Comments on
Dr. Kondo's Presentation

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What this paper is about

- This paper evaluates the impact of skilled workers' migration on local innovative activities

    - The degree of migration is measured by the *inflow* and *outflow* of college graduates into and out of each city (called, brain power *metabolism*)

    - The innovative activity is measured by the quality of patents that are invented by the city's residents

Empirical Model

- Regression Equation:

$$CITED_{it} = \quad \alpha_1 \log(IM_{rt}) + \alpha_2 \log(OM_{rt})$$
$$+\alpha_3 \log(IM_{rt}) \times \log(OM_{rt}) + \cdots$$

- where the quality of patent i in year t is measured by the number of forward citations made by examiners: $CITED_{it}$

- and the metabolism measures are given by the inflow (IM_{rt}) and outflow (OM_{rt}) into and out of city r where the inventors of patent i resided in year t
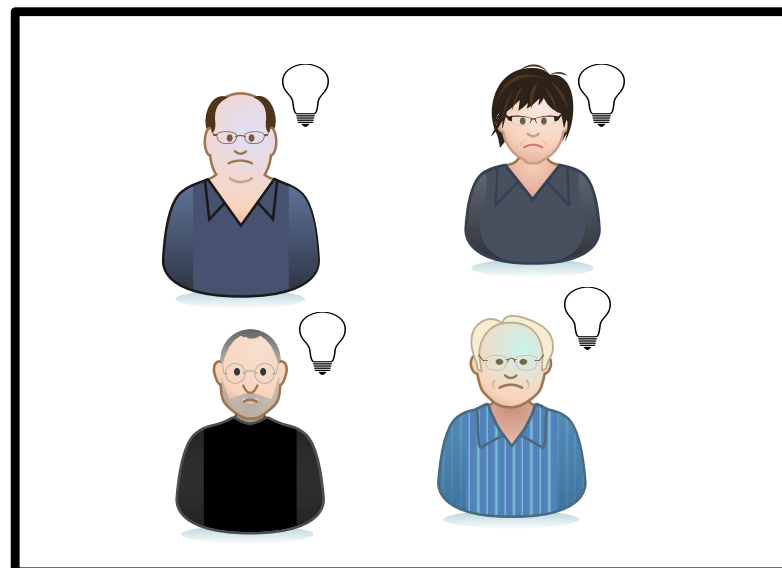
Findings

- The city-level *brain power metabolism* is shown to have significant impacts on the quality of the local innovation activities

  - The **Inflow** of brain power has significant positive effect on innovation, but the in and out flows turn out to be **complementary,** given that *the* cross terms are significantly positive, so the **inflow** effect tend to be larger for cities with larger **outflows**

Intuition

A city with HIGH brain power metabolism
(inflow and outflow are large)
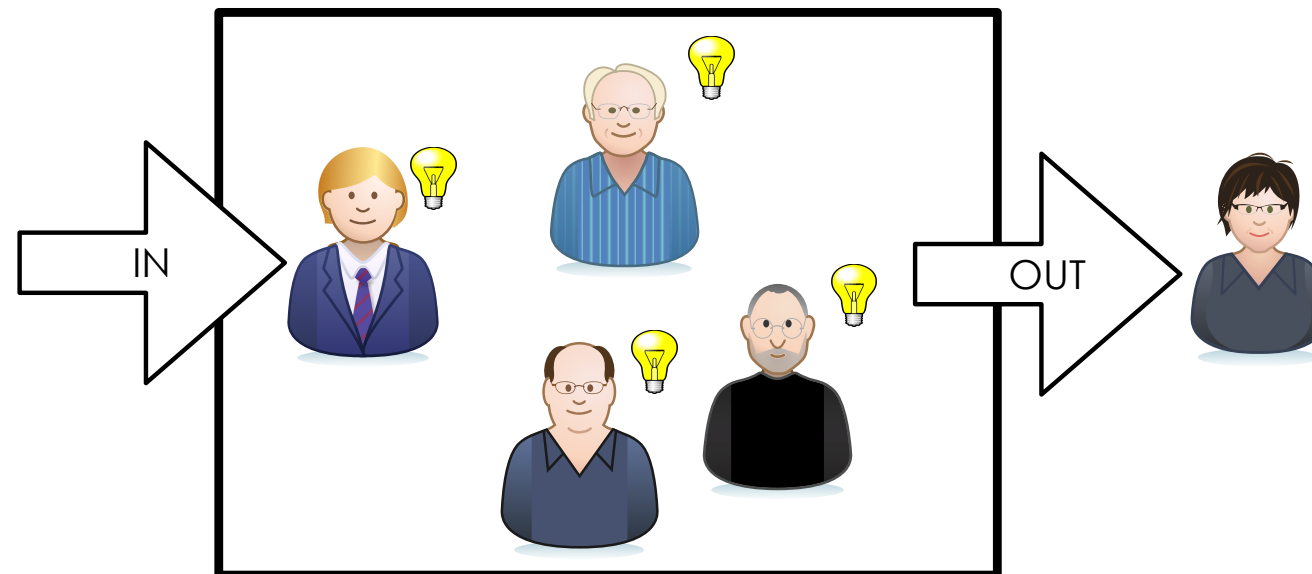
A city with LESS or NO brain power metabolism

Findings

- It is also found that the effects of the brain power *metabolism* are *heterogenous* across cities and periods — the effect tend to be larger for ``big'' cities with high pop densities, large college grad shares and more diversified industry sectors

General Comments

- The result — city's b*rain power* ***metabolism*** is closely related to local innovation — is interesting!

- The paper's focus on the regional human capital ***outflow*** is insightful, while the previous studies on the same topic have focused exclusively on ***inflows***

- By the authors' interpretation, it is suggested by the estimation results that city-level brain power ***freshness*** *and* ***diversity*** enhance the residents' innovation

General Comments

- However, I still wonder whether the link between city's metabolism and its local innovations can be interpreted as **causal**

  - The estimation results do not contradict the mechanism where the brain power freshness and diversity are impoertant.

  - But, it is just indirect evidence

- It needs more specific **identification strategy**

Comment 1

- The regression model might include **endogenous** variables even after fixed effects are included

$$CITED_{it} = \quad \alpha_1 \log(IM_{rt}) + \alpha_2 \log(OM_{rt})$$
$$\cdots + \beta \log(PD_{rt}) + \cdots + u_{it}$$

- City's *Population Density* can be correlated with unobserved factors that could also influence the quality of patents

- Suppose that innovative firms decided their production locations dynamically, and relocated into suburban areas with lower population densities

Comment 2

- It is shown that patents that were invented in cities with large inflow and outflow of college graduates tend to be more valuable than otherwise

- One mechanism is the "Brain Power Diversity"

Mechanism

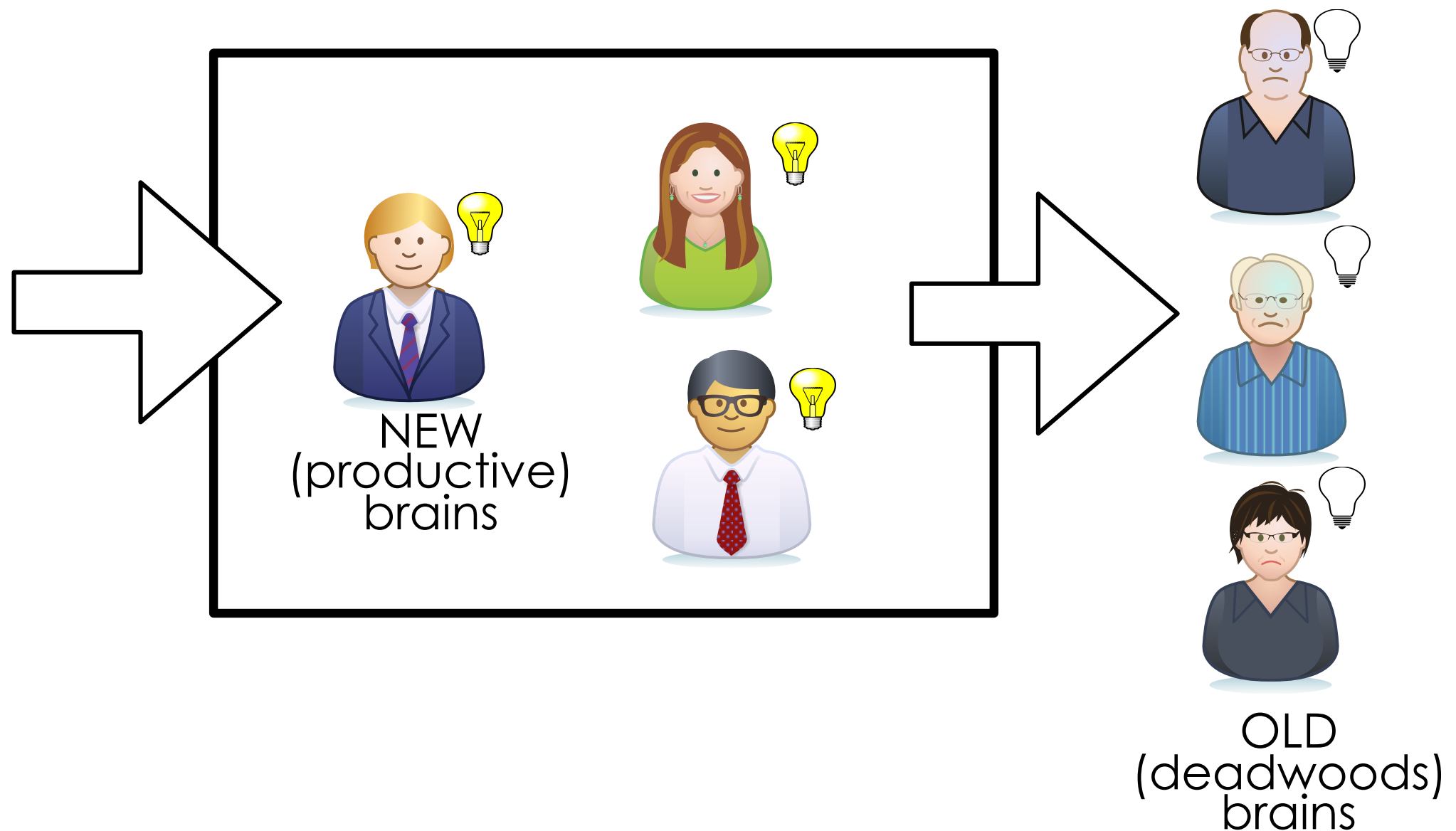In a city with HIGH brain power metabolism
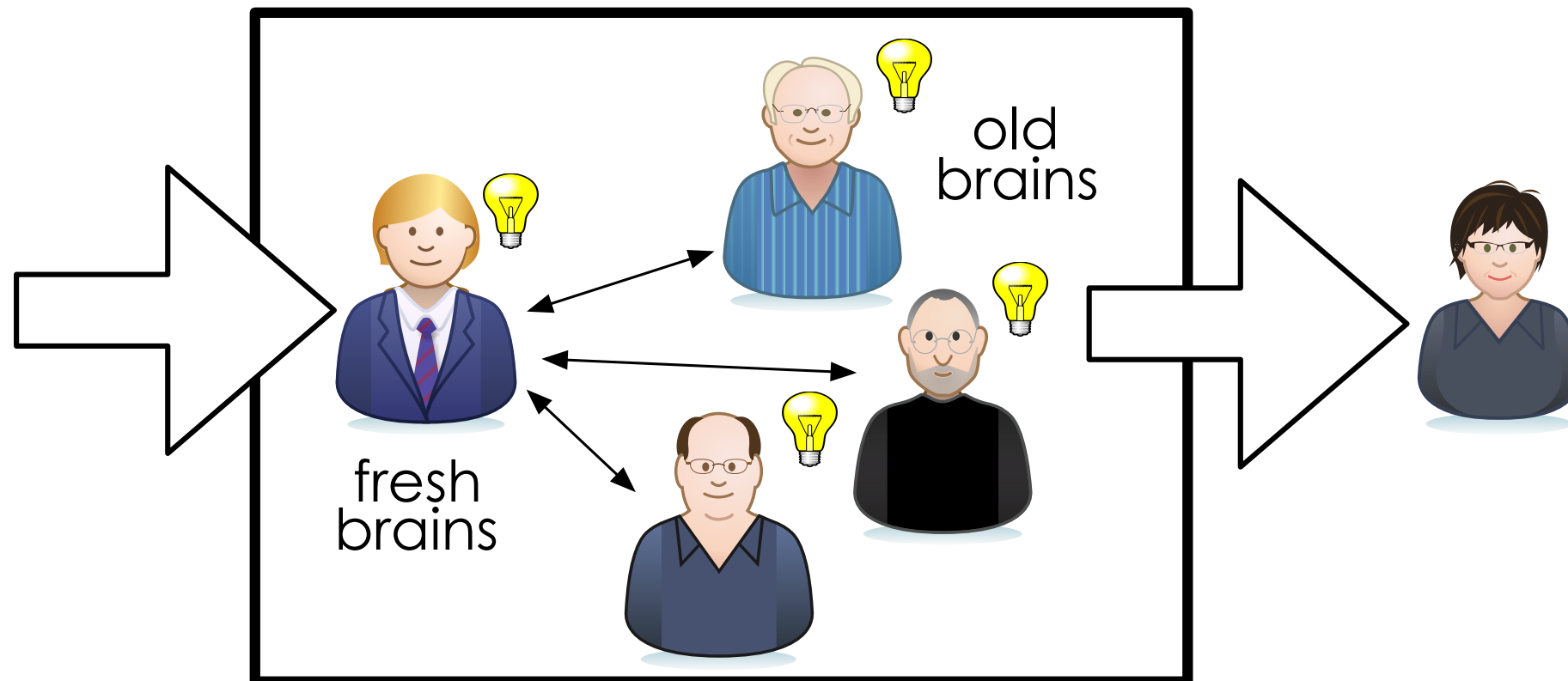
freshness and diversity
of brain powers play
important roles

Comment 2

- Other mechanism is also possible:

- Suppose that firms assigned productive inventors into their main production sites, and transferred the inventors who become less productive out of the sites

Comment 2

- If the alternative mechanism is correct, inventors' innovation level is high in the cities where production establishments are agglomerated. And at the same time, the turnover rates of inventors are likely to be high as well.

- Correlation between city's brain power metabolism and innovative activity can be explained by firms' strategic decisions about the optimal worker assignment

Comment 2

- To show one mechanism more convincing than the other, the authors need to open the *black box* of knowledge production process:

    - How is the functional form of the knowledge production function looked like?

    - Are there any collaborative interactions between inventors with different types of brain power?

- The author should try to explain the detailed role of "fresh brain" in the knowledge production process

Comment 3

- Econometric Issue:

- The model specification would yield biased estimates

- The dependent variable of the regression is forward citation counts, whose distribution is **nonnegative skewed**, with **many zeros**

- The OLS estimate will be biased, though consistent.

- Why not use a count data regression model such as poisson or negative binomial?

- Check whether conclusion is robust

Summary of Comments

- This paper focus on skilled workers' migration flows to explain regional innovation, which is insightfull

- yet, it calls for more specific and clear identification strategy to interpret the estimation results as causal

- Specifically, the future extension should address:

  1) endogeneity of some variables

  2) firms' self-selection problem into regions

  3) estimation of knowledge production function

  4) count data modelling