

equal to 35. It is assumed that the aristocrats are able to ignore most of the rules which govern the lower class due to their prestige and power.

The change in aristocratic desired freedom is a function of traditional values as well as the climate of opposition (Climate\_Opp) to the status quo. Climate of opposition reflects the degree to which the lower class accepts the current state of affairs. When it becomes too high, rebellion begins to take place. Acts of violence by the peasantry are likely to polarize the classes even more, undercutting the position of the moderates and bringing extremists to power. This tendency for aristocratic norms to decrease in the face of stiff opposition to the government is reflected in ECOADF (Effect of the Climate of Opposition on Aristocratic Desired Freedom) (Figure B.1.5). Traditional desired freedom (Trad\_Aris\_Des\_Free) is different from traditional popular desired freedom in that it is a constant. Thus, over the course of the simulation, traditional aristocratic desires are deemed to fluctuate less.

The discrepancy between the aristocratic desired level of freedom (Aris\_Des\_Free) and the government policy for freedom (Gov\_Pol\_Free) results in aristocratic political discontent (A\_P\_Discontent). This discontent results in aristocratic effort to influence legislation. This differs from the effect of popular political discontent because aristocratic actions are not modulated by the level of political freedom and economic welfare present in society. They are assumed to always have the necessary resources and contacts to express their views.

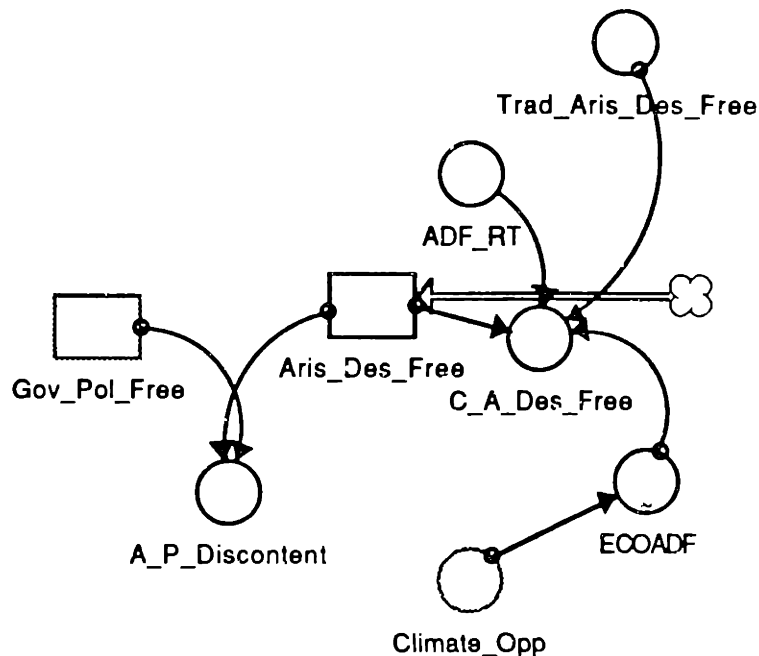


Figure B.1.4: Aristocratic Desired Freedom

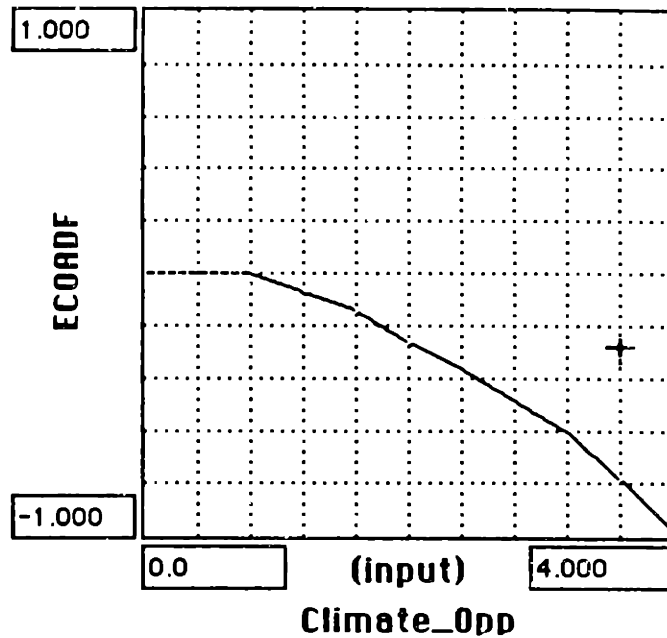


Figure B.1.5: Effect of Climate of Opposition on Aristocratic Desired Freedom

#### *Government Policy for Freedom (Gov\_Pol\_Free)*

The government policy for freedom is a smooth of the political initiative (Pol\_Initiative) with a short time constant (Policy\_RT). This represents the time delays inherent in implementing any new policy. If the executive means to decrease the amount of freedom possessed by the average citizen, he may need to hire more soldiers, build a new prison, etc. It is important to note that the populace and aristocracy react to the level of Gov\_Pol\_Free, not the actual level of freedom (Pol\_Freedom). It is the actions of the government that concern them and motivate response.

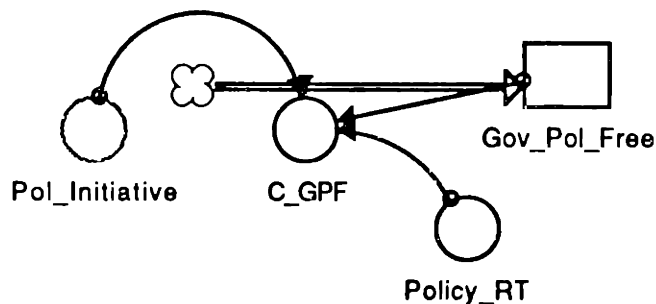


Figure B.1.6: Government Policy for Freedom

#### *Political Freedom (Pol\_Freedom)*

The amount of political freedom present in a society is not just a function of the tolerance of the person/organization executing the laws. Neither is it reflected completely by those laws.

## Appendix B: Description of Model Structure

Freedom may be derived from social customs, economic modes of production, political institutions (i.e. the town meeting), particular demographic or geographic features, etc. Some of these determinants of freedom are difficult to change, others may require only a government whim. For this reason, political freedom is modeled as a first order smooth, tracking the government policy for freedom (Gov\_Pol\_Free) with a certain delay time (Pol\_Free\_RT).

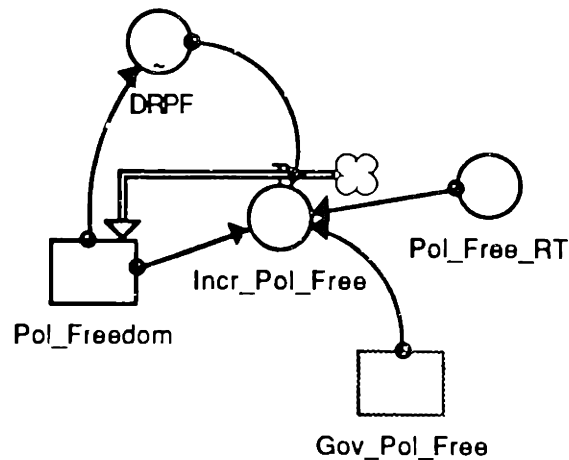


Figure B.1.7: Political Freedom

In addition to government policies, we must also consider natural constraints when formulating an expression for freedom. It takes an incredible amount of energy to totally prevent all dissent. Likewise, as it is no simple task for the government to instill extremely high levels of freedom, as a person's ability to perform a certain action may be constrained by institutions, customs, and environments which the government is unable to affect. The increasing difficulty of the government to impose extreme conditions upon the population is represented in DRPF (Diminishing Returns Affecting Political Freedom) (Figure B.1.8).

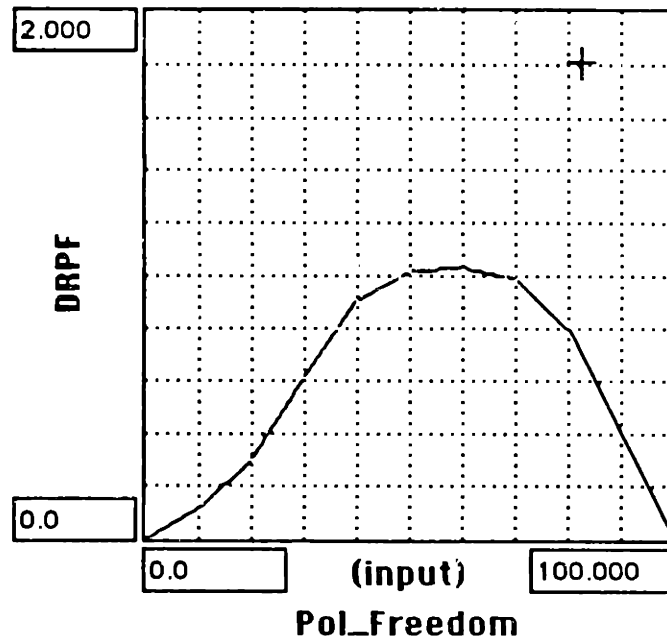


Figure B.1.8: Diminishing Returns Affecting Political Freedom

*Popular Desired Economic Welfare (Pop\_Des\_Eco\_Wel)*

Popular desired economic welfare is a concept similar to popular desired freedom. It is measured in intensive units of welfare (output/person/month) and scaled from zero to one hundred. One hundred represents opulence while zero represents total deprivation. The initial value of popular desired economic welfare is 65.

The rate of change of popular desired economic welfare ( $C\_PDEW$ ) is determined by those economic variables parallel to the political ones which determine popular desired freedom ( $Pop\_Des\_Free$ ). Economic protest ( $Eco\_Protest$ ) increases expectations. Opposition to government polarizes opinions and radicalizes the population. Religious and propaganda influences ( $Rel\_Infl$  and  $Prop\_Infl$ ) sway the populace in the same manner as they affect political expectations. Finally, tradition also affects current desires ( $Trad\_Pop\_Eco\_Wel$ ).

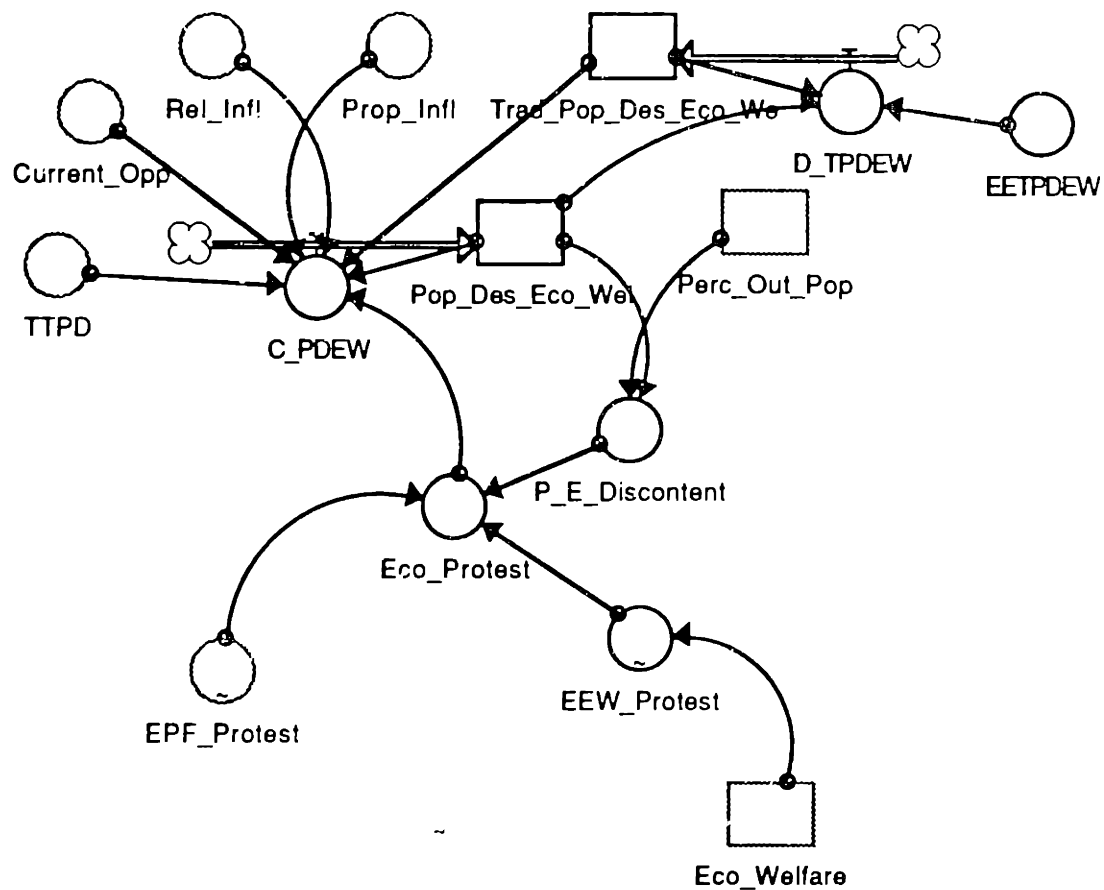


Figure B.1.9: Popular Desired Economic Welfare

## *Aristocratic Desired Economic Welfare (Aris\_Des\_Eco\_Wel)*

Aristocratic desired economic welfare is somewhat different than aristocratic desired freedom in that it refers to the welfare of the aristocrats and not the populace. This change serves to add realism to the model. Reactions are no longer zero-sum as they are in the political hemisphere (if freedom drops, the discontent of the populace rises, however, the discontent of the aristocrats drops). Fluctuating production can add a great deal of subtlety to the behavior of the system. Unfortunately, the cost of this increase in realism is a more complex model. Since Aris\_Des\_Eco\_Wel concerns the income expectations of the upper class for themselves it possesses units other than output/person/month (welfare). We shall define its units to be aristocratic welfare (output\*1000/aristocrats/month). In order to arrive at these units, some simplifying assumptions have been made:

- Aristocrats enjoy an income 1000 times more than that of the average citizen.
  - There is one aristocrat per 1000 peasants. Thus: 1 aristocrat = 1000 peasants
  - Aristocrats 1000 times less sensitive to changes in income than are peasants.
- Thus: perceived aristocratic output=popular output/1000