Input-Output Modelling and Multiplier Effects

Intro to input/output modelling

The input-output model uses a matrix representation of a region’s economy to predict the effect of changes in one industry on other industries, consumers, government and foreign suppliers to the economy. The model considers inter-industry relationships in the regional economy, depicting how the output of one industry goes to another industry, where it serves as an input. This thereby, makes one industry dependent on another, both as a customer of output and a supplier of inputs.

In addition the model also takes into account additional inputs, such as workforce and other various capital requirements. Effects are calculated based on the availability of inputs, cost of input providers and output consumers. These calculated effects are called regional purchase coefficients (RPC) and represent the proportion of regional demand for inputs fulfilled from regional production. In other words, a region containing a large, diverse economy with many suppliers will typically have high industry RPCs. As a result, when production in an export-oriented industry increases, the demand for regional input supply will go up, creating additional economic benefits within the region as dollars filter through supply chains—a.k.a. the multiplier effect.

The multiplier effects calculate the added value to the regional economy from an initial injection of money and resulting “rounds” of spending of that money for goods and services (i.e. inputs) until the money dissipates through “leakage” to economies outside the region. Leakage in a regional economy is inevitable; however, a diversified and well integrated regional economy can have less leakage than a narrow, fragmented regional economy.

Another way to view input-output modelling is as a tub. At one end of the tub you have a faucet that would represent dollars flowing into the economy due to local companies exporting their products, or outside payments to local residents (i.e. social security, disability, etc.). At the other end of the tub you have a drain that represents money leaving the economy and being spent on imports. As a rule of thumb, the more an economy can increase export (e.g. turn up the faucet) or reduce the amount of imports (e.g. plug the drain) the faster the economy will grow (e.g. increase the level of water in the tub) due to multiplier effects.

Multiplier Effects

When evaluating the effectiveness of industry investment, or the impact of an industry, multiplier effects aide in gauging the level of ripple (or spillover) effects the industry’s operation has in a given economy. Impacts are generally broken into three component effects: direct, indirect and induced. Direct effects are created directly in the industry being measured or invested in. Indirect effects pertain to the upstream supply-chain effects resulting from the direct effect. In other words, if a business is expanding and hiring 100 new workers, that business will require more inputs from their suppliers, resulting in increased productivity needs for the supplying industries (i.e. the suppliers will have to expand or hire more workers). Induced effects pertain to the increases in wage and salary spending by both direct and indirectly affected industries. If the businesses must hire more workers, those businesses will have to increase their overall payroll budget. As workers collect wages, they spend on goods and services in the local economy such as supermarkets, restaurants, etc.
Typical multiplier effects are categorized into three groups: sales, jobs and earnings.

**Sales Multipliers**
Sales multipliers show how “deeply-rooted” an industry is in your region—for example, a highly-developed cluster will have a high sales multiplier because every dollar fed into the cluster from the outside has a high ripple effect, propagating through the regional economy for some time before it leaks out. One dollar of sales coming into a highly-developed Automotive Manufacturing cluster, for example, might have a ripple effect of 2.8 (i.e. that one dollar led to a total of $2.80 in regional sales). Industries and clusters with very low multipliers are usually owned outside of the region (so the profit is lost immediately) and also buy mostly from outside the region (a "shallow root system").

**Jobs Multipliers**
A jobs multiplier indicates how important an industry is in regional job creation. A jobs multiplier of 3, for example, would mean that for every job created by that industry, 2 other jobs would be created in other industries (for a total of 3 jobs).

Jobs multipliers are easily misinterpreted—jobs multipliers of 17 or higher are sometimes seen—but a high jobs multiplier for a set of one or more industries in an added-jobs scenario does not necessarily mean that attracting businesses in those industries to the region is the best or most viable option for regional economic growth. Other considerations such as social, economic and environmental feasibility must also be taken into account.

Jobs multipliers are primarily tied to the type of industries in the scenario—industries with a high sales-to-labor ratio typically have a high jobs multiplier, and vice versa. For example, a nuclear power plant might have only 20 workers, but “behind” each of those workers there are millions of dollars of equipment costs and millions of dollars of electricity being generated. Thus, if we bring 20 more nuclear power jobs into the region, that would involve a huge amount of investment flooding into the region (to build another nuclear power plant or double the size of the current one) and millions of dollars in new sales and profits.

Some of that money would go to the employees’ high salaries, while other money would go to local construction companies, real estate, janitorial services, etc. The overall jobs multiplier would be impressive—each new job in nuclear power might support 14 other jobs scattered throughout the rest of the economy (i.e. a jobs multiplier of 15). However, the effort required to attract 20 jobs in nuclear power (with the entire necessary infrastructure) is substantially more than to attract 20 jobs in an industry with a lower jobs multiplier.

**Earnings Multipliers**
An earnings multiplier of 1.5 means that for every dollar of earnings generated by a new scenario, a total of $1.50 (the original $1 direct effect, plus the additional $0.50 indirect and induced effects) is paid out in wages, salaries, and other compensation throughout your economy. This is important for understanding how a given scenario will affect quality of jobs within an area. A scenario whose ripple effect—indirect and induced effects—bring two dozen lawyers and accountants into your region would have a much higher earnings multiplier than a scenario brings two dozen food service workers.

Note: understanding the degree and types of multiplier effects is critical in understanding the scale and scope of any economic development activity. Specific considerations for each of the multiplier effects lead to additional economic, socioeconomic and tax base gains.