

INFORMATION FILTERING, HUMAN CAPITAL EFFICIENCY AND ECONOMIC GROWTH IN POOR NEIGHBOURHOODS

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Abstract.

This paper explores the notion of information filtering and integrates it into an analysis of human capital efficiency and economic growth in poor neighbourhoods. It is argued in this paper that neighbourhood information filtering; that of removing or reducing less useful information from neighbourhood streams, can lead to greater opportunities for economic growth in poor neighbourhoods. The results established in this paper indicate that the filtering of neighbourhood information is not that important for neighbourhood economic growth. However, what does appear to be important for neighbourhood economic growth is the existence of a stock of neighbourhood human capital that has a high degree of efficiency in the conversion of information into income.

Key Words: Poverty, human capital efficiency, neighbourhood economic growth; information filtering

JEL Codes: I: I32; J: J24; R: R23; D: D83

Résumé. Le filtrage de l'information, l'efficacité du capital humain et la croissance économique dans des quartiers défavorisés.

Ce document explore la notion de filtrage de l'information et l'intègre dans une analyse de rentabilité du capital humain et de la croissance économique dans les quartiers pauvres. Ce document démontre que le filtrage de l'information de quartier, l'élimination ou la réduction d'informations utiles issues des courants d'informations de quartier, peuvent créer d'excellentes opportunités de croissance économique dans les quartiers pauvres. Les résultats exposés dans cet article indiquent que le filtrage de l'information de quartier n'est pas important pour la croissance économique. Mais ce qui apparaît être important pour la croissance économique de quartier est l'existence d'un potentiel de capital humain de quartier ayant un niveau élevé de rentabilité pour convertir les informations en revenus.

Ce document fait appel à une série de modèles pour saisir les mécanismes de filtrage de l'information de quartier. Le premier modèle est une simple équation de conservation visant à établir le processus de filtrage de l'information. Le second modèle utilise les résultats de cette équation de conservation pour développer un multiplicateur d'inefficacité du capital humain. Les résultats du second modèle suggèrent que la pauvreté peut s'étendre à un quartier par le biais de la diffusion de capital humain inefficace dans le quartier.

Le troisième modèle examiné dans ce document est un modèle de revenu de quartier sous contraintes qui approfondit le processus de maximisation des revenus de quartier quand la création de revenu de quartier est limitée par l'inefficacité du capital humain. Les résultats des fonctions de contraintes sont ensuite intégrés aux équations de croissance économique de quartier. Les équations de croissance économique sont utilisées pour analyser le processus de croissance économique de quartier quand le taux de croissance économique de quartier est influencé à la fois par l'efficacité et la non-efficacité du capital humain de quartier.

Le document se conclut par un bref examen de certaines préconisations d'orientations possibles concernant la croissance et le développement économiques de

quartier. Ce document suggère que, outre la poursuite de stratégies de développement du capital humain comme moyen d'aborder les problèmes de pauvreté de quartier, les décisionnaires au niveau du gouvernement et des quartiers fassent également de la création d'emploi et de la croissance le fer de lance de leur stratégie globale et locale de croissance économique et d'élimination de la pauvreté de quartier. Tout effort moindre peut finalement provoquer un retour aux cycles de pauvreté qui, à maintes reprises au cours des temps, ont entraîné le sous-développement du capital humain de quartier et la dégradation économique de quartier.

Mots clé : La pauvreté, l'efficacité du capital humain, croissance économique des quartiers, filtrage de l'information

Codes JEL: I: I32; J: J24; R: R23; D: D83

Introduction

Historically, the question of causality has often been at the root of some of the most fundamental issues concerning poverty and the poor. As a result, two ideological approaches have emerged in an attempt to address the causality question (Rank et al, 2003). One approach views poverty in association with specific individual attributes or failings. From this perspective, those who are lacking in human capital (low levels of education or competitive labour market skills) are much more likely to experience poverty than individuals with greater levels of human capital. The second approach views poverty as the result of failings at the structural level, such as the inability of the economy to produce enough decent (above poverty wage) paying jobs. In other words, structural failure occurs when there is an inability of labour markets to provide enough decent paying jobs for all families to avoid poverty or near poverty.

For the last two decades or so, poverty has increasingly been examined through the use of studies designed to evaluate the role that neighbourhoods may play in the existence and persistence of poverty. These types of influences that neighbourhoods may have on poverty and the poor have become known as neighbourhood effects. Generally speaking, studies concerned with neighbourhood effects essentially argue that neighbourhood influences, particularly those associated with close geographical residence, are instrumental in understanding the persistence of concentrated inner-city poverty (Wilson, 1987; Hall, 1997; Pebley and Sastry, 2003). Neighbourhood effects are established on the grounds that individual and group behaviour, and outcomes, have at their foundation social determinants that are largely influenced by neighbourhood characteristics, dynamics, social structure, and social interactions (Durlauf, 1996; South and Crowder, 1999). In essence, according to the neighbourhood effects framework, the individual and the group become a psychological-behavioural, social, and economic reflection of their neighbourhood environment.

Although the literature on neighbourhood effects has been important in helping to develop explanations concerning the spread and persistence of poverty and poor neighbourhoods, the literature also points out that the social mechanisms and processes responsible for the spread and persistence of poverty and poor neighbourhoods are not well understood (Borjas, 1995; NICHD/NIMH, 2000; Bowles et al, 2006).

Studies of poor neighbourhoods that examine neighbourhood social interactions address some of these issues through their emphases on neighbourhood role models and peer groups. Typically, role models and peer groups are examined largely along sociological

and/or psychological lines (deBartolome, 1991; Borjas, 1995). However, what most of these types of studies overlook is that social interactions are largely interactions where information is exchanged. As such, seldom are these neighbourhood groups examined according to the information that is transferred between them. Despite these oversights, some limited research has been done to address the information transfer issue as it relates to neighbourhood social groups (Streufert, 2000; Durlauf, 2003). For instance, Durlauf provides a brief analysis of the role of information transfers in influencing imitative behaviour within neighbourhood groups. Durlauf also extends this same analysis to examine the role of information transfers in altering the perception of the effects of such behaviours. Similarly, Streufert illustrates that under reasonable assumptions, minors in poor neighbourhoods can be led to undervalue the benefits of education through information passed along from neighbourhood adults.

What becomes apparent with neighbourhood social groups in poor neighbourhoods is that the information transferred among individuals within these groups does help to influence behaviour and economic outcomes. Conceptually speaking, given what is known about economic outcomes among individuals in poor neighbourhoods, can the potential for economic growth in poor neighbourhoods be increased by removing or filtering less useful messages from information transfers among individuals within these neighbourhoods? Unfortunately, it appears that no models in the social sciences literature have emerged that address the information filtering issue as it relates to neighbourhood social groups and social interactions. In an attempt to address this issue, the current paper explores the notion of information filtering and integrates it into an analysis of human capital efficiency and economic growth in poor neighbourhoods.

This paper asserts that neighbourhood information filtering; that of removing or reducing less useful information from neighbourhood information streams, can lead to greater opportunities for economic growth in poor neighbourhoods. Please note that information as used in this paper refers to the communication of knowledge or intelligence and is conveyed as messages transmitted among individuals within neighbourhood groups. Also note that useful, as defined in this paper, refers to anything that helps to increase economic growth potential.

Some Brief Comments on Information Filtering

Information filtering is concerned with the removal of redundant, unwanted, undesired, unusable, or harmful information from information streams. According to Schwartz (2004), information filtering and eliminating unusable information from information streams is one of the basic functions of the consciousness.

The literature on information filtering is largely confined to the study of electronic message distribution systems, electronic information retrieval systems (Losee Jr., 1989), and electronic documents retrieval systems (Santos and Vieira, 2004). Subsequently, information filters are more associated with the performance of electronic information search engines. In addition to electronic search engines, information filtering systems are widely utilized within corporate management information systems to filter for appropriate, relevant, and useful information and to deliver it when and where it is needed (Nickels et al, 2005).

Information and its use have been thoroughly discussed in the information economics literature. However, information, as it is discussed within the economics literature, is primarily restricted to matters concerned with trade advantage and trade strategy (Akerlof, 1970; Varian, 1992). Seldom, if ever, is information applied to economic problems concerned with filtering or poor neighbourhoods.

Although the information filtering literature focuses primarily on electronic retrieval and corporate management information systems, the present paper attempts to borrow and integrate some of the basic concepts from information filtering into an analysis of human capital efficiency and economic growth in poor neighbourhoods.

Model of Information Filtering

The model developed in this paper is established on the grounds that the filtering of information generated in a neighbourhood, as well as its usefulness, may be of major importance in the economic growth of a neighbourhood. Given that I represents the information streams generated in some unspecified inner-city neighbourhood, in terms of the frequency of messages conveyed among individuals within these neighbourhood groups per unit of time t , and g is the number of pairings and groupings of individuals in that neighbourhood, also in terms of frequencies, a simple function relating neighbourhood information streams to socially interactive s neighbourhood pairings and groupings can be written as

$$I = s(g), \quad (1)$$

where $I = I/t$ and $s(g) = s(g)/t$. It is assumed here that the function in (1) has the following property; $s'(g) > 0$. The specification of this particular function follows from the social interactions literature (Brock and Durlauf, 2001; Bowles et al, 2006). Also, the use of frequencies is in line with the arguments made by Borjas (1995).

The assertion is made in this paper that not all information will have the same level of significance or relevance regarding its ability to maximize some objective, or regarding its usefulness. Therefore, information can be ranked according to whether it is more useful or less useful. Useful information as used here refers to any information, as generated through social interactions, which help to increase economic growth potential. Less useful information refers to any information, as generated through social interactions, which may be helpful but also has undesirable impacts or may be harmful to economic growth. This paper assumes that the greater the usefulness of information, the greater its potential to increase neighbourhood economic growth opportunities.

Using a materials-balance approach (Anderson, 1987), the left side of (1), the neighbourhood information stream I , can be written as a conservation equation and can be separated into the proportion of I that is useful u and the proportion that is less useful n . As with I , both u and n are considered in terms of frequencies $u = u/t$ and $n = n/t$ or the number of times that the message content of u and n is conveyed among neighbourhood group individuals per unit of some specified time period.

This notion of information usefulness is inspired by Claude Shannon's (1948) measure of information. Shannon's paper asserted that the value of information is a function of the probabilistic value of the message transmitted. It is within this framework of attempting

to measure the usefulness of information, in terms of frequencies, that the following model is formulated.

Rewriting the left side of (1) to reflect these new considerations yields

$$I = u + n \quad (2)$$

Neighbourhood information filtering, or the removal of less useful information, can be depicted by solving for u or

$$u = I - n \quad (3)$$

Information Conversion and Human Capital Efficiency

Given that all other influences remain equal, consider an information use and income producing relationship, at the neighbourhood level, where neighbourhood income $Y (I)$, as influenced by the levels of neighbourhood human capital efficiency h , is a function of some proportion of overall neighbourhood information hI such that

$$Y (I) = hI \quad (4)$$

Please note that the specification in (4) follows closely to that of Branson (1979) and Y and h are observed as frequencies. Also, the assumption is made here that human capital efficiency is a function of educational attainment E and occupational experience x or $h (E, x)$.

Solving (4) for h gives the efficiency of a neighbourhood's human capital stock more clearly as the average product of information, or the proportion of the neighbourhood's information that is converted into income, or

$$h = Y/I \quad (5)$$

Just as efficiency can be depicted, the inefficiencies i existing within the neighbourhood's human capital stock, in terms of its ability to convert information into income, can also be depicted as

$$i = 1 - h = 1 - Y/I \quad (6)$$

Multipliers and the Spread of Inefficient Human Capital

As the economics literature has documented, the multiplier mechanism actually applies much more broadly than to investment alone (Samuelson and Nordhaus, 2001). This notion can be applied to the spread of inefficiency within a neighbourhood framework. Rewriting (6) by multiplying through by I and substituting r for $(1 - h)I$ yields

$$r = I - Y, \quad (7)$$

where r becomes a measure of the information conversion inefficiency of a neighbourhood's human capital stock. Solving for Y yields

$$- Y = r - I \quad (8)$$

To accommodate the time related changes that occur, assume that the relationship in (8) can be written as a function of time t

$$- Y(t) = r(t) - I(t) \quad (9)$$

and that derivatives can be taken such that

$$- dY/dt = dr/dt - dI/dt. \quad (10)$$

Cancelling dt from both sides and dividing through by dr yields

$$- dY/dr = 1 - dI/dr. \quad (11)$$

Dividing (11) by $1 - dI/dr$, multiplying the result by dr , and dividing through by $-dY$ yields the human capital inefficiency multiplier as

$$- dr/dY = 1/1 - dI/dr. \quad (12)$$

Based on the result in (12), for every unit decrease in a neighbourhood's income, the amount of inefficiency in the conversion of information by the neighbourhood's human capital stock increases by a multiple of $1/1 - dI/dr$. The result in (12) suggests that as a neighborhood becomes poorer, the spread of human capital inefficiency in the conversion of information increases. Therefore, distressed neighbourhoods are perhaps the most efficient conduits for the spread of this particular type of inefficiency. Accordingly, as derived in (6), inefficiency in a neighbourhood's human capital stock will be positively associated with inefficiency in that neighbourhood's ability to generate income or $1 - h = 1 - Y/I$. Because of the cyclical characteristic that connects information, inefficient human capital, and inefficient income generation, poor neighbourhoods will perpetuate themselves by perpetuating the spread of human capital inefficiency or $r = (1 - h)I = (1 - Y/I)I = iI = r$.

Maximizing Neighbourhood Income

As was established in the previous section, inefficiencies in the conversion of information help poor neighbourhoods perpetuate themselves. As such, inefficiency can be treated as a constraint to the generation of neighbourhood income. Rewriting human capital conversion inefficiency $(1 - h)I$ as iI and establishing it as a constraint allows it to be written as

$$iI = iu + in. \quad (13)$$

Restating the function in (4) as the objective function and subjecting it to the inefficiency constraint in (13) yields

$$Y(I) = hI + [iI - iu - in]. \quad (14)$$

Taking derivatives of neighbourhood income with respect to u and n , and setting equal to zero, allows neighbourhood income to be maximized such that

$$\partial Y/\partial u = h - i = 0, \quad (15)$$

$$\partial Y/\partial u = h = i, \quad (16)$$

$$\partial Y/\partial n = h - i = 0, \quad (17)$$

and

$$\partial Y/\partial n = h = i. \quad (18)$$

The results in (16) and (18) suggest that equilibrium is reached when changes in the rates at which useful and less useful information are converted into income is equal for both efficient and inefficient human capital.

Neighbourhood Economic Growth: Efficient Human Capital

Recent developments reported in the economics literature suggest that there is a negative association between poverty and economic growth (U.S. GAO, 2007). Similarly, according to Jargowsky (1997), one of the best ways that a neighbourhood can counter poverty is through economic growth. This section provides a model of economic growth that illustrates the influence that the filtering of neighbourhood information may have on neighbourhood economic growth when there is efficient neighbourhood human capital.

Growth equations can now be derived to illustrate one aspect of the neighbourhood economic growth process resulting from information filtering and efficient human capital. If we assume that i is zero and substitute (5), efficient neighbourhood human capital, into (16) we can rewrite the equilibrium condition in (16) as

$$\partial Y/\partial u = Y/I. \quad (19)$$

Separating the variables allows (19) to be written as an economic growth equation or

$$\partial Y/Y = \partial u/I. \quad (20)$$

Taking integrals on both sides yields

$$\int \partial Y/Y = \int \partial u/I, \quad (21)$$

which allows (21) to be written as

$$Y = Y_0 e^{u/I}. \quad (22)$$

The result in (22) suggests that the rate at which neighbourhood income may partially grow is related to the rate at which neighbourhood information streams are filtered or the rate at which information is converted into more useful forms.

Because information filtering allows less useful information to be removed from information streams, the information that remains is better suited for neighbourhood economic growth processes. Thus, neighbourhoods that can filter its information streams will probably grow faster than neighbourhoods that do not or cannot filter its information.

An alternative interpretation for (22), based on the efficiency of the neighbourhood's human capital stock, can be set forth by solving (5) for I and substituting into (22) such that

$$Y = Y_0 e^{h(u/Y)}. \quad (23)$$

The result in (23) suggests that not only is the rate of growth in neighbourhood income related to the growth in the rate of information filtering. The result in (23) also suggests that the rate of neighbourhood economic growth is also related to the efficiency of the neighbourhood's stock of human capital. In other words, what (23) asserts is that the more efficient a neighbourhood's stock of human capital, the less of the neighbourhood's income that needs to be committed to the filtering of information. Therefore, when a neighbourhood's human capital stock has a greater level of efficiency neighbourhood income may grow at faster rates.

A similar analysis can be done using less useful information n . For instance, assume that i is zero, substitute (5) into the equilibrium condition in (18), and separate the variables so that

$$\partial Y/Y = \partial n/I. \quad (24)$$

Taking integrals on both sides and rewriting yields

$$Y = Y_0 e^{n/I} \quad (25)$$

and

$$Y = Y_0 e^{h(n/Y)}. \quad (26)$$

The results in (25) and (26) indicate two things. Firstly, increasing rates of growth in less useful neighbourhood information can stimulate increases in the growth rates of neighbourhood income. Secondly, as indicated by the result in (26), efficient human capital seems to be a very important factor in stimulating neighbourhood economic growth when there are increasing rates of growth in less useful information. In other words, even if neighbourhood information filtering is not very effective in removing less useful information from neighbourhood information streams, if that neighbourhood has a stock of efficient human capital, growth in neighbourhood income can still be achieved.

Highly efficient human capital is skilful in its ability to receive, process, and understand information. Subsequently, information processing and interpretation is important for performing or learning to perform various jobs. Likewise, efficient human capital will have the ability to evaluate, discriminate, and navigate between good and bad ideas or useful and

less useful information. Thus, neighbourhoods with efficient human capital may be more likely to grow even though less useful information is generated.

Accordingly, neighbourhoods that foster and use more efficient human capital may have the tendency to adopt productive practices that contain lower amounts of risk. These practices subsequently may result in greater levels of neighbourhood income. This notion is in line with the arguments of Nelson and Phelps (1966).

Neighbourhood Economic Growth: Inefficient Human Capital

This section examines neighbourhood economic growth, based on information filtering, when there is inefficient human capital. If we assume that h is zero and substitute the last term on the right side of (6), inefficient neighbourhood human capital, into the equilibrium condition in (16) we can rewrite (16) as

$$\partial Y/\partial u = 1 - Y/I. \quad (27)$$

Separating the variables allows (27) to be written as

$$\partial Y/Y = \partial u/Y - \partial u/I. \quad (28)$$

Solving for I in (5), substituting into (28), and rewriting yields

$$\partial Y/Y = \partial u/Y - h (\partial u/Y), \quad (29)$$

which allows the right side of (29) to be factored and written as

$$\partial Y/Y = \partial u/Y (1 - h). \quad (30)$$

Taking the integrals on both sides of (30) yields

$$\int \partial Y/Y = \int \partial u/Y (1 - h). \quad (31)$$

Writing 31) in terms of natural logs gives us

$$\ln | Y | = (1 - h) u/Y. \quad (32)$$

Substituting the right side of (4) into (32) allows (32) to be rewritten as

$$\ln | Y | = (1 - h) u/hI. \quad (33)$$

Solving for Y yields

$$Y = Y_0 e^{(1-h) u/hI}. \quad (34)$$

Cancelling the h terms allows (34) to be written as

$$Y = Y_0 e^{(1-h) u/I}. \quad (35)$$

Thus,

$$Y = Y_0 e^0, \tag{36}$$

and

$$Y = Y_0. \tag{37}$$

The results in (36) and (37) suggest that when a neighbourhood's stock of human capital is inefficient, the income growth rate in that neighbourhood approaches zero. A neighbourhood that has a stock of human capital that is inefficient will lack those capabilities needed to suitably convert information into more useful forms; namely income. Therefore, when a neighbourhood has inefficient human capital, even when less useful information is removed from neighbourhood information streams, zero growth in neighbourhood income may result.

A mirror analysis can be done, using less useful information n , by setting h equal to zero, substituting (6) into the equilibrium condition in (18), separating the variables, substituting I , factoring, and taking integrals yields

$$\int \partial Y/Y = \int \partial n/Y (1 - h). \tag{38}$$

Writing (38) in terms of natural logs gives us

$$\ln | Y | = (1 - h)n/Y. \tag{39}$$

Substituting the right side of (4) into (39) allows us to write (39) as

$$\ln Y | = (1 - h) n/hI. \tag{40}$$

Cancelling the h terms and solving for Y results in zero neighbourhood economic growth or

$$Y = e^0, \tag{41}$$

and

$$Y = Y_0. \tag{42}$$

Based on the results in (37) and (42), the relative usefulness of information generated in a neighbourhood does not appear to be that important. What appears to be of paramount importance is the efficiency or inefficiency of the neighbourhood's stock of human capital. As can be seen from the results of this section, when the neighbourhood's human capital is inefficient, there is zero growth in the rate of neighbourhood income regardless of the degree of usefulness of neighbourhood information.

Conclusions and Further Comments

This paper attempts to integrate concepts concerned with information filtering into an analysis of human capital efficiency and economic growth in poor neighbourhoods. It is argued in this paper that neighbourhood information filtering; that of removing or reducing less useful information from neighbourhood information streams, can lead to greater opportunities for economic growth in poor neighbourhoods. Based on the results established in this paper, it appears that whether neighbourhood information streams contain large proportions of useful information or less useful information is not that important for neighbourhood economic growth. However, what does appear to be of utmost importance for neighbourhood economic growth is efficient human capital. As indicated by the results, if efficient neighbourhood human capital exists, both useful and less useful information can stimulate neighbourhood economic growth. On the other hand, when inefficient human capital is present at the neighbourhood level, regardless of the usefulness of the information streams, the results indicate that the growth rates in neighbourhood income will approach zero.

The results of this paper strongly suggest that if poor neighbourhoods are remotely going to have a legitimate chance at long-term successful and sustainable economic growth, governmental and neighbourhood policy makers must make neighbourhood human capital and skills development a major priority in neighbourhood poverty alleviation strategies. Additionally, although human capital development is extremely important for neighbourhood poverty alleviation, human capital development is almost useless if the local economic system is not producing enough decent paying jobs to support the neighbourhood's families above the poverty line (Rank et al, 2003; Wilson, 1998). Irrespective of individual characteristics or the skills acquired by the neighbourhood's citizenry, if there is a structural failure in the local economy, local labour markets may be unable to provide enough decent paying jobs for all families to avoid poverty or near poverty (Favro, 2006).

In addition to pursuing human capital development strategies as a way to address the neighbourhood poverty issue, governmental and neighbourhood policy makers must also make job creation and growth a vital part of the overall local and neighbourhood economic growth and poverty alleviation strategy. Anything less may eventually lead back to those cycles of poverty that have historically resulted in neighbourhood human capital underdevelopment and neighbourhood economic decay.

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