

Thoughts on How to Model Innovation and Endogenous Growth using REMI

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Presentation Outline

- Two publications that got me thinking:
 - Enrico Moretti's *The New Geography of Jobs*, 2013
 - George Treyz, SYMPOSIUM ON MULTIREGIONAL FORECASTING AND POLICY SIMULATION MODELS. *Journal of Regional Science*, May 1980
- Comparison of REMI and Moretti's methodologies
- Surprisingly, REMI and Moretti's estimates are not that different
- The age-old question: Whether innovation and growth is supply-created or demand-driven
- How do you model supply-created growth with the REMI model?
- Worries generated by another big name: Richard Florida, *The New Urban Crisis*, 2017

So, What is Moretti's Claim?

“My research, based on an analysis of 11 million workers in 320 metropolitan areas, shows that for each high-tech job in a metropolitan area, **five additional local jobs are created outside of high tech in the long run.**” page 60, *The New Geography of Jobs*

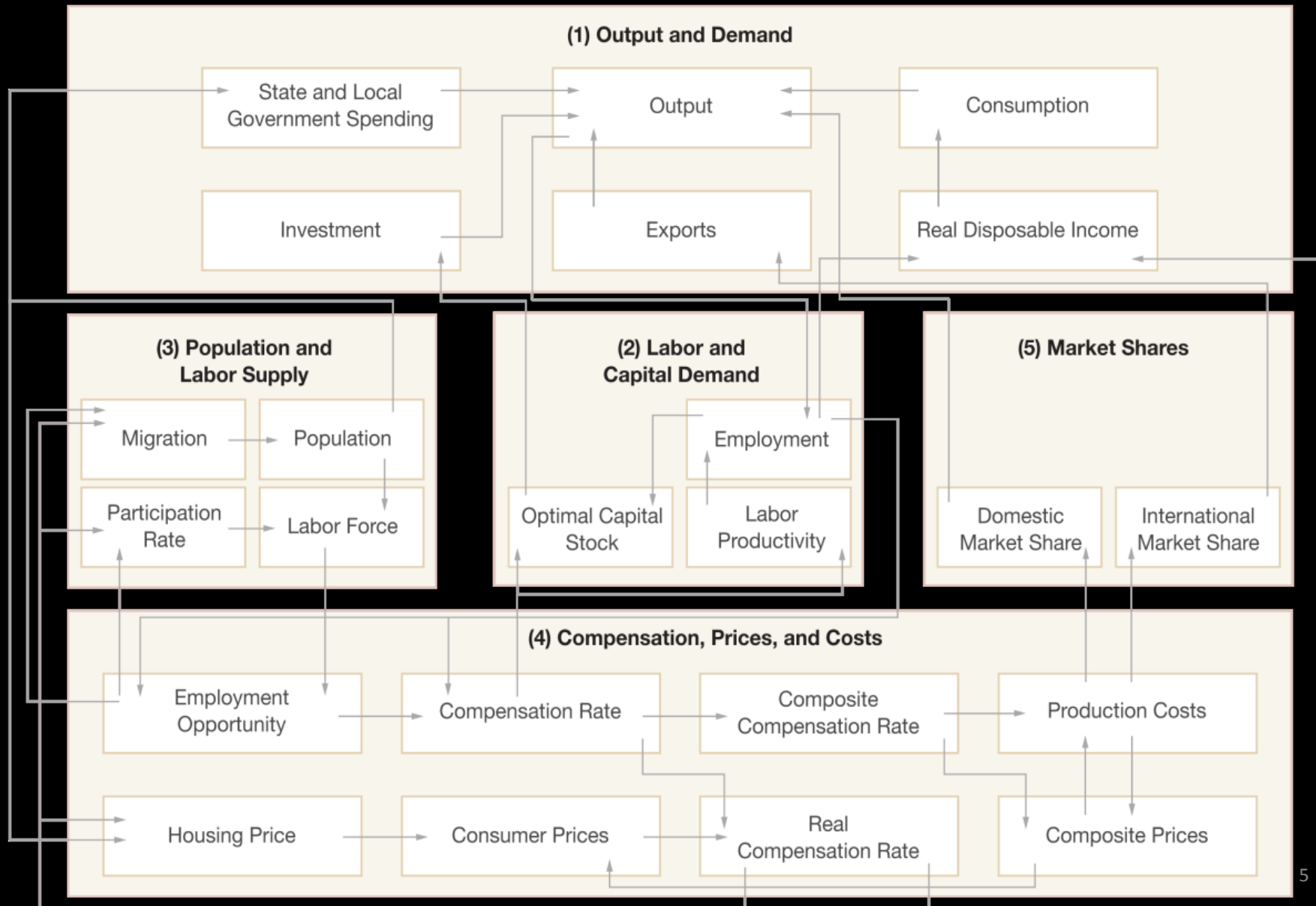
Moretti, “Local Multipliers.” *American Economic Review*, v100, no. 2 (May 2010); pp 373-77.

The Underlying Reason Why We Are REMI Model Users

“The key to the approach presented here is the extent to which theoretical structural restrictions are used instead of unrestricted individual econometric estimates based on single time-series observations for each region.”

“This design strategy is adopted in order to avoid the statistically unreliable coefficient estimates that inevitably occur when large numbers of equations estimated on the basis of individual short regional time series which include large errors in measurements.”

Treyz, G. I. (1980), SYMPOSIUM ON MULTIREGIONAL FORECASTING AND POLICY SIMULATION MODELS. *Journal of Regional Science*, 20: 191–206. doi:10.1111/j.1467-9787.1980.tb00639.



Moretti's Model

$$(1) \Delta N_{ct}^{NT} = \alpha + \beta \Delta N_{ct}^{T1} + \gamma dt + \varepsilon_{ct}$$

$$(2) \Delta N_{ct}^{T1} = \alpha' + \beta' \Delta N_{ct}^{T2} + \gamma' dt + \varepsilon'_{ct}$$

Where:

ΔN_{ct}^{NT} = change over time t of log employment in non-traded sectors in city c

ΔN_{ct}^{T1} = change over time t of log employment in traded sectors (mfg) in city c

The Results are Surprisingly Similar

Industry	Employment Multiplier
Wireless telecommunications carriers (except satellite)	10.0
Medicinal and botanical manufacturing	7.0
Software publishers	6.2
Wired telecommunications carriers	5.8
Satellite, telecommunications resellers, and all other telecommunications	4.2
In-vitro diagnostic substance manufacturing	4.1
Broadcast and wireless communications equipment	3.6
Other basic organic chemical manufacturing	3.5
Biological product (except diagnostic) manufacturing	3.5
Pharmaceutical preparation manufacturing	3.4

The Importance of Having High-Tech Workers, According to Moretti

High-tech workers create cool places; cool places don't create them.

- He does not support Florida's amenities argument.
- *There is no "there" there in San Jose.*

Bread and Butter Factors

- Professional, hi-tech workers make higher-than-average salaries.
- They have expensive consumer tastes. "Zen is expensive."
- But more importantly:

The Importance of Having High-Tech Workers, According to Moretti: Thick High-Tech Labor Markets Matter

“Despite all the hype about exploding connectivity and the death of distance, where we live and work is more important than ever.”

“The [Silicon] Valley keeps its position as the world’s number-one innovation hub not because those who are born there are smarter than anyone else, but because of its unparalleled power to attract great ideas and great talent from elsewhere.”

“If San Francisco Does Not Like Walmart, Why Does Walmart Like San Francisco?”

The Age-Old Question: Whether Innovation and Growth is Supply-Created or Demand-Driven

REMI was Clearly Built by an Economist

An increase in the number of high-tech workers in a region will

- Lower relative wages for these occupations
- Expand the region's market share of tradable goods and services by
 - Lowering production costs
 - Increasing productivity

Employment growth will be insignificant.

Labor Supply Input Variables for REMI

The Labor Access Index – Immediate or Lag Market Share Response (share) policy variable is for changing the access of employers to labor, and labor to industry employment. Markets are able to respond to a change in business conditions, such as the cost of doing business.

Labor Supply Input Variables

The Occupational Training - Changes in occupational specific labor supply by the number of persons entered. They work through occupational compensation rates. An increase in labor supply will reduce the compensation. The Occupational Training (number) policy variables should be used to change the supply of labor for specific occupations.

Result: Smaller than Expected Impact because there was no Direct Change in Demand

Increase Labor Access (a 5% Increase in Prof, Sci, and Tech Services)

	Year 1	Year 2	Year 3
Change in Real GDP	0.7%	0.9%	1.1%
Change in Total Employment	-0.2%	-0.5%	-0.6%
Wages and Salaries (\$ mill)	-1.0%	-1.5%	-1.7%
Prof, Sci, and Tech Services			
Output	2.0%	2.9%	3.8%
Productivity	12.0%	17.3%	20.7%
Employment	-8.9%	-12.3%	-14.0%

Result: Smaller than Expected because there was no Direct Change in Demand

Impact of a 5% Increase in Computer Occupations

	Year 1	Year 2	Year 3
Change in Real GDP	0.001%	0.002%	0.002%
Change in Total Employment	0.001%	0.001%	0.002%
Total Employment Change	20	32	46
Change in Productivity	0.000%	0.000%	0.001%
Wages and Salaries (\$ mill)	0.000%	0.000%	0.000%
Computer Occupations	0.001%	0.001%	0.002%

So What?

- Thick labor markets do matter. “If you can make it there (NYC) you can make it anywhere.”
- REMI models how business responds to changes in labor supply through its production cost function and changes in productivity and its resulting impact on the region’s market share.
- Unfortunately, the user has to “forecast” the likely increase in business activity due to thick labor markets and enter it into the model.

An Idea and Two Worries

An Idea

- REMI could develop an interface that would walk the user through the development of an innovation scenario.
 - Q: What occupation(s) are you expecting to attract to the region?
 - Q: What is the expected change in regional output (by sector) due to an increase in high-tech workers?

But isn't this what I wanted the model to do? Yes, but it can't. But, it can measure the full impact.

The Worries

- A supply side approach only works in large, unique MSAs. Expanding the number of people in key occupations will likely have an insignificant impact in most areas. (REMI is right).
- Growing income inequality due to the growth imbalance of MSAs. Closing with Richard Florida:

Florida *The New Urban Crisis*

- “[Superstar Cities] are not just the places where the most ambitious and talented people want to be—they are where such people need to be.”
- “...Clustering is necessary for economic growth, inequality is not.”

Let’s hope he is right.