Suppose you are in a similar setup as Diamond (1973) where you now have two goods x and y where x is the choice to remain in the current risky location and y is the choice to move away to a non-risky location. In this community, there are N households and the utility of a given household h depends on the choices of other households *to stay*: $U^h(x_1, x_2, .., x_h, .., x_n, y_h)$, where households are *positively affected* by others choosing to stay, such that $\frac{\partial U^h}{x_i} > 0$ (so the opposite of a congestion externality).

The planner chooses a subsidy s for the non-externality producing good, y. From the planner's perspective, there is not only the externality from others' choices but also an additional externality function that depends on the number of households who choose to stay: $e(x_1, x_2, .., x_h, .., x_n)$ where $e' > 0$.

The consumer's problem is as follows:

$$max_{x_h, y_h} U^h(x_1, x_2, .., x_h, .., x_n, y_h) + \mu_h$$
$$\text{s.t.} I_h = p_x x_h + (p_y - s) y_h + \mu_h$$

FOC:

$$\frac{\partial U^h}{\partial x_h} = p_x$$
$$\frac{\partial U^h}{\partial y_h} = p_y - s$$

The social planner's problem is (* omitted on x and y):

$$max_s SWF = \sum_h U^h(x_1, x_2, .., x_h, .., x_n, y_h) - p_x \sum_h x_h - p_y \sum_h y_h + \sum_h I_h - e(x_1, x_2, .., x_h, .., x_n)$$

Planner's FOC:

$$\sum_h \sum_i \frac{\partial U^h}{\partial x_i} \frac{\partial x_i}{\partial s} + \sum_h \frac{\partial U^h}{\partial y_h} \frac{\partial y_h}{\partial s} - p_x \sum_h \frac{\partial x_h}{\partial s} - p_y \sum_h \frac{\partial y_h}{\partial s} - \sum_h \frac{\partial e}{\partial x_h} \frac{\partial x_h}{\partial s} = 0$$

Replace with consumer FOC and rewrite:

$$\sum_{h \neq i} \sum_i \frac{\partial U^h}{\partial x_i} \frac{\partial x_i}{\partial s} - s \sum_h \frac{\partial y_h}{\partial s} - \sum_h \frac{\partial e}{\partial x_h} \frac{\partial x_h}{\partial s} = 0$$
$$s^* = \frac{\sum_{h \neq i} \sum_i \frac{\partial U^h}{\partial x_i} \frac{\partial x_i}{\partial s} - \sum_h \frac{\partial e}{\partial x_h} \frac{\partial x_h}{\partial s}}{\sum_h \frac{\partial y_h}{\partial s}}$$

Since x and y are substitutes in this setting, then we can try to sign this. The left term in the numerator is the product of a positive and negative term, and the right term is subtracting another negative term so the optimal subsidy is actually unclear, i.e. it depends on whether the net externality is positive or negative ($s^* > 0$ if the sum of other individuals' externality-causing actions is smaller than the societal marginal damages from having an additional person live in a risky area, weighted by demand elasticity for living in the safe area). And if that demand elasticity is quite low for everyone, that implies a higher subsidy, all else equal.

The first term in the numerator is a spillover parameter (or function) that I would need to estimate from the data. I think the marginal damages could be calibrated from historical flood damages / insurance payouts, and the denominator demand elasticity might also need to come from the data..

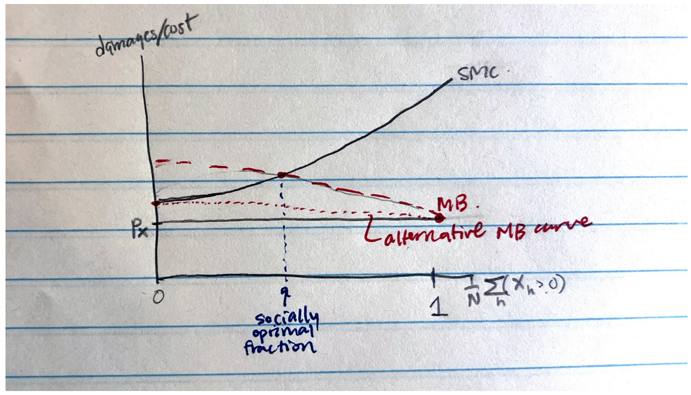

Figure 1: Illustration

I think visually, I'm imaging the standard graph depicting damages on the y-axis, the share of N households that pick x on the x-axis. The marginal benefits curve is downwards sloping while the social marginal damages curve is upwards sloping, with some private price that is constant for everyone p_x. Then without a subsidy or tax that reflects the SMC, households will nearly always stay so long as their marginal benefits exceed their private cost (rightmost dot in Figure).

Is there a world where everyone should go? It depends on these spillovers between neighbors and the true social MC – if the spillovers are weak and/or the society-wide externalities quite large, then you could imagine a world *from the planner's perspective* where they want everyone to leave (see the alternative red dotted line in the Figure).