Keeping up with the Crusoes
Relative Consumption in Networks

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Abstract

We study the dynamics of relative consumption within a complex social network. Previous work on the consumption of positional or status goods made the assumption that consumer know either the exact distribution of consumption in society (e.g. Frank 1985, Robson 1992) or at least the mean and their relation to it(e.g. Ljunqvist and Uhlig 2000). However consumers are unlikely to have accurate views on these often overestimating their own standing, the so-called above-average-effect (Kruger 1999) Furthermore, as the original formulation of relative income hypothesis by Duessenberry (1949) and common sense tells us, the utility of relative consumption derives from local interactions. We study these local interactions in a social network where each node is a consumer whose consumption and leisure choices depend on that of the nodes with which it shares a connection. With a positional comparison-concave utility over consumption of a good and non-positional preferences for leisure, we show that the allocation of consumption and leisure depends on the Bonacich centrality of an agent in the network. As the ineffcient distortion of leisure increases with centrality of the node, optimal taxation shifts resources from nodes with high centrality to nodes with low centrality.

JEL: D13, D31; J22; H23

1 Introduction

Ever since Torsten Veblen added the term Conspicuous Consumption to the English language, there has been a debate within the economic science on the influence of the people around us on our consumption plans. The idea that we do not make our decisions on how much to work and what goods to buy in isolation, but that the social context in which we are embedded is very important seems plausible, but at the same time has not received widespread acceptance within the field.

In order to asses potential welfare impacts stemming from relative consumption, it is important to learn about how people make these comparison, who they are comparing themselves with, and what the impact of comparison is on subjective well-being. Empirical evidence has accumulated recently, that relative consumption does indeed has an impact on reported happiness (Luttmer, 2005) and consumption patterns(Kapteyn *et al.* , 2008).

The challenge is capturing these effects in a theoretical model that is flexible enough to allow for different specifications of reference groups and income distributions. The language of social network theory allows us to catch important heterogeneity among agents, and complex interlinkages in a relative straightforward framework. This allows us to expand upon some conclusions in the literature that assume only global interaction effects.

2 Literature

2.1 Global vs Local envy

The existing literature on relative consumption models can be roughly divided into three types: keeping up with the Jones, rank based preferences and signalling models. In the first type of models, consumers are assumed to not only have preferences over the absolute size or quality of consumption, but also over the size or quality of consumption relative to the societal average. The first to attempt such a model was (Duessenberry, 1949), and later papers include (Abel, 1990). These papers usually assume a utility function of the form $U_i(C_i, \overline{C}, l_i)$, where the utility of an agent i not only depends on own consumption and leisure C_i and L_i but also on the average consumption of the population $\overline{C}$.

The second type of models are referred to as rank based preference models, that assume that consumers do not only care about absolute levels of consumption but also about where they stand within the overall distribution of consumption. Products for which consumers care about rank ordering are labeled positional goods after (Hirsch, 1976). These kind of models have been developed by (Frank, 1985), (Robson, 1992) and (Corneo & Jeanne, 1997) and a typical recent example is (Hopkins & Kornienko, 2004) where utility of consumption of a positional good x and a non-positional good y are defined as $U(x, y) = V(x, y)S(x, F(x))$. Here $V(x)$ is the direct utility of consumption of both goods, and $S(\cdot)$ is a status multiplier that depends on the rank of the positional good consumption within the entire distribution of consumption $F(x)$ in the population.

A third type of models are status signalling models ((**?**)) where people care about what other people think about their wealth. However wealth is unobservable en hence people overinvest in conspicuous goods ub order to signal their wealth.

What is typical of all these models is that consumers overconsume the positional good (they are locked in a game of status the use Hopkins and Kornienko terminology), which generates inefficiencies. The common remedy is more progressive consumption taxes.

Although these models are interesting I would argue that they are somewhat unsatisfactory. For one they assume that everybody is able to observe either their own rank of consumption, or their distance to average consumption perfectly. In practice people are probably not able to do this. There is a well-established literature that shows that people are very bad at estimating their own position to an average, often leading to large overestimations where 90% of subjects believe they are for example above average drivers.[1] (Kruger, 1999)

Another common property of these models is that everybody compares themselves to the entire population, and everybody cares equally for their relative position. I would argue that in practice this is not how relative consumption effects occur. We do not compare ourselve to the entire population, but mainly with our neighbours, our family, friends and co-workers. Thus the interaction that gives rise to conspicuous consumption is a markedly *local* effect. Everybody has their own reference groups. Now one could argue that the above models also only refer to local reference groups, but then they quickly run into trouble with overlapping reference group: if someone outside my reference group affects someone within my reference group, than that in turn affects me.

2.2 Networks

In order to capture local interaction effects stemming from consumption, the theory of complex social interactions seems like an obvious starting points. This theory views society as a set of agents (nodes) that are connected among each other. The topology of interactions defines the network.

So far there has been only one paper that looks at relative consumption in networks, namely a recent working paper by (Ghiglino & Goyal, 2008)). Theirs is a model of a trading network, where two assets are traded, one positional and one non-positional. Prices and allocations of the two assets are determined endogenously in the network. The centrality of each node plays an important part in the analysis, as nodes with a high centrality index try to acquire more of the positional assets. The influence that each node has over the equilibrium price is also related to it's centrality.

[1] This effect is often referred to as the Lake Wobegon effect. It is named for the fictional town of Lake Wobegon from the radio series A Prairie Home Companion, where, according to the presenter, Garrison Keillor, "all the women are strong, all the men are good-looking, and all the children are above average."

2.3 Evidence

2.3.1 Happiness

There are some strong clues that people indeed care about their relative position in society. First of all there's the famous Easterlin Paradox (Easterlin, 2001) that shows that while average income in the West has greatly increased in the last decades, reported levels of life satisfaction have mostly remained flat.

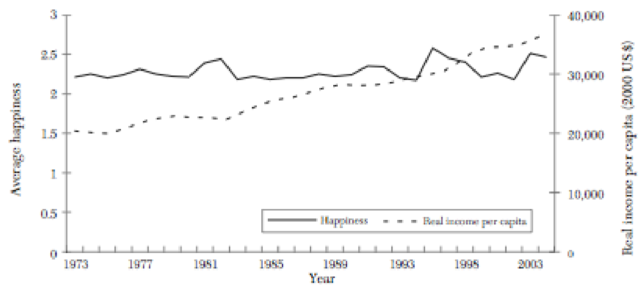


Figure 1. Happiness and Real Income Per Capita in the United States, 1973–2004

Figure 1: Source: Clark et al. (2008)

If utility would only depend on absolute levels of consumption, then one would expect increasing incomes to result in increasing happiness, ceteris paribus. The fact that it has not points to the importance of relative income in the determination of happiness (Clark *et al.* , 2008) When only our relative position matters, then increasing the average would not affect utility: the poorest 10% are still the poorest 10%.

In order to further investigate this hypothesis (Luttmer, 2005) looks at an individual-level panel data, and finds that self-reported happiness is declining in the earnings of neighbours, holding own income constant. The effect is stronger for those that socialize more with neighbours than people outside the neighbourhood. This is a clear indication that it is the actual interaction that drives the effect, and not just the overall average.

(Stutzer, 2004) finds that in Switzerland income aspirations negatively affect reported happiness. (Stadt *et al.* , 1985) already showed that the stated level of income needed for a certain level of satisfaction own income, and with the income of a reference group given by education level and age. So this is another indication that comparison with your reference group influences utility directly.

Finally there's a paper by (Ravallion & Lokshin, 2005) that look for the relative deprivation effects found by Luttmer in U.S. data in the developing country of Malawi. They find for most people either an insignificant or positive effect of neighbours income on wellbeing. Only the most well-to-do seem to be interested in positional concerns. They speculate that for poor people it is actualy beneficial to have richer neighbours as they provide mutual support.

2.3.2 Consumption

As far as I know there are only two studies that test the direct impact of relative concerns on consumption. The first is a paper by(Grinblatt *et al.* , 2004) on automobile expenditures in Finland. They use a database containing all automobile expenditures in two Finnish provinces, matched with exact location data, to show the influence of neighbours' car purchases on other consumers. They find a strong effect, even at the brand and type level. They find that the influence is strongest when the neighbour is of the same social class, and that same class emulation is weakest among the higher classes.

(Kapteyn *et al.* , 2008) look at the effects of the Dutch postcode lottery on consumption and happiness. In this lottery it are not individuals who win, but entire zipcodes. Since almost one third of Dutch people play in this lottery, it provides a nice exogenous variation where on third of a certain zipcode gets a sudden and significant (about E12,500 a household) income shock. They find that for the winner the consumption of outside home diner, durables and automobiles goes up. Non-winner respond by also increasing automobile and exterior home redecoration expenditures. There are no long term effects on happiness for either winner or non-winners.

3 Model

Although the model is influenced by (Ghiglino & Goyal, 2008), I take a somewhat different approach. First of all there is no trading of assets. Instead I model agents as a collection of Robinson Crusoe's that are initially endowed with one unit of leisure, and have acces to some production technology to transform leisure into a consumption good. Heterogenous productivities of this production technology can be interpreted as a wage rate.

Although there is no trading, agents do compare their consumption with their neighbours. Consuming more than a neighbour gives some satisfaction and positive utility, whereas consuming less gives rise to envy and a disutility. Agents do not compare their leisure with that of their neighbours, an assumption standard in the literature(see e.g. (Frank, 1985)).

3.1 Baseline: No social interaction effects

We live in a Robinson Crusoe economy where all consumers are endowed with a time endowment of 1. Each consumer has to decide how to divide his time between leisure l_i and a linear productive activity that produce a consumption good $\theta_i(1-l_i)$. Consumers differ in their productivity parameter $\theta_{i.}$ Utility is given by a Cobb-Douglas utility over leisure and the consumption good: $U_i = (\theta_i(1-l_i))^{1-\alpha} l_i^{\alpha}$. It easily follows that the leisure decision is independent of productivity, and all agents will consume a fraction α leisure and spend a fraction $(1-\alpha)$ working. The resulting income distribution is simply given by the productivity distribution.

3.2 With social interaction effects.

3.2.1 Decentralized equilibrium

Suppose we have an economy with N consumers. Consumer can be connected to their neigbours, forming a network. Let $N(i)$ denote the neighbours of node i and let $n_i = |N(i)|$ denote the cardinality or number of neighbours of node i. The network of interactions can be characterized by an adjacency matrix G, where G_{ij} is equal to one if consumer i has a connection with consumer j and otherwise equal to zero.

Now consumers do not only care about their own consumption, but also about that of their neighbours. Like Ghiglino and Goyal we model this by subtracting the sum of differences with neighbours' consumption from the consumption term. The strength of the social comparison is given by a parameter π :

$$U_i = (\theta_i(1-l_i) - \pi \sum_{j \in N(i)} [\theta_j(1-l_j) - \theta_i(1-l_i)])^{1-\alpha} l_i^{\alpha}$$

So with the neighbours' consumption given, it is easy enough to computer the optimal leisure decision:

$$\begin{aligned} \max_{l_i} U_i &= (\theta_i(1-l_i) - \pi \sum_{j \in N(i)} [\theta_j(1-l_j) - \theta_i(1-l_i)])^{1-\alpha} l_i^{\alpha} \\ &= [(1+n_i\pi)\theta_i(1-l_i) - \pi \sum_{j \in N(i)} [\theta_j(1-l_j)]^{1-\alpha} l_i^{\alpha} \end{aligned}$$

Taking the first order condition and rearranging we find that:

$$l_i = \alpha[1 - \tfrac{\pi}{(1+n_i\pi)\theta_i} \sum_{j \in N(i)} \theta_j(1-l_j)]$$

When the there is no interaction with any neighbour(so either $N(i) = \varnothing$ or $\pi = 0$) then the expression collapses to the isolated consumer result $l_i = \alpha$.

When there are interaction effects, leisure is decreasing in the total expenditure of neighbours $\sum\limits_{j \in N(i)} \theta_j(1 - l_j)$. Thus as consumers compare themselves with more neighbours, or their neighbours increase their consumption, they respond by working longer hours. When π increase, that is an agent assigns more importance to relative consumption, leisure is also increasing. However leisure is increasing in own productivity θ_i. When you're producitivity is much higher than your neighbours, you don't need to work as hard to still stay ahead.

Solving the equilibrium. Although the above first order condition is quite straightforward, finding an equilibrium allocation across an entire network is slightly less so. When I increase my consumption, my neigbours will do so as well, but this will in turn make the neighbours of my neighbours increase their consumption. And when the neighbour of a neighbour happens to my neighbour as well, then this increased consumption would make me again increase mine. Thus consumption effects will ripple through the network in numerous different ways. In order to find the equilibrium allocation the concept of centrality will prove to be central.

We start by writing our problem in terms of vectors, using the definition of the adjacency matrix G.

$$l_i = \alpha - \tfrac{\alpha\pi}{(1+n_i\pi)\theta_i} G_i \begin{pmatrix} \theta_1(1-l_1) \\ \theta_2(1-l_2) \\ \ldots \\ \theta_N(1-l_N) \end{pmatrix}$$

Where G_i is the i'th row of the adjacency matrix. In order to solve the system we normalize the adjacency matrix G in the following way:

$$G^N = \begin{bmatrix} \frac{g_{11}\theta_1}{(1+n_1\pi)\theta_1} & \frac{g_{12}\theta_2}{(1+n_1\pi)\theta_1} & \ldots & \frac{g_{1N}\theta_N}{(1+n_1\pi)\theta_1} \\ \frac{g_{21}\theta_1}{(1+n_2\pi)\theta_2} & \ldots & \ldots & \ldots \\ \ldots & \ldots & \ldots & \ldots \\ \frac{g_{N1}\theta_1}{(1+n_N\pi)\theta_N} & \ldots & \ldots & \frac{g_{NN}\theta_N}{(1+n_N\pi)\theta_N} \end{bmatrix}$$

Thus every connection from i to j g_{ij} is weighted according to the number of neighbour of i and according the the productivity ratio of j and i.

No we can represent the vector of all leisure decisions in the network L simply by the following equation:

$$L = \alpha J - \alpha\pi G^N(J - L)$$

Where J is the vector of ones. Solving for L:

$$L = [I - \alpha\pi G^N]^{-1}[\alpha I - \alpha\pi G^N]J$$

When $\alpha\pi$ is smaller than the inverse of the modulo of the largest eigenvalue of G^N then the inverse $(I - \alpha\pi G_N)^{-1}$ can be expressed as:

$$(I - \alpha\pi G_N)^{-1} = \sum_{s=0}^{\infty}(\alpha\pi G_N)^s$$

which means that:

$$\{[I - \alpha\pi G^N]^{-1}\}_{(i,j)} = \sum_{s=0}^{\infty}(\alpha\pi)^s\{(G_N)^s\}_{(i,j)}$$

Where $\{(G_N)^s\}_{(i,j)}$ counts the number of paths from consumer i to consumer j of length s, weighted by degree and relative productivity. This allows us to give a nice interpretation to the matrix $[I - \alpha\pi G^N]^{-1}$. When we define a centrality vector B as:

$$B = [I - \alpha\pi G^N]^{-1}J$$

Then B_i gives the weighted sum of paths of all possible lengths originating from consumer i.Thus the leisure decision by an agent i in a network G is characterized by two components: a direct local interaction effect of the relative productivity of the immediate neighbours $[\alpha I - \alpha\pi G^N]$ and a global equilibrium effect governed by the term $[I - \alpha\pi G^N]^{-1}$ and the centrality of the agent.

3.3

Central Planner Solution

Now that we have obtained the decentralized equilibrium, the next step would be to compare this with a centralized social planner solution:

$$\max_{\{l_i\}} \sum_i (\theta_i(1-l_i) - \pi \sum_{j\in N(i)} [\theta_j(1-l_j) - \theta_i(1-l_i)])^{1-\alpha} l_i^\alpha$$

However it turns out that this problem is not very tractable. Whereas in the decentralized case the first order condition for each agent only took into account the own utility function, the central planner needs to take into account the impact of each leisure decision on others. This problem becomes hopelessly recursive and so far I have not been able to solve it.

Only for the case where all productivities are equal is the solution straightforward: setting $l_i = \alpha \; \forall i$ results in no welfare losses due to social comparison and sets the efficient amount of leisure. In other cases the optimal leisure allocation will need to be approximated numerically.

3.3.1 Optimal Taxation

Seeing the effect of different productivity endowments and reference groups on equilibrium investment in positional good is one thing, but the next question obviously is: could a government or social planner intervene to reduce the welfare cost of social comparison by judiciously applying taxes?

The government could for example levy a tax on consumption goods, trying to encourage more leisure taking. However if the government introduces a flat-tax this will not effect the leisure-consumption tradeoff:

$$\begin{aligned} U_i &= ((1-\tau)\theta_i(1-l_i) - \pi \sum_{j\in N(i)} [(1-\tau)\theta_j(1-l_j) - (1-\tau)\theta_i(1-l_i)])^{1-\alpha} l_i^\alpha \\ &= (1-\tau)^{1-\alpha}[(1+n_i\pi)\theta_i(1-l_i) - \pi \sum_{j\in N(i)} [\theta_j(1-l_j)]^{1-\alpha} l_i^\alpha \end{aligned}$$

And agents will still engage in inefficient consumption competition.

But now suppose the central planner levies a targeted consumption tax τ_i on each agent i. The government's problem is thus:

$$\max_{\{\tau_i\}} \sum_i ((1-\tau_i)\theta_i(1-l_i) - \pi \sum [(1-\tau_j)\theta_j(1-l_j) - (1-\tau_i)\theta_i(1-l_i))])^{1-\alpha} l_i^\alpha$$

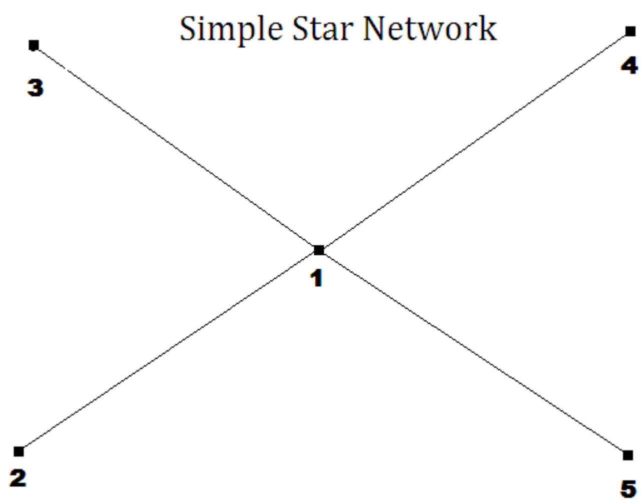
$$\text{s.t.} \sum_i \tau_i \theta_i (1-l_i) \geq B$$

$$l_i = \alpha[1 - \frac{\pi}{(1+n_i\pi)\theta_i} \sum_{j\in N(i)} \theta_j(1-l_j)]$$

Again, this problem is not tractable to solve in analytically, but some numerical approximations can nevertheless give some interesting insights.

Example 1 *Star Network*

We start with a very simple star network, where one node is highly central and is connected to four spokes. In order to make comparison to the social planner solution easier, we set $\theta_i = 1\forall i$, $\alpha = 0.5$ and $\pi = 0.1$. In this setup, because of the equal productivities, the optimal planner solution entails setting $l_i = \alpha = 0.5 \forall i$.



A simple star network

When computing the decentralized solution we find as expected that the node with the highest centrality works the most hours and has the highest consumption.

node	Centrality	Leisure	Consumption	Utility
1	1.1503	0.4248	0.5752	0.5027
2	1.0523	0.4739	0.5261	0.4970
3	1.0523	0.4739	0.5261	0.4970
4	1.0523	0.4739	0.5261	0.4970
5	1.0523	0.4739	0.5261	0.4970

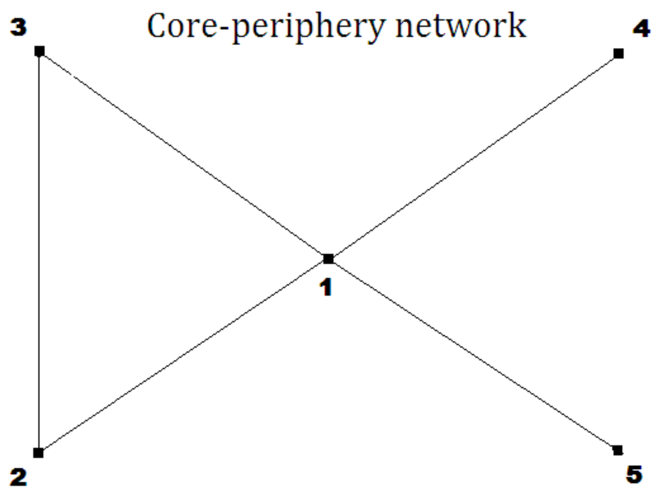
The central node with it's 0.57 units of consumption is negatively affecting it's neighbours, leading to welfare losses. A central planner could try to remedy this, by levying consumption taxes. We set the total revenue collected by the government to zero ($B = 0$), such that the tax policy is purely redistributional. We then find the following numbers for optimal taxation:

node	Tax	Centrality	Leisure	Consumption	Utility
1	0.15	1.1825	0.4088	0.5025	0.4459
2	-0.04	1.0439	0.4780	0.5428	0.5113
3	-0.04	1.0439	0.4780	0.5428	0.5113
4	-0.04	1.0439	0.4780	0.5428	0.5113
5	-0.04	1.0439	0.4780	0.5428	0.5113

The government should tax the central agent at a rate of 15% and use the revenue to subsidize the periphery to the tune of 4%. Although this redistribution increases welfare, it does little to combat the distortions. The central agent starts working even harder in order to not fall too much behind his neighbours. The effect on periphery players goes in two directions. On the one hand they have to work less to keep up with the central agent, but on the other hand their tax subsidy increases their marginal benefit of work. The two effects seem to mostly cancel out.

Example 2 *Core Periphery*

We now turn to a slighly more complicated network. By linking two of the spokes of the star, we create a connected core of three nodes, and two nodes that form the periphery. Now we have two agents with a single neighbour, two with two neighbours, and one central agent connected to all.



A Core-Periphery Network

The decentralized equilibrium is as could be expected, where the leisure is decreasing in centrality.

Node	Centrality	Leisure	Consumption	Utility
1	1.1533	0.4234	0.5766	0.5009
2	1.0936	0.4532	0.5468	0.4964
3	1.0936	0.4532	0.5468	0.4964
4	1.0524	0.4738	0.5262	0.4969
5	1.0524	0.4738	0.5262	0.4969

And optimal taxes only subsidize the two peripheric agents, while the central agents pays the highest taxes and the two other core agents only pay a 1% tax.

Node	Tax	Centrality	Leisure	Consumption	Utility
1	0.13	1.1810	0.4095	0.5137	0.4519
2	0.01	1.0886	0.4557	0.5389	0.4967
3	0.01	1.0886	0.4557	0.5389	0.4967
4	-0.08	1.0432	0.4784	0.5634	0.5214
5	-0.08	1.0432	0.4784	0.5634	0.5214

3.4 Lessons

Three main lessons can be learned from these two examples.

First, it is optimal to shift consumption away from central agents and toward the less connected. The optimal tax rate increases with centrality. This is related to the work by (Ballester *et al.* , 2006) on finding the key player in a network. The key player is the player that if removed would have the biggest effect on total activity in the network. In Ballester et al. the Bonacich centrality helps identifying this player.

Second, although the consumption taxes cause an aggregate welfare improvement, the gains are not very evenly distributed. In the second example not only does the consumption inequality somewhat increase (a gini of 0.0228 vs 0.0223), but the main effect is a big increase in utility inequality (a gini of 0.0019 vs 0.0329). Especially the central node has quite a large loss in utility. It is a question if this increase in utility inequality is desirable.

Third, setting optimal consumption taxes and subsidies does not result in the efficient allocation. (Remember that in the above examples the optimal allocation of leisure was $l_i = \alpha$ for all agents). Since the network topology determines the pressure to engage in positional activity, setting higher taxes only results in even more wastful expenditure. This suggests that the optimal way to tackle distortions due to consumption externalities is not through taxes. Instead direct regulation on maximum labour hours is a much more effective way to constrain positional arms races.

4 Conclusion

Introducing a network structure into the study of relative consumption allows us to study optimal taxation in a new light. When the envy of others consumption is not just based on a global average, but on direct local interactions, the structure of the network of interlinkages start to matter. This could provide another motivation for more progressive income taxation. If for example it could be shown that richer people often play a more central role in their network of friends, then this alone would be justification for higher income taxes.

The next step will be to take the theory to the data. This could be done using the data from the the National Longitudinal Survey of Adolescent Health, that has collected information on friend networks in high school, and also contains employment and income data for each subject. The centrality of a subject in their social network should be a predictor for the number of hours that subject works outside school hours.

References

Abel, Andrew. 1990. Asset Prices under Habit Formation and Catching up with the Joneses. *The American Economic Review*, **80**(2), 38–42.

Ballester, Coralio, Calvó-Armengol, Antoni, & Zenou, Yves. 2006. Who's Who in Networks. Wanted: The Key Player. *Econometrica*, **74**(5), 1403–1417.

Clark, AE, Frijters, P, & Shields, MA. 2008. Relative income, happiness, and utility: an explanation for the Easterlin paradox and other puzzles. *Journal of Economic Literature*, **46**(1), 95–144.

Corneo, G, & Jeanne, O. 1997. Conspicuous consumption, snobbism and conformism. *Journal of Public Economics*, Jan.

Duessenberry, James S. 1949. *Income, Saving and the Theory of Consumer Behavior*. Harvard University Press.

Easterlin, Richard. 2001. Income and Happiness: Towards a Unified Theory. *The Economic Journal*, **111**(473), 465–484.

Frank, Robert. 1985. The Demand for Unobservable and Other Nonpositional Goods. *The American Economic Review*, Mar, 101–116.

Ghiglino, Christian, & Goyal, Sanjeev. 2008. Keeping up with the neighbours: social interaction in a market economy. *University of Essex Discussion Paper Series no 655*, Jun, 49.

Grinblatt, Mark, Keloharju, Matti, & Ikaheimo, Seppo. 2004. Interpersonal Effects in Consumption: Evidence from the Automobile Purchases of Neighbors. *Yale ICF Working Paper No. 04-10*, Mar, 43.

Hirsch, F. 1976. *Social Limits to Growth*. Harvard Univ. Press, Cambridge, MA.

Hopkins, E, & Kornienko, T. 2004. Consumption, Status and Redistribution. *econ.ed.ac.uk*, Jan.

Kapteyn, A, Kooreman, P, Kuhn, P, & Soetevent, A. 2008. Measuring Social Interactions: Results from the Dutch Post Code Lottery. *NBER Working Paper 14035*, Jan.

Kruger, J. 1999. Lake Wobegon be gone! The" below-average effect" and the egocentric nature of comparative ability .... *Journal of Personality and Social Psychology*, Jan.

Luttmer, EFP. 2005. Neighbors as Negatives: Relative Earnings and Well-Being. *The Quarterly Journal of Economics*, **120**(3), 963–1002.

Ravallion, Martin, & Lokshin, Michael. 2005. Who Cares about Relative Deprivation? *World Bank Policy Research Working Paper No. 3782*, Nov, 47.

Robson, Arthur. 1992. Status, the Distribution of Wealth, Private and Social Attitudes to Risk. *Econometrica: Journal of the Econometric Society*, Jul, 837–857.

Stadt, Huib, Kapteyn, Arie, & Geer, Sara. 1985. The Relativity of Utility: Evidence from Panel Data. *The Review of Economics and Statistics*, **67**(2), 179–187.

Stutzer, Alois. 2004. The Role of Income Aspirations in Individual Happiness. *Journal of Economic Behavior & Organization*, **54**(1), 89–109.