2nd May, 2012

LSE MSc Economics

EC428: Development and Growth

Extended Essay: ‘A Social Learning Model to Explain the Urban Bias’

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Abstract

This paper seeks to provide an explanation for urban bias by examining governments' investment decisions in light of divergent speeds of information exchange in the rural and urban sectors. Using a political economy model, it is shown that under certain conditions, a government may have an incentive to choose a project that is less likely to be welfare-conducive because concentration of the beneficiary effects in the urban region means the government will stay in power for longer.

Word Count: approx. 5882

1 Introduction

This paper seeks to provide a model to explain urban bias. This section introduces the concept of urban bias and provides a brief review of the literature on the topic. It then outlines the structure of the rest of the paper.

Urban bias was initally brought to prominence by Lipton (1977), who defined it as the fact that "polities are so structured as to provide rural people with inefficiently *and* unfairly few resources." Lipton argued that the bias exists primarily due to an 'invisible hand' leading to self-interested urban agents, and rich rural agents, to favour the urban sector of the economy. This would manifest itself primarily in 'price twists': state-induced market distortions that meant that the prices of goods and services departed significantly from the prices they would command under a market economy. Further work was done by Bates (1981), who looked at Sub-Saharan Africa in particular. He, too, identified a system whereby governing powers had an incentive to disfavour a country's rural population.

An issue of the Journal of Development Studies[1] discusses the urban bias thesis in greater detail. In the introduction, Varshney (1993) highlights four flaws of the literature on urban bias. Firstly there is an issue of definition: it has not been made clear who or what qualifies as 'rural' or 'urban'. For example, some attempts at exposing the bias have grouped the urban poor under the heading of 'rural poor'. Secondly, the literature seemed to cast urban bias as a problem in the entire developing world. Nevertheless, there is ample reason to believe that certain regimes are more susceptible to urban bias than others. Authoritarian China's attitude towards its rural population is markedly different from democratic India's, for example. Thirdly, much of the theory has put too much emphasis on the economic aspects of urban bias, and too little on the political aspects. Finally, the theory of urban bias might have lost its relevance due to the increased sway

[1] Journal of Development Studies, Taylor & Francis Group, Volume 29, Issue 4, 1993

of rural areas caused by technological change.

Other articles in the issue argue for or against the urban bias thesis. Timmer (1993) provides a counterexample to the urban bias thesis by demonstrating rural bias in South-East Asia. Widner (1993), on the other hand, examines how political institutions might limit the urban bias, based on an analysis of the Côte d'Ivoire.

Bates defends the urban bias thesis in the last section of the special issue. Bates (1993) argues that, although the content of the theory of urban bias was lacking, the hypothesis itself remains valid nevertheless. Directions for further research that he suggests are to look at political institutions more closely, and political ideology in particular.

More recent work on the relevance of urban bias was undertaken by Jones and Corbridge (2010). They outline the history of the thesis and warn of the dangers of overcompensating: a very firm belief in the urban bias thesis may skew policy towards rural populations while it is in fact the urban poor that suffer most.

Perhaps inspired by Bates' and Varshney's recommendation to look at the political economy aspect of urban bias, Majumdar et al. (2004) provide a theoretical analysis of urban bias. They argue that it is the urban sector's superiority in obtaining information on government quality that drives the urban bias. Moreover, they argue the bias may be reversed depending on what shocks (negative or positive) hit the economy.

This paper presents a different argument: the divergence in *speed* at which information travels - not the quality of information - is what drives at least part of urban bias. If word about government's bad faith spreads very quickly in one area, and slower in another, the government has an incentive to minimise the risk of appearing to act in bad faith in the former area. Since rural populations are not as concentrated as urban populations, government has an incentive to prolong its tenure by investing in urban areas.

The rest of this paper is outlined as follows. The second section proposes a simple political economy model where government has to choose to invest in a project. In the third section, a social learning model is introduced to assess what parameters drive the decisive factor of the political economy model. The fourth section concerns approaches to empirical tests, and policy implications. The fifth section concludes.

2 Political Economy

This section outlines a simple political economy model where the government earns a wage for each period it stays in power. With different probabilities of project success, the number of periods a government may hope to stay in power if a project fails can influence it to take a sub-optimal decision.

The model has the following features. Before the first period, the government chooses to invest in one of several projects. The benefits accrue to households directly, but information on their effect spreads slowly amongst households, as examined through the dual-sector social learning model introduced in the next section. Each period the government is in office, it earns a wage w. It does not discount the future and is risk-neutral.

The ejection mechanism is Schumpeterian[2] in nature: rather than election cycles, households have the possibility of 'throwing the rascals out'. At the end of each period, households cast a vote over whether they want to remove the current government. This is to capture both democracies and non-democracies in this paper: both institutions are susceptible to such an ejection mechanism (although citizens tend not to vote, but take to the streets) but only democracies feature election cycles.

Assume the government must choose from three projects, all at the same

[2]See Schumpeter (1994 (1942))

(zero) cost. Each has a probability p_g^a of succeeding, a probability p_g^b of being 'unsuccesful' and a probability $1-p_g^a-p_g^b$ of being a disaster. If a project succeeds, more than half of all households benefit; if it is unsuccessful, more than half does not benefit. If it is a disaster, no household benefits and the government gets a zero payoff: it is removed from office immediately.

Households are aware of the relevant probabilities, but cannot observe the government's choice. They are also unaware of the exact outcomes in each state - they only know at least a majority benefits if a project is successful, that less than a majority but more than none benefits if it fails, and that none benefit if it is a disaster. Hence they believe that any possible allocation of benefits across households is equally likely *ex ante*.

The difference between the first two projects is as follows. In the first project - call it the 'urban' project with probabilities p_u^a, p_u^b - the potential *non*-beneficiaries after an 'unsuccessful' outcome are located primarily in the rural sector. In the second - the 'rural' project with probabilities p_r^a, p_r^b - they are located primarily in the urban sector. The non-benificiaries are centered on their respective sector's 'counterpart agent' - the agent responsible for communication between the two sectors in the social learning model introduced in the next section.

The third project has a probability $p_s^a = 0$ of succeeding, but allows the government to extract rent. Unbeknownst to the public, the rent on the third project is insufficient to induce the government to ever choose it. Nevertheless, because the public does not observe the government's choice of project, it will always assume that an outcome that does not benefit a majority of the population is the result of government rent-seeking and an attempt to exploit imperfect monitoring. Any household that observes that less than the majority has benefited from a project will vote to eject the government because it believes the government attempts to seek rents at the expense of its citizens.

At the outset of the model, households are aware only of whether they have benefited from the government project or not. In the next section, a social learning model is introduced to model how information about other households' condition spreads amongst households. This is used to determine the parameters that determine how many periods it takes for a majority of citizens to vote to eject the government if either of the first two projects fails.

Call T_u the number of periods it takes for a majority to vote to evict the government if the first project is unsuccessful, and call T_r the equivalent for the second project. Call V the future benefit to the government of staying in power indefinitely when either project succeeds, which can also be expressed as a multiple of w, Rw - we can interpret R as the number of periods the government can hope to exist, or the number of periods until the next election cycle.

The government will choose to undertake the first project if:

$$p_u^a \cdot (w + V) + p_u^b \cdot \sum_{t=1}^{T_u} \cdot w + (1 - p_u^a - p_u^b) \cdot 0 \geq p_r^a \cdot (V) + p_r^b \cdot \sum_{t=1}^{T_r} \cdot w + (1 - p_r^a - p_r^b) \cdot 0 \quad (1)$$

This means that for some $T_u, T_r, p_r^a, p_r^b, p_u^a, p_u^b$, the government chooses to undertake the first project - which favours the urban sector - even though $p_r^a > p_u^a, p_r^b > p_u^b$, i.e. even though the second project is more likely to lead to a welfare-increasing outcome. In the next section, the factors that determine T_u and T_r are determined using a social learning model.

3 Social Learning

This sections starts with a brief outline of the general social learning model as presented by Geanakoplos and Polemarchakis (1982). This is followed by an extension to include the possibility of communication between two distinct sectors. The aim is to model how information spreads amongst households in two different sectors, and across the two sectors. This will make it possible to determine the factors that affect T_r, T_u which in turn affect the government's decision whether to invest in the rural or urban sector. These factors are considered in the final part of this section.

3.1 The Basic Social Learning Model

Assume the economy consists of N households - where N must be an integer value - and that there is a possibility set Ω of 2^N possible states of the world relevant to them. Each possible state ω completely characterizes which households have benefited from a government project and is depicted as follows:

$$\omega = \{B_1, B_2, \ldots, B_N\}$$

where $B_i = 0$ indicates household i has not benefited from the government project, and $B_i = 1$ indicates that it has.

Each period, households announce their belief regarding the likelihood that some subset of Ω, E, has occurred. After observing other households' announcements, households readjust their beliefs and announce accordingly in the next round, until agreement is reached. The information set for each household i at round t, $I_i^t(\omega)$ is the set of all states that household i (still) considers possible at period t given the actual state of the world ω.

Assume that for each household, the possibility set Ω is partitioned into $\mathcal{P} = \{P_1, \ldots, P_N\}$ sets so that for all $P_i \neq P_j \in \mathcal{P}$, $P_i \bigcap P_j = \emptyset$ and $\bigcup_{P \in \mathcal{P}} P_i = \Omega$. It is common knowledge what each household's partition is.

At the start of each period, each household announces their belief regarding the event E, which is:

$$q_i^t(\omega) = \frac{p\left(I_i^t(\omega) \bigcup E\right)}{p\left(I_i^t(\omega)\right)} \tag{2}$$

Afterwards, households observe each other's announcements. In the next period, they announce their beliefs, updated with the information inferred from each other's announcements. Common knowledge of each household's partition allows them to make inferences that sharpen their information sets. Under certain conditions (see Geanakoplos and Polemarchakis (1982)) the announcements will converge to probability one or zero at some period t.

3.2 Social Learning Extended To Multiple Sectors

To extend the social learning model to two distinct groups, three factors are introduced: firstly, the possibility of different group sizes. Secondly, the possibility that 'news travels faster' in one group than another. Thirdly, a point of contact between the two groups.

For the first point, simply assume that the first and second group (from hereon the 'urban' and the 'rural' groups) are proportion θ and $1 - \theta$ of the population, respectively, and that the first θN households belong to the urban group, and the following $(1 - \theta)N$ belong to the rural group. θN and $(1 - \theta)N$ must be integer values to avoid considering 'half' households.

For the second point, assume the following: (a) each household's position in the order of the set of possible states reflects some form of geographical proximity; (b) the arrangement of the households is circular, so that an announcement by urban household θN is observed by urban household 1, and likewise for the rural group; (c) each announcement is only observed by a certain number of households on either side of the household making the announcement. Call this number r_u for the urban fraction of the population, and r_r for the rural fraction. Both numbers r_u and r_r are strictly positive integers, to reflect the discrete nature of the set-representation of the population.

It is assumed throughout that information spreads faster in the urban region - i.e. $r_u > r_r$. This is justified based on several arguments. As Majumdar et al. (2004) argue, urban areas have better access to media and communications; moreover, they are more densely populated. Both would imply that news spreads significantly faster in urban areas. Mass communication in the developed world - primarily internet and mobile telephones - has all but eradicated this difference, and would explain why an urban bias there (if there is one!) is far less severe. Bates (1981) makes very much the same point in reference to large and small farmers. He argues that the latter group lacks sway over policy as they are "widely scattered".

For the third point, assume that two households, one in each group, observe each other's announcements. Call them the rural and urban counterpart households. For example, household $\theta N/2$ in the urban group observes the announcement made by household $(1-\theta)N/2$ in the rural group, and vice versa. Through their counterparts' announcements, they deduce what the state of affairs is in the other sector. Moreover, they spread this news to households in their own group.

Modeling communication between the rural and urban sector in this manner is realistic because it reflects an existing channel of communication between the urban and rural sector, which is that people often keep in touch with family in the city or in the countryside. It is unrealistic to assume that only one household does this. Nevertheless, it is a useful approximation, and the size of the respective groups can be altered to reflect the proportion of households in each group that is in contact with friends or family in a different group.

3.2.1 Convergence in Dual-Sector Social Learning

This subsection examines how information spreads in a social learning model with two distinct sectors, ignoring the possibility of counterpart agents relating the two sectors to each other for the moment.

Throughout this paper, assume that for each household the possibility set is split into two partitions by the following rule: one partition contains all states of the world where the household benefited from the government project, the other all states of the world where this is not the case. Since each household's partition is their only source of information in the first round, this consists of a private signal telling the household whether it has benefited or not. Assuming each state is equally likely, the announcement for all agents in the first period simply reveals their private signal:

$$q_i^1 = \begin{cases} \sum_{j=(N/2)}^{N-1} 2^{-1} \cdot \frac{(N-1)!}{j! \cdot (N-1-j)!} & \text{if } B_i = 0 \\ \sum_{j=(N/2)+1}^{N-1} 2^{-1} \cdot \frac{(N-1)!}{j! \cdot (N-1-j)!} & \text{if } B_i = 1 \end{cases}$$

where $2^{-1} = \frac{2^{N-1}}{2^N}$ is the denominator from (2) above, and reflects the *ex ante* probability that the states which have not been ruled out by i's private signal have occurred. This means it is equivalent to the probability that any state has occurred, multiplied by the number of states i has no information on.

The equivalent of (2)'s numerator is the probability of the intersection of the event set with the information set. In this case, and throughout the rest of this paper, the event set is that strictly more than half of *all* agents, regardless of their sector, do not benefit by the government project. This coincides with the possibility of 'not succeeding' in the preceding simple political economy model. The convergence results for this event set matter to the outcome of the political economy, hence it is examined here.

If $B_i = 0$, household i only needs information that exactly half the population or more have not benefited by the program in order to deduce with certainty that the event E has occurred. There are $\sum_{j=(N/2)}^{N-1} \frac{(N-1)!}{j! \cdot (N-1-j)!}$ states, each having occurred with equal probability *ex ante*[3], in the household's information set where this is possible. The numerator for the case where $B_i = 1$ is straightforward.

At the end of the first period, each household has observed the announcements made by r (either r_r or r_u) households on either side, so $2r$ in total. From each announcement, the household can infer whether a household it observes has benefited by the government project or not. Call b_i^t the number of households i observes in period 2 that have not benefited by the government project, including i itself.

In period 2, household i therefore announces the following probability of the event-state being the actual state:

$$q_i^2 = 2^{1+2r} \cdot \sum_{j=\frac{N}{2}-b_i^2}^{N-1-2r} \frac{(N-1-2r)!}{j! \cdot (N-1-2r-j)!}$$

and subsequently for all following periods t:

$$q_i^t = 2^{1+2(t-1)r} \cdot \sum_{j=\frac{N}{2}-b_i^t}^{N-1-2(t-1)r} \frac{(N-1-2(t-1)\,r)!}{j! \cdot (N-1-2(t-1)r-j)!}$$

where b_i^t is the number of households that have not benefited by the government project that i has observed up until period t.

Household i indirectly infers whether households that are more than r away from him have benefited by the government project or not, by observing the changes to the announcements made by the households within r spaces of him. The mechanism is as follows.

[3]Recall this belief follows from households ignorance of the *exact* potential distribution of project benefits

Household i observes $2r$ other households at the end of the first period. At the beginning of the next period, he incorporates their announcements into his own. Household $j = i + r$ does the same.

In the second period, therefore, i observes j's announcement and vice-versa. j's announcement conveys information about households i through to $i + 2r$. Since i has directly observed the announcements of the households on the interval $[i, i + r]$, he can deduce what happened to the households on $(i + r, i + 2r]$ and thereby increase his knowledge about which households have benefited from the government project.

Household j does the same and obtains information on households up to $j + 2r = i+3r$. In the third period, both households make new announcements. From j's announcement in round three, i can infer how households $i+2r+1$ and $1+3r$ have benefited from the government project.

This process may, under certain circumstances, have to repeat itself until household i has obtained information on *all* potential project beneficiaries in its group. Since the set of households is circular, this means all other households must have done the same: in the next period, their announcements are identical.

Under different circumstances, convergence may occur before all announcements in a group have indirectly been observed. For example, if *all* households in a group have not benefited by the government project and the group is larger than a majority, then announcements will converge once all households have observed a majority of households that have not benefited by the government project. This will occur *before* they have observed all households in their group.

The convergence in announced probability may, in the scenario of two distinct groups, differ from zero or one. Without communication between the two groups, and given that the event and information space do take into account the other group, certainty may never be reached by either group if a majority of the households that experience no benefit is not contained in either group.

The number of periods required for within-group convergence depends on the group size, the distribution of government benefit within that group, and the rate r_g by which information spreads in the relevant group g.

It remains to examine convergence when there is a point of communication between two groups. The next subsection will focus on this, and assesses the case relevant to the political economy model introduced earlier.

3.2.2 Convergence When Communication Between Two Sectors Exists

This subsection assesses convergence between two sectors, but is limited to two cases. Both are instances of the event E, where exactly a majority of households has not benefited by a government project, but in the first instance the larger part of these households is in the urban group, in the second it is in the rural group.

The focus will be on the two 'counterpart' households. Two households, one in each group, observe each other's announcements. Communication between the two groups is necessary if announcements in either group are to convergence on probability one.

In accordance with the political economy model, assume that all agents that have not benefited by the government project are centered around the counterpart household in each group. Consider two possible arrangements: firstly, the case where the entire urban region has not benefited by a government project, and enough households in the rural region have not benefited either so that the two combined make up exactly a majority ($N/2+1$ households). Secondly, the reverse: the entire rural region has not benefited, and enough agents in the urban region have not benefited so that the two combined make up exactly a majority. The relative size of the urban and rural groups is held constant in both cases, but they are not necessarily equally large.

In the first case, it will take the 'counterpart' urban household

$$\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil$$

periods to observe all other urban households' announcements.

In the first period (ignoring the counterparts for the instance), he observes $2r_u$ others. Through the mechanism described above, he will indirectly obtain information on an additional $2r_u$ households every period. To calculate the number of periods necessary for the counterpart to observe every household, simply divide the size of his group by the number of households he obtains information on every period.

The upper ceiling of this number is used in case $(\theta \cdot N)/2r_u$ is not a rounded number. If that occurs, that implies that in the penultimate round, before all households are indirectly observed, less than $2r_u$ households remain. Nevertheless, the additional round is required to observe *all* households.

Once the counterpart urban agent has information on all agents in his group at the end of round $\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil$, he announces accordingly in round $\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil + 1$.

Over this number of periods, the counterpart urban household has also announced to its counterpart in the rural area, and he has observed the rural households' announcements indirectly. In the first period, the urban counterpart directly observes only his rural counterpart's announcement, and infers whether they have benefited by the government project or not.

At the end of the second period, the urban counterpart has inferred information on $2r_r$ agents from his observation of the rural counterpart's announcement. Since the rural counterpart has observed those $2r_r$ households in the first period, he includes the information he deduces from them in his announcement at the start of the second period. Since *all* partitions are common knowledge, the urban counterpart can infer from this announcement what happened to the $2r_r$ households close to the rural counterpart household.

So by period $\lceil \frac{\theta \cdot N}{2r_u} \rceil + 1$, the urban counterpart's announcement will also convey information on the rural households he has thus observed indirectly. The number of additional households he takes into account in his announcement is

$$\left(\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil - 1 \right) \cdot 2r_r + 1$$

The urban counterpart announces information from the rural region conveyed by the rural counterpart, but this information is always lagged one period behind the rural counterpart's announcement. So, in the first period, the urban counterpart only observes his rural counterpart's announcement that reveals his private signal. In the second period, he can therefore only relay information on one rural household.

By the end of the second period, however, he has observed another announcement by his rural counterpart. This allows him to divine whether $2r_r$ rural households have benefited by the government project. In the third period, his announcement therefore relays information on $1 + 2r_r$ households.

As an illustrative example, assume that at the end of the third period, the urban counterpart agent has observed all agents in his group, i.e. $\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil = 3$. His announcement in that period covers $1 + 2r_r$ rural agents, and he observes an additional $2r_r$ rural agents at the end of the period. When he gives his announcement about *all* urban agents in round $\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil + 1 = 4$, this announcement also includes the $1 + 2r_r + 2r_r = (3 - 1) \cdot r_r + 1 = \left(\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil - 1 \right) \cdot 2r_r + 1$ rural households he has observed thusfar.

Assume that by period $\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil + 1$, the total number of households the urban 'counterpart' announces about is exactly the majority of agents that have not benefited by the government project, i.e.

$$\left(\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil - 1\right) \cdot 2r_r + 1 + \theta N = N/2 + 1$$

This means that in the previous period, the urban counterpart household had observed exactly the number of households necessary to be *certain* that the event E occurred. He has, indirectly and directly, received complaints from an exact majority that they have not benefited from the government project.

The counterpart's announcement in the following period therefore states that the event has definitely occurred:

$$q_{\text{counterpart}_u}^{\left\lceil \frac{\theta \cdot N}{2r_u} \right\rceil + 1}(\omega) = 1$$

In the second relevant case, it is examined how many periods are required for the rural household to announce that the event has definitely occurred, if no rural households have benefited by the government project, and exactly enough urban households have not benefited either to create a majority.

It will take

$$\left\lceil \frac{(1-\theta) \cdot N}{2r_r} \right\rceil + 1$$

periods for the rural 'counterpart' household to announce that all rural households have not benefited by the government project, but convergence may occur before then depending on θ, r_r and r_u.

Convergence requires *at least* two periods: if in the first period the rural counterpart observes enough households for a majority, he can only announce so in the second period. In the first period, the rural counterpart observes one urban household (his counterpart) and $2r_r$ rural households after he has announced his own private signal. At the end of the second period, he observes $2r_r$ rural agents indirectly, as well as $2r_u$ via the urban counterpart household. In the third period, he will therefore announce on $2+2r_r+2r_r+2r_u$ households. In the $T+2$th period, his announcement conveys information about $2+2r_r+T\cdot(2r_r+2r_u)$ agents.

Convergence therefore occurs in round $T+2$ if $2+2r_r+T\cdot(2r_r+2r_u)$ constitutes a majority. This gives us an expression for T:

$$N/2+1 = 2+2r_r+T\cdot(2r_r+2r_u)$$
$$T = \left\lceil \frac{N/2-1-2r_r}{2r_r+2r_u} \right\rceil$$

3.2.3 Determining T_r and T_u

The above examines the amount of periods required for convergence, that is: the number of periods required for the *first* household to announce that the event-state E has definitely occurred. This is not sufficient to determine how many periods the government stays in power. Households will only vote against it when they are aware that the event state has occurred. The following examines how many additional periods are required for a majority of households to vote against the government, after observing that the event-state E has occurred.

Determining T_r

Recall that it took $\left\lceil \frac{\theta\cdot N}{2r_u} \right\rceil + 1$ periods for the urban counterpart agent to converge on certainty, and announce accordingly. At the end of that period, $1+2r_u$ households will have observed the counterpart's announcement, adjusted their beliefs and voted against the government. This brings the total tally of ejection votes to $2+2r_u$. These households announce certainty in the next period too, which is observed by an additional $2r_u+2r_r$ households, bringing the total tally to $2+4r_u+2r_r$.

After $\left(\left\lceil \frac{\theta\cdot N}{2r_u} \right\rceil - 1\right)$ periods, all urban households have voted against the government. Recall that it was assumed that an exact majority is comprised by the entire urban region and the $\left(\left\lceil\frac{\theta \cdot N}{2r_u}\right\rceil - 1\right) \cdot r_r + 1$ rural households that have been indirectly observed by the urban counterpart over the time it took for him to obtain information on all urban households. An identical number of rural households have voted against the majority by this period.

This means it takes

$$T_r = \left(\left\lceil\frac{\theta \cdot N}{2r_u}\right\rceil - 1\right) + \left\lceil\frac{\theta \cdot N}{2r_u}\right\rceil + 1$$
$$T_r = 2 \cdot \left\lceil\frac{\theta \cdot N}{2r_u}\right\rceil$$

periods for a majority to vote against the government after the project fails to benefit a majority, when the non-beneficiaries are concentrated in the urban region.

Determining T_u

In section 2.2.2 it was determined that it required $T + 2 = \left\lceil\frac{N/2-1-2r_r}{2r_r+2r_u}\right\rceil + 2$ periods for the rural counterpart to converge on certainty, and announce accordingly, if the majority of non-beneficiaries were in the rural sector. In that period, $2 + 2r_r$ households vote against the government. In the period after, $2 + 4r_r + 2r_u$ households do.

x periods after, $2+2r_r+x\cdot(2r_r+2r_u)$ households vote against the government. This constitutes a majority if $x = \left\lceil\frac{N/2-1-2r_r}{2r_r+2r_u}\right\rceil$. This means a majority votes against the government in period $T + 2 + x$, which leads to the conclusion that it takes

$$T_u = 2\left\lceil\frac{N/2 - 1 - 2r_r}{2r_r + 2r_u}\right\rceil + 2$$

period for a majority vote to eject the government when the rural sector is the non-beneficiary sector in case of an unsuccessful project.

3.3 Bias Towards The Urban Sector

If we substitute these values into equation (1), we get:

$$p_u^a \cdot (V) + p_u^b \cdot \left(2\left\lceil\frac{N/2-1-2r_r}{2r_r+2r_u}\right\rceil+2\right)\cdot w \geq p_r^a \cdot (w+V) + p_r^b \cdot \left(2\cdot\left\lceil\frac{\theta\cdot N}{2r_u}\right\rceil\right)\cdot w$$

We can manipulate this inequality to find a condition for investment in the first project:

$$\begin{aligned}
(V)\cdot(p_u^a - p_r^a) &\geq w\cdot\left(p_r^b T_r - p_u^b T_u\right)\\
(R)\cdot(p_u^a - p_r^a) &\geq p_r^b T_r - p_u^b T_u \qquad (3)\\
&= p_r^b\left(2\cdot\left\lceil\frac{\theta\cdot N}{2r_u}\right\rceil\right) - p_u^b\cdot\left(2\left\lceil\frac{N/2-1-2r_r}{2r_r+2r_u}\right\rceil+2\right)
\end{aligned}$$

That is, the government invests in the first project if the expected surplus value of 'succeeding' exceeds the expected deficit value of being 'unsuccessful'.

There are several scenarios where this may occur, depending on the values of $p_u^a, p_r^a, p_u^b, p_r^b, \theta, N, r_r$, and r_u. Straightforwardly, the likelihood of investment in the first project is decreasing in p_r^a, p_r^b and increasing in p_u^a, p_u^b. The effect of the other parameters is discussed below. In each instance, discrete changes of integer magnitude are considered, as the parameters under discussion are all integers (except θ, which will not be analysed).

r_u*: Urban Sector Information Spreading*

A Δ change in r_u changes the right-hand side of (3) as follows:

$$2p_r^b\left(\left\lceil\frac{\theta N}{2(r_u+\Delta)}\right\rceil-\left\lceil\frac{\theta N}{2r_u}\right\rceil\right)-2p_u^b\left(\left\lceil\frac{N/2-1-2r_r}{2r_r+2(r_u+\Delta)}\right\rceil-\left\lceil\frac{N/2-1-2r_r}{2r_r+2r_u}\right\rceil\right)$$

Both terms inside the brackets are negative for positive Δ. The overall effect of a positive Δ on the right hand side of (3) is negative if:

$$\frac{p_r^b}{p_u^b}>\frac{\left\lceil\frac{N/2-1-2r_r}{2r_r+2(r_u+\Delta)}\right\rceil-\left\lceil\frac{N/2-1-2r_r}{2r_r+2r_u}\right\rceil}{\left\lceil\frac{\theta N}{2(r_u+\Delta)}\right\rceil-\left\lceil\frac{\theta N}{2r_u}\right\rceil}=\frac{\Delta T_u}{\Delta T_r}$$

An increase in r_u positively affects the likelihood of investment in the first project if the ratio of the resulting change in T_u to the resulting change in T_r is less than the ratio of the likelihood of enjoying T_r periods of w to the likelihood of enjoying T_u periods of w. So the more likely it is that the second project will be unsuccessful, the more likely it is that an increase in r_u will improve the prospects of the first project, as r_u reduces the number of periods that the government will enjoy wages w if the second project is unsuccessful.

r_r: Rural Sector Information Spreading

The right hand side of (3) is affected by a Δ change in r_r as follows:

$$-2p_u^b\cdot\left(\left\lceil\frac{N/2-1-2(r_r+\Delta)}{2(r_r+\Delta)+2r_u}\right\rceil-\left\lceil\frac{N/2-1-2r_r}{2r_r+2r_u}\right\rceil\right)$$

The term inside brackets will be negative, so the overall effect of a positive change Δ on the right hand side of (2) will be positive. This means that an increase in rate at which news spreads in the rural sector unequivocally increases the attractiveness of investing in the first project, as it directly reduces the number of periods the government can hope to earn wages if investment in the second project is unsuccessful.

N - Size of the Population

If N changes by Δ, the change in the right-hand side of (3) is:

$$2p_r^b \cdot \left(\left\lceil \frac{\theta(N+\Delta)}{2r_u} \right\rceil - \left\lceil \frac{\theta N}{2r_u} \right\rceil \right) \\ - 2p_u^b \left(\left\lceil \frac{(N+\Delta)/2 - 1 - 2r_r}{2r_r + 2r_u} \right\rceil - \left\lceil \frac{N/2 - 1 - 2r_r}{2r_r + 2r_u} \right\rceil \right)$$

For a positive Δ, there are four different values Δ can take that are of interest. In the first case, Δ is so small that $\left\lceil \frac{\theta(N+\Delta)}{2r_u} \right\rceil$ is in the range

$$[\lceil \theta N/(2r_u) \rceil, \lceil \theta N/(2r_u) \rceil + 1) \tag{A}$$

while $\left\lceil \frac{(N+\Delta)/2-1-2r_r}{2r_r+2r_u} \right\rceil$ is in the range

$$[\lceil (N/2 - 1 - 2r_r)(2r_r + 2r_u) \rceil, \lceil (N/2 - 1 - 2r_r)(2r_r + 2r_u) \rceil + 1) \tag{B}$$

in which case the impact of a change in N is too small for the right hand side of (3) to change.

In the second case, Δ is large enough for $\left\lceil \frac{\theta(N+\Delta)}{2r_u} \right\rceil$ to be in the range

$$[\lceil \theta N/(2r_u) \rceil + 1, \lceil \theta N/(2r_u) \rceil + 2) \tag{C}$$

but not large enough to move $\lceil ((N+\Delta)/2 - 1 - 2r_r)(2r_r + 2r_u) \rceil$ out of range (B). Clearly, this is dependent largely on the value of the model's other parameters. This result means that the change in the right-hand side of equation (3) is $2p_r^b \cdot 1$; such a change makes investment in the rural project more attractive.

In the third case, Δ is large enough for $\lceil ((N+\Delta)/2 - 1 - 2r_r)(2r_r + 2r_u) \rceil$ to be in the range

$$[\lceil (N/2 - 1 - 2r_r)(2r_r + 2r_u)\rceil + 1, \lceil (N/2 - 1 - 2r_r)(2r_r + 2r_u)\rceil + 2) \qquad \text{(D)}$$

Again, this fails to move $\left\lceil \frac{\theta(N+\Delta)}{2r_u} \right\rceil$ out of its range (range A), dependent on the value of other parameters. This result imples that the right hand side of equation (3) is diminished by $-2p_u^b$. This sort of change makes investment in the urban project more attractive.

In the final case, Δ is sufficiently large to push $\lceil ((N+\Delta)/2 - 1 - 2r_r)(2r_r + 2r_u)\rceil$ into range D, and $\left\lceil \frac{\theta(N+\Delta)}{2r_u} \right\rceil$ into range C. In this case, the total change on the right hand side of (2) is $2p_r^b - 2p_u^b$: this is positive if $p_r^b > p_u^b$, which would make investment in the urban project less attractive.

θ - Relative Size of the Urban Sector

Section 3.2.2 made an assumption about the number of households necessary to obtain a majority. This means that increases in the relative size of the urban sector cannot be analysed thoroughly, as there has been assumed a direct relation with the number of rural households necessary to obtain a majority.

Overall, the interesting result is that investment in the first project may occur even if $p_r^a > p_u^a, p_r^b > p_u^b$, i.e. if the second project has a higher probability of benefiting households, and therefore is expected-welfare maximising.

A numerical example would be $p_u^a = 0.22, p_r^a = 0.25, p_u^b = 0.43, p_r^b = 0.45$, which means that the rural sector is more likely to provide benefits to households $(0.7 > 0.65)$. Further determine $R = 10, \theta = \frac{2}{5}, N = 50, r_u = 5, r_r = 4$, so that the majority of the population is in the rural sector, and news spreads slightly faster in the urban sector.

Entering these values into equation (3) will show that, despite the higher likelihood of a welfare-enhancing outcome with the second project, the government will prefer to invest in the first.

4 Discussion

This section discusses two issues. Firstly, it considers how the model might be tested empirically. Secondly, it considers the policy implications of the model.

4.1 Empirical Testing

The model presented here lends itself to empirical investigation, and perhaps more so than other models of urban bias. This is because the result depends on empirically verifiable parameters. Majumdar et al. (2004)'s model, by contrast, relies on the charisma of a politician which is hard to measure empirically. Lipton (1977) likewise invokes hard-to-measure lobbying power.

The challenging parameters in the model are $p_r^b, p_u^b, p_r^a, p_u^a, r_r$ and r_u, which represent the speed at which information travels in the two regions and the relevant probabilities of government success. All others - population size, proportion of population that lives in a rural area - are readily available. $p_r^b, p_u^b, p_r^a, p_u^a$ are hardest to approximate, but also somewhat irrelevant. Aside from the philosophical implications of measuring such probabilities, [4] it is unrealistic government investments can have only three possible outcomes, or even that the number of potential outcomes can be known exactly. The model can still be usefully tested by assessing empirical observations of the remaining parameters.

There are many measures that could serve as reasonable indicators of r_r and r_u. Attempts have already been made by for example Reinikka and Svensson (2004),

[4] As, for example, the actual outcome can be argued to always have had probability 1 *ex-post*. Moreover, determining the probability would not be mechanical as it is for, say, dice.

who use proximity to newspaper outlets. This measure could be transformed into average proximity to newspaper outlets for both regions as a measure of the speed at which information travels.

Alternative measures could be population density as the closer people live together, the faster news travels among them. Other options are to look at infrastructure for telecommunications, number of phones and mobile phones per capita, newspaper circulation, or a composite of these various measures.

If the model is correct, then it would predict a high negative correlation between urban-to-rural public investment and the measure for rural sector information spreading. Unless we have a good reason to think urban projects are more likely to succeed than rural projects, there should be little or no correlation between urban-to-rural public investment and the measure for urban sector information spreading, or increases in the population overall. And while the model setup has not allowed us to make any predictions on the effect of changes in the relative size of either sector, it seems intuitive that a larger rural population commands a larger share of investment.

4.2 Policy Recommendations

The primary policy recommendation would be to increase the rate of information exchange in the rural sector. This would reduce inefficiency as governments lose incentives to allocate funds to the urban sector, and it would be a more equitable outcome.

This result could be achieved by, amongst others things: providing free newspapers to rural regions, improving rural telecommunications structure, providing easier access to telecommunications, and perhaps to a lesser degree by improving literacy in agrarian areas.

5 Conclusion

Using a social learning model to examine the speed of information exchange in two different sectors, this paper uses a political economy model to show how divergent speeds can lead to urban bias.

The most important finding is that government may have an incentive to invest in the urban sector, even though investment in the rural sector is more likely to lead to a welfare-enhancing outcome. Furthermore, a low rate of relaying information in the rural sector unequivocally increases the likelihood that this happens. The effect of other parameters is ambiguous, and depends primarily on the ratio of the probability of success for the relevant projects.

Testing the model is not entirely straightforward, but should be possible to some extent. It predicts a strong negative correlation between the ratio of public investment in the urban region to public investment in the rural region and the rate of information exchange in the rural region. The results should be ambiguous on the model's other parameters.

Policy recommendations would be to invest in the rural sector to increase its speed of information spreading. This could be done, for example, by investing in telecommunications infrastructure, access to newspaper, and literacy (which should also increase demand for newspapers).

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