CHAPTER 15

Logrolling

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Incentives to engage in the exchange of votes in legislatures, or logrolling, have existed since the inception of legislatures. Most prominently, logrolling is alleged in the United States, where a plurality rule is employed to elect representatives from single-member districts. In legislatures elected by proportional representation, incentives to exchange votes also exist, however. Often that exchange is more formalized via the formation of a governing coalition (Schofield 1987a).

In the political science literature, early discussions of logrolling go back at least to Bentley (1907). From then until the early 1960s, the exchange of votes in legislatures had been viewed with disdain and thought of as welfare reducing. Beginning with the seminal contribution of Buchanan and Tullock (1962), logrolling was seen as potentially welfare enhancing. Today, no consensus exists in the normative public choice literature as to whether logrolling is on net welfare enhancing or welfare reducing, that is, whether logrolling constitutes a positive- or a negative-sum game. This essay will describe various arguments and avenues via which the exchange of votes can be welfare enhancing or welfare reducing. I will address the following questions: under what conditions logrolling may be welfare enhancing, whether a logrolling mechanism can be designed that has favorable properties, and whether related voting processes may maximize welfare. The public choice literature has wedded logrolling with cyclical majorities by showing that some of the potentially negative impacts of logrolling stem from the possibility of unstable majorities. Instability of coalitions may turn welfare-enhancing arrangements into welfare-reducing ones. Investigations of the apparent stability of coalitions and collective choices in the real world, have explored whether mechanisms exist to induce stability, whether some institutions preserve welfare-enhancing arrangements, and whether chaotic trading, which reduces welfare, can be channeled

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Table 1.

	Issues	
Voter	*A*	*B*
1	5	−1
2	−1	5
3	−1	−1

into ordered trading that is welfare enhancing. The role of leaders and parties has been explored as a potentially important mechanism to ensure that vote trading is a positive-sum game. Thus, logrolling potentially can improve welfare in two ways: via the design of a specific voting rule that allows logrolling via additional institutional arrangements.

Recently, logrolling has been studied empirically. The results confirm the prevalence of logrolling in the House of Representatives and support the view that trades are ordered and that a large degree of stability prevails in Congress. The results present evidence for extensive logrolling among specific agricultural interests, and further evidence exists for logrolling coalitions among legislators representing broader interests such as city, labor, and farm groups.

1. Definition

A logrolling situation is defined as follows: Let (x,y) and (z,w) be pairs of mutually exclusive issues. Let voter preferences with respect to each pair be separable. Let each voter vote sincerely. A logrolling situation exists if

$$xPy \text{ and } zPw, \text{ but } ywPxz$$

where P stands for social preference as defined by the voting rule employed (Bernholz 1974b, 53). For many theorems regarding logrolling, it suffices if the first two social relationships are characterized by R (e.g., x and z do not lose to y and w, respectively).[1]

Logrolling is illustrated in Table 1. Voters 1, 2, and 3 vote on issues A and B using simple majority rule. The payoffs for these three voters on issue A are 5, −1, and −1, and the payoffs for the voters on issue B are

1. I will use the terms logrolling and vote trading interchangeably. Alternatively, one can think of logrolling as applying to deals that go into omnibus bills and the term vote trading as applying to deals that are voted on separately.

−1, 5, and −1. If everyone votes sincerely, neither issue *A* nor issue *B* passes. However, voters 1 and 2 have an incentive to form a vote-trading, agreement: voter 1 agrees to vote for *B* and in exchange the second voter agrees to vote for *A*. In the absence of the vote trade and with sincere voting, both issues fail.[2] In the presence of the vote-trading agreement – which implies sophisticated voting and therefore a misrepresentation of preferences – both issues pass. In this example, total utility is increased by 3 units for each issue and society is better off overall. The trade is welfare enhancing in this case, social choices obtained by simple majority rule are improved by trading votes. If the −1's in Table 1 are replaced by −3's, voters 1 and 2 still have an incentive to trade votes. However, in this case society is worse off overall, by −1 for each issue. Welfare has decreased.

Trading can impose an externality or utility loss on nontraders. If these losses are large, then the community as a whole is worse off. In the first example, logrolling occurs in the context of a positive-sum game; in the second example, a vote trade is arranged in the context of a negative-sum game. The controversy surrounding the optimality of logrolling can be viewed as a discussion over whether logrolling is a positive- or negative-sum game.

2. The normative potential of logrolling

Simple majority rule elicits a simple yes or no vote on a given issue but not the degree to which a voter favors or opposes an issue, that is, it reveals ordinal preferences on binary issues but not cardinal preferences. Thus, majority rule makes no allowances for differences in intensities of preferences among voters. Vote trading occurs because intensities differ. Scholars who look favorably upon logrolling have been intrigued by its potential to reveal intensities of preferences.

The normative logrolling literature asks whether social benefits are maximized if votes are traded in a legislature. Pareto-superior bills are ensured if the unanimity rule is used (Wicksell 1896). In this context, vote trading, combined with the unanimity rule, implies an alteration of bills until every legislator gains from the package. For legislators to come to an agreement to pass an issue under the unanimity rule, the benefits to the voters favoring the issue have to outweigh the losses of those initially opposed to the issue. If this condition holds, logrolling can increase aggregate utility in a committee or legislature that uses majority rule.

2. The distinction between sincere and sophisticated voting was introduced by Farquharson (1969).

Voting under majority rule only allows the voter to register the direction of a preference, not its intensity. This shortcoming of majority rule can in principle be eliminated by vote trading. Individuals exchange votes on issues they do not feel strongly about for votes on issues they do feel strongly about. Buchanan and Tullock (1962) were the first to notice the normative potential of logrolling: that logrolling allows for an expression of different intensities of preferences and that collective choice with vote trading may bring society closer to the provision of a socially optimal level of public goods.

If issues decided upon are local public goods, the logrolling coalition may pass proposals that redistribute income from the minority to the winning coalition, rather than achieve an efficient allocation of resources. However, logrolling can lead to a Pareto-optimal allocation of resources when side payments are allowed (Buchanan and Tullock 1962, 190–2). With money side payments, the redistribution of income accompanying allocative efficiency outcomes is eliminated. The mixing of allocative and distributional issues is one of the forces that drives the instability associated with vote-trading agreements, discussed later in this essay. I will also discuss how the instability caused by mixing allocative and distributive issues points to a definition of jurisdiction that corresponds to the spillover benefits of public goods.

Another positive account of logrolling comes from Coleman (1966), who suggests that the outcomes of vote trades are Pareto efficient. Each member of a committee trades votes with other members on public good issues. Members sell their votes for issues they do not feel intensely about and secure votes on public goods issues that are intensely favored by them. Expected utility is maximized when costs of selling another vote equal benefits from obtaining another vote. At this point, an equilibrium is reached that maximizes a social welfare function. Coleman concludes that majority rule with vote trading is more likely to maximize aggregate welfare than majority rule without vote trading. If by the passage of bills total utility increases, vote trading on public goods is the analog to the Walrasian market for private goods. The socially optimal level of public goods is selected if majority rule is combined with logrolling.

It appears that Coleman's description of the vote-trading process is too optimistic. Vote-trading outcomes may not be stable, implying a lack of equilibrium in the vote-exchange market (Mueller 1967; Park 1967). If trade agreements are broken, instability may arise, and shifting coalitions may lead to a decrease in welfare. The Pareto frontier may not be reached if voters misrepresent their preferences to increase their bargaining power (Mueller 1967). For example, voters have an incentive to announce that they are opposed to issue *X* even though they favor it, to induce other committee members to vote for another issue *Y* they favor

in exchange for their support on X. In this case, it is not clear how the best trades are chosen to reach a social optimum. An additional complication is introduced if voters cheat. Once the issue X is voted on, some traders have an incentive not to fulfill their part of the bargain. The potential for cheating increases with the number of voters, since the probability that a given vote is decisive decreases with the size of the group. The problem has an analog in private markets, where collusion is impossible if the number of sellers is large. Each seller receives a greater gain from breaking the cartel contract than from abiding by it. Since individuals know about this potential for reneging on trade agreements, they may not enter into them with large groups (Mueller 1967).

Scholars have addressed the question of whether a voting system can be designed that allows the expression of preference intensities as in logrolling thereby resulting in an outcome that maximizes welfare. Reneging on trades occurs because no votes are actually exchanged (Mueller 1973). Thus, part of the problem of achieving Pareto optimality via vote trading can be solved if votes are literally exchanged. Mueller (1973) suggests that a voter be given a certain number of votes and allowed to allocate them to issues he or she feels intensely about. Votes are actually traded and voters cannot form vote-trading coalitions. Physical exchange of votes is not enough to solve the problem of voters' having an incentive to misrepresent their preferences, however, if they are aware of the preference structure of other voters. The literal exchange of votes has desirable properties only if nobody knows about the preferences of other voters, that is, there is no communication between them (Coleman 1967).

A simulation approach has been employed in which voters reveal intensities of preferences for various public goods through the exchange of votes in Walrasian markets (Mueller, Philpotts, and Vanek 1972). Actual vote trading occurs once an equilibrium set of exchange ratios has been established. The results show that, generally, total utility tends to increase if vote trading is allowed.

Were society to decide to use a unanimity rule on allocative efficiency issues, vote trading would lead to an optimal allocation of resources. The concerns surrounding the optimality of logrolling are in part due to an electoral system that does not define jurisdictions according to the spillover of public goods. Further, current voting rules do not distinguish decisions on the redistribution of income from those on allocative efficiency. In Tullock's road example, each access road is a local public good. The problem here is that voters other than the voters affected by the public good decide on the production of the good. A proper definition of the jurisdiction, according to the spillover of the public good, would have reduced the incentive to combine issues of allocative efficiency with issues of income redistribution. To ensure proper definition of the jurisdiction, an appropriate decision has to be made at the constitutional stage. If the constitution were to restrict the legislature to vote only on allocative efficiency issues, vote trading would be more likely to bring society to the Pareto frontier than if votes were traded on issues of redistribution of income.

Nonetheless, there is hope that positive benefits can be achieved even in the current political setup. Congressional leaders have incentives to maximize welfare in the legislature (Koford 1982). In Koford's model, legislators can trade only through the party leader. Party leaders form a kind of clearing house that balances credits and debits, and set prices at which they are willing to defeat or pass a bill. Votes for or against a measure as desired by leaders are paid by the legislators. Leaders who interact frequently with legislators come to know their true preferences. Knowing the legislators' true preferences, and the requirement that all trades are made through the party leaders, ensures that preferences cannot be misrepresented and that leaders can provide efficient vote-trading services. Competition to become a leader ensures that those most skillful at arranging trades become leaders. Leaders from different parties form a collusive duopoly that maximizes joint gains (Koford 1987). Competition between parties occurs over the division of the gains.

Logrolling allows intense minorities to have their way on some issues. This may be desirable, especially in a winner-take-all plurality system such as that in the United States. In an electoral system of proportional representation, minorities are represented according to their relative size within the electorate. In a winner-take-all system, minorities are effectively shut out except when they are clustered within one electoral district. If such clustering exists, this minority can increase its importance and its representation in the political process via vote trading. Logrolling may make the political process more appealing to these minorities.

3. Point voting

Point voting can be thought of as an alternative to logrolling for revealing preference intensities and assuring an efficient allocation of resources. It has been considered as a possible mechanism to elicit preferences for some time (see, for example, Musgrave 1959, 130–1; Mueller 1973). However, it was thought that this process was as vulnerable to strategic manipulation as other voting processes. Voters might not reveal their true preferences and have incentives to allocate all points to the issues they feel most intensely about (Philpotts 1972).

Hylland and Zeckhauser (1979) devise a version of point voting that appears nearly to eliminate the possibility of strategic manipulation. As

proposed by Hylland and Zeckhauser, point voting assumes that tax shares have already been assigned and that the only decision left is the level of provision. The goal of the procedure is to reveal intensities of preferences as an alternative to vote trading. An iterative procedure is proposed. First, the government or auctioneer announces quantities of n public goods and voters allocate their vote points to increase or decrease the proposed quantities. Next, the government aggregates vote points and calculates the new quantities of public goods, and the process of allocating vote points continues with the newly proposed quantities. The process stops when the number of all voting points to increase the proposed quantities equals the number of points to decrease the proposed quantities of public goods. Hylland and Zeckhauser's innovation is the way in which vote points are aggregated by the government. They found that voters have an incentive to reveal their preferences honestly if the government aggregates the square roots of the vote points allocated by each voter. Aggregating the square roots provides sufficient penalty for voters who allocate their preferences by placing all of their vote points to their most preferred issue. The procedure ensures that voters allocate to each issue just the sufficient number of vote points to ensure a Pareto-optimal allocation of public goods.

The issue of strategic manipulation of voting procedures is addressed in the work of Gibbard (1973) and Satterthwaite (1975). They show that immunity to strategic manipulation and satisfying the independence axiom are logically equivalent. It follows from their work that voters can improve the outcome of a voting process by misrepresenting their preferences. The point voting procedure overcomes the obvious strategy of misrepresentation of preferences by allocating all vote points to the most preferred issue. The aggregation rule of the square roots of vote points invalidates this strategy. The iterative nature of the procedure allows some scope for strategic manipulation, but such strategies are not apparent.

Point voting is a decentralized way to obtain information on individual preferences for public goods. Intensities of preferences are revealed just as efficiently as private goods markets provide information about consumer preferences. If one thinks of the number of points as the voter's endowment, then the process of deriving the socially optimal level of public goods is similar to the pure vote-exchange model.

4. Negative sides of logrolling: Instability of logrolling equilibria

In Tullock's (1959) early discussion of logrolling, he gave the following example of a situation in which logrolling is expected to occur:[3] voters have to decide on the maintenance of access roads to a main highway, with a few farmers served by each access road. If all voters voted on each road separately, none would be repaired since only a minority of voters benefit from a given road. However, if more than half of the voters form a vote-trading agreement in which they contract to support the repair of each other's roads, then the roads reaching these voters will be repaired. Logrolling can ensure that at least half of the roads are maintained. The road example is a potentially positive-sum game; benefits exceed costs. However, some of the gains from the vote-trading coalition may be lost; members of the coalition repair the roads beyond optimal levels because they do not have to bear the full costs of the repair if costs are shared equally among all farmers. Some of the costs are born by farmers not in the winning coalition. In this case majority rule with trading can lead to too much government spending.[4]

With vote trading voters are better off than if they did not exchange votes on issues of interest to them since bargains among voters are mutually beneficial. An equilibrium is reached when the marginal cost of maintaining the access roads is twice the marginal benefit (Buchanan and Tullock 1962). Buchanan and Tullock's account of the logrolling process is optimistic in that an equilibrium is reached. The road repair example is typical of an entire class of issues decided by majority rule with respect to a mixing of issues of allocative efficiency with issues of redistribution of income. Benefits from building the road exceed costs. Allocative efficiency is improved if the roads are built. However, costs are not born by the beneficiaries alone but by nonbeneficiaries as well, causing an oversupply of the good. Further, resources are transferred from a minority to a majority.

In this early literature on vote exchanges it was hoped that logrolling was the solution to the Arrow paradox. The Arrow paradox can be viewed as resulting from our lack of information on any but ordinal preferences. The Arrow paradox can be avoided if a measure for the intensity of preferences can be found. In this case, given a certain aggregation rule, the outcome that maximizes social welfare could be selected. Intensities of preferences are revealed through vote trades. Thus, it was suggested that logrolling causes cyclical majorities to vanish (Buchanan and Tullock 1962, 333) and that vote trading leads to "free-

3. Previous to Tullock (1959), Downs (1957, 55) addressed implicit logrolling, that is, the formation of a platform composed of various proposals. In the political science literature early discussions of logrolling go back to Bentley (1907).

4. Downs (1961) challenged Tullock's argument, noting that there is a tendency for government to undersupply general interest legislation. Mueller also (1989, 333–4) raises doubts regarding the hypothesis that logrolling leads to a larger than optimal size of government.

dom from Arrow's impossibility theorem" (Coleman 1966, 1115). However, it was shown that a social choice process involving logrolling is plagued by cyclical majorities.

Cycling occurs when an alternative proposal beats all other proposals under the voting rule used. Cycling implies the presence of intransitive social preferences. The close relationship between vote trading and cyclical majorities can be illustrated by using Table 1. From this table, four combinations of issue pairs arise: (A,B), $(\sim A,B)$, $(A,\sim B)$, and $(\sim A,\sim B)$. A cycle exists over these issue pairs. After voters 1 and 2 have agreed to form a coalition for the passage of both issues (A,B), voter 3 has an incentive to approach voter 2 for the passage of the $(A,\sim B)$ pair. This combination makes voter 2 better off by 3 units and voter 3 better off by 2 units of utility. Next, voter 1 has an incentive to approach voter 3 with the proposal to pass none of the issues $(\sim A, \sim B)$. Voter 3 will abandon the coalition with 2 to enter a more favorable coalition with 1. From this point, the cycle can start all over again with the combination (A,B).[5] Bernholz (1973) shows formally that preferences that allow for a logroll imply the existence of a voting cycle.[6] Although individual preferences may be transitive, group preferences are intransitive in situations that allow vote trading. The possibility of cycling through logrolling implies that the potential benefits from a logroll may go unrealized if coalitions are not stable.

The sequence of possible trades and outcomes is virtually endless, giving enormous powers to an agenda setter who can stop trades at a point in the sequence that is most advantageous to him or her (McKelvey 1976). If the potential for a cycle exists, an agenda setter can lead the committee through a series of votes to his or her preferred outcome. Shifting coalitions do not only occur when the loser proposes a platform to make a voter abandon a logroll coalition and join the previous loser; shifting coalitions can occur simply because the agenda setter is altering the proposals put before the committee in a particular way. Observationally, shifting coalitions due to agenda setting and those due to seeking better trades are equivalent. The cycling results have severe implications for the normative properties and stability of the political process. Logroll coalitions are predicted to be inherently unstable, and the outcomes of the political process may be far from anything resembling optimality. The

5. Caplin and Nalebuff (1988) claim that for reasonable spatial preferences cycles cannot occur for majorities greater than 64 percent.

6. Downs was probably the first to indicate a relationship between vote trading and the voting paradox (1957, 55–60 and 64–9). Other references showing that the existence of logrolling implies the possibility of cycles are Bernholz (1973, 1975), Koehler (1975a, 1975b), Oppenheimer (1975), and Schwartz (1975, 1981).

only way a logroll does not create the potential for a cycle is when a unanimity rule is used (Bernholz 1973).

The theorems of Bernholz and others link the instability of the classical voting paradox with vote trading. They say that, if a majority of voters prefers the passage of some package of minority positions, there exists an alternative bundle of some other minority positions preferred by some other majority. Thus, an agreement is unstable because some voters have the power to overturn it in favor of an alterative outcome. Further, these results are troubling in another dimension. Public choice addresses the issue of how to induce cooperation in collective choices and how to overcome the problems associated with the prisoner's dilemma. Once the cooperation problem is overcome, however, via some vote-trading contracts, the issue of instability of the outcome immediately arises. As in the prisoner's dilemma, players have an incentive to find a more advantageous arrangement: an outcome is potentially unstable if cooperation is an integral part of that outcome. Therefore, it is difficult to induce individuals to cooperate; players know that once cooperation is achieved, some actors have the power to overturn the outcome in favor of another.

Some scholars suggest that the possibility of reneging is unlikely to arise because of credibility issues (Coleman 1967; Mueller 1967). Riker and Brams (1973) stress the possibility that trades may be broken and that this phenomenon causes instability. They emphasize that logrolling is most likely a negative-sum game. The costs imposed on nontraders outweigh the benefits achieved by traders. In this view, logrolling is a negative-sum game and every voter can lose if majorities are cyclical. Rational trades make all members worse off over a cycle, and logrolling is more often a move away from the welfare frontier than a move toward it. The conclusion of this argument is that logrolling is unimportant in legislatures (Riker and Brams 1973, 1240). The Riker and Brams model has been criticized on the grounds that voters do not sell their votes in the best market (Tullock 1974) and that in their model voters are myopic and trade even if it makes them worse off (Bernholz 1974a). Schwartz (1975) responds to Riker and Brams by showing that the outcome in the absence of vote trading can be Pareto inefficient. He shows that when it is, there exists at least one potential vote trade that can make every legislator better off than he or she would have been in the absence of vote trading.

The centralized vote-trading model stands in stark contrast to the previous model in its optimism about the vote-trading process (Koford 1982). In the central vote exchange model reneging is not an issue since vote trades are organized centrally by party leaders. Votes are prices paid for the passage of legislation. Costs of passing the bill are costs

incurred by legislators who are opposed to the legislation but vote for it. These costs are minimized: leaders have incentives to select those legislators to help pass a bill for whom it is cheapest to do so. Further, legislators pass only bills for which benefits exceed costs. Thus, vote trading exist within the confines of a positive-sum game.

5. Apparent stability in social choices

It appears that we do not observe endless cycling in the real world. Acts are passed and remain unaltered for a long time. Outcomes from one session to the next do not differ as much as indicated by the cycling theorems. Once Congress has regulated an industry, it takes many years and overwhelming evidence of the inefficiencies of the policy to assure deregulation of the industry. Stability seems dominant. At least some degree of stability is also evidenced by Mayhew's (1966) account of logrolling coalitions between legislators representing city, labor, farm, and western interests. Neither does it appear that reversals and cycles occur in other areas of collective choice. For example, incumbents get reelected and are not defeated by challengers as predicted by cycling theory. No erratic shifts of allocations of resources among government sectors occurs as might be expected if different majorities govern from period to period. Tullock (1981) noted that the theory that predicts cyclical majorities stands in sharp contrast to reality and asks why stability is observed in legislatures, although instability is predicted by innumerable chaos theorems.

Stories about cyclical majorities focus entirely on short-run incentives and assume a degree of myopia. If foresight is added to the story, the results change. If members of the winning coalition have foresight and understand that they will ultimately receive less if coalitions are unstable, cheating on vote trades is less likely. Rational behavior predicts that if one player is breaking a vote-trading agreement to achieve a larger payoff, this player has to expect that subsequently other players will also break vote-trading contracts with him. A degree of myopia is required for the player breaking a vote-trading contract to expect others not to do the same. Cheating is profitable in the short run, but the relevant question is whether cheating is profitable on balance, or in the long run. For an individual player cheating may be profitable if it takes a long time until someone else cheats. The relevant decision rule for cheating is to compare the present value of payoffs under reneging on a vote-trading contract and not reneging. If it pays more to stick to the present agreement, voters will not break the contract. By this line of reasoning, a representative who expects to stay in the legislature for another few sessions is less likely to break vote-trading agreements than a legislator

who is serving his or her last term. Misrepresentation of preferences is not profitable if it is not credible. Knowledge of constituency characteristics of committee members serves to decrease the potential of misrepresentation of preferences: committee members have incentives to acquire information about constituency characteristics of fellow members to reduce the potential of preference misrepresentation.

Experimental studies provide hope about the efficiency and stability of logrolling agreements. Experiments with students using the auction method of voting showed that voters did not behave strategically (Smith 1977). Vote-trading situations have a core in many but not all experimental settings (Ordeshook 1986). In this case a core is defined when the sincere outcome is undominated. Experimental results indicate much more stability in outcomes than expected if majority rule is used (Fiorina and Plott 1978; McKelvey and Ordeshook 1980).

The solution concept for zero-sum games proposed by von Neumann and Morgenstern (1953) is stable. They argue for the absence of cyclical majorities, reasoning that if a trader knows a certain trade will be overturned, he may stick to a relatively advantageous trade. In a divide-the-dollar game between three voters, a stable coalition over many periods between two of the voters assures a win of 50 cents for each period. If one of the voters reneges and majorities turn cyclical, the average expected gain is 33 cents. Along similar lines, Oppenheimer (1975) suggests that a bargaining set can be used as a predictor for logrolling. Some experimental evidence suggests the competitive solution will prevail (McKelvey and Ordeshook 1980).

Haefele (1971) and Koford (1982) suggest that party leaders arrange trades, form winning coalitions, and maximize the welfare of party members. Haefele emphasizes the role of parties in legislatures. In his model, parties help the formation of coalitions and induce stability in outcomes. As previously noted, Koford (1982) proposes that party leaders in Congress provide "efficient vote-trading services." Leaders are thought of as passing bills when the total demand for the bill exceeds the total demand against the bill. Leaders maximize expected consumer (representative) surplus. They pass bills for which positive demand exceeds negative demand by forming vote-trading coalitions. If the trading process is organized in this manner, efficiency is enhanced and potential reneging is minimized. Welfare is increased via a centralized process: bills are passed only when total demand for exceeds total demand against. Leaders from both parties cooperate in securing vote trades that maximize welfare of their party members in the legislature. If the majority party would attempt to maximize the surplus of its members only, for example via internal logrolling, the minority party would have incentives to offer vote trades to members of the majority party that designed to break up

this coalition. A cooperative duoploy has stronger stability properties than any other equilibrium (Koford 1987). In a later paper Koford (1990) argues that transactions costs (i.e., the costs of informing citizens how their representative voted on a bill) lead to logrolling coalitions that organized along party lines.

One expects the vote-trading coalition to be a minimum winning coalition (Riker 1962). Every unnecessary member included in the winning coalition implies that the net payoff is smaller for the members than needed to secure victory. The largest share for each member is secured when the coalition has the minimum number of members to ensure passage of the bill. However, minimum winning coalitions are potentially unstable (Tullock 1981). Losers always have an incentive to reformulate the platform, so they are included in the winning coalition. Tullock proposes that a form of logrolling that includes nearly every voter in a legislature is a device to form stable coalitions; minorities are not excluded from getting some benefits so that they are not tempted to form alternative coalitions. A formation of larger than necessary coalitions induces stability. In the limit the whole committee is in the coalition.

Instability implies the formulation of new vote-trading contracts. This involves decisions on which issues to trade votes on and decisions on the price of votes. Transaction costs of formulating new vote-trading contracts are assumed to be zero in formal models that produce instability theorems. Once transactions costs of making and breaking a contract are introduced, a degree of stability is introduced (Coleman 1983). An alternative and more formal argument was put forth by Shepsle and Weingast (1981), who argued that institutional structures produce stability. For example, institutions restrict the number of bill reformulations via the congressional committee system and devices such as the closed rule. Institutional arrangements may produce equilibria known as structure-induced equilibria; in these equilibria, committees, viewed as gate keepers, play an important role in arriving at stable outcomes. The committee system admits only certain preferences in the drafting of the bill. The closed rule in Congress prevents amendments from the floor, thereby restricting the number of alternatives. Further, stability may be induced because of constraints on agenda setters. Agenda setters often are not at liberty to pick any pairs of alternatives they wish (Niemi 1983). Constraints on the number of alternatives that are proposed in a legislative body also induce stability (Niemi 1983).

Bernholz (1978) emphasizes that a legislator knows neither the duration of his stay in Congress nor the number of issues that may come up. In this case, a stable prisoner's dilemma supergame emerges since the same types of issues are repeatedly voted on and the same players reappear in successive games. The gains from cooperation are positively related to the stability of the game. In a repeated game, voters cannot do

better by violating vote-trading contracts; once a voter breaks a contract, he loses trustworthiness, which is an impediment to future contracting. A shortcoming of this model, as with most models of logrolling, is the impossibility of predicting the types of coalitions formed. All one can say is that once a vote-trading coalition is formed, it should be stable. Assuming repeated games and addressing the consequences of loss of trustworthiness seem appropriate for models of legislatures.

It is useful to view the logrolling literature as belonging either in the category of anarchic trading or in the category of ordered trading. Anarchic trading implies instability, shifting coalitions and negative welfare effects. Ordered trading produces welfare gains and is stable. The theorems that relate logrolling to cyclical majorities, as in the work of Bernholz (1974b), and Riker and Brams (1973), belong in to the anarchic category. The work by Haefele (1971) and Koford (1982) are examples of ordered trading. In this type of categorization, Mueller's (1973) vote-market suggestion is viewed as one mechanism of transforming chaotic trading into ordered trading as occurs in private goods markets. Ordered trading is implied by models that show the importance of legislative structure (Shepsle 1979; Shepsle and Weingast 1981). If instability were widespread in Congress, evidence for reciprocity in vote trades should be virtually nonexistent, supporting the view that trading is anarchic. Evidence presented by Stratmann (1992) does not support the anarchic trading idea. He finds reciprocity among members from agricultural districts voting for their colleague's commodity price supports, quota restrictions, and so forth. In another study, he found nonideological reciprocity between representatives of city, labor, and farm districts on votes for subsidies to these sectors of the economy (Stratmann 1995).

Ordered trading is also predicted by models that view parties as institutions that reduce the transactions costs of organizing logrolling coalitions Koford (1990). By organizing these coalitions, they maximize their members' net benefits. Using party cleavage as a means to organize trades, legislators divide into two groups with similar preferences in each group. The location of the parties is endogenous: their location is such that the issue that divides most legislators divides the party (Koford 1990). One can think of legislators as using party as a device, a marker, along which vote-trading coalitions are organized. The driving factor, however, motivating a legislator to trade votes and motivating his or her choice of trading partners must be the similarities of constituencies between legislators of the same party.

6. Evidence for logrolling

Empirical work on legislatures must face the problem that most theories give little or no guidance on how to proceed in estimating relationships. In

the area of logrolling, theory predicts that anything can happen. Paradoxes occur in the literature because everyone is allowed to trade with everyone else. For example, voters mildly opposed to proposition *B* may trade votes with a minority intensely favoring proposition *B* in exchange for the minority votes against issue *A*. If this were true, then no empirical relationships could be found. However, there appear to be some patterns in vote trading and stability in legislatures. For example, the trade among commodity interests within a block of legislators interested in farm subsidies has been reported as ongoing since the inception of government subsidies to the agricultural sector (Black 1928). Caught in this dilemma – the lack of theoretical guidance for empirical work and the appearance of stable empirical relations – empirical work on legislative voting behavior is proceeding on a thin rope in the specification of statistical models. However, progress has been made.

Early studies by political scientists often do not explicitly address the issue of logrolling but report vote trading in the process of their descriptions of legislative behavior.[7] Mayhew (1966) studies the House of Representatives in the United States from 1948 to 1962.[8] He focuses on votes addressing farm, city, labor, and western issues. During that time, most representatives from the Democratic party tended to vote in ways benefiting special interests. Examining the constituency benefiting from various types of legislation, Mayhew argues that legislation benefiting farm, city, labor, and western interests could not have passed if every legislator had voted sincerely. Mayhew observes that Democrats representing various special interests supported each other on four different types of issue. He infers logrolling from statements in the *Congressional Record*, for example, by Alfred Santiano who states "I say to you Members from the farm States whom we have supported time and time again that this policy of Government aid is a two-way street. We want you to support us to the same extent we supported you" (81). Mayhew draws the conclusion that "the Democratic party in 1947–62 was transcendentally a party of 'inclusive' compromise. . . . Some congressmen wanted dams, others wanted mineral subsidies, others wanted area redevelopment funds, others wanted housing projects, still others wanted farm subsidies. As a result, the House Democratic leadership could serve as an instrument for mobilizing support among all Democrats for the programs of Democrats with particular interests. 'Indifferent' Democratic congressmen frequently backed such programs 'even against the debatable best interest of the people of their own communities' " (Mayhew 1966, 150). Froman (1967) emphasizes that bargaining between legislators is important for the passage of many types of legislation. Froman describes bargaining as taking the form of simple logrolling (the pork-barrel kind), time logrolling, compromise, and side payments. He provides anecdotal evidence for these types of bargaining. Jackson (1974) hypothesizes that logrolling occurs on those votes that are poorly explained by constituency variables in regression equations. Using this criteria and analyzing roll calls from the 1963 Senate, he comes to the conclusion that vote trading is important for some votes.

7. Logrolling can occur either via explicit trades of votes on bills or amendments or via the inclusion of various issues in a single bill voted on as a package. Most studies have focused on the explicit exchange of votes on bills or amendments that are voted on separately.

8. For other early empirical work related to logrolling see Fenno (1973) and Ferejohn (1974).

More recently, economists have worked on the empirical identification of logrolling and logrolling coalitions in Congress. Kau and Rubin (1979) attempted to identify logrolling and to distinguish between self interest, ideology, and logrolling in congressional voting. In a conditional logit analysis, they used observations on representatives' actual votes on a variety of issues – dichotomous variables – as the explanatory variable for the dependent vote variables. For example, roll-call votes on hijacking and consumer protection were among the votes used to explain a roll-call vote on a highway program. This identification of logrolling coalitions has two shortcomings. First, this analysis may serve to examine what kinds of coalitions form, but no theory underlies the analysis as to what vote variables should be included in the regression equation. Given this lack of guidance from formal logrolling models, this issue is difficult to address. Second, the same unobserved constituency variables or any other set of variables may influence the vote on the left-hand side and right-hand side of the regression equation. In this case the actual vote variable on the right-hand side of the regression equation is correlated with the error term and the estimated coefficient on the vote variable is biased. A solution to this problem is to use the predicted vote index of a probit model that is a function of constituency variables. Voting on bills is an expression of the direction of preferences, not their intensity. However, by using the predicted value of the vote index, a measure of intensity of preferences is found. For example, on votes on increases in wheat subsidies, ceteris paribus, this index is higher the larger the number of wheat farmers among the constituency of the voting representative. Further, the index is a linear combination of observed variables. Thus, no observed variables can potentially cause a correlation between the error and the predicted vote index.[9]

9. Stratmann (1992) uses a three-equation simultaneous probit model to test for the presence of logrolling coalitions. A good first assessment on whether logrolling is important for a particular set of votes can be obtained by simply inserting the predicted vote value into the regression equations.

Empirical work must face the issue of which votes are those where logrolling is expected. Some guidance is provided by theory. Votes that are potentially subject to logrolling are votes where a minority of legislators is intensely in favor (opposed), while the majority of legislators are mildly opposed (in favor) or indifferent. Logrolling gives a specific prediction: *xPy* and *zPw* but *ywPxz*. Vote trades are predicted on issues that would not pass if every legislator votes his or her honest preferences but that are passed if logroll coalitions are formed. Likely candidates are votes where the minority interest has won. Among this set of votes, applying Riker's (1962) size principle, likely candidates are votes in which the outcome has been reasonably close. Using this reasoning and the statistical method outlined above, Stratmann (1992) identifies logrolling statistically among agricultural interests on amendments to the 1985 farm bill. Among the findings are that representatives from tobacco districts traded votes with legislators representing other agricultural commodity interests, specifically sugar and peanut farmers. Fairly equal size on the peanut-vote coefficient in the sugar regression and the sugar-vote coefficient in the peanut regression provided evidence for nonideological reciprocity and coalition formation. This finding is consistent with the many anecdotal reports indicating that vote trades have been formed among legislators representing specific farm commodity interests. A recent anecdote comes from former Senator Gore (1992), who writes "As a member of the Southern 'farm block' in Congress, I have followed the general rule that I will vote for the established farm programs of others in farm states . . . in return for their votes on behalf of the ones important to my state."

One expects that legislators marginally opposed to legislation, rather than strongly opposed, are those being sought as members of the logrolling coalitions. The opportunity cost of voting for special interest legislation is lower for a legislator who is marginally opposed than for a legislator who is strongly opposed because of the characteristics of his or her constituency. Thus, if leaders organize logrolling coalitions and vote trades efficiently, they will select legislators as members of the vote-trading coalition who are marginally opposed. Evidence suggests that those legislators who are the cheapest to buy for membership are most likely to be members of the vote-trading coalition. For example, on an amendment on peanut subsidies, it was found that 120 legislators switched their vote due to a vote-trading agreement. These legislators made up a disproportionate share of those who had a probability between 0.3–0.4 and 0.4–0.5 of voting for peanut subsidies: 90 percent of legislators who were in the 0.3–0.4 range switched votes and 65 of 134 legislators who were in the 0.4–0.5 range switched.

In another study, Stratmann (1995) examines some of the votes analyzed by Mayhew. Mayhew (1966) argues that logrolling coalitions were organized in the Democratic party. Stratmann assesses whether vote exchange agreements independent of party pressure determined roll calls in the House of Representatives. Vote trades between interests favoring legislation benefiting city, farm, and labor constituencies were analyzed. It was found that vote-trading agreements were qualitatively and quantitatively important. For one set of estimates, it was found that membership in the vote-trading coalition caused 71 legislators to switch their vote to favor farm subsidies, 135 representatives switched their votes to favor city subsidies, and 58 representatives switched to favor labor legislation.

If logrolling is beset with unstable coalitions, composition of the winning coalitions varies constantly. The net redistribution of benefits will be zero in the long run since every voter is a member of the voting coalition at least sometimes. Using a variance test to examine cyclical majorities in the U.S. Congress, Stratmann (1996) finds no evidence of cycling and finds that federal grants and pork-barrel projects are unevenly distributed among congressional districts. These results point to the importance of institutions in legislative decision making.

Studies that examine the normative properties of logrolling assume that logrolling is an important element of congressional voting. This assumption is validated by casual observation and empirical studies with different levels of sophistication (Mayhew 1966; Kau and Rubin 1979; Stratmann 1992). A question less explored is how logrolling coalitions form. One explanation is that party leaders or presidents organize these coalitions or that logrolling coalitions are formed along party lines (Koford 1987). Observing votes along party lines on redistributive issues (for example, on urban redevelopment programs) does not imply that party leaders are the causal factor that drives the formation of the logrolling coalition. The underlying cause of legislators' trading along party lines may be that it is the lowest cost exchange available. Fiorina (1974) emphasized the difference between reelection constituencies and geographic constituencies. If legislators from the same party have similar reelection constituencies then similarities in election constituencies may lower the opportunity cost of vote trades between party members. Thus, party affiliation is a merely veil behind which legislators with similar constituencies trade votes.

7. Conclusion

In the 1960s and early 1970s, the research on logrolling focused primarily on normative issues. The subsequent literature linked the apparent

stability of social choices to institutions that may induce stability and may produce some degree of optimality into the collective choice. Recently, empirical work has reiterated the importance of vote exchanges in legislatures. These studies measure vote trades and point to ways in which logrolling coalitions are formed.

To date, empirical findings appear to point to stable coalitions. For example, the ongoing vote-trading coalitions between farm, city, labor, and western interests has been documented from 1947 to 1962. Further, reciprocity in vote trades has been found, indicating no widespread reneging on vote-trading agreements. Empirical studies on logrolling may help to solve the normative issues surrounding the exchange of votes.

Following the argument by Riker and Brams (1973), one may argue that even if no cycle is observed and coalitions are stable, the fact that a potential for a cycle exists implies that the outcome of the collective decision is arbitrary. However, political institutions may produce incentives that lead to an outcome that is far from arbitrary. Following Koford's (1982) line of reasoning, political leaders calculate utilities and maximize welfare. In this case, the outcome is not determined by an agenda setter who leads a committee to his preferred outcome but by the party leaders' quest to maximize welfare.

So far, the scarce evidence on vote trading appears to be consistent with the hypothesis that leaders efficiently organize vote trades: many of the legislators who voted for a bill because of a logroll agreement were legislators marginally opposed to the passage of the bill. Thus, representatives for whom it was cheapest to vote against constituency interests were solicited as members of the logrolling coalition. These results suggest that these coalitions are not formed as suggested by the cycling theorems. At one step in a cycle, high demanders form a winning coalition with very low demanders, opposing those with moderate intensity. For example, at some point in the cycle wheat farm representatives are expected to trade and form a winning coalition with legislators strongly opposed to peanut subsidies. This implies that legislators with a low probability of voting for peanut subsidies vote for these subsidies due to the vote-trading agreement. The evidence is not consistent with this prediction (Stratmann 1992). Many of the traders are legislators marginally opposed to peanut subsidies. This is consistent with the hypothesis that party leaders arrange low-cost trades that in turn enhance stability. More studies are needed to be more confident that these findings hold for many vote trades.

Evidence for stability in logrolling coalitions and the stable distribution of federal funds among congressional districts point to the importance of congressional institutions. Which institutions specifically induce

stability in logrolling agreements or which institutions help to organize coalitions is somewhat ambiguous. Little or no systematic evidence exists that identifies quantitatively the contribution of potentially stability inducing institutions, as, for example, party leaders, the committee system in Congress, or congressional rules. Finding empirical regularities in the voting behavior of legislators and coalition formation in legislatures will indicate which coalitions are stable, give a clue about the causes that lead to the formation of coalitions, and stimulate further research.