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Batabyal, Amitrajeet and Kourtit, Karima and Nijkamp, Peter

Rochester Institute of Technology, Jheronimus Academy of Data Sciences, Jheronimus Academy of Data Sciences

7 March 2019

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by

Amitrajeet A. Batabyal,[2]

Karima Kourtit,[3]

and

Peter Nijkamp[4]

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For their helpful comments on two previous versions of this paper, we thank the Editor-in-Chief Tomaz Dentinho, two anonymous referees, and participants in (i) an International Meeting in the Jheronimus Academy of Data Science (JADS), 's-Hertogenbosch, the Netherlands, in November 2018 and (ii) the annual conference of the Southern Regional Science Association, Arlington, Virginia, in April 2019. In addition, Batabyal acknowledges financial support from the Gosnell endowment at RIT. The usual disclaimer applies.

2

Corresponding Author. Department of Economics, Rochester Institute of Technology, 92 Lomb Memorial Drive, Rochester, NY 14623-5604, USA. E-mail: aabgsh@rit.edu

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JADS, Sint Janssingel 92, 5211 DA's-Hertogenbosch, The Netherlands. E-mail: k_kourtit@hotmail.com

4

Alexandru Ioan Cuza University, Iasi, Romania, A. Mickiewicz University, Poznan, Poland, and JADS, Sint Janssingel 92, 5211 DA's-Hertogenbosch, The Netherlands. E-mail: p.nijkamp@jads.nl

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Abstract

We study the impact that the provision of a local public good (LPG) by two cities has on their ability to attract and retain members of the creative class. This creative class consists of two types of members known as *engineers* and *artists*. Engineers are wealthier than artists and they also value the LPG more. We first focus on each city in isolation. We compute the marginal value and the marginal cost of the LPG and then determine the provision of this LPG when the provision is determined by *uniform* contributions and majority voting. Next, we allow the creative class members to *migrate* between the two cities and analyze whether engineers or artists migrate, the equilibrium distribution of the creative class, and the efficiency of the LPG provision. Finally, we consider the situation in each city just before migration and study how much of the LPG is provided when *proportional* contributions and majority voting determine this provision. A related question we address is whether engineers or artists now have an incentive to migrate and, if yes, we identify who would like to migrate and to which city.

Keywords: Artist, Creative Class, Engineer, Local Public Good, Majority Voting

JEL Codes: R11, H40

1. Introduction

As a result of his many contributions to the literatures in urban economics and regional science in the last two decades, Richard Florida has been successful in popularizing the twin notions of the *creative class* and *creative capital*. In this regard, Florida (2002, p. 68) points out that the creative class "consists of people who add economic value through their creativity." This class consists of professionals such as doctors, engineers, lawyers, scientists, university professors, and, notably, bohemians such as artists, musicians, and sculptors. The distinguishing feature of these people is that they possess creative capital which is defined to be the "intrinsically human ability to create new ideas, new technologies, new business models, new cultural forms, and whole new industries that really [matter]" (Florida, 2005, p. 32).

A key point made by Florida in his many writings[5] and by his adherents such as Stolarick *et al.* (2011) is that urban and regional planners ought to focus substantively on the activities of the creative class because the group of people comprising this class gives rise to ideas, information, and technology, outputs that are significant for the growth of cities and regions. Therefore, cities and regions that want to prosper in this era of globalization need to do all they can to attract and retain members of this creative class who are, for all intents and purposes, the basic drivers of economic growth.

Is there any difference between the prominent and established notion of human capital and Florida's newer concept of creative capital? In answering this question, Batabyal and Beladi (2018) have rightly noted that there is little or no difference between the notions of human and creative capital when the accumulation of this creative capital depends on the completion of many years of formal education. In contrast, there can be a lot of difference between the notions of human

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See, for instance, Florida (2002, 2003, 2014).

and creative capital when creative capital is either present innately or when it is based on the accumulation of professional and business experiences but *not* on the completion of a formal education. Because creative capital is of two types, it is, as noted by Porter and Batabyal (2016), a *more general* concept than the primarily schooling based notion of human capital. Batabyal and Beladi (2018) refer to members of the creative class whose possession of creative capital is the result of many years of schooling as *engineers* and to those who possess creative capital either innately or largely by gathering professional and business experiences as *artists*. In this way of looking at the issue, the aggregate creative class in, for instance, a city is the sum of the engineers and the artists in this city.[6] We shall utilize this two-part classification of the creative class in our subsequent analysis in this paper.

Once one accept's Florida's (2002) contention that cities seeking to thrive economically need to attract and retain members of the creative class, the next logical question is "How are cities to do this?" Florida (2002, 2008) and other researchers such as Buettner and Janeba (2016) have answered this question by pointing out that local public goods (LPGs) such as cultural amenities, quality schools, and public transit are a key means by which cities can effectively undertake the dual "attract" and "retain" functions.[7] Even though this point is now understood, to the best of our knowledge, there are *no* theoretical studies of the impact that the provision of LPGs by cities has on their ability to attract and retain members of the creative class.[8] Given this lacuna in the literature, our objective in this paper is to provide the *first theoretical* analysis of the provision of

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See Marlet and Van Woerkens (2007) for additional details on this point.

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See Audretsch and Belitski (2013) for a discussion of related issues.

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For theoretical analyses of other questions concerning the creative class, see Usman and Batabyal (2014), Batabyal and Beladi (2016), and Batabyal and Nijkamp (2016). That said, the reader should understand that there is *no* overlap between the issues we study in the present paper and the questions analyzed in these cited papers.

a LPG by two cities and the effect that this provision has on the ability of these two cities to attract and retain members of the creative class.

The remainder of this paper is organized as follows. Section 2 delineates our model of an aggregate economy that consists of two cities. As noted previously, the creative class consists of two types of members known as engineers and artists. Engineers are wealthier than artists and they also value the LPG more. Section 3 focuses on each city in isolation. Section 3.1 computes the marginal value and the marginal cost of the LPG for both engineers and artists. Section 3.2 determines the willingness to pay for the LPG on the part of the engineers and the artists. Section 3.3 studies the optimal provision of the LPG in each city when this provision is made on the basis of *uniform* contributions and majority voting. Section 4 concentrates on the case in which engineers and artists can migrate between the two cities. Section 4.1 examines which creative class members migrate. Section 4.2 first describes and then discusses a key property of the equilibrium distribution of the creative class in the two cities. Section 4.3 studies whether the provision of the LPG in each city is efficient. Section 5 analyzes the section 4 scenario *just before* migration. Section 5.1 asks how much of the LPG will be provided in each city when this provision is made on the basis of *proportional* contributions and majority voting. Section 5.2 studies whether any creative class member will now want to migrate. Finally, section 6 concludes and then suggests two ways in which the research described in this paper might be extended.

2. The Theoretical Framework

Consider an aggregate economy that consists of two cities denoted by A and B. From a real world perspective, we can think of these cities in one of two ways. In the first interpretation, these two cities are geographically proximate only and examples of such cities would include Minneapolis and Saint Paul (in Minnesota), Buffalo and Rochester (in New York), and Dallas and

Fort Worth (in Texas). In the second interpretation, these two cities are not only geographically proximate but they also have a water body of some sort that plays a major role in the lives of the two cities. Examples include Minneapolis and Saint Paul with the Mississippi river running through Minneapolis, Newcastle and Gateshead (in England) with the Tyne river separating them, and Reggio Calabria and Messina (in Italy),[9] on either side of the Strait of Messina.

Our analysis focuses on the creative class in each of these two cities. As such, let us denote the engineers and the artists---who together comprise the creative class in each city---by ϵ and α, respectively. Without loss of generality, we assume that the engineers are wealthier than the artists. Engineers have an income of $I_{\epsilon} = \$2000$ and artists have an income of I_{α}=\$1000.

Both cities seek to attract and retain members of the creative class by providing a LPG such as a quality school, a cultural amenity, or public transit, that we denote by L. Again, without loss of generality, we suppose that engineers value the LPG more than the artists.[10] Specifically, the value of the LPG to each type of individual in the creative class is given by

$$V_i = \frac{LI_i}{10} - \frac{L^2}{2}, i = \alpha, \epsilon. \quad (1)$$

Finally, the cost of the LPG per resident in either city is given by[11]

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See Musolino (2018) for additional details.

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This and the preceding assumption that the engineers are wealthier than the artists together tell us that the richer members of the creative class value the LPG more than the poorer members. This implication is supported by the work of Emerson (not dated) and Banzhaf (2014). That said, excluding the knife edge case in which both engineers and artists value the LPG equally, our results would essentially be reversed if we assumed that the artists are relatively wealthier and that they value the LPG more than the engineers. In other words, the conclusions we state about engineers (artists) in this paper would be true of artists (engineers) if we were to alter the two assumptions mentioned above.

11

The reader will note that we have used specific numerical values to describe some of the variables (such as 2000 and 1000) and coefficients (such as 5). We have done this mainly to simplify the mathematical analysis in what follows and to obtain concrete results. If, instead, we worked with general values then it would be extremely difficult to obtain tangible results because the subsequent mathematical analysis would give rise to algebraic expressions that could not be interpreted without additional

$$C = 5L. \quad (2)$$

With this description of our aggregate economy of two cities out of the way, our next task is to analyze the provision of the LPG in each city in isolation.[12] To this end, we first compute the marginal value and the marginal cost of the LPG for both engineers and artists.

3. Two Cities as Isolated Units

3.1. Marginal values and costs

Differentiating equation (2) with respect to L, it is clear that the marginal cost of the LPG to both the engineers and the artists is

$$MC = 5. \quad (3)$$

Substituting $I_\epsilon = 2000$ in equation (1) and then differentiating this equation with respect to L, the marginal value of the LPG for the engineers is

$$MV_\epsilon = 200 - L. \quad (4)$$

Using an analogous process, the corresponding marginal value for the artists is

$$MV_\alpha = 100 - L. \quad (5)$$

Next, let us ascertain the willingness to pay (WTP) for the LPG on the part of the engineers and the artists.

3.2. Willingness to pay for the LPG

To determine the WTP_ϵ for the LPG on the part of the engineers, we substitute their income $I_\epsilon = 2000$ in equation (1) with $i = \epsilon$. This gives us

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assumptions. That said, we emphasize that qualitatively speaking, our modeling strategy is without loss of generality in the sense that results similar to what we obtain can be obtained for any (sensible) numerical values of the relevant variables and coefficients. In addition, note that in any real world scenario, we would have to work with actual numbers of the sort we utilize in this paper. The only issue to recognize here is the *ex ante*, we typically do not know the values of these variables.

12 The objective function in equation (1) is quadratic in L and hence the first-order necessary conditions for an optimum such as equations (4) and (5) below are linear in L. Therefore, our modeling framework can be thought of as one kind of linear-quadratic framework.

$$WTP_{\epsilon} = 200L - \frac{L^2}{2}. \tag{6}$$

Similarly, substituting $I_{\alpha} = 1000$ in equation (1) with $i = \alpha$, the WTP_{α} for the LPG for the artists is

$$WTP_{\alpha} = 100L - \frac{L^2}{2}. \tag{7}$$

Having ascertained these two WTP expressions, we now want to analyze the optimal provision of the LPG in each city when this provision is made on the basis of *uniform* contributions and majority voting.

3.3. Uniform contributions and LPG provision

To analyze the impact of majority voting, it will be necessary to make an assumption about the *number* of engineers and artists in the two cities under study. To this end, suppose that there are 400 (200) engineers and 200 (400) artists in city A (B). Both types in the creative class contribute uniformly to the provision of the LPG. Clearly, engineers are in the majority in city A. As such, the so called median voter theorem[13] tells us that the optimal choice L of the LPG in city A will be determined by their preferences. Therefore, combining equations (2) and (6), the optimal L or L^A solves

$$max_{\{L\}}\, 200L - \frac{L^2}{2} - 5L. \tag{8}$$

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See Hindriks *et al.* (2013, pp. 351-356) for a textbook discussion of the median voter theorem.

Differentiating the maximand in (8) and then simplifying the resulting expression, the L^A we seek is given by

$$L^A = 195. \quad (9)$$

In contrast to city A, the artists are in the majority in city B. Therefore, the optimal level of the LPG in this city or L^B is given by their preferences. Mathematically, combining equations (2) and (7), we are interested in obtaining the solution to

$$max_{\{L\}}\ 100L - \frac{L^2}{2} - 5L. \quad (10)$$

Solving the maximization problem in (10) and then simplifying, we get

$$L^B = 95. \quad (11)$$

The reader should note that L^A and L^B are determined on the basis of *uniform* contributions and, in particular, with majority voting. From this state of affairs, we infer that the minorities in the two cities---artists in city A and engineers in city B---will be *unhappy* with the outcome of majority voting specified in equations (9) and (11). Consequently, in principle, the minorities in each of the two cities may want to migrate to the other city. Therefore, we now analyze the case in which engineers and artists can migrate between the two cities.

4. Migration between the Two Cities

4.1. Which creative class type will migrate?

The analysis in section 3.3 and, in particular, equations (9) and (11) clearly tell us that the minorities in the two cities are unhappy because they get either too little or too much of the LPG. Therefore, the minority artists in city A will want to migrate to city B and be a part of the majority of artists there. If we denote the gain in utility to the artists from migrating by the function $U_{\alpha}(\cdot)$

and the two levels of the LPG in question by L_α and L_ϵ then, in symbols, the gain in utility to the artists from migration can be expressed as

$$U_\alpha(L_\alpha) - U_\alpha(L_\epsilon) > 0. \quad (12)$$

Like the artists, the minority engineers in city B will want to migrate to city A and become a part of the majority of engineers. Using notation analogous to that used in the preceding paragraph, in symbols, the gain to the engineers from migrating to city A can be written as

$$U_\epsilon(L_\epsilon) - U_\epsilon(L_\alpha) > 0. \quad (13)$$

It should be clear to the reader that this kind of migration allows both engineers and artists to obtain their preferred level of the LPG. This notwithstanding, we can certainly ask what the migration driven equilibrium distribution of the creative class in the two cities looks like. We now proceed to answer this question.

4.2. The equilibrium distribution of the creative class

As a result of the migration delineated in section 4.1, it is straightforward to specify the equilibrium distribution of the creative class. Specifically, all the engineers will choose to live in city A which is where they were initially in the majority. Similarly, all the artists will choose to live in city B which is where they were at first in the majority. Two points are now worth emphasizing. First, unfettered migration between cities A and B results in the reinforcement of the initial majority in each of these two cities. Second, this kind of migration also results in *complete* segregation by creative class type. In other words, after migration, all engineers (artists) live in city A (B). It should be noted that this kind of segregation arises entirely because of economic forces and not because of the innocuous racial preferences (or micromotives) discussed by Schelling (1978).

We reiterate that post-migration, every engineer and every artist living either in city A or in city B obtains his sought after level of the LPG. In other words, every resident of city A is a relatively wealthy engineer who obtains L_ϵ level of the LPG through majority voting. Similarly, every individual living in city B is a relatively poor artist who obtains level L_α of the LPG, also via majority voting. So, no member of the creative class is unhappy with the post-migration distribution of the engineers and the artists across the two cities. We now study whether the provision of the LPG in each city is efficient.

4.3. Efficiency of LPG provision

To ascertain whether the provision of the LPG in the two cities is efficient, we shall use the so called Samuelson rule.[14] There are two ways of interpreting this rule. In the first interpretation, this rule requires the provision of a public good to be such that the sum of the marginal WTP for the public good is equal to the marginal cost of providing it. In the second interpretation, the efficient provision of a public good involves equating the average WTP to the per capita marginal cost.

When there is no migration---see the analysis in section 3.3---the creative class in city A consists of $2/3$ engineers and $1/3$ artists. In this case, using equations (3), (4), and (5), the efficient level of the LPG or $L = \hat{L}^A$ satisfies

$$\frac{2}{3}(200 - L) + \frac{1}{3}(100 - L) = 5. \quad (14)$$

Substituting $L = \hat{L}^A$ in equation (14), this equation can be solved to give us

14 See Hindriks *et al.* (2013, pp. 154-156) for a textbook exposition of the Samuelson rule.

$$\hat{L}^A = \frac{500}{3} - 5 \;\Rightarrow\; \hat{L}^A = 161.67. \tag{15}$$

Similarly, before migration, city B has $2/3$ artists and $1/3$ engineers. Therefore and once again using equations (3), (4), and (5), the efficient level of the LPG or $L = \hat{L}^B$ is now given by

$$\frac{2}{3}(100 - L) + \frac{1}{3}(200 - L) = 5. \tag{16}$$

Solving equation (16), using $L = \hat{L}^B$, we get

$$\hat{L}^B = \frac{400}{3} - 5 \;\Rightarrow\; \hat{L}^B = 128.33. \tag{17}$$

Let us now compare the solutions we have just obtained in equations (15) and (17) with the corresponding section 3 solutions in equations (9) and (11). We obtain

$$95 = L^B < \hat{L}^B = 128.33 < 161.67 = \hat{L}^A < L^A = 195. \tag{18}$$

We have just seen that without migration, the *efficient* levels of the LPG in cities A and B are given by equations (15) and (17). However, after migration, we have *complete* or *perfect* sorting of the two types---that together comprise the creative class---across the two cities. What complete or prefect sorting means in the context of this paper is that all the engineers live in city A and all the artists live in city B. Put differently, unfettered migration gives rise to homogenous communities in the two cities under study. That said, note that the efficient provision of the LPG in each city *matches* the level preferred by those who live in this city. These preferred levels are given by equations (9) and (11). Therefore, on the basis of our reasoning thus far, we obtain the efficient and the preferred levels of the LPG and these are given by

$$L^B = \hat{L}^B = 95 \; and \; L^A = \hat{L}^A = 195. \tag{19}$$

We now proceed to our penultimate task in this paper. Specifically, we want to analyze the situation in the two cities just before migration by the engineers and the artists.

5. The Situation Just Before Migration

5.1. Optimal provision of the LPG

The key point to note is that we now wish to study the scenario in which the LPG is provided to members of the creative class in the two cities on the basis of proportional and *not* uniform (see section 3) contributions. To this send, we suppose that an appropriate authority requires the wealthier engineers to contribute $3/4$ of the cost of the LPG in the city in which they choose to reside and the poorer artists are required to contribute $1/4$ of the cost of the same LPG. Given this stipulation, we now want to know how much of the LPG will be provided with majority voting in each of the two cities.

Recall that in the uniform cost sharing case studied in section 3, the cost of the LPG per creative class member was $C = 5L$ and therefore the marginal cost was simply constant and equal to 5. Now, to model the fact that we are working with proportional contributions, let C_i^j denote the marginal cost of providing the LPG to a creative class member of type $i = \alpha, \epsilon$ in city $j = A, B$. Given that the engineers (artists) contribute $3/4$ $(1/4)$ of the cost of the LPG, it is straightforward to confirm that in each city j, we have

$$C_\epsilon^j = 3C_\alpha^j. \tag{20}$$

Let θ^j denote the fraction of engineers in city $j = A, B$. Because the average cost of providing the LPG per creative class member is $C = 5L$, it follows that

$$\theta^j C_\epsilon^j + \left(1 - \theta^j\right)\frac{C_\epsilon^j}{3} = 5. \tag{21}$$

Solving equation (21) for the marginal cost of providing the LPG to engineers in city j or C_{ϵ}^{j}, we get

$$C_{\epsilon}^{j} = \frac{15}{1+2\theta^{j}}. \tag{22}$$

Using a similar line of reasoning for the artists, the corresponding marginal cost of providing the LPG to artists in city j or C_{α}^{j} is

$$C_{\alpha}^{j} = \frac{5}{1+2\theta^{j}}. \tag{23}$$

Inspecting equations (22) and (23), we see that as the fraction of engineers in the creative class or θ^{j} increases, the marginal cost of providing the LPG *decreases* for *both* the engineers and the artists.

From the analysis in section 3.3, we deduce that $\theta^{A} = 2/3$ and that $\theta^{B} = 1/3$. Substituting these figures in equations (22) and (23), we get

$$C_{\epsilon}^{A} = \frac{45}{7}, C_{\alpha}^{A} = \frac{15}{7}, C_{\epsilon}^{B} = 9, and\ C_{\alpha}^{B} = 3. \tag{24}$$

The engineers are in a majority in city A and hence they will select their preferred level of the LPG in this city. This selection will involve equating the marginal value to the marginal cost. Using equations (4) and (24), this means that $L = L_{\epsilon}^{A}$ solves

$$200 - L = \frac{45}{7} \Rightarrow L_{\epsilon}^{A} = \frac{1355}{7} = 193.57. \tag{25}$$

Similarly, the artists are in the majority in city B. Hence, the level of the LPG that is provided in this city will be the level that corresponds to their preferred level. Using equations (5) and (24), this level $L = L_{\alpha}^{B}$ solves

$$100 - L = 3 \Rightarrow L_{\alpha}^{B} = 97. \tag{26}$$

Compared to the case of uniform contributions analyzed in section 3, proportional contributions increase the cost of the LPG to the engineers $(45/7 > 5)$ and reduce the same cost $(3 < 5)$ to the artists. This means that the engineers will want less of the LPG but the artists will want more of the same. Once again compared to the case of uniform contributions, the effect of the present state of affairs is to *lower* the difference in the level of the LPG that is provided across the two cities under study.

Note that like in the uniform contributions case, the level of the LPG that is provided is higher in city A because there is a majority of engineers in this city who value the LPG more than the artists. However, now with proportional contributions, the engineers have to pay *more* for the LPG than do the artists. This *lowers* their demand for the LPG and hence, from equations (9) and (25), we now have $L_{\epsilon}^{A} = 193.57 < 195 = L^{A}$.

In contrast, the demand for the LPG increases in city B which is populated by a majority of artists. This is because these artists can now make the engineers pay more for the LPG and hence equations (11) and (26) tell us that $L_{\alpha}^{B} = 97 > 95 = L^{B}$. Putting these findings together, the basic takeaway from the analysis in this section is that proportional contributions have an *equalizing* effect on the dispersion of the levels at which the LPG is provided in the two cities A

and B. We now proceed to our final task in this paper and that is to determine whether, with proportional contributions, any creative class type will want to migrate from one city to the other.

5.2. Does any creative class type want to migrate?

An implication of equations (22) and (23) is that migrating engineers tend to reduce the cost of providing the LPG and hence, in general, they are worth attracting. Now, consider the engineers in city B where the level of the provided LPG is determined by the preferences of the artists who are in the majority. Compared to the engineers in city A, these city B engineers get less of the LPG---in symbols we have $L_{\alpha}^{B} < L_{\epsilon}^{A}$---and they pay a higher cost because there are fewer engineers in city B. As such, by migrating to city A, these engineers will obtain their preferred level of the LPG at a lower marginal cost because there are more engineers in city A. This line of reasoning tells us that *all* engineers in city B will want to migrate to city A. Therefore, before we consider the migration decision of the artists, the fraction of engineers in city A will increase from $\theta^{A} = 2/3$ to $\theta^{A} = 600/800 = 3/4$ and it will decrease in city B from $\theta^{B} = 1/3$ to $\theta^{B} = 0$.

Let us now consider the artists in city A. If these artists migrate from city A to B then, using $\theta^{A} = 3/4$ and $\theta^{B} = 0$, this act raises their marginal contribution cost for the LPG from $C_{\alpha}^{A} = 5/(1 + 2\theta^{A}) = 2$ to $C_{\alpha}^{B} = 5/(1 + 2\theta^{B}) = 5$. However, this same act of migration also gives them their preferred level of the LPG because they now reside in city B exclusively with other artists. Therefore, depending on how the positive impetus (preferred level of the LPG) compares with the negative impetus (higher marginal cost), the artists in city A may or may not want to migrate to city B. This state of affairs also tells us that there will typically be no equilibrium in this model. This will happen either because the artists in city A will want to migrate to city B or, if they stay in city A, then the artists in city B will want to migrate to city A. This completes our analysis of the use of a LPG by the two cities A and B to attract and retain members of the creative class.

6. Conclusions

In this paper, we studied the effect that the provision of a LPG by two cities had on their ability to attract and retain members of the creative class. This creative class was composed of engineers and artists. Engineers were wealthier than artists and they also valued the LPG more. We first concentrated on each city in isolation. We computed the marginal value and the marginal cost of the LPG and then determined the provision of this LPG when the provision was determined by *uniform* contributions and majority voting. Next, we permitted the creative class members to *migrate* between the two cities and analyzed whether engineers or artists migrated, the equilibrium distribution of the creative class, and the efficiency of the LPG provision. Finally, we examined the situation in each city just before migration and studied how much of the LPG was provided when *proportional* contributions and majority voting determined this provision. A related question we addressed was whether engineers or artists now had an incentive to migrate and we identified who wanted to migrate and to which city.

An analysis of the sort conducted in this paper can be used to inform the task of using one or more LPGs to attract members of the creative class in actual cities of the sort delineated in the first paragraph of section 2. In this regard, Cao and Cao (2014) show that the light rail transit (LRT) system has been important in impacting residents positively in the Minneapolis and Saint Paul metropolitan area. As such, apposite city officials in these two cities can seek to improve and/or extend the LRT system as a way of attracting members of the creative class to Minneapolis and to Saint Paul. Second, in a comparison of 520 school districts in New York state, Ruggiero and Vitaliano (1999) demonstrate that the Buffalo and the Rochester school districts score well in terms of the metric of "cost efficiency." Therefore, officials in these two cities can certainly attempt to attract the creative class to their cities by either maintaining or improving the quality of their school districts.

Third, in his study of the provision of LPGs in Dallas and Fort Worth, Stone (2014) contends that "school district quality" is an effective LPG variable. Therefore, as in the case of Buffalo and Rochester, city officials in Dallas and Fort Worth can also endeavor to attract the creative class to their cities by maintaining or ameliorating the quality of their school districts. Fourth, the report of ERS Research and Consultancy (2017) suggests that the health and well-being impacts of the arts and culture in Newcastle and Gateshead are substantial. Hence, in principle, city officials in these two cities can seek out creative class members by focusing on artistic and cultural activities. Finally, the work of Musolino (2018) suggests that in order to attract the creative class to Reggio Calabria and Messina in Italy, it will be necessary to take steps to integrate these two urban areas. This integration can be undertaken by breaking down the geographic and other "walls" that presently separate these two cities. One way to do this would be to improve the transport infrastructure between and within these two cities.

The analysis in this paper can be extended in a number of different directions. In what follows, we suggest three possible extensions. First, using the methods discussed in Acemoglu (2009), it would be useful to generalize the analysis conducted here by explicitly analyzing a dynamic model in which cities use LPGs and other means to attract and retain members of the creative class. Second, in a dynamic setting, creative class members and city authorities will typically interact with each other on multiple occasions. Hence, analyzing such interactions between creative class members and city authorities in a repeated game setting is likely to be instructive.[15] Finally, it would also be helpful to embed the aggregate economy of two cities

[15] The methodology employed by Oladi (2004) may be useful here.

analyzed here in a probabilistic environment and to then study the impact that uncertainty about the marginal cost of LPG provision and/or the migration decision has on the ability of the two cities under study to attract and retain members of the creative class. Studies that analyze these aspects of the underlying problem will provide additional insights into the roles that artists and engineers can play in enhancing the economic well-being of cities.

References

1. Acemoglu, D. 2009. *Introduction to Modern Economic Growth*. Princeton University Press, Princeton, NJ.
2. Audretsch, D.B., and Belitski, M. 2013. The missing pillar: The creativity theory of knowledge spillover entrepreneurship, *Small Business Economics*, 41, 819-836.
3. Banzhaf, H.S. 2014. The market for local public goods, *Case Western Reserve Law Review*, 64, 1441-1480.
4. Batabyal, A.A., and Beladi, H. 2016. Creative capital accumulation and the advancement of India's creative economy, *Environment and Planning C*, 34, 356-363.
5. Batabyal, A.A., and Beladi, H. 2018. Artists, engineers, and aspects of economic growth in a creative region, *Economic Modelling*, 71, 214-219.
6. Batabyal, A.A., and Nijkamp, P. 2016. Digital technologies, knowledge spillovers, innovation policies, and economic growth in a creative region, *Economics of Innovation and New Technology*, 25, 470-484.
7. Buettner, T., and Janeba, E. 2016. City competition for the creative class, *Journal of Cultural Economics*, 40, 413-451.
8. Cao, J., and Cao, X. 2014. The impacts of LRT, neighborhood characteristics, and self-selection on auto ownership: Evidence from Minneapolis-St. Paul, *Urban Studies*, 51, 2068-2087.
9. Emerson, P. not dated. Introduction to microeconomics lecture 27 notes on public goods. Accessed on 14 May 2019 from http://people.oregonstate.edu/~emersonp/201/notes/27.pdf

10. ERS Research and Consultancy. 2017. NGCV, Economic Impact Assessment 2016-2017 Final Report. Accessed on 23 May 2019 from http://ngcv.tv/documents/_view/5a0890d17bbb88140b8b456e
11. Florida, R. 2002. *The Rise of the Creative Class*. Basic Books, New York, NY.
12. Florida, R. 2003. Cities and the creative class, *City and Community*, 2, 3-19.
13. Florida, R. 2005. *The Flight of the Creative Class*. Harper Business, New York, NY.
14. Florida, R. 2008. *Who's Your City?* Basic Books, New York, NY.
15. Florida, R. 2014. The creative class and economic development, *Economic Development Quarterly*, 28, 196-205.
16. Hindriks, J., and Myles, G.D. 2013. *Intermediate Public Economics*, 2nd edition. MIT Press, Cambridge, MA.
17. Marlet, G., and Van Woerkens, C. 2007. The Dutch creative class and how it fosters urban employment growth, *Urban Studies*, 44, 608-630.
18. Musolino, D. 2018. Characteristics and effects of twin cities integration: The case of Reggio Calabria and Messina, 'walled cities' in southern Italy, *Regional Science Policy and Practice*, 10, 315-334.
19. Oladi, R. 2004. Strategic quotas on foreign investment and migration, *Economic Theory*, 24, 289-306.
20. Porter, A., and Batabyal, A.A. 2016. Physical capital mobility, the educational and quality aspects of creative capital, and output production, *Regional Science Policy and Practice*, 8, 167-175.

21. Ruggiero, J., and Vitaliano, D.F. 1999. Assessing the efficiency of public schools using data envelopment analysis and frontier regression, *Contemporary Economic Policy*, 17, 321-331.

22. Schelling, T.C. 1978. *Micromotives and Macrobehavior*. W.W. Norton and Company, Inc., New York, NY.

23. Stolarick, K., Lobo, J., and Strumsky, D. 2011. Are creative metropolitan areas also entrepreneurial? *Regional Science Policy and Practice*, 3, 271-286.

24. Stone, S.B. 2014. A more accurate measure of local public goods: Overlapping government combinations as units of analysis, *Urban Studies Research*, Article ID 963503.

25. Usman, U., and Batabyal, A.A. 2014. Goods production, learning by doing, and growth in a region with creative and physical capital, *International Review of Economics and Finance*, 33, 92-99.