Allocation of Education, School District Policy and Housing Market Efficiency

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Abstract

The consumption of urban public resources, for example, public schooling, is typically geographically bundled with home locations. When consumers differ in valuations of housing and in abilities, the positive and assortative matches between school qualities and student abilities sometimes fail to be achieved by the housing market equilibrium, resulting in a misallocation in education. This paper proposes a mechanism that improves school matches by making the property tax imposed on the high quality house-school bundle deductible conditional on school performance. When the demand for housing is inelastic, the school match effect dominates the tax-induced distortion from the consumption of housing. Moreover, such tax is Pigouvian corrective if private valuations are inconsistent with social preferences on school assignments.

Introduction

Under school district policy, school choice is predetermined by the occupation of affiliated housing. The intended purpose is to produce a "fair" enrollment arrangement. But it leads to a higher price of housing to make children be well educated.[1][2] The good school does not necessarily serves its intended students to produce a higher level of educational outcome. Such inefficiencies comprehensively exist in the allocation of scarce public resources—failures of perfect matches between public goods and residents arise because of a discrepancy between private valuations of geographical bundles that link public goods with the consumption of housing, and social willingness in the assignment of public services.

Main Mechanism

We seek for the optimum reallocation that produces the second best outcome derived from a Walrasian equilibrium where heterogeneous consumers differ in valuations and abilities exchange for two units of house-school bundles. An imposition of "conditional deductible" property tax contingent on school performance on the high quality bundle results in: (a) the low ability type is penalized if she consumes the high quality bundle, (b) a desirable transaction of houses, to produce good school matches along the extensive margin, but (c) a potential distortion in house consumption along the intensive margin. Optimal tax is higher provided that: (i) housing demand is inelastic, (ii) matching surplus in schooling is greater, and (iii) abilities are less dependent on wealth.

The Model

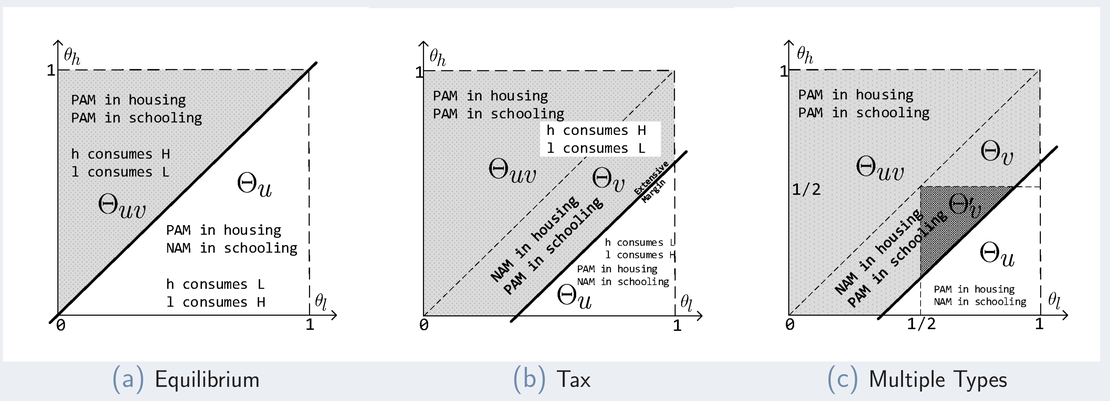
Two jurisdictions $i = H, L$, each consists of a house (of quality x_i) and a school (of quality y_i): $x_H > x_L$ and $y_H > y_L$. Two consumers $j = h, l$ where ability type is $h > l$. Private valuations on housing is $\theta_j \in [0,1]^2$ and $\theta_j \xrightarrow{i.i.d} f(.)$. Utility of consuming bundle i is $\theta_j u(x_i) + \rho\theta_j v(y_i) + z$, where $\rho > 0$, $u' > 0$ and $u'' < 0$. Each with unit demand and endowment. Each agent solves

$$\max\{\text{consuming endowment, making a transaction}\}.$$

Under Walrasian equilibrium, h consumes H iff $\theta_h > \theta_l$ (event Θ_{uv}, i.e., the shaded area in Figure 1a). Total surplus is total utility from housing consumption plus educational outcome. The two dimensional matching properties are defined as

- PAM in housing: better housing is consumed by one with higher marginal utility such that total utility from housing is maximized at $\max_{j\in h,l} \theta_j u(x_H) + \min_{j\in h,l} \theta_j u(x_L)$.
- PAM in schooling: the high ability is assigned with a better school such that educational outcome is maximized at $v(y_H)$, where the l type produces zero outcome.

Hence total surplus is supermodular.[3][4] However, the Walrasian equilibrium does not necessarily yields two dimensional perfect matches, e.g., school match is inefficient in event Θ_u in Figure 1a. Due to a discrepancy between private and social valuations on school matches (externalities): $\rho(\theta_h - \theta_l)\Delta v \neq \Delta v$, the Walrasian equilibrium fails to achieve first-best outcome.



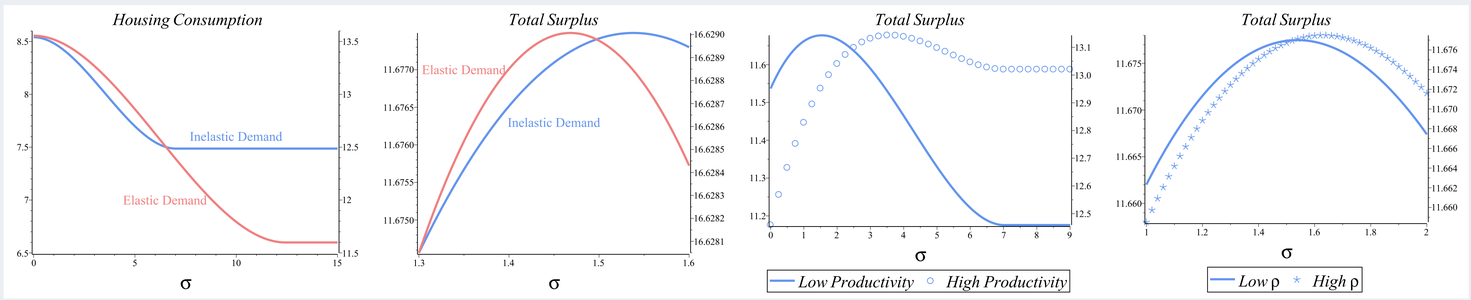
(a) Equilibrium (b) Tax (c) Multiple Types

Figure: Equilibrium Matching

Consider a "Conditional Deductible Property Tax"—the one who consumes H with a poor school performance pays σ, which is deductible for h and penalizes l. Such deductibility promotes school matches at the cost of a distortion in housing, i.e., $\Theta_v = \{\boldsymbol{\theta} | \theta_l > \theta_h > \theta_l - \frac{\sigma}{\Delta u + \rho\Delta v}\}$ in Figure 1b. To balance the trade-off, the authority solves

$$\max_{\sigma} \int_{\Theta_{uv}\cup\Theta_v} (\theta_h u_H + \theta_l u_L + \Delta v) f(\boldsymbol{\theta}) d\boldsymbol{\theta} + \int_{\Theta_u} (\theta_l u_H + \theta_h u_L) f(\boldsymbol{\theta}) d\boldsymbol{\theta}.$$

Results



(a) Total Utility from Housing (b) Welfare:Elasticities (c) Welfare:Education (d) Welfare:Externalities

Figure: Numerical Examples

A two-dimensional Trade-off: a marginal increase of σ from zero leads to: (i) a switch from NAM to PAM in school matches (school match effect along the extensive margin) that yields Δv and (ii) a distortion in that better housing is consumed by one with lower marginal utility (intensive margin, Figure 2a): $(\theta_l - \theta_h)\Delta u$.[5] The latter is dominated evaluated at $\theta_h = \theta_l$.

The interior optimum is

$$\sigma^* = \Delta v (\Delta u + \rho\Delta v) / \Delta u,$$

which is higher with (i) an inelastic demand (Figure 2b),[6] (ii) higher matching surplus (Figure 2c) and (iii) a greater level of discrepancy between private and social valuations (Figure 2d).

Discussions

The results are robust with multiple types and competitive supply. Consider a unit mass of consumers that are indexed by $\theta_j^k \in [0,1]$ where k is a ranking indicator (Figure 1c). The capacity of each jurisdiction serves half of the population. Hence the conditional deductible tax stimulates a transaction at $\Theta_v' : \theta_h^{k<1/2} \geq \theta_l^{k\geq 1/2} - \frac{\sigma}{\Delta u + \rho\Delta v}$ which is a subset of Θ_v.

In addition, if housing qualities become endogenously adjustable, then the progressiveness of redistributing from high-end to low-end housing is complementary with σ, if the likelihood ratio of inefficient housing consumption

$$\frac{\int_{\Theta_{uv}\cup\Theta_v} \theta_l f(\boldsymbol{\theta}) d\boldsymbol{\theta} + \int_{\Theta_u} \theta_h f(\boldsymbol{\theta}) d\boldsymbol{\theta}}{\int_{\Theta_{uv}\cup\Theta_v} \theta_h f(\boldsymbol{\theta}) d\boldsymbol{\theta} + \int_{\Theta_u} \theta_l f(\boldsymbol{\theta}) d\boldsymbol{\theta}},$$

is non-decreasing in σ. Taking school match effects into account, narrowing the housing quality gap is educationally desirable but introducing an additional inefficiency that further deviates from Utilitarian optimum that equalizes marginal utilities. However, it cancels out some inefficient distortions previously produced by σ.

Some References

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