REGIONAL MODELLING

REGIONAL MODELLING

- Intense interest in regional results
- Policies which are good for nation but bad for one region may not be politically feasible
- The ideal: we tell what will happen to employment and house prices in each electorate

The Sledgehammer Approach: Model

Simply add a regional subscript (or two) to each variable and data.

2 sources

1 reg	ORANI-G	V1BAS(c,s,i)	size 37 x 2 x 35
8 reg	MMRF	V1BAS(c,s,i,r)	size 37 x 9 x 35 x 8

9 sources

8 locations

known as: Bottoms-up approach

Database has grown by factor of [9/2]*8 = 36

Number of variables also 36 times bigger

Solve time and memory needs move with SQUARE of model size.

So model needs 1000 times as much memory and takes 1000 times longer to solve.

The Sledgehammer Approach: Data

$$\text{Data Productivity} = \frac{\text{(no of numbers in model data)}}{\text{(no of numbers supplied by ABS)}}$$

1 reg ORANI-G Data Productivity = 5

8 reg MMRF Data Productivity = 5*36 = 180

Beyond ordinary imaginative power !

Poor quality: regional input-output tables

Crippling lack: inter-regional trade matrix

Can only get: a few regional vectors (industry employment, some final demands by commodity)

The Sledgehammer Approach: Results

Voluminous: many matrices, often 3 dimensional

Hard to analyse and report

The Sledgehammer Approach: Summary

Desirable --- but very costly.

A simpler approach

Modest data requirements: no trade matrix

Same technology each region. reasonable !

Same prices each region.

National factor markets

Add one regional subscript to quantity variables

National supply side, regional demand side.

We can simulate:

regional effects of national shocks

effect of car tariff cut on Victoria

regional effects of regional demand shocks

effect of Olympic Games on Sydney

but not

effects of region-specific supply side shocks

Queensland abolishes payroll tax

A simpler approach: Cost Benefit Analysis

Compared to MMRF/Sledgehammer:

70% of the benefit

10% of the cost

The simple approach: intuition

Value-added by region and sector

Growth rates from national model

	North	Central	South	Total	%
Rice	30	40	3	73	2.50
Gold	10	60	0	70	9.00
Other	60	100	27	187	3.00
Total	100	200	30	330	

Which region does best?

Central, because it specializes most in producing gold (the fastest-growing industry).

Assumption: gold sector grows at same rate in each region.

The simple approach: arithmetic

Specialization: Sector shares in regional value-added

	North	Central	South	%
Rice	30	20	10	2.50
Gold	10	30	0	9.00
Other	60	50	90	3.00
Total	100	100	100	
%	3.45	4.70	2.95	4.16
Advantage	-0.71	0.54	-1.21	

Regional Advantage = Regional GDP %change minus national GDP %change

Regional GDP %change

National GDP %change

gdp = x1prim_i = GDP at factor cost

The simple approach: consistent with national model results

We assumed:

each sector grows at national rate in every region.

Therefore, if we added changes in regional outputs for each sector, the sum would be equal to national change in output for that sector.

So regional results are consistent with national results.

The simple approach: doubt sets in

Output, employment and income grew faster in Central.

But we assumed:
each sector grows at national rate in every region.

Surely demand for haircuts grows faster in Central (because income grew more).

Therefore, output of haircut industry grows faster in Central than elsewhere (because haircuts must be consumed where they are produced).

We need local multiplier effects.

Revision of the simple approach

Two sorts of industry:

LOCAL industries: demand must be mainly satisfied locally (ie, local production must follow local demand).

NATIONAL industries: grow everywhere at national rate (local production follows national demand).

Regional household consumption follows regional wage income.

Revised simple approach: benefits

Introduces strong regional multiplier effect:

Gold output up

More wage income in Central

more consumption in Central

more demand for LOCAL commodities

LOCAL industries in Central grow more than national average

Wage income in Central up even more

Even more consumption.....and so on

Strong regional multiplier because:

a few local service industries account for a large share of the economy.

Local Industries in OZDAT934.HAR

DrinksSmokes

Construction

Repairs

CommunicSrvc

OwnerDwellng

Education

CultuRecreat

ElecGasWater

Trade

Hotel_Cafe

FinanceInsur

PropBusSrvc

HealthCommun

OtherService

Many small regions would mean fewer local commodities

Revised simple approach = ORES = LMPST

ORES: ORANI regional equation system

LMPST : Leontief, Morgan, Polenske, Simpson, Tower (1965)

also called: Tops-down regional extension

as opposed to: Bottoms-up regional model (MMRF)

See Green Book, Chapter 6 (tough)

REGIONAL MODELLING

- Tops down method with minimal data requirements
- Necessary data
  - base year data for each industry showing regional shares in value added (or output)
  - base year data for local commodities only, showing regional shares in investment demand, in consumption demand, in government demand and in international (export) demand

REGIONAL MODELLING

- Do not need regional data for input-output coefficients
  - it is assumed that the economy-wide input/output coefficients relating to commodity supply and industry costs apply at the regional level
- Do not need data on inter-region trade
  - for local commodities, trade is assumed to be zero
  - for national commodities, inter-state trade is irrelevant to working out the allocation of output across regions.
- Results obtained for percentage changes in aggregate and industry output and employment by region

REGIONAL MODELLING: METHODOLOGY

- **Step 1: Allocate industries into one of two groups**
  - ***National*** **industries produce commodities that are extensively traded across regions**
    - **e.g., most agricultural, mining and big manufacturing industries**
  - ***Local*** **industries produce commodities that are essentially not traded across regions**
    - **e.g., some service industries and most industries producing perishable items such as bread and fresh milk for consumption**
- **In Australian model, 27/112 industries are local, but that 27 represent over 60 per cent of value added in most regions.**

REGIONAL MODELLING: METHODOLOGY

- **National industries**
  - output in region r assumed to be independent of region r's demand
  - default assumption is that percentage change in output for national industry j in region r (x(j,r)) is the same as the national-level percentage change (x(j)), i.e.,

$$x(j,r) = x(j), \quad \text{for all } r$$

  - always must conform to the constraint that

$$\sum S(j,r)\, x(j,r) = x(j)$$

where the sum is across regions and S(j,r) is the share of region r in national output of industry j

Exogenous

REGIONAL MODELLING: METHODOLOGY

- **Local industries**
  - **output of local commodity i in region r must meet demand for commodity i in region r**
  - **demand for local commodity i in region r includes**
    - **intermediate and investment demand for in r by local industries and national industries located in r**
    - **regional household demand for i**
    - **government demand for i in r**
    - **and if i is a margin commodity, the usage of i in facilitating commodity flows in region r**

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REGIONAL MODELLING: METHODOLOGY

- For local commodities, household consumption in region r is related to income generated in r
  - this gives rise to regional multiplier effects
  - if a region has an over-representation of national industries that have large percentage increases in output, then the effect on aggregate real value added in that region is multiplied through a relatively large increase in regional income and hence a relatively large increase in household consumption of local commodities.

REGIONAL MODELLING: OUTPUTS

- Regional output and employment by industry
- Aggregate regional output and employment
- Regional advantage matrix
  - decomposes the difference between percentage change in region r's real value added (x(r)) and the percentage change in national real GDP (x) into contributions made by each industry

REGIONAL MODELLING: OUTPUTS

- **Regional advantage formula**

```
x(r)- x = SUM_OVER_IND {  [S(j,r)-S(j)] * [x(j)-x]
                +   S(j,r) * [x(j,r)-x(j)]  }
```

where **S(j) is the share of industry j in national value added**

x(j) is the percentage change in national output of j

note: We can cancel out the `S(j,r)*x(j)` **terms**

REGIONAL MODELLING: OUTPUTS

- Regional advantage formulae tells us which industries are making a positive contribution to the differential, x(r) - x.
- Industry j makes a positive contribution (is a strength) of region r if:
  - its output increases by more than real GDP (x(j) > x) and its share in region r is larger than its share in the national economy (S(j,r) > S(j)) or
  - its output increases by less than real GDP (x(j) < x) and its share in region r is less than its share in the national economy (S(j,r) < S(j)) or
  - its output in region r increases by more than its national output (x(j,r) > x(j))

Recipe for Regional Success

Winning regions:

Have more than their share of faster growing industries

AND/OR

Have less than their share of slower growing or contracting industries

Loser regions:

Specialize in slower growing or contracting industries

AND/OR

Have less than their share of faster growing industries

More doubts

If we allow growth rates of local industries to differ between regions, how we be sure that those regional outputs are consistent with the national model?

Answers:

(a) We can check that they do add up properly.

(b) Green Book, Chapter 6 proves that they MUST add up properly (but yields little insight).

Key assumptions in DPSV proof

Same industry technology in all regions, means:
National demands for inputs are unaffected whether (growth in) production takes place in NSW or Tasmania.

LES: Same marginal budget shares in all regions means:
National household demands are unaffected whether income is spent in NSW or Tasmania.

Region shares in other final demands are exogenous.

Initially, each region is self-sufficient (or nearly so) in each local commodity.

Still more doubts

Industry technology is NOT the same in all regions. For example, in Victoria, electricity industry uses brown coal, but in South Australia they burn oil or gas.

Partial Solution: in National model, split electricity industry into 8 parts, corresponding to each region, with different input requirements. Victorian electricity industry will use coal, SA industry will use oil/gas.

Regional shares of the 8 industries will locate:

100% of the "Vic" electricity industry in Victoria

100% of the "SA" electricity industry in South Australia, etc

If we did this for EVERY sector we would be back to MMRF.

The End