

Les modèles âge-période-cohorte : principes, applications et controverses récentes

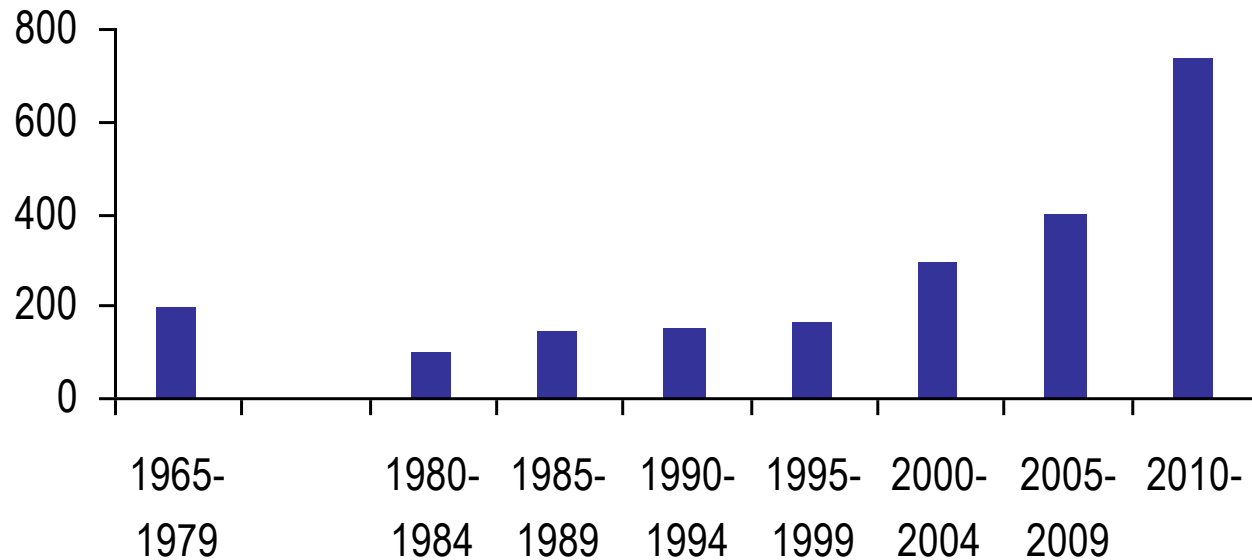
Rencontres de statistique appliquée, Ined
« Notions d'âge, de période et de cohorte : peut-on démêler les effets ? »

Céline GOFFETTE
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Origines

UN INTÉRÊT ANCIEN

- Ryder N., (1965), The Cohort as a Concept in the Study of Social Change, *American Sociological Review*, 30(6), 843-861.
- + de 2000 citations

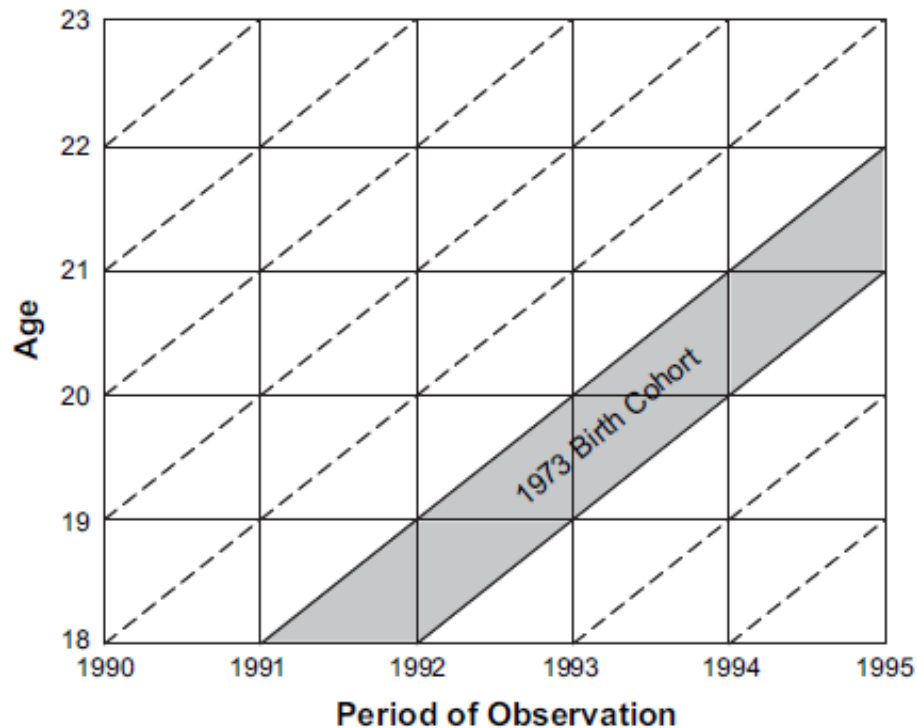


- Analyses âge-période-cohorte: applications à diverses structures de données
 - Données agrégées
 - Données individuelles longitudinales
 - Données individuelles en coupe transversale répétée

Origines

DONNÉES

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$$\text{Age} = \text{Période} - \text{Cohorte}$$

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$$Y = (1 * \text{Age}) + (1 * \text{Period}) + (1 * \text{Cohort})$$

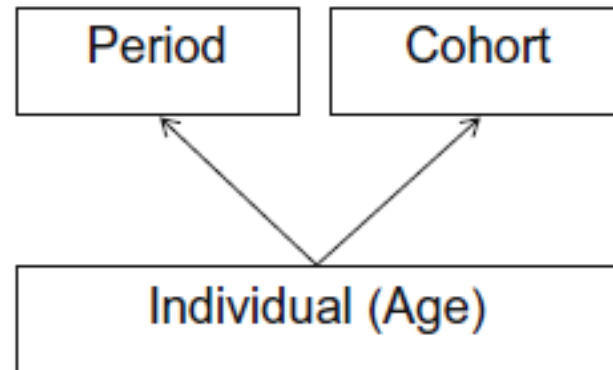
$$Y = 2 * \text{Age} + 2 * \text{Cohort}$$

$$Y = 2 * \text{Period}$$

Les modèles HAPC

PRINCIPES

- Yang et Land (2006), 'A mixed models approach to the age-period-cohort analysis of repeated cross-section surveys, with an application to data on trends in verbal test scores', *Sociological Methodology*, 36(1), 75-97.
- Modèles multiniveaux à classification croisée
- La période et la cohorte vues comme des **contextes** dans lesquels les individus évoluent



Les modèles HAPC

ÉCRITURE DU MODÈLE

$$\left\{ \begin{array}{l} y_{i(j_1j_2)} = \beta_{0j_1j_2} + \beta_1 \text{Age}_{i(j_1j_2)} + \beta_2 \text{Age}_{i(j_1j_2)}^2 + e_{i(j_1j_2)} \end{array} \right.$$

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Les modèles HAPC

ÉCRITURE DU MODÈLE

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Les modèles HAPC

RÉSOLUTION DU PROBLÈME D'IDENTIFICATION ?

the underidentification problem of the classical APC accounting model has been resolved by the specification of the quadratic function for the age effects (Yang and Land 2006, p. 84)

An HAPC framework does not incur the identification problem because the three effects are not assumed to be linear and additive at the same level of analysis (Yang and Land 2013, p. 191)

This contextual approach . . . helps to deal with (actually completely avoids) the identification problem (Yang and Land 2013, p. 71)

- Yang Y. (2008), 'Social Inequalities in Happiness in the United States, 1972 to 2004: An Age-Period-Cohort Analysis, *ASR*, 73(2), 204-226.

"This study conducts a systematic age, period, and cohort analysis that provides new evidence of the dynamics of and heterogeneity in, subjective well-being across the life course and over time in the United States. I use recently developed methodologies of [hierarchical age-period-cohort models](#), and the longest available [population data series on happiness from the General Social Survey, 1972 to 2004](#).

Applications

TRAVAUX DE YANG C. YANG

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I find distinct life-course patterns, time trends, and birth cohort changes in happiness.

*The **age effects** are strong and indicate increases in happiness over the life course.*

***Period effects** show first decreasing and then increasing trends in happiness.*

***Baby-boomer cohorts** report lower levels of happiness, suggesting the influence of early life conditions and formative experiences."*

Applications

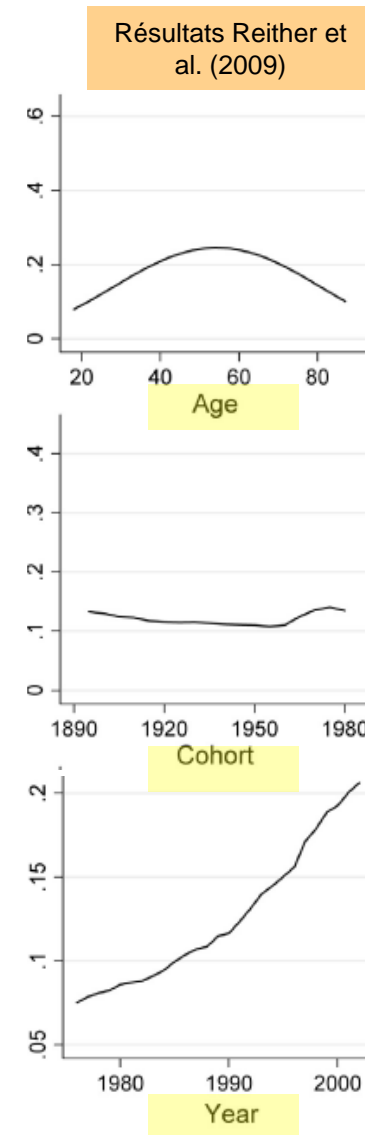
L'ARTICLE CONTROVERSÉ

- Reither, E. N., Hauser, R. M., & Yang, Y. (2009), 'Do birth cohorts matter? Age-period-cohort analyses of the obesity epidemic in the United States', *Social Science & Medicine*, 69, 1439-1448.
- National Health Interview Surveys, 1976-2002
- HAPC model of obesity ($BMI \geq 30$) for US adults

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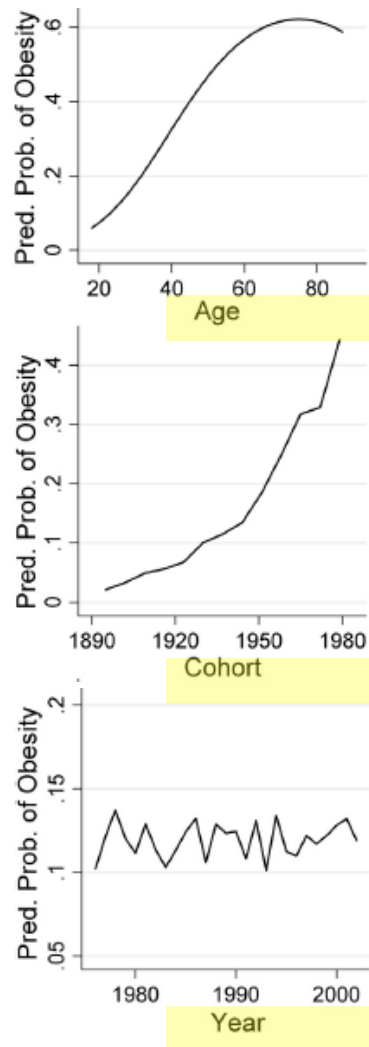
- Reither, E. N., Hauser, R. M., & Yang, Y. (2009), 'Do birth cohorts matter? Age-period-cohort analyses of the obesity epidemic in the United States', *Social Science & Medicine*, 69, 1439-1448.
- Bell, A & Jones, K (2014), 'Another 'futile quest'? A simulation study of Yang and Land's Hierarchical Age-Period-Cohort model', *Demographic Research*, vol. 30, pp. 333-360.
- Bell, A & Jones, K (2014), 'Don't birth cohorts matter? A commentary and simulation exercise on Reither, Hauser and Yang's (2009) age-period-cohort study of obesity', *Social Science & Medicine*, 101, 176-180.
- Reither, E. N., Masters, R. K., Yang, Y. C., Powers, D. A., Zheng, H., & Land, K. C. (2015), 'Should age-period-cohort studies return to the methodologies of the 1970s?', *Social Science & Medicine*, 128, 356-365.
- Bell, A & Jones, K (2015), 'Should age-period-cohort analysts accept innovation without scrutiny? A response to Reither, Masters, Yang, Powers, Zheng, and Land', *Social Science & Medicine*, 128, 331-333.
- Reither et al. (in press), 'Clarifying hierarchical age-period-cohort models: A rejoinder to Bell and Jones', *Social Science & Medicine*.

Critique

UNE PROFONDE REMISE EN CAUSE

Données simulées

Bell et Jones (2014)



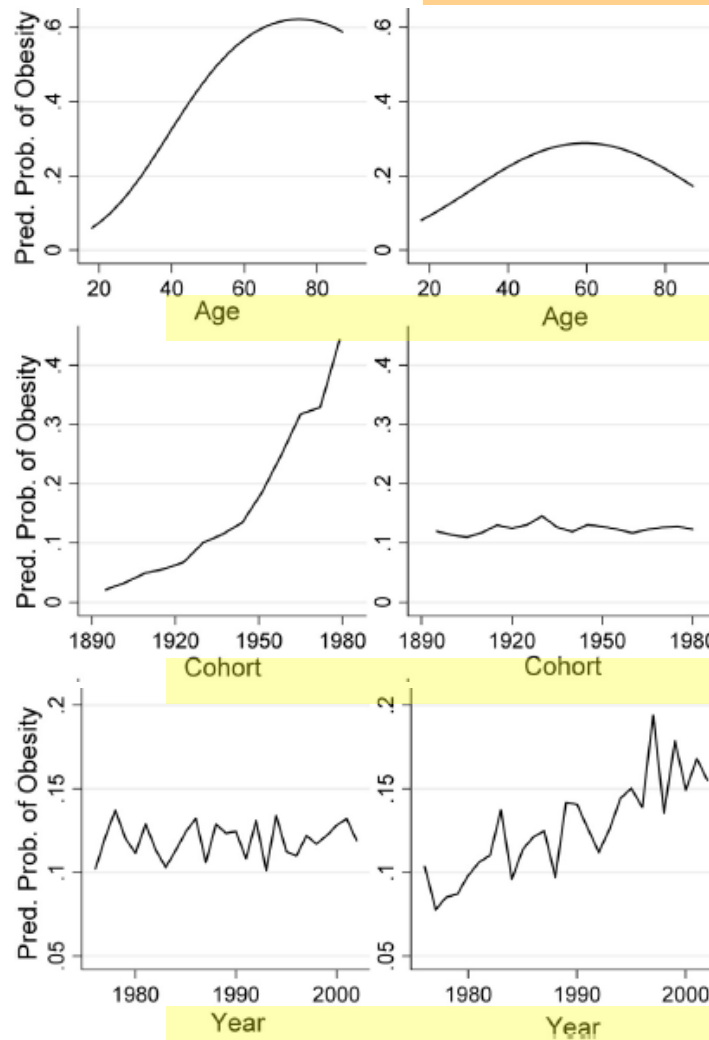
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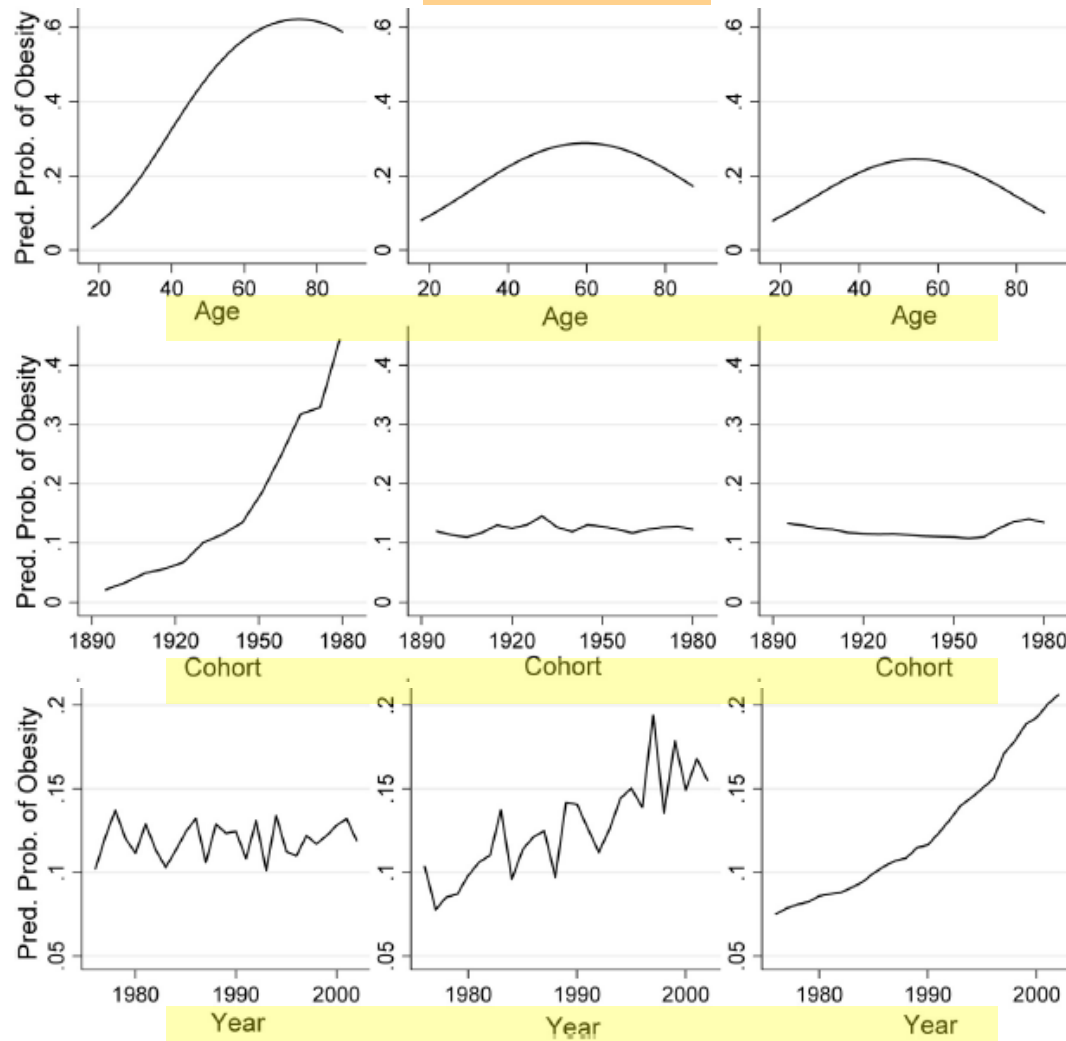
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Résultats Reither et
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- Fienberg (2013) : *The search for methodological solutions to the APC identity is an endless and fruitless quest [...]. It is surely time to move onto substantively focused considerations of the meaning of the three components in setting of interest.*
Smith, Mason et Fienberg (1982) : *Waiting for a solution to the so-called APC problem is like "Waiting for Godot".*

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- Shahar (Commentary - Period and cohorts "effects": interesting history, weak science) : *Something is methodologically incoherent, if not ridiculous, in a problem that was created by choosing AGE, PERIOD and COHORT to represent unknown causal variables among which the problem does not exist. Indeed, fit a model with true causal variables and the problem is gone.*

Quelles leçons tirer ?

- Jones et Bell (2014):
 - *The HAPC model does not solve the identification problem.*
 - *We do think that the conceptual structure that underlies the HAPC model can be valuable.*
 - *Where there are no trends in the periods or cohorts, the HAPC model works well, meaning that it can be used to assess random variations in period and cohorts.*
 - *Where trends do exist, one solution would be to make a decision based on theory as to which of periods or cohorts are most likely to have generated the data, and to include that term in the HAPC model as a linear fixed effect.*
- Jones et Bell (2015):
 - *Where the choice is between compelling speculation and misleading evidence dressed up as science, we would always choose the former.*
 - *The model does not work as a general purpose APC model; no model does.*

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