"The Kentucky Dark Patch Knight Riders' Rebellion"

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The longest and most violent sustained civil conflict in the United States during the century between the end of the Civil War and the racial conflicts of the mid 1960s was the Dark Patch Tobacco War in portions of Kentucky and Tennessee, which lasted from 1904 to 1909 (Cunningham 1983, back cover). The Night Riders were a response to the American Tobacco Company—the Duke Trust—setting the purchase price for tobacco at a ruinously low level for farmers. More specifically, the Night Riders were an armed response to the tendency of some farmers in the Dark Patch (so called because of the color of the tobacco leaf raised in the region, in contrast to the bright or burley tobacco) to sell at a premium their tobacco to the Trust outside of the unified Association purchasing system (Saloutos 1939, 356). When appeals to reason and economic interest had failed, the Dark Patch Tobacco Association resorted ultimately to forcible intervention with their neighbors (Waldrep 1986, 587).

The sufficient and proximate cause of the conflict in the Dark Patch was a sharp decrease in the price offered to farmers for their crop (McCulloch-Williams 168). In the last decade of the Nineteenth Century, farmers had received comfortable profits with a price of 8 to 12 cents per pound (Cunningham 9). As the Twentieth Century dawned, however, acquisition of monopoly power among tobacco purchasers through collaboration between the domestic monopoly American Tobacco Company and the foreign purchasing interests (commonly referred to as the "Regie") resulted in agreed purchasing territories and fixed low prices for tobacco purchasing agents (McCulloch-Williams 1908,

168). Lack of competitive bidding among tobacco buyers resulted in prices dropping to an average of four cents a pound in the period 1901— 1903 (Nall 1991, 78), which was two cents per pound under the actual cost of production, let alone providing a living for the farmer and his family (Cunningham 38). The situation was even worse for those regions where prices dipped as low as three, two, and in some case one cent per pound. (Nall 1991, 14).

Initially the farmers, under the leadership of wealthy planter Felix Ewing, sought to band together voluntarily in the Planters' Protective Association to counter the monopoly of buyers with a monopoly of producers (Miller 1936, 15-16). The concept was for farmers to sell their yields to the Association at a set Association price (initially at 8 cents per pound—two cents per pound over the costs of production (Nall 1991, 22-23, 126)—with the Association to store the tobacco in its own warehouses and pay the farmers when the Association in turn sold its holdings (Waldrep 1986, 568). The initial voluntary approach, in which "… initial members begged, cajoled, and actually prayed with many growers to join," soon had between 70% to 95% (percentages varying from county to county within the Dark Patch) of the tobacco farmers in the Dark Patch signing contracts to deliver their crops only to the Association (Nall 1991, 24).

The first year of the Association experiment was unsuccessful. Both non member producers and Association members who disregarded their pledges to the Association undermined the attempt at meeting the Tobacco Trust on an even economic basis while seeking individual profit as the trust paid out as much as 10 to 12 cents per pound in an attempt to destroy the Association (Cunningham 51). In 1906, for example, non-members were selling to the Trust at ten to twelve cents a pound while Association members were receiving seven and one-eighth cents (Nall 1991, 50). This failure of a strictly voluntary association of tobacco producers was mirrored in the early 1920s by the Burley [Bright Leaf] Tobacco Growers Cooperative Association. Facing the same sort of

steep decline in the price of Bright Leaf Tobacco as had the Dark Patch growers (Barth 1925, 455-456), the Burley Growers' Association similarly had widespread voluntary membership expressed by a pledge on the part of growers to sell only to the Burley Association, which would then hold the crop and sell at an acceptable price and then use the proceeds of sale to pay the producers (Barth 1925, 457-458). The result was initial success, followed by a steady decline in prices received by the Association and its members (Barth 1925, 462).

Thereafter, adopting resolutions in a mass meeting held at Stainback School House (Cunningham 1983, 54) some members of the Association agreed to become "Possum Hunters" (so-called because their work—like hunting possums—was done at night). Possum Hunters agreed to visit nonmembers to "counsel and instruct" them in groups of "not less than five nor more than 2,000" (Nall 1991, 45). From the implied menace of the nighttime visits of (potentially) large groups of Possum Hunters, it was a short step to the outright violence of the masked Silent Brigade (as the Night Riders called themselves) (Miller 1936, 22). The Night Riders acted by attacking individual farms and their crops (Nall 1991, 50) and occupying entire towns so as to destroy Trust warehouses and machinery and menace and whip Trust supporters (McCulloch-Williams 1908, 170). Where persuasion, even en masse, was unsuccessful, "… the night rider has been the most efficient association missionary—a virulent one, it is true, yet he has brought people in" (McCulloch-Williams 1908, 169). The high point of the Association control was 1908, when the group had near total control of the Dark Leaf tobacco crop. But observers from the Burley Tobacco Association's vantage acknowledged that the result was secured by the violence of the Night Riders rather than any other cause (Barth 1925, 463).

The Night Riders protected themselves from official interference by inducting into membership the governmental elite of the affected Dark Patch

counties (Cunningham 1983, 65) to the point of being "… in practically entire control of the legal machinery—the courts and officers of the counties and judicial districts; and these county and district governments…were practically at that time independent of the State's Executive" (Miller 1936, 22). It was not until attorneys for some victims injured by the Night Riders hit on the tactic of moving plaintiffs out of Kentucky to establish residency and qualify for suit in federal courts that this monopoly was broken and alleged Night Riders could be subject to judicial process (Nall 1991, 174-175).

The prices received by Association members and nonmembers permit a clear measurement of the economic impact of the Trust, Association and Night Riders. This permits comparison of producers' economic condition before and after the agreement of the American Tobacco Company and Regie, as well as before and after activity of the Night Riders, This is in line with Gurr's suggestion that aspects of his posited Relative Deprivation concept can be measured through "indicators of economic activity" (Gurr 1970, 56). The Association managed increases from four (or three or two, in some cases) cents per pound in 1904 to seven and one-eighth cents per pound in 1906 (Nall 1991, 35). With Night Rider activity increasing in 1906, 1907 and 1908, prices went to eight and four-fifths cents a pound in 1907 and eight and one-half cents per pound in 1908 (with a much larger crop for Association members in the latter year, hence a much larger profit per person) (Nall 1991, 123) reaching twelve cents per pound in 1909 and early 1910 (Cunningham 1983, 168; Nall 1991, 191).

Economic prosperity has been viewed as one of the elements leading to the election of anti-Association candidate Augustus Willson as governor (Cunningham 1983, 110-111). Running as a "law and order" candidate in a time in which the success of the Association in raising tobacco prices back to a profitable level (thereby removing the excesses of the Trust from public concern), Willson state militia units into occupy towns and cities and guard non-members'

farms and individual witnesses against Night Rider defendants (Cunningham 1983, 114). To avoid possible compromise, militia units were stationed far from home. In addition to guard details, the units patrolled and acted to interdict Night Rider meetings and operations (Cunningham 1983, 168).

Militia operations were assisted by information disclosed in the various federal court civil trials of alleged Night Riders (Nall 1991, 169). Association practice of voluntary self-assessment to defray expenses and judgments suffered by Night Riders caused disagreement in many lodges as to amounts and even whether to contribute to the cause, as the pressure of Trust prices disappeared. Membership dropped as the financial burdens of association exceeded any perceived benefit (Cunningham 1983, 168). Fear of possible ruinous verdicts caused many Night Riders to deed their assets to their wives in order to escape loss of their meager assets (Cunningham 1983, 166). Over six thousand members withdrew from the Association between 1908 and 1910 (Cunningham 1983, 169). Although some local lodges persisted in the period 1912-1915, deterioration for the Association as a whole was inexorable with success. Achievement of the Association goal of a price for tobacco from which a farmer could live meant that the reason for its existence had ended.

Even the Association's periodical, the *Black Patch Journal*, counseled the Night Riders, "Rider, turn the reins of your horse's head homeward and there dwell in peace. The human heart can not condemn your zeal, but common sense does your foolishness" (Nall 1991, 176). The Dark Patch Tobacco War, being limited in time and space and being well documented, provides an opportunity to evaluate the validity of some theories of revolution. The boom and bust in tobacco prices, coinciding with the period just before and just after the collaboration of the American Tobacco Company and the Regie, provides an almost textbook example of Gurr's J-curve model of relative deprivation,

"revolutions are most likely to occur when a prolonged period of objective economic and social development is followed by a short period of sharp reversal" (Gurr 1970, 52-53).

The success of the Night Riders in reversing the economic effects of the J-curve steadily upward in 1906-1909 can be used to investigate the effect when an economically generated revolutionary movement achieves its economic goals. The Night Riders—in light of their control of local law enforcement and judiciary—also provide an opportunity to examine the effect of a high degree of control of coercive resources as suggested by Tilly (1978, 216). This paper proposes to utilize agent-based modeling (ABM) and Spreadsheet Modeling (Kiel and Elliott 1997, 19) of Fuzzy Cognitive Maps (Kosko 1993 172-177; McNeill and Freiberger 1993, 237-240) (collectively the concepts are conflated as "Spreadsheet FCMs") to analyze the Night Riders in the Dark Patch Tobacco War as revolutionaries. It is possible to use Spreadsheet-FCMs as well as the NetLogo (Wilensky 1999) ABM modeling system to vary the characteristics and investigate the operation of the process.

Use of these two methodologies provides a useful check of one against the other, as SpreadsheetFCM concentrates on the operation of macro-level forces and NetLogo ABM evaluates the results of interactions of many individual agents, allowing a situation to play itself out once agents have been given characteristics expressed as simple rules of behavior. Each method thus compensates for the implicit assumptions (and potential omissions and oversights) of the other (O'Sullivan and Haklay 2000, 1,409-1,425). Both Spreadsheet FCMs and NetLogo ABM are applications of the theory of complex adaptive systems. By generating data in simulations, computer modeling answers objections many have expressed to the theory—that it is "science without facts." The new science of complex adaptive systems has been developed to explain nonlinear phenomena—i.e. phenomena manifested by an

entity that cannot be predicted by summation of the properties and actions of the entity's components. A complex adaptive system is defined as "… an adaptive network exhibiting aggregate properties that emerge from the local interaction among many agents mutually constituting their own environment."(Horgan 1995, 106; Cederman 1997, 50; Ruthen 1993, 132) Component agents' individual adaptive actions may in turn change the behavior of the entire system (Pascale 1999, 84; Fontana 1991, 160)

The definition of the term "revolution" is difficult. There is general agreement that the aftermath of an event called "revolutionary" must have some important difference from the state of affairs before the event (Dunn 1972, 231). In the current context, the important difference should reflect a significant change of a political nature, attempted or accomplished (Welch 1980, 127; Salvemini 1954, ii). Some writers require success as a criterion of revolution (Dunn 1972, 12), reserving other term such as "rebellion" for unsuccessful attempts (Welch 1980, ix). Others require that a revolution result in an alteration of the structure of society (Colburn 1994, 6), referring to a restructuring of the top levels of the state without accompanying social change as a "military coup d'état" (Welch 1980, ix). Let us assume for the remainder of this paper that "revolution" is a flexible term that can best be considered using the principle, "I may not be able to define it but I know it when I see it" and follow the Dark Patch War as "rebellious" or "revolutionary" in nature and thus subject to analysis.

Revolutions have characteristics that are shared with complex adaptive systems. As noted in Jack Goldstone's proposed "Fourth Generation theories," (Goldstone 2003, 12) revolutions have a number of contributing causes (Welch 1980, 129), factors that result in unexpected and uncontrolled effects in the course of a revolt (Welch 1980, 200). Often triggered by seemingly minor causes,

revolutions may be studied as an example chaotic or catastrophic change, behavior characteristic of a phase transition in complexity theory (Cohen and Stewart 1995, 211). Goldstone attributes the unpredictability of the course of revolutions to "path dependency" in which the course of events of a revolution are affected (but not completely determined) by the actions of individual agents (Goldstone 2003, 12).

Goldstone distinguishes the "First Generation" of revolutionary theory—the "Natural Histories" school of analysis—as being descriptive chronologies of events in a revolution rather than having predictive value (Goldstone 24). He also differentiates the "Second Generation" of "General Theories of Revolution" which did advance hypotheses as to conditions ripe for revolution—the psychological discontent of relative deprivation (with its famous J-curve of increasing prosperity followed by a sharp drop in circumstances and the loss of future expectations); the institutional imbalance analysis in which discontent is a product of the economic, political and educational subsystems of society growing at sharply different rates, rendering adjustment among the societal elements difficult if not impossible; and the resource mobilization analysis in which the truism that would be revolutionaries must have the material wherewithal to rebel (Goldstone 2003, 56).

In regard to this latter point, the existence of widespread discontent was a necessary condition for not only the armed Night Rider movement to rise in the Dark Patch (Wickham-Crowley 2003, 288-289; Gold 2003, 214) but, also, for their activities to continue (Nall 1991, 126). The tacit, passive support of the population raised the group to the status of "social bandits" (Brown 1975, 16). "Social Bandit" is a term developed by Eric Hobsbawm to describe … outlaws whom the lord and state regard as criminals, but who remain within the peasant society, and are considered by their people as heroes, as champions, avengers, fighters for justice, perhaps even leaders of liberation and in any case as men to be

admired, helped, and supported… It would be unthinkable for a social bandit to snatch the peasants' (though not the lord's) harvest in his own territory… (Hobsbawm 2000, 20). Goldstone also contrasts his "Fourth Generation" of theory with "Third Generation" structural theories which assess vulnerability to revolution in terms of competitiveness with other states resulting from the organization and form of a state (Goldstone 2003, 67). Under this analysis, the vast expansion of the economic and military power of the United States during the last half of the Nineteenth Century was an increase in competitiveness with respect to other states. The structural approach would appear to predict a lessening of revolutionary tendencies during the Industrial Revolution.

The question remains: why did the social banditry of the Night Rider subside, despite advocacy for broader scope and continued action by Dr. David Amoss (Cunningham 1983, 119-120)? Was achievement of that the Association's economic goals of increasing tobacco prices to an acceptable level enough to cause the revolutionary impulse to subside? If so, a computer model of the satisfaction of Gurr's J-curve hypothesis might support the theory by virtue of its conforming to the actual events in the Dark Patch War. Similarly, the degree and timing of the Association's acquisition of control of the mechanisms of force which were actually brought to bear on the Dark Patch can provide support for Tilly's hypothesis of success predicated on control of available coercive resources. In assessing the validity of either, possible explanation through computer simulations, the "tape can be rewound" numerous times (Dean et al. 2000, 179) and the projections compared to the actual record to determine the "goodness of fit" of the different proposed explanations (Dean et al. 2000, 180).

In this case, the price per pound of tobacco was taken as representative of the degree of revolutionary impulse and the number of members of the association was the other variable tested, as indicative of the scope of Relative

Deprivation and the consequent revolutionary impulse, following Gurr's suggestion (Gurr 1970, 83). Shifts in the price of tobacco act as a substitute for direct measurement of changes in the intensity of the RD felt by the Association members (as all members received the same price, the average price would reflect the average RD.) Similarly, the size of the membership of the Association can act as an indicator of the scope of the RD in the Dark Patch (Gurr 1970, 56).

Tilly's hypotheses about extent of mobilization in a revolutionary movement and likelihood of success therein also can be assessed by applying the model. The degree of mobilization of coercive forces can be indicated by the size of the membership of the Association and, more particularly, the Night Riders, when compared to the overall population of the Dark Patch. As the percentage of the population of armed Night Riders grows, so does the degree of mobilization of the coercive forces (Tilly 1978, 216). The effect of increased Night Rider membership and activity is (at least in terms of outward behavior) an increased commitment to the policies of the Association. Conversely, Governor Willson superseded local law enforcement by ordering in state militia units to provide security for law and order (Cunningham 1983, 168; Nall 1991, 163-164).

When the local judiciary was superseded by the federal court (Nall 1991, 167), the Association monopoly of coercive force in the Dark Patch ended and the impact of the Night Riders and the Association significantly lessened. Spreading from those already possessed of it to those peculiarly susceptible to it, the schema of revolutions can be treated as if it were a disease. If a revolution, like an epidemic, is to be successful by spreading throughout a population and inciting violent insurrection, the schema's transmission must surpass a percolation threshold: more people must acquire the idea of revolution successively over time than lose it (whether through death, imprisonment, disillusion, maturity or boredom) (Schroeder 1991, 345-346). If more people fall away from the revolution than join it, it will either fizzle out or be stillborn, as may be appropriate. Indeed,

the original model of the NetLogo version of revolution—Rebel 1—was adapted from the Virus model (Wilensky 1998) derived in biology. NetLogo (Wilensky 1999) is an example of agent-based modeling. In such computer modeling, a collection of entities ("agents") are given certain qualities and rules of behavior and set in an environment with defined characteristics as individuals. The experimenter then sits back and observes what happens. "[*F*]*undamental social structures and group behaviors emerge from the interaction of individual agents operating on artificial environments under rules that place only bounded demands on each agent's information and computational capacity.*" (Wilensky 1999, 46, emphasis in the original).

Agent-based modeling allows the investigator to examine problems which are not well-defined, whether because of incomplete information, or the uncertainties inherent in any human activity, or in any situation with "… complex and poorly defined problem areas" (Finegan 2005). Agent-based modeling observes the actions and attributes of individuals through time, rather than averaging the characteristics of an entire population and tracking the collective activity as a unit (Reynolds 2005). In this case, the model "Rebel—1" was developed. A variation on the Virus Model, Rebel—1 has several variable factors controlled by sliders, which can thus be altered to observe the results. Such results can then be compared with the actual outcome to see if the hypothetical conditions are valid descriptions of the mindsets of populations in the past. Thus increasing susceptibility or resistance to rebelliousness, allowing bitterness to fade with age, and other possibilities can be tested.

The Rebel—1 model was set with an infectious rate of 70% to reflect the fact that at least 70% of the farmers in the Dark Patch signed pledges of their crop to the Association (in some counties the percentage was as high as 80% to 95%, but the lower figure is adopted as conservative) and, thus, would be susceptible to rebelliousness in the period of conflict with the Tobacco Trust (Nall 1991, 88).

The chance of becoming loyal or neutral after being a rebel was set at 50%. A sample population of 300 individuals was created, with 3.3% set as rebels at random to reflect the 5,000 farmers and their families attending the first meeting of the Association called by Ewing at Guthrie in September, 1904. Each "TICK" represents a week in the time scale of this model, roughly two weeks in real time. The SETUP button resets the graphics and monitors and randomly distributes 298 green susceptible people and 2 red rebels (of randomly distributed ages). Independents, grown opposed to the Night Riders or satisfied with the Trust prices, are shown in blue. The GO button starts the simulation and the monitoring function. The INFECTIOUSNESS slider determines how great the chance is that rebelliousness transmission will occur when a rebel and neutral occupy the same patch. For instance, when the slider is set to 50, the rebelliousness will spread and conversion from neutrality to rebel status will occur in roughly one of every two chance encounters. In this case INFECTIOUSNESS is set at 70% to reflect the (minimum) 70% initial participation of tobacco growers in Association pledges in order for a county to qualify as a county member of the Association (Nall 1991, 88).

Table 1

Year	Price (lb.)	Chance-Recovery	Duration	% Rebels	% Loyal
1904	4 cents	50%	26 Weeks	66.4	29
1905	11 cents	50%	26 Weeks	75.5	20.2
1906	11 cents	50%	26 Weeks	55.8	36.5
1907	8.8 cents	50%	26 Weeks	48.3	43.7
1908	8.5 cents	50%	26 Weeks	58.4	37.8
1909	12 cents	50%	26 Weeks	54.4	41.2

The CHANCE-RECOVERY slider controls the likelihood that rebelliousness in a given individual will end in neutrality/loyalty. When this slider is set at zero, for instance, the rebellion is always to the death. CHANCE-RECOVERY is initially set at 50% to reflect the balance between the farmers' desire for independence in the conduct of his own affairs on the one hand and the desire for a fair price for all (Cunningham 1983, 49). After every 26 clicks, the CHANCERECOVERY slider is reset to reflect the new price of tobacco. In this case, CHANCERECOVERY is increased 5% for every full 1 cent per pound increase over the 6 cents per pound break even point and an additional 1% for each one-tenth cent received beyond that price. This alleviation of the economic Relative Deprivation is a chance to test Gurr's J-curve hypothesis.

Table 2

Year	Price (lb.)	Chance-Recovery	Duration	% Rebels	% Loyal
1904	4 cents	50%	X	3	0
1905	11 cents	75%	26 Weeks	68.1	27.2
1906	11 cents	75%	26 Weeks	67.1	26.7
1907	8.8 cents	68%	26 Weeks	47.6	48.7
1908	8.5 cents	65%	26 Weeks	42	52.7
1909	12 cents	80%	26 Weeks	36.1	59.3

The DURATION slider determines the percent of the average lifespan (which is 1500 weeks, or approximately 27 years, in this model) that a rebel goes through before his participation in rebellion ends in either death, loyalty or neutrality. For the purposes of the simulation (and based on an average male

lifespan of roughly fifty years in 1900), real-world time periods should be divided in half to reflect the limitations of the model. Note that although zero is a slider possibility, it produces a rebellion of very short duration—after the fashion of the uprisings after Dr. King was assassinated or Watts in 1965 (approximately 2 weeks) not a revolt with no duration at all. Initially, DURATION is set at 26 weeks to reflect the experience of a one year reflected in the original Association pledge to sell, (Nall 1991, 35) the financial commitment of Ewing's original backers (McCulloch-Williams 1908, 169) and in the experience of the Bright Leaf Tobacco association some years later (Barth 1925, 462).

In both TABLE ONE and TABLE TWO, DURATION remains constant at 26 weeks. Tilly's hypothesis of control of coercive means as necessary to a successful revolution (Tilly 1978, 216) is tested by running the overall model (with no changes in TABLE ONE and changes in CHANCE-RECOVERY only in TABLE TWO to isolate the impact of changes in price per pound) without Night Rider participation by leaving DURATION set at the 26 week period. In TABLE THREE, DURATION increases to 52 weeks in 1907 to reflect the activities of the original 5,000 Night Riders in late 1906 and 1907; increase to 78 weeks in 1908 to reflect the doubling to 10,000 Night Riders in that year and is set at maximum for 1909 to reflect the increase to 50,000 active Night Riders out of a population of 700,000 in the Dark Patch. The increase in DURATION in any given year reflects the increased tendency of Association members and other Dark Patch inhabitants to conform their behavior to the Association policies, ultimately resulting in near total conformity of behavior after September, 1909.

The requirement for the sharp variation in prices—the J-curve—as a precondition of the Association and Night Rider movements can shown by allowing the price to remain at the 1890s level of 12 cents per pound. This would lower INFECTIOUSNESS—the arbitrary figure of 2% is used in the model to reflect an endemic base of discontent unrelated to economic deprivation— and

keep CHANCE-RECOVERY at 80% throughout, using the same methodology for determination of its value. Under these conditions there is minimal conflict in the first two years under investigation (1905 and 1906) and then the revolution ends completely, with 0% levels of both rebels and loyalists.

Table 3

Year	Price (lb.)	Chance-Recovery	Duration	% Rebels	% Loyal
1904	4 cents	50%	X	3.3	0
1905	11 cents	75%	26 Weeks	68.1	27.2
1906	11 cents	75%	26 Weeks	67.1	26.7
1907	8.8 cents	68%	52 Weeks	52.3	36.6
1908	8.5 cents	65%	78 Weeks	94.3	4.8
1909	12 cents	80%	Max Weeks	100 (Sept.)	0

Table 4

Year	% Rebel	% Loyal
1905	0.7	0.5
1906	0.3	0.8
1907	0	0
1908	0	0
1909	0	0

Thus, using the NetLogo model Rebel—1 provides support for Goldstone's multiple causation hypothesis in his Fourth Generation of revolutionary theory. Both Gurr's J-curve and Tilly's control of means of coercion seem to be required for the Dark Patch War to follow the sequence that actually occurred. In contrast to the combination of many individual decisions represented by Rebel—1, Spreadsheet FCMs show the macro-level interactions of forces analogous to the Structural Theories. Kosko's "Fuzzy Cognitive Maps" is a

modeling technique that can represent accommodation of coarse-grained (uncertain) CAS schemata to the real world (Kosko 1993 172-177; McNeill and Freiberger 1993, 237-240). Fuzzy Cognitive Maps connect nodes of concepts (either entities or functions) with fuzzy rules represented by arrows, their interactions and adjustments reflected in successive iterations (Kosko 1999, 303-304, n.27). The actual execution of the process can be illustrated by a spreadsheet method developed by Douglas Kiel and Euel Elliott to explore nonlinear systems (Kiel and Elliott 1997, 19). Their "logistic map" was originally intended to illustrate chaotic functions, but can be adapted to show the operations of complex adaptive systems. Basically, the technique calls for entering the initial conditions and operations in the first row of cells, applying a cumulative formula in the second row and copying the operative formula through enough rows to provide as many iterations as time periods under consideration, (Kiel and Elliott 1997, 20) allowing operations to be tracked as they work themselves out in the computer model (Axelrod 1997, 28).

In the case of the Dark Patch War, the relationship of macro-level forces of membership numbers and prices for tobacco are illustrated in the Fuzzy Cognitive Map shown as Figure 1. The Spreadsheet FCM shown in TABLE FIVE expresses Figure 1 in a spreadsheet. Both the Association and the Independents enter 1905 with 5000 members, based on the number of farmers attending the first Association meeting in Guthrie, Kentucky in September, 1904 and the assumption that there are approximately equal numbers of committed Independents and Association members at the outset, to reflect the balance between the farmers' commitment to a fair price on the one hand and to maintaining independence on the other. Association membership is then adjusted in subsequent years by subtracting the value total of the price (expressed in cents per 100 pounds) of the Independent price minus the Association price—note that if the Association price is greater than the

Independent price then the result of the subtraction is a net addition of members to the Association. Similarly, the Independent numbers are adjusted by subtracting the Association price minus the Independent price. By expressing the prices in cents per 100 pounds values in the hundreds and thousands may be created and the price can then be a crude measure of the changes in membership numbers.

Table 5

Year	Association Members	Independent Members	Association Price	Independent Price
1905	4,300	5,700	400	1,100
1906	3,200	6,800	0	1,100
1907	3,200	6,800	880	880
1908	3,200	6,800	850	850
1909	3,200	6,800	1,200	1,200

Allowing only economic factors to operate, quickly, results in a substantial advantage in the numbers of Independents and a 36% decrease in the number of Association members. Even in years in which the Independents and the Association members receive the same prices, the advantage in the number of Independents is maintained. The coercive force of the Night Riders is illustrated in Figure 2. TABLE SIX expresses Figure 2 as a spreadsheet. There, the effect of changes in prices paid is carried over from TABLE FIVE but the impact of Night Rider violence is illustrated by taking the number of Independents determined by economic factors only and subtracting from that total the product of one-tenth times the then-current number of Night Rider members.

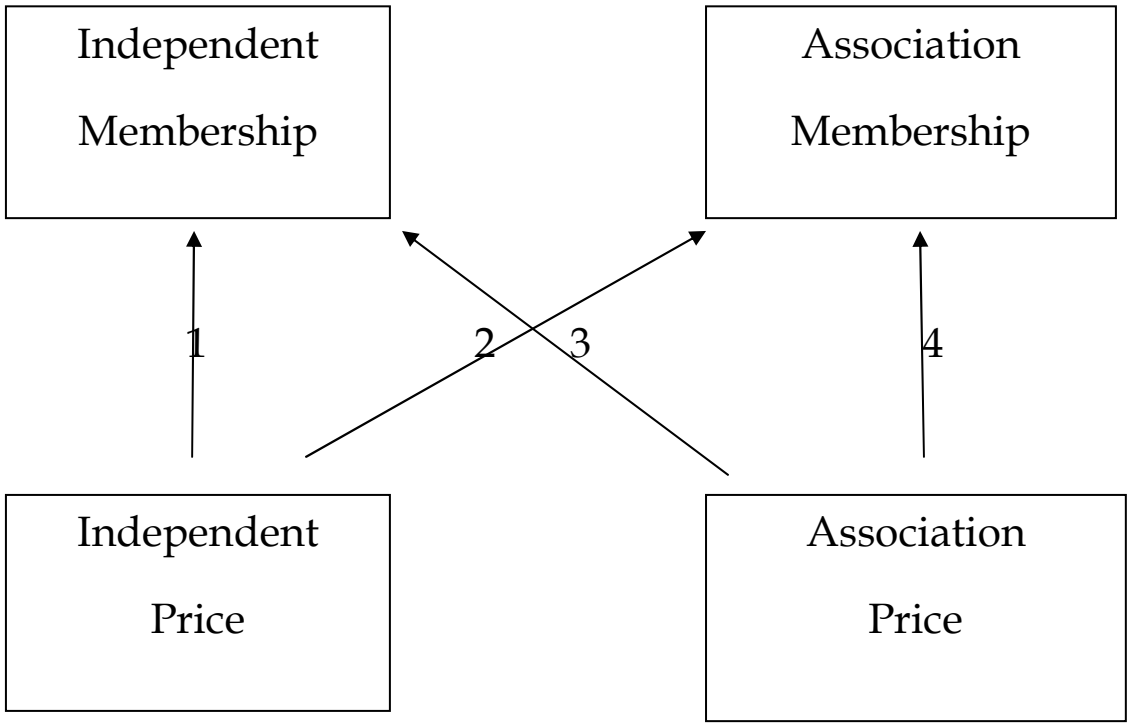
Again, the adjustment is only a crude indicator of the impact, based on the idea that relatively larger numbers of Night Riders were required to effect a conversion from Independent to Association supporter.

Table 6

Year	Association Numbers	Independent Numbers	Association Price	Independent Price	Knight Rider Numbers
1905	4,300	5,700	400	1,100	0
1906	3,200	6,100	0	1,100	0
1907	3,200	5,600	880	880	5,000
1908	3,200	4,600	850	850	10,000
1909	3,200	<400	1,200	1,200	50,000

As was the case in the NetLogo model, the addition of coercive force is necessary if the Dark Patch War is to follow the actual sequence of events—conversely, the absence of Night Rider violence dooms the Association movement to ineffectiveness in the face of Trust pricing policies designed to undercut Association solidarity and unity.

Figure 1



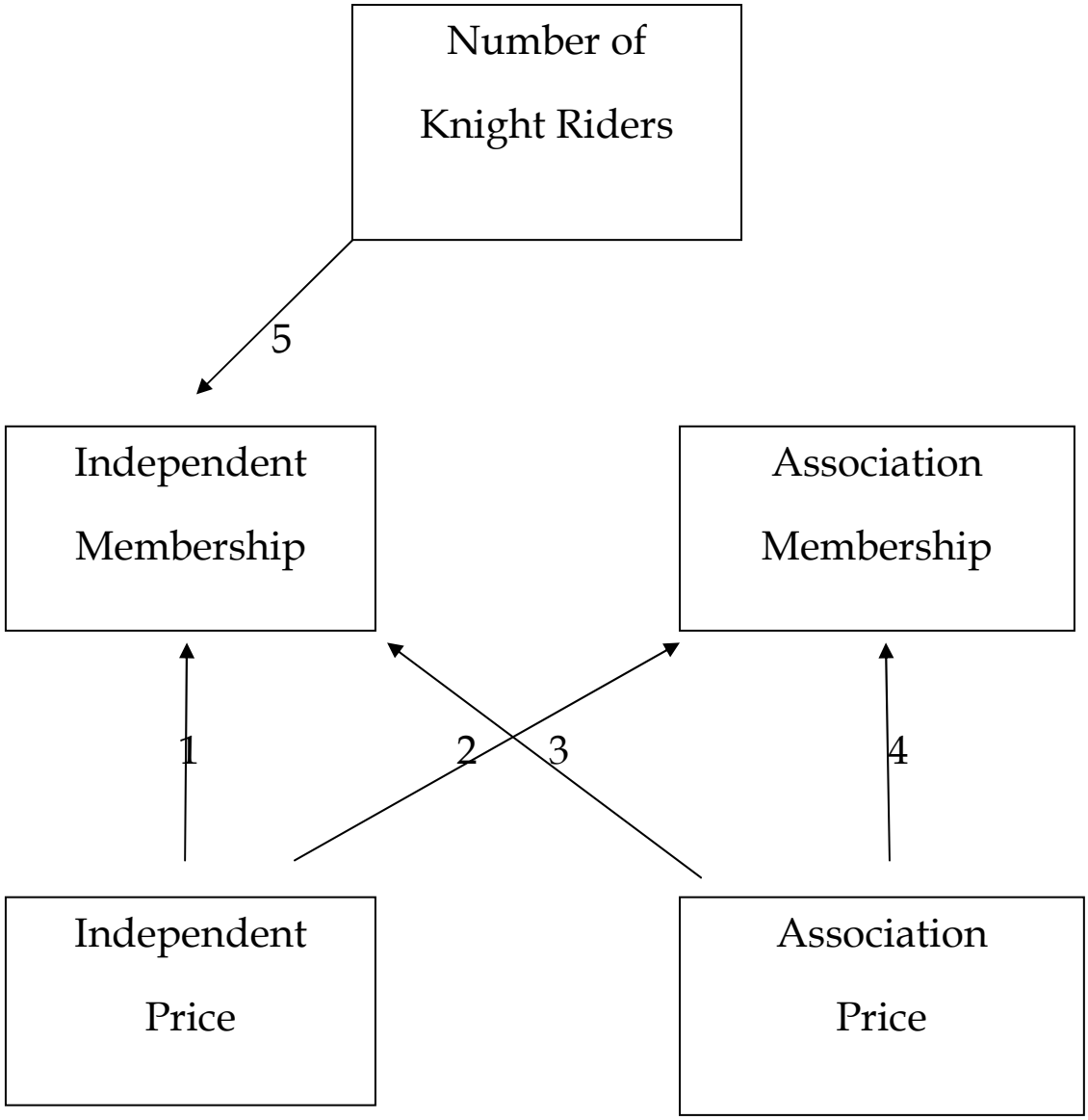
1=Increase if IP>AP

2=Decrease if IP>AP

3=Decrease if AP>IP

4=Increase if AP>IP

Figure 2



1=Increase if IP>AP

2=Decrease if IP>AP

3=Decrease if AP>IP

4=Increase if AP>IP

5=Decrease

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