

Economic Fortune-Tellers

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Can mathematical models foretell the course of future economic events? The answer turns out to be yes: they can help us discover the complex interconnections between various economic elements

Although economic models are never a crystal ball that allows us to divine the future, they can be very useful in making economic prognoses. Such models are able to accurately predict the shorter- and longer-term impact of today's decisions and various phenomena (such as a financial crisis or an atomic bomb explosion), but as they are not "clairvoyant" they cannot predict specific events occurring at particular times. For example, it is possible to accurately predict the effects of today's financial crisis on the Polish economy looking 3-8 years ahead, yet it would have been difficult to pinpoint the precise onset of this crisis a few years in advance.

My own research involves Computable General Equilibrium models (CGEs), which reflect a country's entire economy rather than one selected sector. They make it possible to predict the impact of various policies in several economic sectors - from the agricultural sector through various branches of industry (heavy, processing, etc.) to service sectors (education, health service, civil service, etc.).

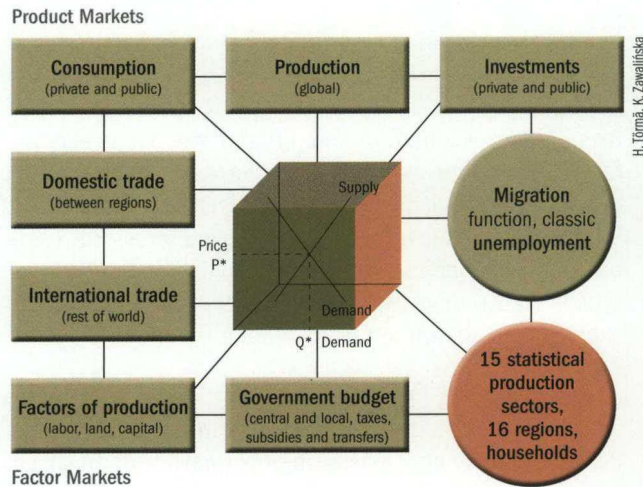
Economy under the microscope

But how is this possible? Mathematical equations are used to model the complexity of real relationships between all economic entities (companies, households, the government) in specific countries and regions, as well as between them. The models include hundreds of thousands of equations which replicate simplified behaviors of all economic actors. For example, the models frequently assume that companies are driven by profit growth, while consumers strive to maximize utility (satisfaction) and the markets seek balance through price adjustment (with supply and demand equating). Moreover the equations model such obvious

relationships as how a price increase on a given product may trigger lower sales given existing budgetary restrictions of the consumers (according to demand equations). Producers, in turn, are prone to supply the market with more product when its price is higher (reflected in supply equations), and so on. Therefore CGE models represent the economy in a simplified and experimental manner - they are a kind of approximation that reproduce complex economic connections occurring on a grand scale, such as the exchange of goods and services (described by equations of domestic and international trade), the behavior of employers and job seekers (described by job-market equations), as well as the behavior of people aiming for better quality of life (described by migration equations).

How do the Finns do it?

Despite their significant simplifications, economic models have the advantage of allowing us to observe and control real economic mechanisms on an experimental level when the actual reality is too complex to be fully understood and controlled. We can introduce phenomena such as floods, droughts, economic crises, and so on into the experimental model and study their impact on individual sectors and economic entities. It is also possible to predict the results of different variants of the same policies on economic growth, levels of employment,



Economic models based on hundreds of thousands of mathematical equations are designed to reflect real connections between all economic entities



Talvivaara Mining Company

Finland's regional model, RegFin, was used to predict the impact of the construction of a nickel mine in Talvivaara in Eastern Finland, with the conclusion that it would result in the creation of over 3000 jobs

migration, trade, inflation, and many other economic variables. For example, RegFin, a regional CGE model for Finland, has been used to assess the results of such varied policies and ventures as the construction of a motorway between Turku and Pori, the creation of a leisure and sports complex Simpsiö and NovaPark, an increase of Finland's bioenergy potential, decentralization of the production of renewable energy, the recession in the metallurgy sector, a reform of Finland's social security policies, a reform of the EU Common Agricultural Policy, tax reforms, as well as *ex-ante* evaluation of the rural development policies.

The RegFin model has also been used to predict the potential outcomes of the construction of a nickel mine in Talvivaara in Eastern Finland, with the conclusion that the project would contribute to the creation of over 3000 jobs not only in mining itself, but also in the construction, transport, and service sectors. The predictions suggested that the region would see significant economic development and that the mine would turn out high profits, especially as the price of nickel increased tenfold between 2001–2007. The analysis of the model resulted in a decision to press ahead with construction of the mine.

In another example of a successful model application, after analyzing potential outcomes of the possible closing of the School of Engineering and Business in Raahе, local government decided to keep it open, as the simulations indicated that shutting it down would spell major losses for the local population and business. Therefore predictions based on economic modeling do indeed have large potential to influence political and economic decision-making around the globe. ■

Further reading:

- Törmä H. (2008). Do Development Projects of Small Towns Matter, and Can CGE Help? *Spatial Economic Analysis*, 2, 247–268.
- Törmä H., Zawalinska K. (2007a). Talvivaaran nikkeli-kaivoshankkeen aluetaloudelliset vaikutukset [Regional Economic Effects of Talvivaara Nickel Mine: CGE simulation]. Helsinki University. Ruralia Institute. *Report 14*.
- Törmä H., Zawalinska K. (2007b). Raahen tekniikan ja talouden yksikön aluetaloudelliset vaikutukset [Regional Economic Effects of Raahе School of Engineering and Business: CGE simulation]. Helsinki University. Ruralia Institute. *Report 13*.
- Zawalińska K. (2009). *Instrumenty i efekty wsparcia Unii Europejskiej dla regionalnego rozwoju obszarów wiejskich w Polsce [Instruments and Impact of EU Assistance for the Regional Development of Rural Regions in Poland]*. Warsaw: Wydawnictwo IRWiR PAN.