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MAKing Sustainable development and WELL-being frameworks work for policy analysis

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Potential uses of discontinuity analysis to support measurement of indicators

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WP4

- Provide time series and multivariate methodology including nowcasting to be applied to well-being indicators and SDGs
  - nowcasting and mixed frequency models for the integrated analysis of well-being and SDGs
  - multivariate analysis of indicators
  - estimators of discontinuity

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Outline

- Discontinuities
- Modelling evolution of data
- Estimating changes
- Further challenges with new data sources
- Conclusions

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Discontinuity estimation

- Large part of quality of time series in official statistics comes from *continuity*
- Inevitable changes from time to time
  - planned, eg collection approach, methodology
  - unplanned, eg shifts in environment
- Changes in measurement are *discontinuities*
  - distinct from real changes
  - often confounded

Modelling evolution of data

- Consider time series of estimates
- Construct suitable model
  - often complex: seasonality, nonstationarity
  - may be better to use multivariate approaches to borrow strength across related series
- State space models provide flexible approach
  - fitted with Kalman filter, stepwise updating
  - especially suitable in rotating panels

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Nowcasting

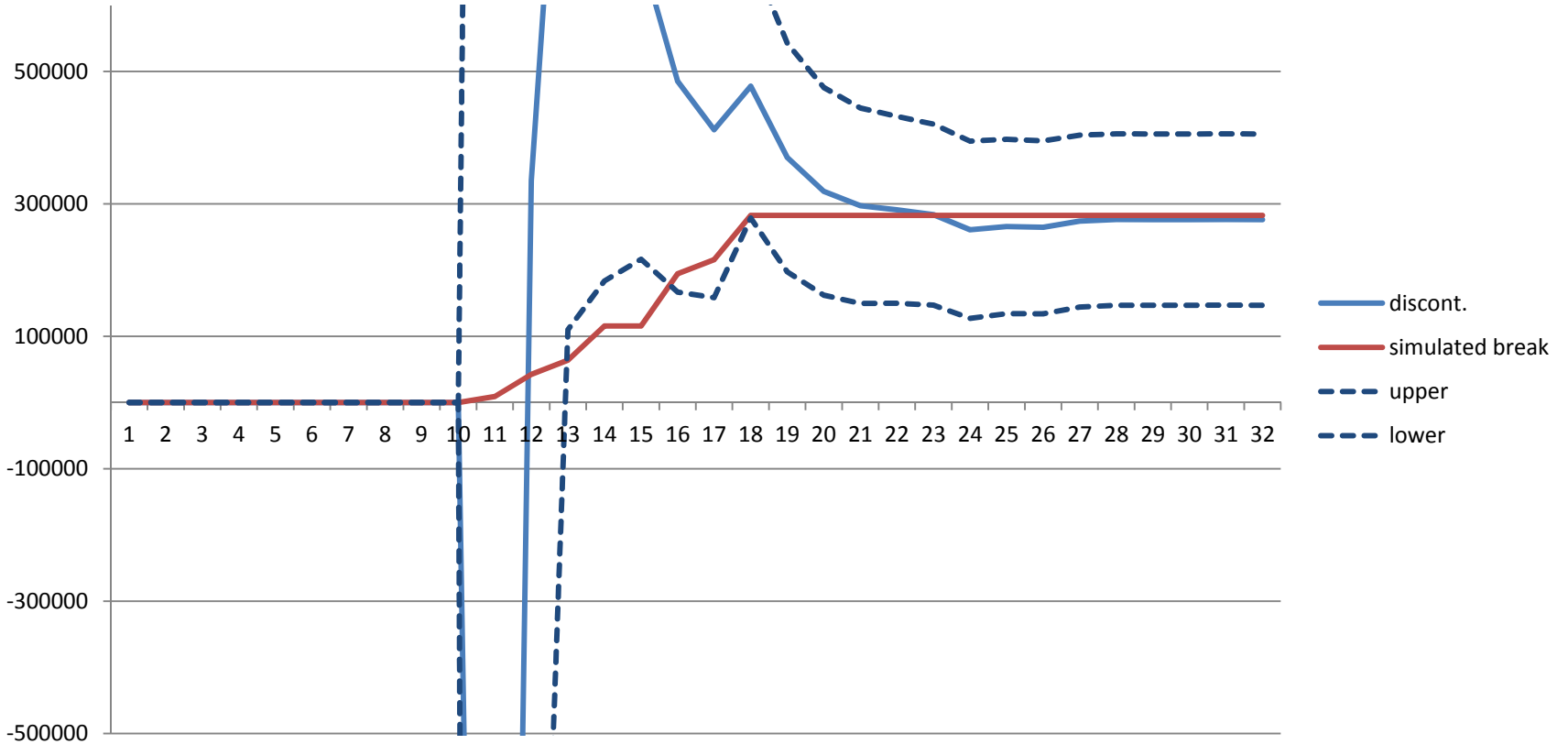
- Developed time series models give estimates for latest period based on
  - partial information or incomplete rotations
  - related (higher frequency or faster) series
- 'nowcasting'
- more timely or flash estimates
  - model-based

Adding discontinuities to a model

- Add parameter for discontinuity
  - abrupt change d_t = …, 0, 0, 0, 1, 1, 1, …
  - roll-out d_t = …, 0, 0, 0, 0.25, 0.5, 0.75, 1, 1, 1, …
- Roll-out may be designed as experiment – parallel run
- Estimation improved if pilot information available

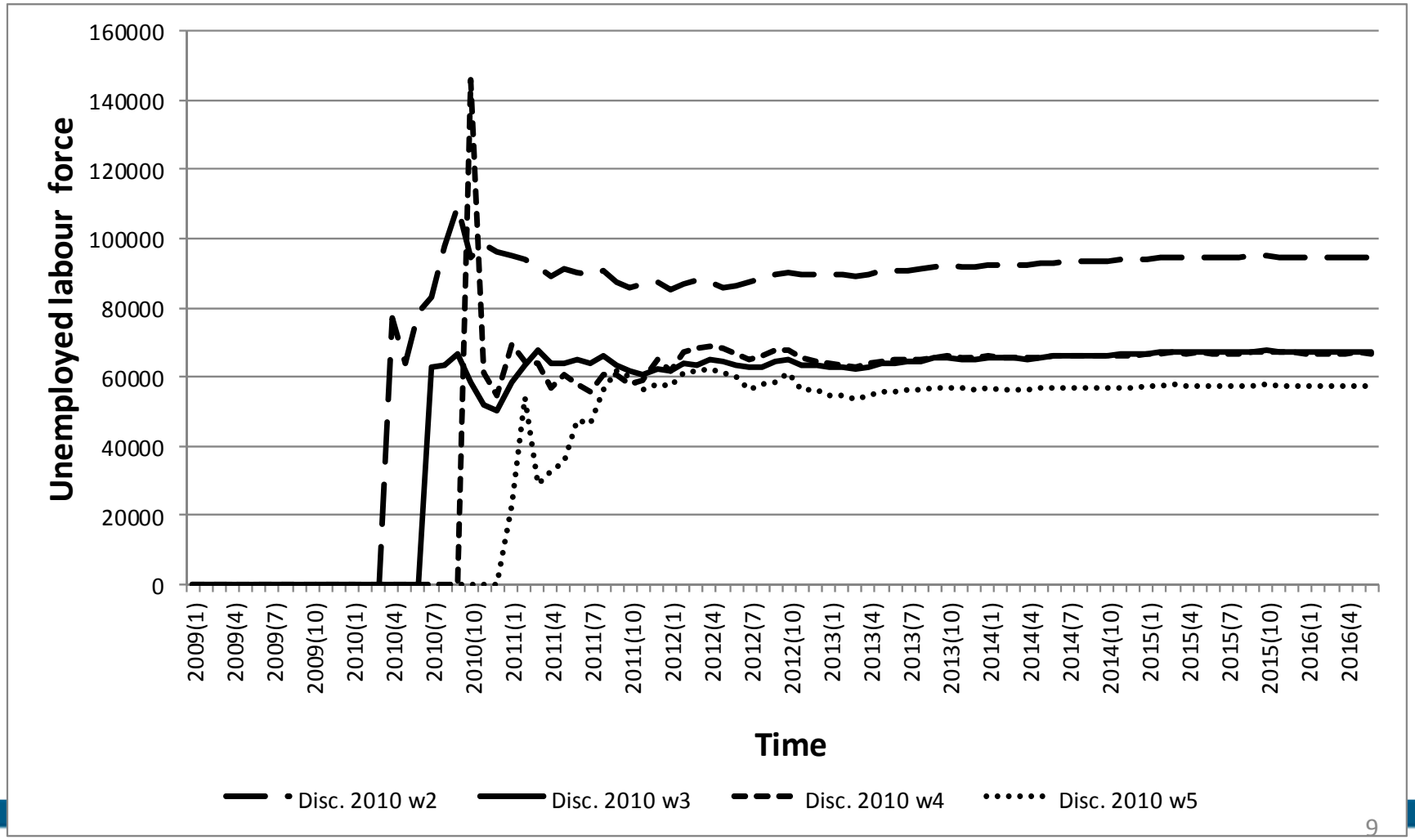
Power analysis simulation

UK IPS

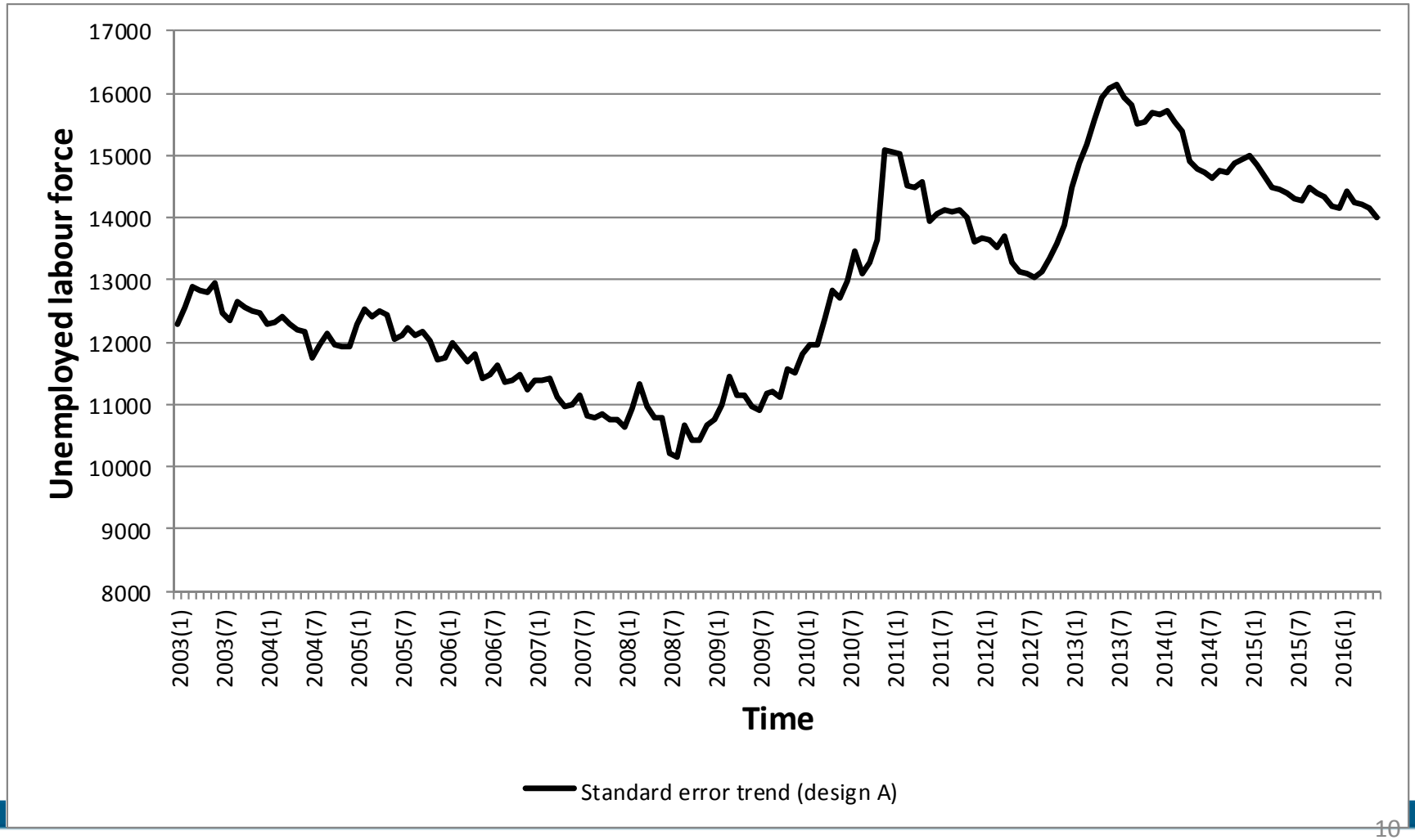


Filtered estimates of discontinuities

NL LFS



Pay price in variance



Application to wellbeing indicators

- ‘Traditional’ discontinuity analysis for planned changes
- Changes in related series underpinning model-based indicators
  - unexpected administrative data changes
  - big data changes (how to detect?)
- Changes from introduction of new related data

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Small area estimates and discontinuities

- Indicators at regional level important
- Changes at regional level harder to detect
  - nowcasting with related series
  - borrow strength across regions/time
  - small area discontinuities benefit from availability of prior series as good predictors

National Survey in Wales

- 5 surveys replaced by single National Survey
- Whole-survey discontinuities estimated
- Project to produce detailed discontinuity estimates by region × survey × variable
  - based on pilot implementation
  - relatively small sample size

Welsh Health Survey pilot

(table extract)

Health Board	Gender-Age	WHS			Large-scale test			Direct Discontinuity			FH Discontinuity		
		Result	Lower CI	Upper CI	Result	Lower CI	Upper CI	Result	Lower CI	Upper CI	Result	Lower CI	Upper CI
Abertawe Bro Morgannwg University Health Board	Male 16-44	35.7	27.4	44.1	29.6	11.9	47.3	-6.1	-25.7	13.5	-10.8	-20.3	-1.2
Aneurin Bevan Health Board	Male 16-44	32.5	27.2	37.7	24.7	11.4	38.1	-7.7	-22.1	6.6	-11.1	-17.8	-4.4
Betsi Cadwaladr University Health Board	Male 16-44	30.9	26.1	35.7	30.9	14.6	47.3	0.0	-17.0	17.1	-9.3	-15.6	-2.9
Cardiff & Vale University Health Board	Male 16-44	32.3	24.5	40.1	11.0	-0.7	22.8	-21.2	-35.4	-7.1	-11.2	-20.4	-2.0
Cwm Taf Health Board	Male 16-44	35.4	26.6	44.3	52.6	14.3	90.9	17.1	-22.2	56.5	-10.2	-20.1	-0.3
Hywel Dda Health Board	Male 16-44	23.9	17.2	30.7	13.7	-1.3	28.7	-10.3	-26.7	6.2	-7.9	-16.1	0.4
Powys Teaching Health Board	Male 16-44	34.1	21.3	46.9	12.6	-6.1	31.3	-21.5	-44.2	1.1	-12.2	-25.5	1.0

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Conclusions

- State space models flexible for time series evolution
  - allow incorporation of many sources – multivariate
  - discontinuity estimation important to handle changing methods (controlled) and data sources (often uncontrolled)
  - outstanding question of how to detect uncontrolled changes

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