\frac{1}{2}D-c$	$p+\Delta V^{jj}$, p

Figure 2. Normal form of the game where the Leader has an intrinsic preference for competition

Assumptions 1 - 4 from Section 2.1 hold. The intrinsic preference for competition is denoted by ΔV^{jj}. As before, the significance of this term's notation will become apparent in the next part of the model.

2.4 Analysis of the Game with Intrinsic Preference for Competition

The Leader chooses to *compete* when the Expert is *competing* if and only if $p+\Delta V^{jj} > \frac{1}{2}D-c$. This easily holds given the parameters of p and the addition of ΔV^{jj}. Similarly, even when the Expert is *cooperating*, the Leader will *compete* given that $\frac{1}{2}D+\Delta V^{jj} > D-c+p$.

Proposition 3 (Dominant competitive strategy)**.** When ΔV^{jj} is sufficiently large the Leader with intrinsic preference for competition will always choose to *compete* regardless of which strategy the Expert chooses to play.

This is because their payoff from *competition* is larger in both scenarios. When the Expert *competes* and *cooperates*, the Leader's payoff conditions for *competition* are $p+\Delta V^{jj} > \frac{1}{2}D-c$ and $\frac{1}{2}D+\Delta V^{jj} > D-c+p$ respectively.

Proposition 4 (Reciprocal competition)**.** The Expert is aware that the Leader has intrinsic preference for competition and as such also chooses to *compete* to maximise their own payoff.

The Expert will never *cooperate* when the Leader *competes* as $p > \frac{1}{2}D-c$.

Remarks. Note that the payoff structure when $\Delta V^{jj}=0$ is identical to when $\Delta V^{ii}=0$. In other words, when the Leader has no intrinsic preference for either strategy, a pure coordination game emerges. We emphasise that the combined payoff is larger when the mutual *cooperative* strategy is obtained because $2(D-c+p) > 2(p)$.

The outcome of both games with intrinsic preference in Sections 2.2 and 2.4 are in truth, intuitively unsurprising. Consequently, we turn to the relative size of intrinsic preferences as the point of interest. From Propositions 1 and 3 we see it is necessary for both ΔV^{ii} and ΔV^{jj} to be sufficiently large so that there is incentive to continue playing a dominant strategy of *cooperation* or *competition* respectively. With some rearrangement, the non-reciprocal conditions of players with intrinsic preference for cooperation and competition respectively simplify to $\Delta V^{ii} > c - \frac{1}{2}D + p$ and $\Delta V^{jj} > \frac{1}{2}D - c + p$. Given the assumptions about the value of p and c it follows that $\Delta V^{jj} > \Delta V^{ii}$ as $p + \frac{1}{2}D - c > p + c - \frac{1}{2}D$. There are two possible interpretations of this relationship. Firstly, it is easier to adopt a *cooperative* dominant strategy than it is to maintain a *competitive* dominant strategy. This is because the payoff condition to maintain a *cooperative* dominant strategy with intrinsic preference for cooperation is satisfied at a lower threshold than the *competitive* dominant strategy. This would theoretically result in more instances of leader cooperation and therefore achievement of the payoff maximising *(cooperate, cooperate)* equilibrium. However, given that we continue to observe non-cooperative leaders in real life situations, we instead interpret the larger ΔV^{jj} as reflective of the higher value placed on non-cooperative behaviour.

The next section of this paper explores the origins of the higher value ascribed to intrinsic preference for competition (ΔV^{jj}) to explain how it becomes so pervasive within society.

3 The Proliferation of Cooperation (and Competition)

From where do the intrinsic preferences for cooperation and competition originate? In Appendix B we provide one possible explanation. In summary, patriarchal social systems are manifested through first mover advantage for the male player in a domestic game where players choose how to allocate time between domestic and 'external' work. This advantage results in a single equilibrium of *(compete, cooperate)* for the male and female players respectively instead of two equilibria of *(compete, cooperate)* and *(cooperate, compete)*. The male player therefore develops a dominant strategy to *compete* and the female player adopts a *cooperative* dominant strategy in response. Although played privately, the dominant strategies across numerous households are mutually strengthened over time to become a social norm which can be identified as a 'trait.'

The strategies of *cooperation* and *competition* look different when displayed by a man or woman. As such, each 'type' of trait is a bundle of characteristics for a single set of men and women. It is assumed that children are socialised to an entire bundle of traits and the respective male (female) role in that bundle is adopted by the respective son (daughter). Traits are as follows. The *Traditional* trait denoted by j promotes obvious distinction between the social, emotional and employment expectations between genders. Under this trait, women cooperate while men compete. Alternatively, people with the *Progressive* trait denoted by i demonstrate less rigidity between gender roles. Here

women compete and men cooperate. Having identified how individual strategies of cooperation and competition relate to specific traits, we turn our attention to the cultural transmission approach to explore the pervasiveness of these traits in society.

3.1 Setup of the Model

Our simplified cultural transmission model utilises the foundational notation of Bisin and Verdier (2001) in their seminal paper. We also draw upon their later work with Topa (Bisin et.al (2004)) and the research of Hiller and Baudin (2016) to model cultural transmission with two parents. The original model assumes asexual parental reproduction. As this model directly considers gender roles as a dependent variable, it is necessary that we consider gendered parents and as such further reflect reality with a parental couple.

Suppose there are only two traits in society that cover the entire population. Using q^i (q^j) to denote the fraction of people in society who have the i (j) trait,[5] we assume that each family is comprised of two parents and one child. Parents may be of the same or different type and are known as homogamous or heterogamous parents respectively. There are two means through which a child can be socialised to a trait in a single period: *direct transmission* from parents to child, and *horizontal transmission* from a random 'cultural parent' in the population to child. We assume that only homogamous parents can directly socialise their children as heterogamous parents cannot collectively decide which parental trait to which their child should be socialised.

As such, a child from a homogamous family ii is directly socialised with probability $\tilde{d}^i$ which is comprised of d^i - the endogenous effort parents expend on directly socialising their child, and m - the exogenous probability that a child will be socialised to that trait incidentally by simply observing either parent without specific socialisation effort. It follows that the probability a child from a homogamous family i is horizontally socialised is $(1-\tilde{d^i})$. Meanwhile, a child from a heterogamous family ij may pick up trait i from their i trait parent with probability $\frac{m}{2}$. Because $\tilde{d}^i = d^i + m$, when $d^i = 0$, the probability that a child from a heterogamous family is horizontally socialised is simply $(1-m)$. The respective probabilities can be found for transmission of trait j. We are then able to find the probabilities that a homogamous family ii will have: a child socialised to trait i (eq. 2), a child socialised to trait j (eq. 3), and that a heterogamous family ij will have a child socialised to trait i (eq.).

$$P_{ii}^i = \tilde{d}^i + (1-\tilde{d}^i)q^i \tag{2}$$

$$P_{ii}^j = (1-d^i\tilde{)}q^j \tag{3}$$

[5] Recall that i refers to the *Progressive* trait type and j refers to the *Traditional* trait type.

$$P_{ij}^{i} = \frac{m}{2} + (1-m)q^{i} \tag{4}$$

The probability of direct transmission from parent to child is equivalent to the endogenous level effort (d^i) that parents (as a couple) expend on socialisation in order to maximise their collective utility function. Note that as utility is calculated in parental couples, heterogamous couples have no utility function as neither parent is able to directly socialise the child. Using equations (2) and (3), parental utility is as follows

$$\overbrace{U^{ii}}^{\text{Utility of } ii \text{ parents}} = \overbrace{\underbrace{P_{ii}^{i}}_{\text{Prob } ii \text{ has } i} \underbrace{V^{ii}}_{\text{Value of } i \text{ child}}}^{\text{Expected utility of } i \text{ child}} + \overbrace{\underbrace{P_{ii}^{j}}_{\text{Prob } ii \text{has} j} \underbrace{V^{ij}}_{\text{Value of } j \text{ child}}}^{\text{Expected utility of } j \text{ child}} - \overbrace{H(d^{i})}^{\text{Cost of effort}} \tag{5}$$

Assumption 6 (Imperfect empathy)**.** Bisin and Verdier (2001) note that parents have 'imperfect empathy' when making choices for their children. This means that while they act to maximise their child's wellbeing, it is according to their own preferences. We therefore include parents who display benevolent sexism as part of the *Traditional* group.

Assumption 7 (Cost of effort)**.** The cost to parents (as a couple unit) is assumed to be of the functional form $H(d^i) = \frac{(d^i)^2}{2}$.

3.2 Analysis of the Cultural Transmission Model

Maximising the parental utility function with respect to effort d^i and setting the first order condition equal to zero we find that

$$d^{i} = (V^{ii} - V^{ij})q^{j} \equiv \Delta V^{ii} q^{j} \tag{6}$$

Lemma (Optimal effort)**.** The level of effort a homogamous parental couple ii expend to directly socialise their child has a positive relationship to the fraction of the population with the alternative trait and level of cultural distaste which is denoted by ΔV^{ii} (Bisin and Verdier (2001)). If ΔV^{ii} is large, then the parent values having a child similar to themselves more highly than having a child who is of a different trait.

Given the above probabilities of cultural transmission for each kind of trait, we derive the law of motion to describe how trait i moves through the population. The fraction of people in the next period who identify as trait i is denoted by $\dot{q}^i$ and is calculated as:

$$\overbrace{\dot{q}^{i}}^{\text{New } i} = \overbrace{\underbrace{P_{ii}^{i}}_{\text{Prob } ii \text{ has } i} \underbrace{q^{i}q^{i}}_{ii \text{ marry}}}^{ii \text{ with child } i} + \overbrace{\underbrace{P_{jj}^{i}}_{\text{Prob } jj \text{ has } i} \underbrace{q^{j}q^{j}}_{jj \text{ marry}}}^{jj \text{ with child } i} + \overbrace{\underbrace{P_{ij}^{i}}_{\text{Prob } ij \text{ has } i} \underbrace{q^{i}q^{j}}_{ij \text{ marry}}}^{ij \text{ with child} i} - \overbrace{q^{i}}^{\text{Initial } i} \tag{7}$$

Proposition 5 (Law of motion)**.** With some expansion and simplification, $\dot{q}^i$ becomes $q^i(1-q^i)(d^iq^i - d^jq^j) - q^iq^j[q^i(1-m)+\frac{m}{2}]$.[6] Substituting our identified solution for optimal parental effort results in

$$\dot{q}^i = q^i(1-q^i)(q^jq^i(\Delta V^{ii} - \Delta V^{jj})) - q^iq^j[q^i(1-m)+\frac{m}{2}]. \tag{8}$$

In Appendix C we show the law of motion of single parent transmission to be $q^i(1-q^i)(\Delta V^{ii}q^j - \Delta V^{jj}q^i)$.

Corollary 1 (Inefficiency of transmission)**.** Transmission in a two parent model is slower than transmission in a single parent model.

This can be seen through the entirely separate term subtracted from an otherwise similar base form in Equation 8. This term is equivalent to the probability that a child of heterogamous parents is socialised to trait i (P^i_{ij}). That the term is subtracted reflects the inefficiency of transmission from heterogamous marriages as each parent in the couple relies upon random socialisation from a cultural parent to socialise the child to their desired trait. This inefficiency does not exist in the single parent model as parents do not need to match with another parent to procreate, and as such all parents have direct control over how likely it is that their child will be socialised to their trait through the effort they expend.

Corollary 2 (Population size impacts)**.** The two parent model shrinks the base size of transmission compared to the single parent model.

In the former, the parental fractions of the population are multiplied together and squared. The result is clearly smaller than in the latter case where they are multiplied once. Additionally, changes to the population size of each trait type has implications on probabilities of socialisation. Supposing that $q^j > q^i$, the majority trait population has a socialisation advantage. The larger q^j, the more likely that a person socialised to trait j will be able to find a fellow trait j person to form a homogamous marriage. In turn this family can directly affect $\tilde{d}^j$, that is, the probability with which their child is directly socialised to trait j. Conversely, it is more likely that a person socialised to trait i will have to form a heterogamous family and as a result, rely on socialisation by a cultural parent. This cultural parent has a higher probability of being of the majority trait which in this example is j.

Corollary 3 (Cultural distaste impacts)**.** The larger the gap in cultural distaste for ii parents towards trait j and cultural distaste for jj parents towards trait i, the faster the dynamical equation moves.

Cultural distaste of ii parents is unlikely to be large in the first place. In reality, the argument that *Progressive* (trait i) families will not display even benevolent sexism as described in Assumption 6 is unlikely to be maintained. This is because while the hostile sexism in the traditional trait would be explicitly rejected, the pervasiveness of benevolent sexism can be difficult to identify even in a progressive household. The consequence of this is then a dulled awareness

[6] See Appendix A for the full working.

of this form of gender norms and therefore reduced cultural intolerance for *ii* parents.

Remarks. Through the law of motion equation, we can see that gender related traits in general move more slowly through populations due to the fact that families require two parents to create and then efficiently socialise offspring. Thus particular attention is needed to change cultural traits such as gender where unanimous consent of both parents is necessary. Conversely, changing other cultural norms where only one parent is needed is much easier. In its most extreme form, a trait may in fact be in decline due to the initial level of cultural intolerance. Decline of trait i occurs when $\Delta V^{jj} > \Delta V^{ii}$. We can now return to the findings of our Leader - Expert game as discussed in Section 2 and emphasise the identical notation of intrinsic preference and cultural distaste. Although exact interpretations of these term slightly differ - intrinsic preference for own behaviour in the Leader - Expert game, and cultural distaste of child's type, they are analogous in practice. Noting that the Leader - Expert game is genderless, we assume the intrinsic preference notation ΔV^{jj} and ΔV^{ii} represents the preference of a man specifically. This allows us to equate intrinsic value for competition, with cultural distaste for the traditional trait – both shown by j. Conversely, the intrinsic value for cooperation can be equated with cultural distaste for the progressive trait – both shown by i. In the leadership game with intrinsic preference it was found that $\Delta V^{jj} > \Delta V^{ii}$. Thus the cultural intolerance of trait j leads to the decreasing population size of people socialised to trait i. This is a self-reinforcing mechanism. As more people are socialised to trait j, more people develop the cultural intolerance ΔV^{jj} which further propagates trait j in society until the trait i population disappears. Recall that trait j represents the traditional trait type which promotes competition in men and cooperation in women.

One caveat against such an extreme dynamical result, is that in reality it is possible that some people with traditional traits have *negative* cultural distaste ($\Delta V^{jj} < 0$). In this case trait j parents actively try to unlearn behaviours and value a child socialised to the other trait. This opportunity for changes to cultural distaste is not accounted for in this cultural transmission model as it is assumed children immediately socialise *their* children as parents in the next period. More simply, there can be a change in cultural distaste levels within a generation if parents make a conscious effort to 'resocialise' themselves as adults then pass on the i trait to their child thereby tempering the declining effect slightly. The model also simplifies this observed reality out by assuming d^j is individually determined but then interpreted as population wide aggregated cultural distaste when it appears the law of motion equation. We assume that resocialisation is costly in itself which prevents mass negative cultural distaste from eventuating.

4 Discussion

The cultural transmission model in Section 3 provides a dynamic explanation for the enduring nature of gender social norms that result in an intrinsic preference for cooperation in women and competition in men. The leadership game

in Section 2 demonstrates how the intrinsic preferences of leaders affects achievement of the optimal equilibrium in coordination games with experts. Considering the implications of both games, we arrive at an explanation for the stylised observation that female leaders are better at managing crisis than their male counterparts.

It is summarised as follows. Women are socialised to have a stylised intrinsic preference for cooperation and thus cooperate more than men (see remarks from Section 3.2). Female leaders continue to value cooperation such that their expert colleagues reciprocate and both parties obtain the highest combined payoff (see Propositions 1 and 2 in Section 2.2). Conversely, men are socialised to have an intrinsic preference for competition and thus compete more than women. Male leaders also values competition and as such their expert colleagues reciprocate in kind leading to the suboptimal combined payoff (see Proposition 3 and 4 in Section 2.4). Access and quality of technical information from experts is critical for effectively managing emergency situations thus female leaders are more successful in times of disaster.

This view of information and the leader in crisis situations is consistent with Hermalin's influential 1998 paper (see also Komai et.al (2007)) which claims that a leader maintains followers because they possess special information the followers do not have. Intuitively, the proposition that information is a key instrument of effective crisis management responses is consistent with our understanding of asymmetric information. Individuals within society have aims that often require collaboration with others in the group. Consequently, a leader who can coordinate individuals based on the private or specialised information each holds is critical. It is also only the leader who has the authority to act on this special information and can be the connection across sources and jurisdictions (Rose (1993)). Conversely, only the expert has the special information and interpretive skill to make this information meaningful for the leader. The payoffs in our game reflect another implication of Hermalin's research: that a difference exists between *actually* having special information, and *pretending* to hold special information. We identify the latter scenario as an example of competitive behaviour from leaders. Competition is characterised by disregard for the occupational authority the other player holds and includes attempts to project the role of the other player onto themselves. For example, a leader may believe there is political gain if they do not seek advice from experts because followers view them as 'strong' and 'independent'.[7] Alternatively, they may apply the expert information in a partisan, politicised way that obscures the true conclusions of the special information. On the other hand, a competitive expert may try to use their knowledge to become the 'leader' themselves and bypass jurisdictional convention. A cooperative leader defers to expert information even if it does not necessarily 'fit' with their political aims.

We now consider three sketches of crisis management responses as relating to the first year of the COVID-19 pandemic crisis to illustrate the outcomes of Leader - Expert game in actuality.

[7] Waylen (2021) observes that performances of hyper-masculinity in leaders including Trump, Johnson, Bolsonaro and Duterte such as ' risk-taking behavior, downplaying of the virus, and reluctance to implement or adhere to mitigation policies contributed to comparatively low levels of trust in scientific advice and adherence to Covid mitigation rules.'

Leader as Expert

If the Leader undermines the Expert's authority to position themselves as an expert in their place, the Leader chooses to *compete* with the Expert. That a leader chooses not to reciprocate the actions of the expert reflects their higher utility and therefore intrinsic preference for competition as the cost of cooperating for any player is arbitrarily small. This is consistent with our finding in Section 2.2 that $\Delta V^{jj} > \Delta V^{ii}$. One obvious example of the 'Leader as Expert' scenario is USA under President Donald Trump and Dr Anthony Fauci in 2020 until the former left office. As has been well documented in print, television and online coverage (Paz (2020)), Trump repeatedly minimised the risks and severity of COVID-19 comparing it to the seasonal flu, claimed that it would disappear one day without explanation and disparaged the effectiveness of protective measures such as masks. The majority, if not entirety of this was in direct contradiction to the advice and expertise of Fauci, Director of the National Institute of Allergy and Infectious Diseases as well as key personnel on the national Coronavirus Taskforce. Trump went further than to undermine the expert health advice when he presented himself as an expert of sorts by suggesting alternative and unsubstantiated treatments such as injecting disinfectant and light therapy (Broad and Levin (2020)) as well as appropriating drugs for other ailments such as hydroxychloroquine which have since been disproven (Kravitz (2020)). Trump's approach to the unfolding crisis hampered the overall management of the pandemic as he normalised the spread of misinformation and weakened public compliance by contradicting state level mandates (Walters (2020)).

In practice, the extent of an expert's reciprocal competition or cooperation is likely to be influenced by the severity of crisis and individual sense of duty to the role or institution. This is likely the case here as Fauci continued to supply information to Trump despite ongoing personal and professional attacks. This was characterised by his later comments that he was 'really focussing like a laser beam on what...[the] goal is. [I] am a scientist and I am a physician. My goal is to help develop vaccines' (Fauci (2020)). Nonetheless, regardless of the Expert's choice to reciprocate, so long as the Leader is *competing*, the equilibrium will not be the optimal outcome. Indeed, by the end of 2020 the number of deaths had reached 341,199 (CDC (2020)), almost 100,000 more casualties than the combined number of American deaths from the Korean, Vietnam and First World War alone (Waxman and Wilson (2021)).

Expert as (de facto) Leader

At times the Expert passively *competes* when they fail to sufficiently defer to the Leader. Noting that our model supposes the Expert remains generalised and without particular strategic preference, we speculate about the consequences of the Expert's intrinsic preference for competition. Doing so reveals that whether experts compete may be affected at least in part by exogenous forces such as public support. Specifically, although experts may not explicitly seek this power, by accepting and capitalising on media coverage, the expert becomes a de facto leader. A plausible example of this is Dr Anders Tegnell of the State Epidemiologist of the Public Health Agency of Sweden. Highly trained in

the area of infectious diseases, he has come to be considered a cult figure and primary 'architect' of Sweden's relatively relaxed response to the pandemic. This included minimal restrictions and no masking requirements. While it is almost impossible to directly compare the outcomes of virus management policy due to even the most minor differences between nations, taking the most baseline measures, Sweden recorded four to ten times more deaths than its Scandinavian neighbours (Claeson and Hanson (2021)) for relatively little economic gain (Mann (2020)).

The pandemic has revealed significant fault lines across demographics that mediate the degree of impact of the virus from likelihood of contraction, health risks, economic burden of restrictions and access to vaccination. One such division is between lower socio-economic and new migrant communities who are more likely to face a higher risk of death or serious illness and economic fallout from shrinking casual or unskilled employment. The COVID-19 virus has also been particularly threatening for older populations (OECD (2020)). Undoubtedly, each management policy pathways is complex and ultimately require an imperfect solution. This holds regardless of whatever the strategy may be. However, excessive veneration of an unelected expert and their policy direction (O'Shea (2020)) can obstruct accountability as minority groups with less political voice or community engagement is overlooked in for the sake of a singular goal or narrative. To mitigate this risk experts must work with their leader as it is the leader who has oversight, jurisdictional authority and obligations over the entire expanse of actors, issues and levers that make up the state. We can thus conclude that a functional relationship between leader and experts is critical for both the practical and ethical accountability of policy decisions.

Expert Leading with Leading Experts

It is clear then that we need not just 'good' leaders and 'smart' experts, but leaders and experts who work together. This is consistent with our finding that both players in the Leader - Expert game choosing a *cooperative* strategy results in the highest combined payoff when intrinsic preference is equal to zero. This also holds when traits are added in the Leader - Expert game with traits. The case of the first female President Tsai Ing-Wen of the Republic of China (Taiwan) and her Vice President, provides a compelling example of such a relationship.

According to the Constitution of Taiwan, the role of Vice President is largely ceremonial. Indeed, their greatest responsibility is transient in that their key role is to take over for the President[8] if required, thereby ceasing to technically be Vice President. Despite this, President Tsai Ing-wen - the first female President of Taiwan, looked to her Vice President, Dr Chen Chien-jen for crucial support from the outset of the pandemic. With a doctorate in epidemiology from John Hopkins University, substantial research contributions and appointment as Health Minister for three years prior to the Vice Presidency, Chen had both technical understanding of the crisis at hand as well as familiarity with the practicalities of political life (Hernández and Horton (2020)). Wielding relatively little personal power, he was required to work with and under the leadership of Tsai. For her part, the President recognised the benefits of delega-

[8] Article 49

tion and in giving up some of her own personal authority to a trusted deputy was able to enact a crisis response policy based on speed and communication that was the envy of the international community. Indeed by April 2020 - only three months after the Taiwan Centre for Disease Control (CDC) identified the virus as an emerging communicable disease, Taiwan had achieved technical elimination of the virus without a complete lockdown (Summers et.al (2020)).

Incidentally, the Taiwanese case also draws attention to the additional need for cooperation between the institutional organisations themselves to which the Leader and Expert belong. In 2003, Chen's appointment to Health Minister was a daunting prospect as the country was in the midst of the SARs outbreak. A central responsibility of his role was the redevelopment of the nation's crisis management systems regarding infectious diseases. Since then, Taiwan has maintained a robust network of information sharing and coordination between essential management agencies. Thus when pandemic emerged again in 2020, all relevant management bodies were already in a cooperative relationship alongside Tsai and Chen. This was largely facilitated through the Central Epidemic Command Centre that funnelled information and other micro level networks together (John Hopkins (2020)). Consequently, we see that strong infrastructure linking the institutions both expert and leader represent mirrors the relationship of individual experts and leaders.

Evidence for the *Double Bind*

Through each of these vignettes, we see how our simplified Leader - Expert games and respective equilibria are consistent with observed crisis management situations. We have so far avoided discussion on how preference for cooperative behaviour in female leaders as shown in the cultural transmission section of our model, corroborates key concerns in gender scholarship. To address this we turn to the concept of the *double bind* to show how cooperation in the private sphere affects preference for cooperation in positions of power. Jamieson (1995) describes the double bind as an impossible situation where the subject is expected to fulfil two roles simultaneously. Crucially, social norms create a false dichotomy that portray these roles as distinct and incompatible. She summarises the dilemma as such: 'women who are considered feminine will be judged incompetent, and women who are competent, unfeminine' (pg. 16). Thus the crux of the double bind ultimately rests on the qualities and behaviours that the subject *should* display but is seen to not. Furthermore, these competing norms are distinctly gendered such that breaking out of the mould requires significant personal burden for some groups in particular. Because archetypal leadership qualities are associated with 'masculine' ways of being such as 'strength, authority and decisiveness' Appleby (2015), escaping this trap is almost impossible for female leaders. This is because the notion of what is 'feminine' is intricately linked with expectations about women's role in domestic life - specifically, motherhood, childrearing and homemaking. Clearly, the role of politician is demanding regardless of gender and so it is reasonable to expect that family compromises or

arrangements are made - for example, the other parent is the full-time child carer. For male politicians, this poses no problem as leadership expectations are aligned with 'masculine' behaviour. However, for female politicians, to do the same is perceived as failure to fulfil the parallel expectation of 'feminine' behaviour in whole or in part and often results in public castigation. Former Australian Prime Minister Julia Gillard (Hall and Donaghue (2013)) and former US senator, Secretary of State and First Lady Hillary Clinton (Jones (2016)) provide two high profile examples of the intense media scrutiny and political undermining that occurs when female leaders reject the mould. In truth, rejection or more saliently - the *perception* of rejection of these norms is hard to avoid, even without active effort on the part of the subject. This highlights the very impossibility of satisfying the double bind.[9] Upon deeper reflection, we thus find that there are in fact two layers to female leaders' intrinsic preference for cooperation.

The first is unconscious and consistent with broader scholarship about cultural transmission that occurs at an individual level. Being part of a club, community group or even member of general society results in valuing behaviours that make one similar to others. As shown by our model, just as parents derive value from having a child like themselves, we can assume that the child values being like their parent to the extent that they in turn pass on that hereditary trait to their own child. However, in considering the applied concept of the double bind, we uncover a second, more nuanced type of preference for cooperation. This time, the woman in power knows that she is subject to the double bind. As a result she recognises that like the proverbial porridge she must be *just right* - in other words, 'assertive' enough to adequately lead, but also 'feminine' enough to avoid political and personal derision from the public if she deviates from perceived social gender norms. Consequently, feminine associated behaviours such as being 'caring,' cooperation or collaboration, deferential (or at the very least, respectful) modes of communication when dealing with others, and acknowledging own shortcomings, are strategically employed to obtain their desired political outcome.[10] The result of this is that female leaders have an intrinsic preference for cooperative behaviour because of the socialisation process, but also because cooperative behaviour allows them to mitigate the effects of the double bind while still achieving political goals. In working congenially with colleagues, adversaries, constituents and experts, the female leader is able to induce cooperation from their partner to achieve effective crisis management outcomes.

[9] For example, speaking on the minefield of family for female politicians, Gillard notes that only childlessness due to a 'health-related condition' is an accepted solution to the motherhood double bind (Ellis (2021)). More simply, in this case the woman avoids the practical work-life balance challenges of having children whilst in a demanding role, yet escapes judgement that she is not *feminine, natural* or *motherly* because childlessness was not of her own choosing. Ellis herself ruminates on this comment, 'what sort of sickness lies at the heart of a culture where, politically speaking, the only way a woman can win is if she has fertility issues?' (pg. 156).

[10] Hillary Clinton again provides an insightful case study into this approach. As a freshman to the Senate in 2000, Clinton 'kept her head down, found common ground, and won them [Republican Senators] over' (Klein (2016)) despite facing an aggressive campaign in the preceding election, and hostile Senate upon entry. Klein and Traister (2021) later describe 'the...little things she did to ensure that the old white bulls of the Senate would work with her, like stepping aside in photographs so she wasn't in the middle of a photograph or pouring them tea...going to...Senator [Robert] Byrd and asking for him to teach her about Senate rules, bringing her mother to meet him' noting 'these little signals of subservience, coming from a woman who had no need to frame herself as subservient' were deliberate.

5 Concluding remarks

In this paper we focused on the observation that women in power appear to manage crisis situations more effectively than their male counterparts. We developed a two part model to show how gender norms are particularly resistant to change due to socialisation inefficiencies. Additionally, once these norms are established, intrinsic preference for cooperation among women is a self perpetuating trait.

We demonstrated that in a symmetric Leader-Expert game, each player prefers to match the action of their partner so that they both choose to *cooperate* or *compete* with one another. Consequently, when the Leader has an intrinsic preference for one specific strategy, the Expert is incentivised to reciprocate in kind. Through the cultural transmission portion of our model, we found that men are more likely to be socialised to have an intrinsic preference for competition while women are socialised to value cooperation. The consequence of this is that Leader-Expert games played with a female leader result in the *(cooperate, cooperate)* Nash equilibrium while a game with a male leader results in the *(compete, compete)* equilibrium. Because the combined outcome of a mutual *cooperative* equilibrium results in a higher payoff than the outcome of a mutual *competitive* equilibrium, we thereby provide a mechanism for effective female crisis leadership.

We also showed that gendered preference for competition or cooperation is not random, rather that these intrinsic preferences are made more persistent over time due to the inefficiency of two parent transmission, relative population sizes and levels of tolerance for this arrangement in society.

The topic of gender and society is both exceedingly complex and frustratingly simple. As such, we note that our model is predicated upon stylised fact and acknowledge the interplay of our model with other factors in reality. For example, countries with female leaders tend to be more progressive, prosperous and with existing infrastructural capacity to deal with crisis (Aldrich and Lotito (2020)). This is a salient point and further supports our view that the behaviour and perception of women in power is linked to the behaviour and perception of women in broader society. Still, in even the most gender parity achieving nations, there is evidence that traditional gender norms continue to impact the competitive and cooperative behaviour (Buser et.al (2017)). This illustrates that although the political participation of women has advanced significantly, there are still many facets of inequality and injustice that are only now being uncovered. Gender related inequity and inequality continues to warrant our attention as its improvement benefits all of society.

For this reason further empirical investigation into this topic would enrich our theoretical findings. We can also speculate the effects of extensions to our model such as allowing both Leader and Expert to have intrinsic preference. Alternatively, modelling intrinsic preference based on intersectional, overlapping characteristics is likely to provide interesting insights about how leadership management relates to other characteristic based assumptions such as the

model minority myth. [11] Further exploration in this space may uncover intersecting points with existing economic and identity research such as that by Akerlof and Kranton (2000), as well as reveal additional welfare implications.

As a final remark, reference to 'gender' in Economics often inadvertently means 'women', when in truth gender inequality in its many arenas affects all participants regardless of gender (Nelson (1992)). One possible - but incomplete, conclusion of our work would be to advocate that women need to simply *compete more*. This would miss the point. While freedom from inequality undoubtedly requires pushback over gendered expectations, mutual collaboration is a public and natural good in our societies. Indeed as we have previously discussed, the most effective outcome in the crisis leadership game is achieved when both Leader and Expert cooperate. The human species is unique in its innate propensity for cooperation through 'shared intentionality' (Tomasello and Carpenter (2007)) so much so that to cooperate should neither be distinctly masculine or feminine. Folbre (2012) writes that 'women may not be able to gain the freedom to care less unless they can persuade men to care more'. Similarly, our model shows that female leaders may neither be able nor should be burdened with solving *all* the world's crises on their own without the cooperation of men. Because of this, a compelling next step would be to turn our attention to improving the norms and systemic frameworks that normalise *greater cooperation* and *less competition* in men.

[11] Wong (2018) writes that the model minority stereotype is 'used to portray Asian Australians as upstanding Australian citizens, as examples to other 'troublesome' migrants, to keep them in line.' Cultural background is likely another trait 'type' that requires two parent transmission - similar to gender related norms. Additionally, conceptions of the myth intersect with gender studies. Specifically, as it pertains to *cooperative* behaviour as Wong also notes one central aspect of the stereotype is that 'We [Asian Australians] are all meek and submissive—especially the women—and even though there are those of us out there who are supposedly domineering and seductive, we can ultimately be tamed. We are quiet, obedient. We don't complain.'

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