The impact of migration and trade on regional resilience: a local sensitivity analysis

The two great hang-ups of further global economic development today are (im)migration and the unequal geographical distribution of the gains to trade across regions within countries. In this paper we apply a recently developed method of sensitivity analysis to scenarios generated on a spatial general equilibrium model of sub-national regional economies in which all EU regions are represented at NUTS2 level. The exercise is an attempt to get answers to the following questions:

- Is a migration stop more harmful to regional economic development in the medium term than a reversal of trade liberalisation?
- To what extent is economic cohesion undermined by trade?
- What use are spatial computable general equilibrium models in quantifying the impact of trade and migration policies?

We use the method of local sensitivity analysis with interactions between model runs, which has been developed by Borgonovo *et al* (2014). It is particularly well suited for combining information from multiple scenarios simulated with the help of complex computational codes since it is frugal on the number of model runs. Borgonovo *et al* consider their approach to be particularly useful for extended cost-benefit analyses with the help of CGE models and for understanding the source of changes in social welfare and its geographical distribution. We begin this paper by addressing some conceptual issues that are specific to the use of general equilibrium models in scenario analysis.

Assuming away national borders, geography in economic models is fully shaped by trade costs. They can be sector-specific, asymmetric and taking into account natural barriers and other impediments to trade, including those erected by people defending their interests. Migration –the movement of people from one constituency to another– has economic implications and, to complicate things, may be motivated in turn by geographical attractiveness. Among the push and pull factors are differences in income and employment prospects, the relative ease of integration in the recipient society and changes in climate.

The interplay of economic, demographic and social change and their effects on the geographical distribution of wealth is captured by economic models to the extent that relations are quantifiable and data are available. Scale is crucial here. The greater the granularity, the less power has the empirical law of large numbers and the more serious the lack of data. But the higher the level of aggregation, the lower is the degree of verifiable information on the behaviour of geographical units and social groups. Implicit in our use of regional models for analysing the costs and benefits of trade and migration is that the scale of countries and nations is too coarse for dealing with the impact of shifts in preferences and attitudes, and definitely when they concern the breaking apart of world markets, customs unions and monetary blocks.

Computable General Equilibrium (CGE) models start from a set-up à la Arrow-Debreu where supply and demand depend on prices, partitioned according to sectors, markets, places of origin, etc. Computationally and conceptually the system of prices is assumed to evolve to a new equilibrium after a shock to exogenous variables or a change in the aggregate behaviour of economic agents, usually pictured as the representative household or firm. With this begins a string of assumptions, and a process of both simplification and complication, to arrive at a CGE model that is solvable in hours of computer time and robust to variations in parameters within the range of theoretically and

empirically verified estimates. To name a few assumptions that are highly relevant to the analysis of migration and trade: households are not distinguished by family composition; household consumption is geared by constant elasticities of substitution (CES) distinguishing between products from different places but not between producers; producers in some sectors have a degree of monopolistic power within their region, others are operating under perfect competition. The great advantage of CGE models is that they force consistency of price setting across markets, including on factors of production. The disadvantage is that much differentiation of economic agents is lost.

The spatial setting of new economic geography adds a few more unrealistic assumptions to most CGE models. Dixit-Stiglitz imposes a love of variety on consumers that is only tempered by goods losing their value with the distance of transport (the iceberg assumption). Downhill is the same as uphill and travel by sea not differentiated from travel by land, let alone air. This is only partly because data are hard to get; using trade and distance decay functions and gravity equations also allows for more robust single parameter estimates, at the expense of differentiation by country and region (Bosker and Garretsen, 2010). For bilateral trade between regions within the EU we can follow the more sophisticated estimation, detailed in Thissen *et al* (2015). It makes use of estimated inter-regional supply and use tables that are available and made fully consistent with the national WIOD tables. Trade flows with missing regions are estimated by gravity equations. We also have 267 x 267 asymmetric trade cost data for different product groups taken from the European Commission's TRANSTOOLS project. However, although all this greatly enhances the geography captured, it also greatly reduces the possibility of estimating trade elasticities. This is one reason for relying heavily on sensitivity analysis, using the variation in empirical estimates from various outside sources as the bounds for variation of parameter estimates across the 267 regions.

A more fundamental issue is that CGE models are calibrated on a state of equilibrium that never is, and any recursive dynamics are geared on paths that are generated exogenously to the model. Even apart from computation time limits, the notion of introducing model consistent expectations in a CGE model, requiring it to be solved forwards and backwards, is difficult to square with dynamic adjustment to an equilibrium path. For this reason, the path is usually generated with the help of a more aggregate dynamic general equilibrium model such as the Commission's QUEST, which is then superimposed on the spatial CGE. This does not take away that a wage or Phillips curve type of mechanism provides a feedback from calibrated unemployment in each region from one year to the next in the simulation. Regional differences in wages and unemployment levels are the main push and pull factors in the bilateral migration equations. Again, region-specific sensitivity analysis using the variation in the parameter estimates of the wage equation is called for.

The paper applies local sensitivity analysis only to the parameters in the migration and wage equation and only to the extent that baseline migration is reversed to zero. An off-model adding up constraint is imposed on bilateral migration in the EU. The migration equations in the model generate net migration flows for all regions and, given the distributed lag adjustment to unemployment in the wage curve, corner solutions are not encountered. Nevertheless, the head counts in some regions can significantly change in the simulations, to the extent that GDP per capita is no longer a suitable indicator of the level economic development, if it ever was. The sensitivity analysis focuses instead on GDP, employment and the number of firms in the region.

In the same vein, the parameters most directly affecting bilateral trade are varied within bounds. This concerns all substitution elasticities in the trade and consumption equations, but not the cost of transport. The latter are varied exogenously and uniformly to generate an economic integration scenario from which one or more regions are cut off in various combinations. A downward shift in substitution elasticities can be interpreted as a change in preferences towards home products. The method of local sensitivity analysis then allows computing indices of sensitivity for all regions.

In a precursor to the present exercise, Di Comite *et al* (2016) presented the results of simulations keeping vertical linkages fixed at the baseline, and the same for labour and capital movements. They found that labour and capital mobility tend to magnify agglomeration effects both in terms of GDP and number of firms. Removing vertical linkages tends to lower agglomeration in terms of GDP and increase the number of firms in the poorer regions, but the latter result is not very robust to the type of changes in the accessibility of the regions.

References

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