



PBL Netherlands Environmental  
Assessment Agency

# The Resilience of Dutch Regions to Economic Shocks

Measuring the relevance  
of interactions among  
firms and workers

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## Introduction and theoretical background

- Following the recent economic recession, the idea of **regional resilience** received increased attention in Economic Geography and Regional Science. (Martin 2012, Fingleton et al. 2012).
- Some paper discuss some possible **determinants of resilience** (McCann McCann and Ortega-Argilés 2011, Glaeser et al 2011), but the overall attention has been limited.



## Introduction and theoretical background

- In our analysis, by assuming an **evolutionary perspective**, we attempt to study what causes regional resilience
  - › **3 important determinants** of regional resilience are conceptualized and integrated them into one coherent framework
  - › use this framework to build an **indicator of resilience of Dutch regions**



## A model of adaptive resilience

- A shock is made of two parts. The initial **downturn** and the process of **recovery** (Fingleton et al. 2012).
- Similarly, we construct a **two-stage model**
  - › the first stage is the shock : which regions are more resistant to a fall in demand?
  - › The second stage is the recovery: which regions adapt better to the new situation?



## A model of adaptive resilience – The shock

- We argue that resilience to shocks depends on how it **propagates** through the **input-output structure** (McCann and Ortega-Argilés, 2011).
  - › **embeddedness**
  
- The propagation through the supply-chain is studied with the **Leontief input-output model** (Miller and Blair, 2009).
  - › An exogenous shock in demand is simulated.
  - › The input-output framework then shows how the shock is propagated (Leontief inverse matrix:  $(I-A)^{-1}$ ).



## A model of adaptive resilience – The recovery

- After the initial downturn, we argue that the **second stage (recovery)** follows an adaptive and evolutionary process
- We link the ability of regions to recover from shocks to the ability of laid-workers to find a new job and being reabsorbed in the labor market.
- Regions differ in capacity of **recovering** according to
  - › intersectoral labor mobility (**relatedness**)
  - › interregional labor mobility (**connectivity**)



## A model of adaptive resilience – The recovery

### – Intersectoral labor mobility

- › Laid-off workers may find jobs in their sector of origin or in different ones
- › But intersectoral labor mobility is imperfect. Some sectors use the same labor skills, some other are unrelated. (Frenken et al 2007, Neffke and Henning, forthcoming)
- › The skill-relatedness of regional industrial portfolio, makes some regions better suited to adapt to economic shocks.



## A model of adaptive resilience – The recovery

### – Interregional labor mobility

- › When work opportunities in a region are limited, the newly unemployed can look for jobs in neighboring regions
- › This implies a cost for the commuting, but it is better than the more expensive alternatives of unemployment or (up to a certain distance) residential relocation.
- › Central and connected regions adapt better to shocks for the wider range of options its citizens are given.





## A model of adaptive resilience – The recovery

- To coherently integrate these elements into one framework of recovery, we borrow the concept of **matching function** from labor economics
- A matching function is a function that inputs a) number of people searching for jobs **U** b) number of jobs available **X**, and outputs number of successful contracts signed, per unit of time **m**. (Mortensen and Pissarides, 1998).

$$m = f(U, X)$$



## A model of adaptive resilience – The recovery

- We want to give the model a **regional and sectoral dimensions**: we can imagine that the likelihood that 2 sector-regions form a contract depends on their **relatedness (r)** and **connectivity (c)**.

$$m_{ro,rd}^{so,sd} = f(U_{ro}^{so}, X_{rd}^{sd}, c_{ro,rd}, r_{so,sd})$$



## A m o d e l o f a d a p t i v e r e s i l i e n c e – The recovery

- We, then, obtain an indicator of **regional resilience** dividing by unemployment.

$$resilience_{ro} = \frac{\sum_{rd,so,sd} m_{ro,rd}^{so,sd}}{\sum_{so} U_{ro}^{so}}$$

- The indicator measures the **number of contracts** signed by residents in region  $ro$ , per unit of time, per unemployed person: **speed of recovery**



## Empirical analysis

The model is used for empirical analysis of resilience of regions in the Netherlands.

- **Working paper**

- › We divide the Netherlands into 12 provinces (NUTS2)
- › We distinguish among 59 goods and services (Nace 1.1 - 2 digits)

- **PBL publication**

- › 443 gemeenten
- › 437 goods and services (Nace 1.1 - 4 digits)



## Measurement and data – working paper

- The 3 elements we identified as cause of regional resilience can be linked to smart specialization (McCann and Ortega-Argilés, 2011): **embeddedness**, **relatedness** and **connectivity**.



## Measurement and data – working paper

### Embeddedness

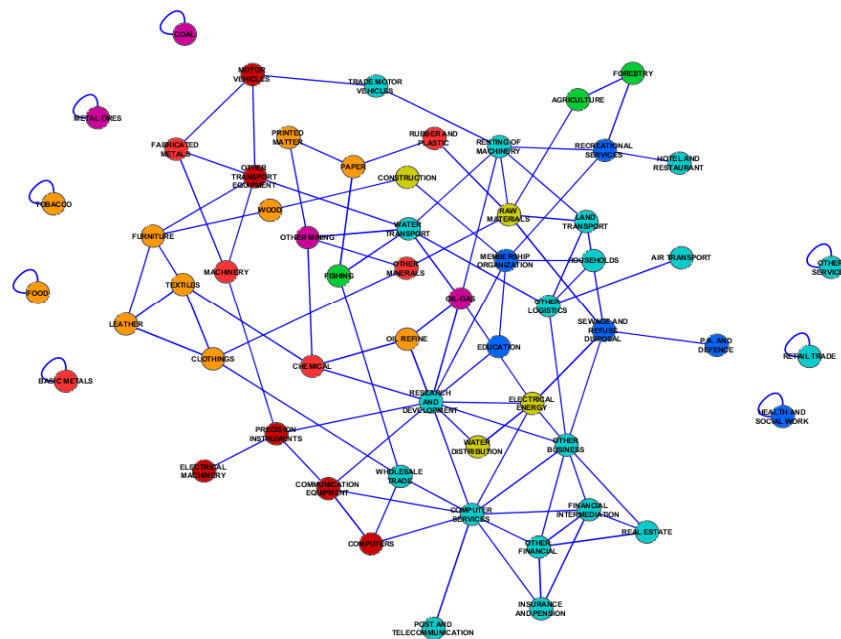
We use regional/sectoral input-output tables constructed by PBL. PBL methodology involves crossing several available data sources to **infer the most likely regional input-output structure.**

# Measurement and data – working paper

## Relatedness

We use labor flows among Dutch industries is taken from 2001 until 2004 (CBS, Statistics Netherlands)

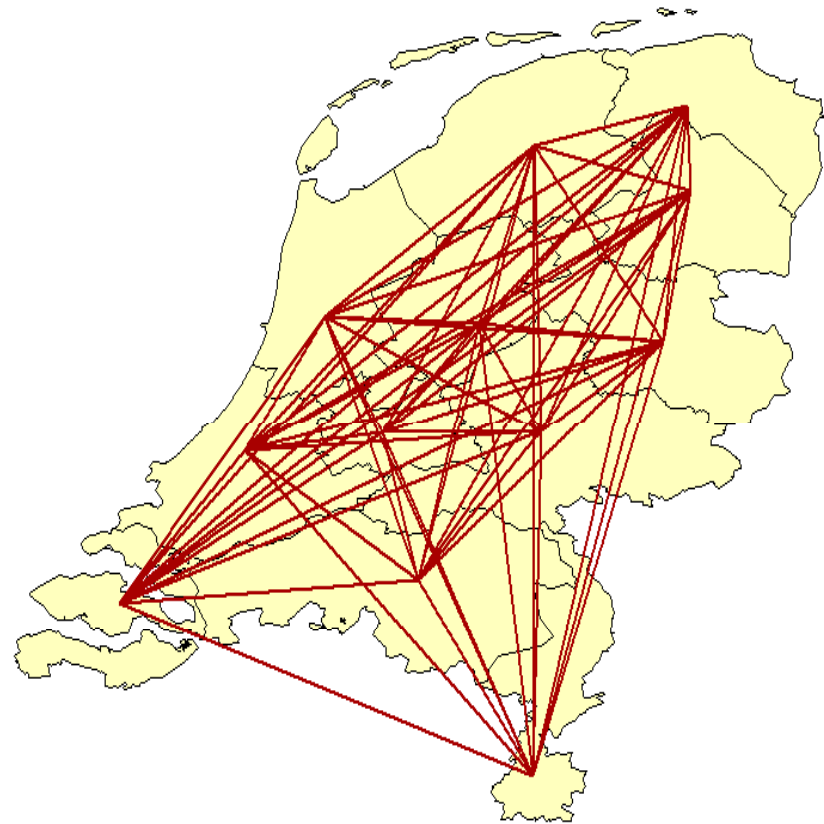
Methodology: Neffke and Henning (forthcoming)



## Measurement and data – working paper

### Connectivity

We estimate the expected labor flows using commuting data (CBS, Statistics Netherlands) and travel costs

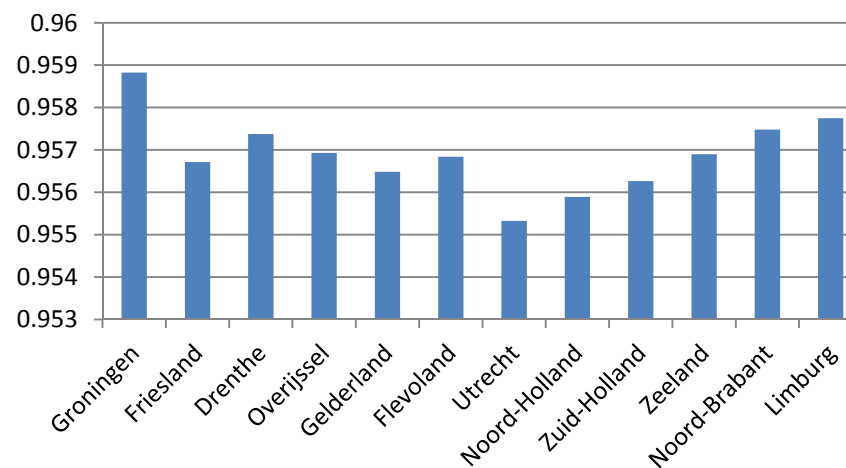






## Results for Dutch regions – the shock

- **First stage:** We simulate a shock of demand for Dutch products by 5% (while global demand unaffected)

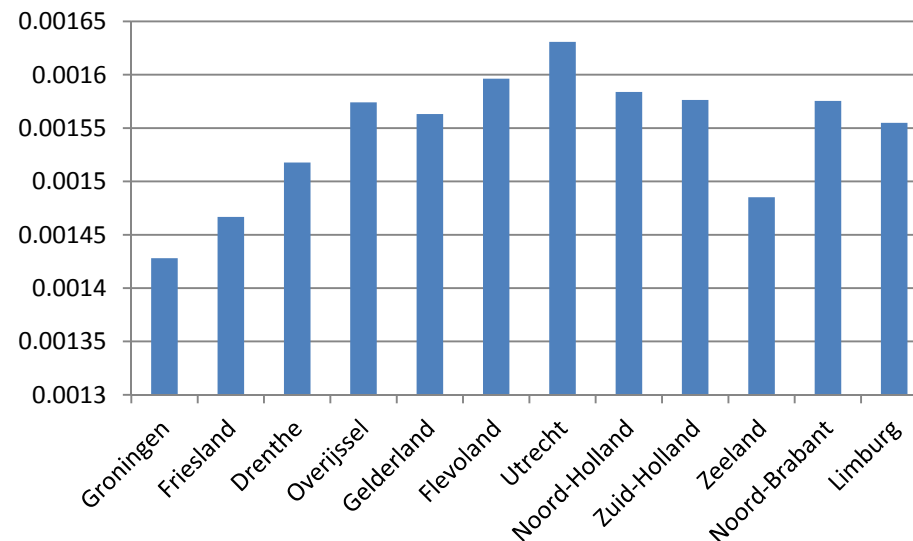


- Embedded regions hit harder



## Results for Dutch regions – the recovery

- **Second stage (a):** we simulate the adaptation process only for relatedness

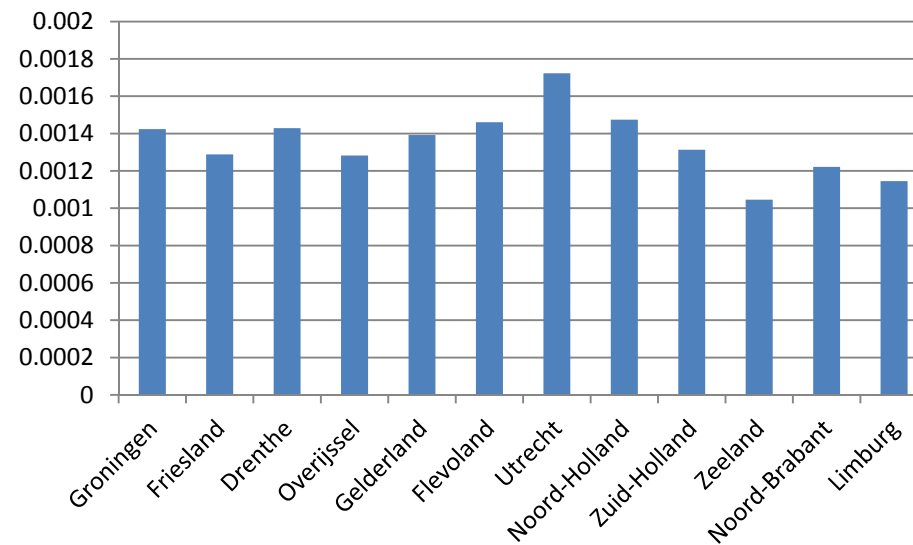


- Regions specialized in related activities recover faster



## Results for Dutch regions – the recovery

- **Second stage (b):** we simulate the adaptation process only for connectivity

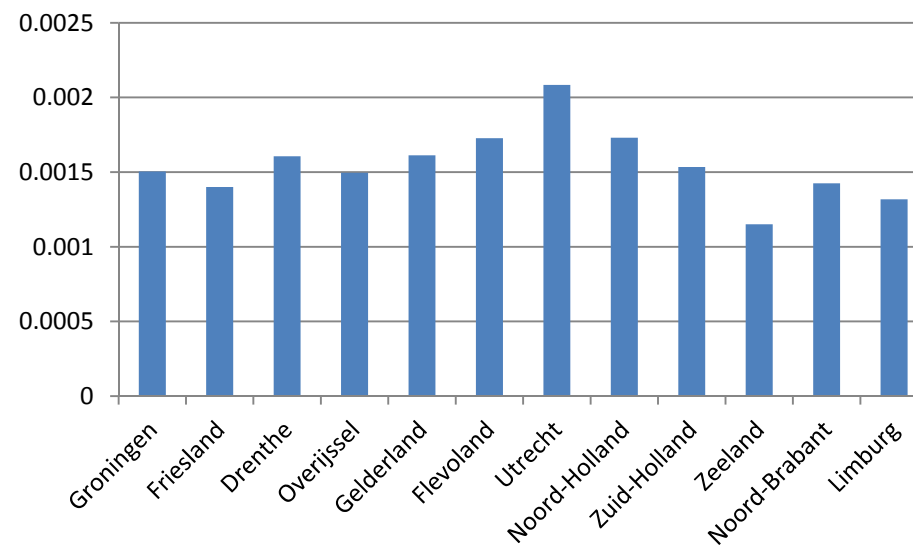


- Central regions recover faster



## Results for Dutch regions – the recovery

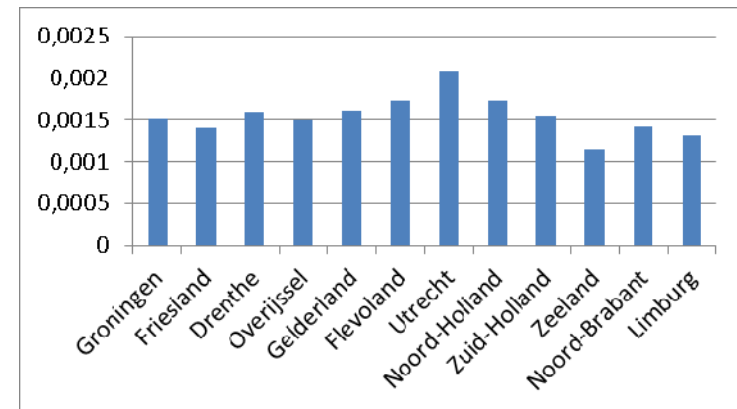
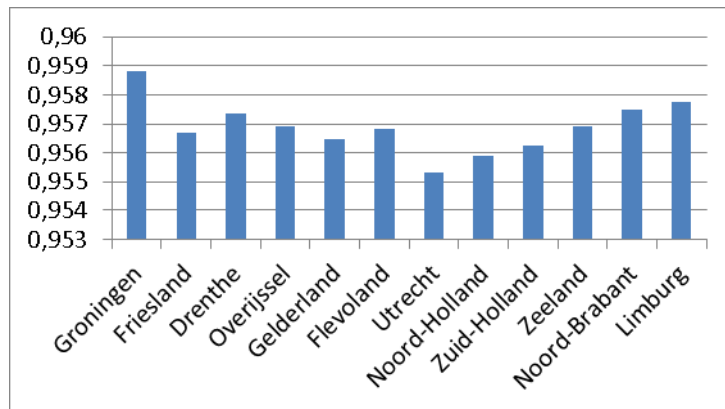
- **final resilience**: we simulate the adaptation process for both **connectivity** and **relatedness**



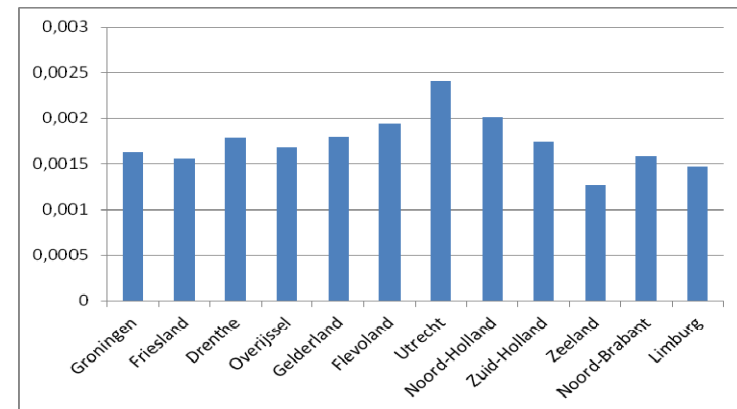
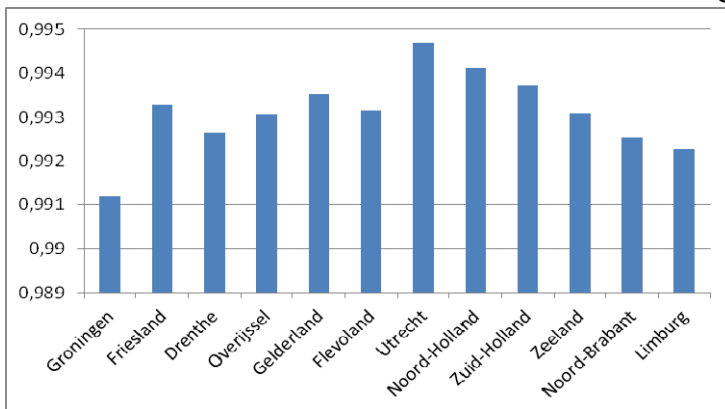


## Sensitivity to shocks (I)

5% internal demand shock



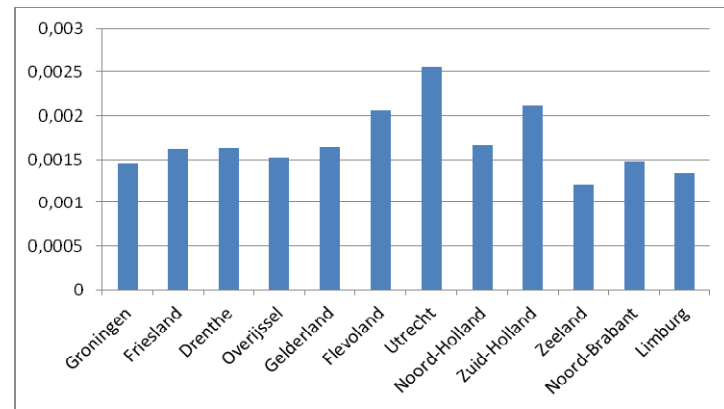
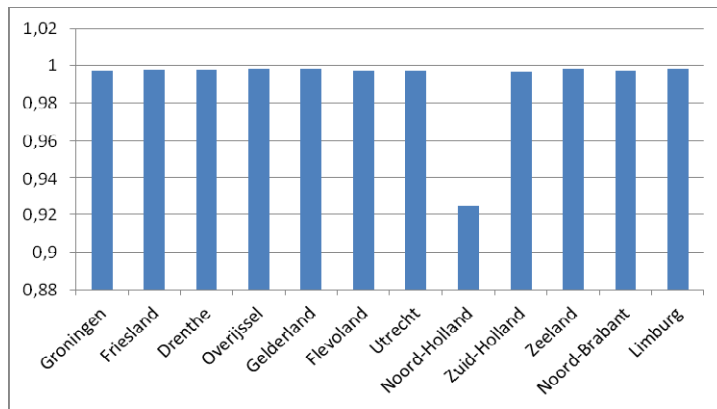
5% foreign demand shock



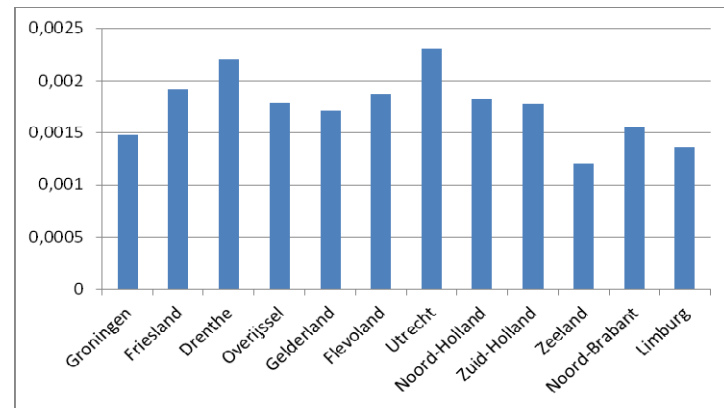
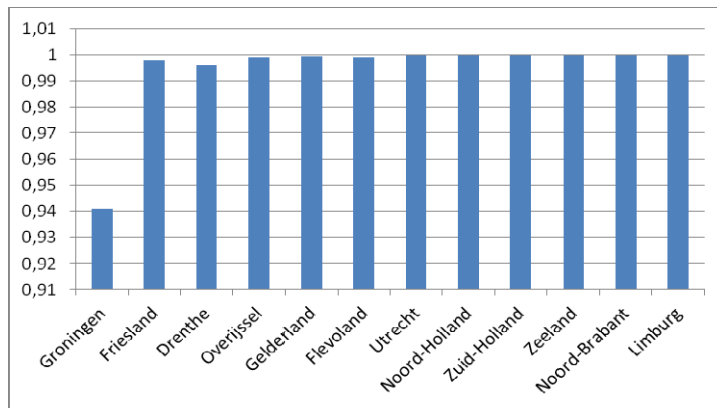


## Sensitivity to shocks (II)

10% Noord-Holland shock



10% Groningen shock





## Conclusions of the working paper

- In this analysis, we attempted to **conceptualize** and model the **determinants** for regional resilience.
- The adaptive process, as we thought of it, is **relatively stable** and central regions, or regions specialized in skilled-related activities, are more resilient than other regions.
- However, a consistent localized **shock may compromise the adaptation capacity** of a region.
- This can **change the course of growth** of a region, in favor of other ones.



## Extensions of PBL publication (work in progress)

We explore resilience at a finer **scale of analysis**.

### – GEOGRAPHICAL SCALE

- › 443 gemeenten
- › Inclusion of bordering regions
  - \_ 27 Belgian NUTS3
  - \_ 52 German NUTS3





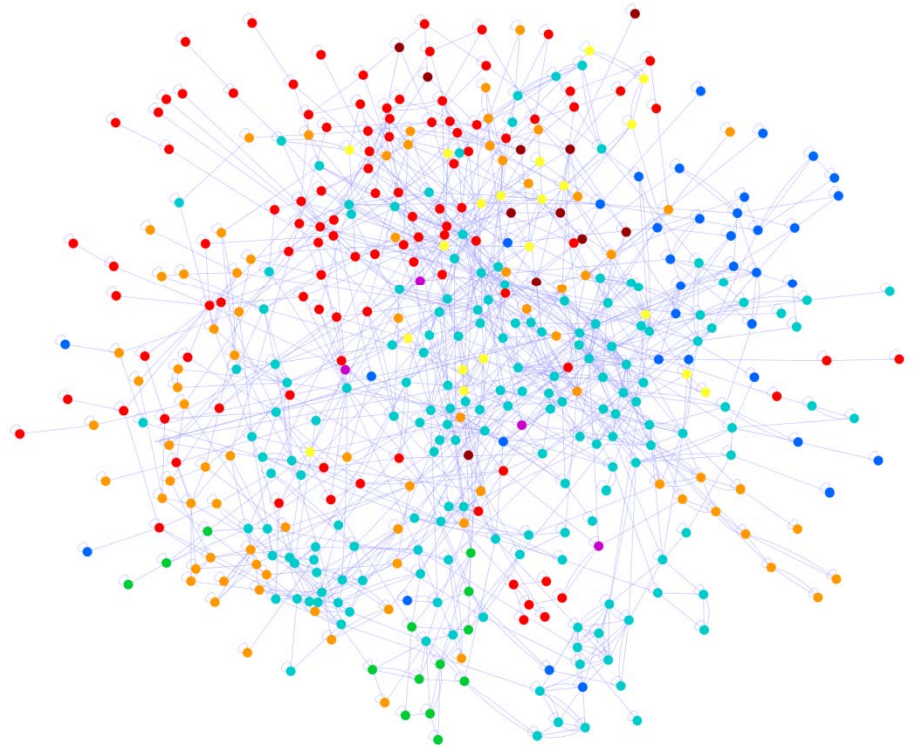


## Extensions of PBL publication (work in progress)

We explore resilience at a finer **scale of analysis**.

### – SECTORAL SCALE

- › 437 products and services
- › NACE rev1.1 (2002)

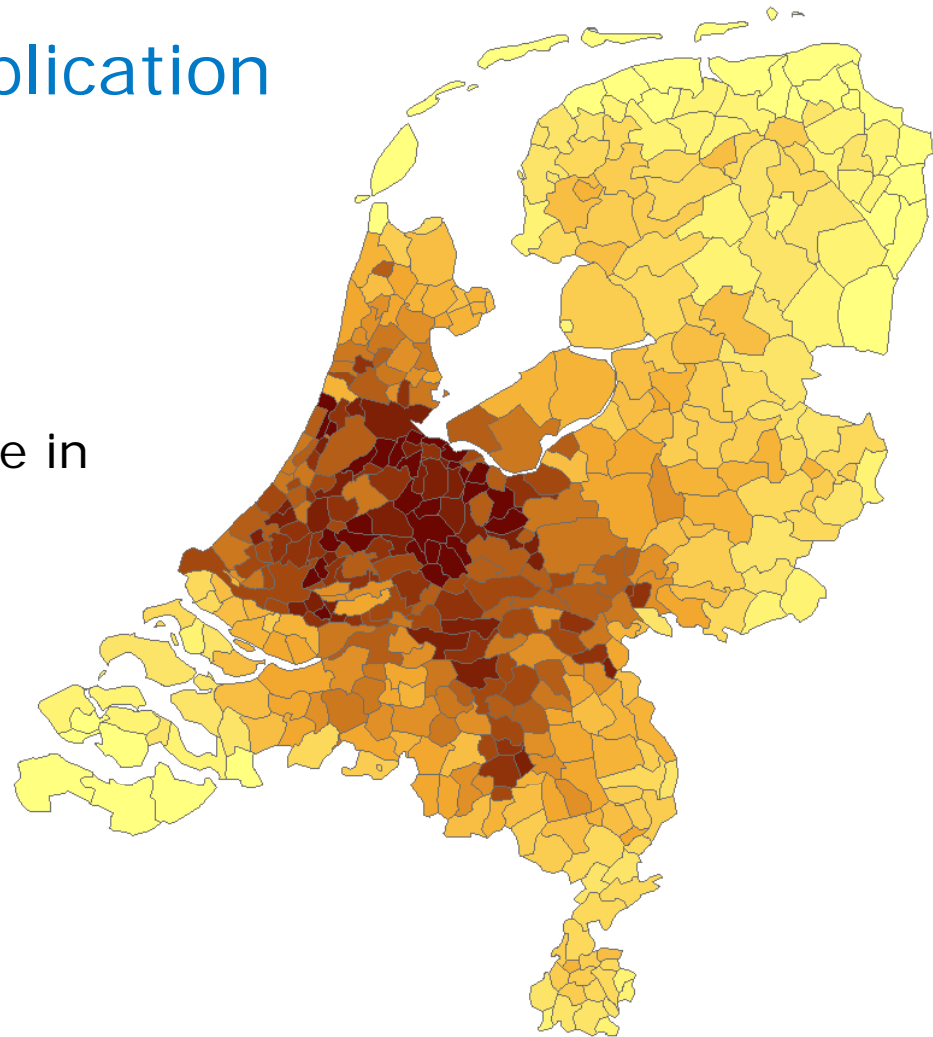




## Extensions of PBL publication (work in progress)

### **Preliminary results**

of resilience using a 5% decline in  
employment.





Questions?



A p p e n d i x

## Functional form of matching

$$m_{ro,rd}^{so,sd} = \frac{c_{ro,rd} r_{so,sd} U_{ro}^{so} \tilde{X}_{rd}^{sd}}{X_{rd}^{sd}}$$