

Measuring period fertility with parity-duration approach

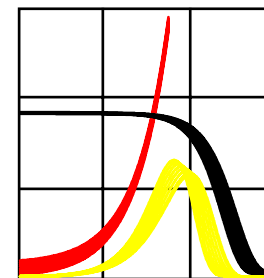
A sound alternative to the conventional total fertility rate?

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INTRODUCTION (1)

- Period Total Fertility Rates (TFR) affected by changes in the timing of childbearing
- Low and “lowest-low” ($TFR < 1.30$) fertility in Europe tightly linked to ‘fertility postponement’
- ◆ TFR may lead to the *misinterpretation of levels, as well as trends and cross-country differences in fertility*

Possible solutions:

- 1) Adjust the TFR for tempo distortions (Bongaarts-Feeney 1998, Kohler-Philipov 2001)
- 2) Use other measures of period fertility, which may better depict fertility *quantum* in times of shifts in fertility timing; e.g.

PATFR: index of total fertility based on age-parity fertility tables (Rallu and Toulemon 1994) ◆ also distorted by tempo effects: Adjusted PATFR (Kohler and Ortega 2002)

INTRODUCTION (2)

Shortcomings of the adjustment methods:

Considerable fluctuations, 'extreme' values, frequent violation of the underlying assumptions (Bongaarts-Feeney adjusted TFR), complex computation (Kohler-Ortega adjusted PATFR)

Is there an alternative to the TFR which can be used to depict period fertility quantum without a need for further adjustment?

Fertility as a function of parity and time elapsed since the last previous birth: A parity-duration approach

OVERVIEW OF PRESENTATION:

- 1) **The parity and duration model**
- 2) **Application for Austria & the Czech Republic**
- 3) **Tempo effects in the parity-duration rates**
- 4) **Discussion: Advantages and limitations**

Results for Austria reported in:

T. Sobotka, M. Winkler-Dworak, M. Rita Testa, W. Lutz, D. Philipov, H. Engelhardt, and R. Gisser. 2005. "Monthly estimates of the quantum of fertility: Towards a fertility monitoring system in Austria". *Vienna Yearbook of Population Research* 2005: 109-141.

The parity and duration model

- Neglected in contemporary fertility analysis (exceptions include Toulemon 1994, Barkalov and Dorbritz 1996, Toulemon 2004)
- Assumption: Duration since the last previous birth (birth interval) is of paramount importance
- Pioneered to analyse marital fertility (e.g. Henry 1961)

Two main approaches:

- 1) **Rates** ('incidence rates', rates of the 1st kind) by birth order and duration from the last previous birth; analogy to the TFR
- 2) **Probabilities or intensities** of giving another birth by current parity (birth order) and duration from the last previous birth (exposure-based indicator; analogy to the PATFR approach)

For **birth order 1**, age ('duration since birth', 'duration since age x') serves as 'duration' category

Approach 1: 'Incidence rates' by duration

Duration-specific 'incidence rates':

for births of order $i \geq 2$

B: live births

$$n_{i,d}(t) = B_{i,d}(t) / B_{i-1}(t-d)$$

(Incidence) rate of childbearing at birth order i and duration d since the time of the last previous birth

For any given birth order, the sum over all durations gives a parity progression ratio (PPR_d)

$$PPR_{i,i+1} = \sum_{d=0}^{25} n_{i,d}$$

- Less data intensive: For any period t , births by birth order in the last 20-25 years & births in t by duration d and birth order i

Computation of parity-duration 'incidence rates': an illustration

Live births in 2002

Previous birth in	Live births in the year of the previous birth		Duration (Birth Interval)	Births in 2002		Duration-parity incidence rates in 2002	
	Order 1 [1]	Order 2 [2]		Order 2 [3]	Order 3 [4]	Order 2 [5]=[3]/[1]	Order 3 [6]=[4]/[2]
....
1991	64762	45916	11	904	476	0.0140	0.0104
1992	60646	43567	10	1162	546	0.0192	0.0125
1993	58695	44477	9	1601	654	0.0273	0.0147
1994	50825	39345	8	1958	599	0.0385	0.0152
1995	44522	37026	7	2234	684	0.0502	0.0185
1996	42106	34817	6	2692	696	0.0639	0.0200
1997	42812	34520	5	3388	672	0.0791	0.0195
1998	43124	34394	4	4990	857	0.1157	0.0249
1999	43069	33606	3	6495	912	0.1508	0.0271
2000	43904	33873	2	4794	1015	0.1092	0.0300
2001	43337	34216	1	1445	500	0.0333	0.0146
2002	44745	34447	0	874	478	0.0195	0.0139
Sum of incidence rates (PPRd)						0.732	0.237

Approach 2: Parity-duration birth probabilities

Parity-duration birth probabilities:

for births of order $i \geq 2$

$$q_{i,d}(t) = B_{i,d}(t) / P_{i-1,d}^F(t_{1.1.})$$

No. of women (on Jan. 1) at parity $i-1$ who reached this parity in $t-d$

where i = parity (birth order) and d = duration since the last previous birth

For any given birth order, a summary indicator is parity progression ratio (PPR_d); multiplicative:

$$PPR_{i,i+1} = 1 - \prod_{d=0}^{d \max} (1 - q_{i,d})$$

- ♦ Data intensive: Implies an estimation of the number of women at each parity by the year when they reached this parity

Total fertility: the period average parity (PAP)

Index of total fertility: “**Period Average Parity**” (PAP)

By birth order (for $i \geq 2$):

$$PAP_i = PAP_{i-1} \cdot PPRd_{i,i+1}$$

For the total fertility:

$$PAP = PATFR_{i=1} + \sum_{i=2}^{i \max} PAP_i$$

For b.o. 1 the index of fertility derived from
age-parity fertility table

- I use both unadjusted $PATFR_1$ and adjusted $PATFR_1$ (Kohler-Ortega (2002) adjustment)

DATA & METHODS

ANALYSIS:

- Period fertility in Austria (1984-2004) and the Czech Republic (1989-2004)
- Focus on *PPRd* and *PAP* indicators based on ‘incidence rates’ (rates of the first kind);
- lack of data for constructing the life-table based indicators; both approaches only for Austria 1999-2004

DATA:

Database of births in Austria (Statistics Austria; Project “Birth Barometer” (Geburtenbarometer); all indicators computed in a monthly format

Data on births by birth order & duration provided by the Czech Statistical Office (courtesy of K. Zeman)

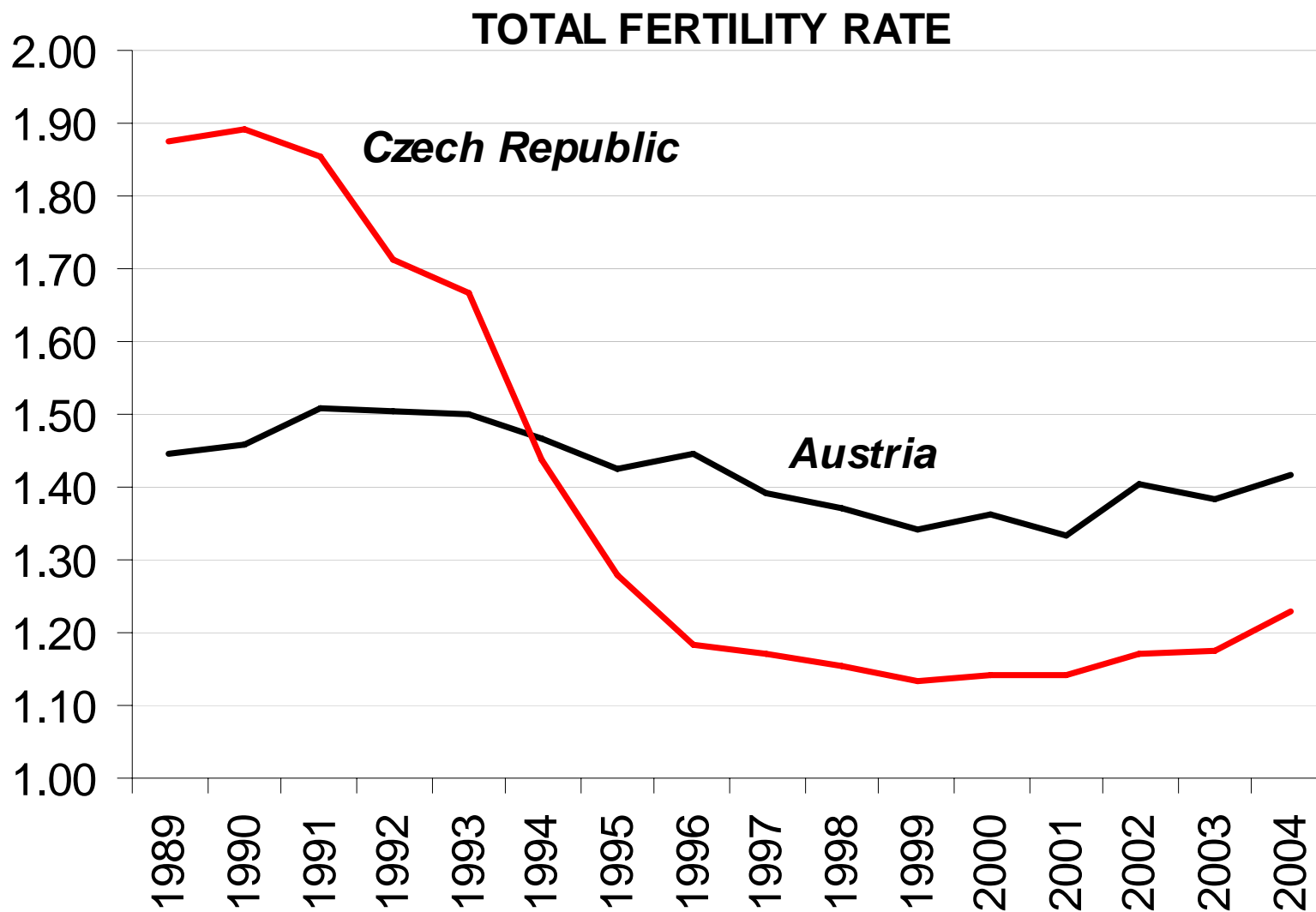
SETTING

Two countries with different patterns of fertility change:

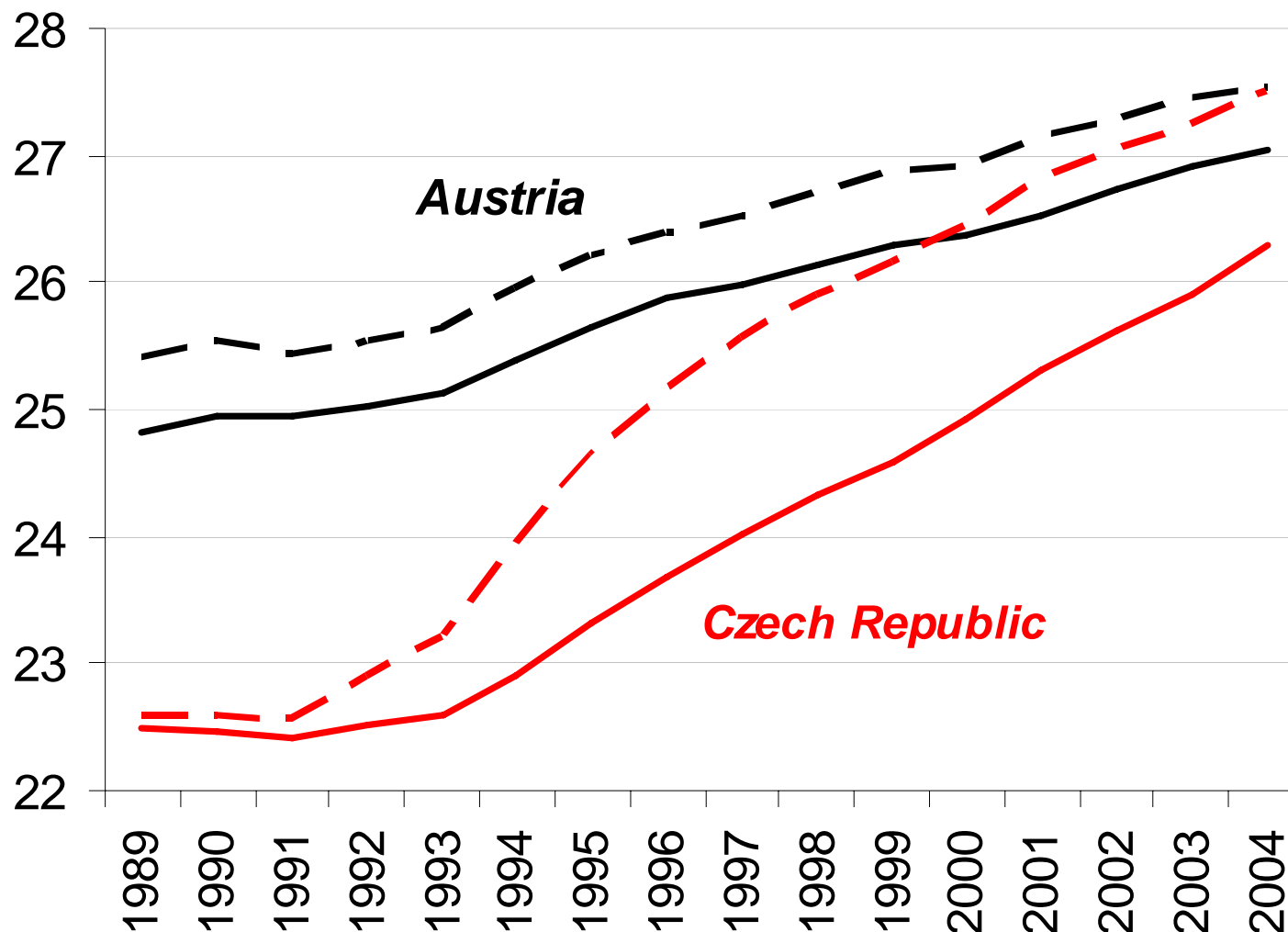
Austria: Gradual fertility changes and fertility postponement

Czech Republic: Rapid shift in fertility patterns after 1989: fertility decline, intensive postponement.
Substantial tempo effects!

“Fertility crisis” in the Czech Republic?

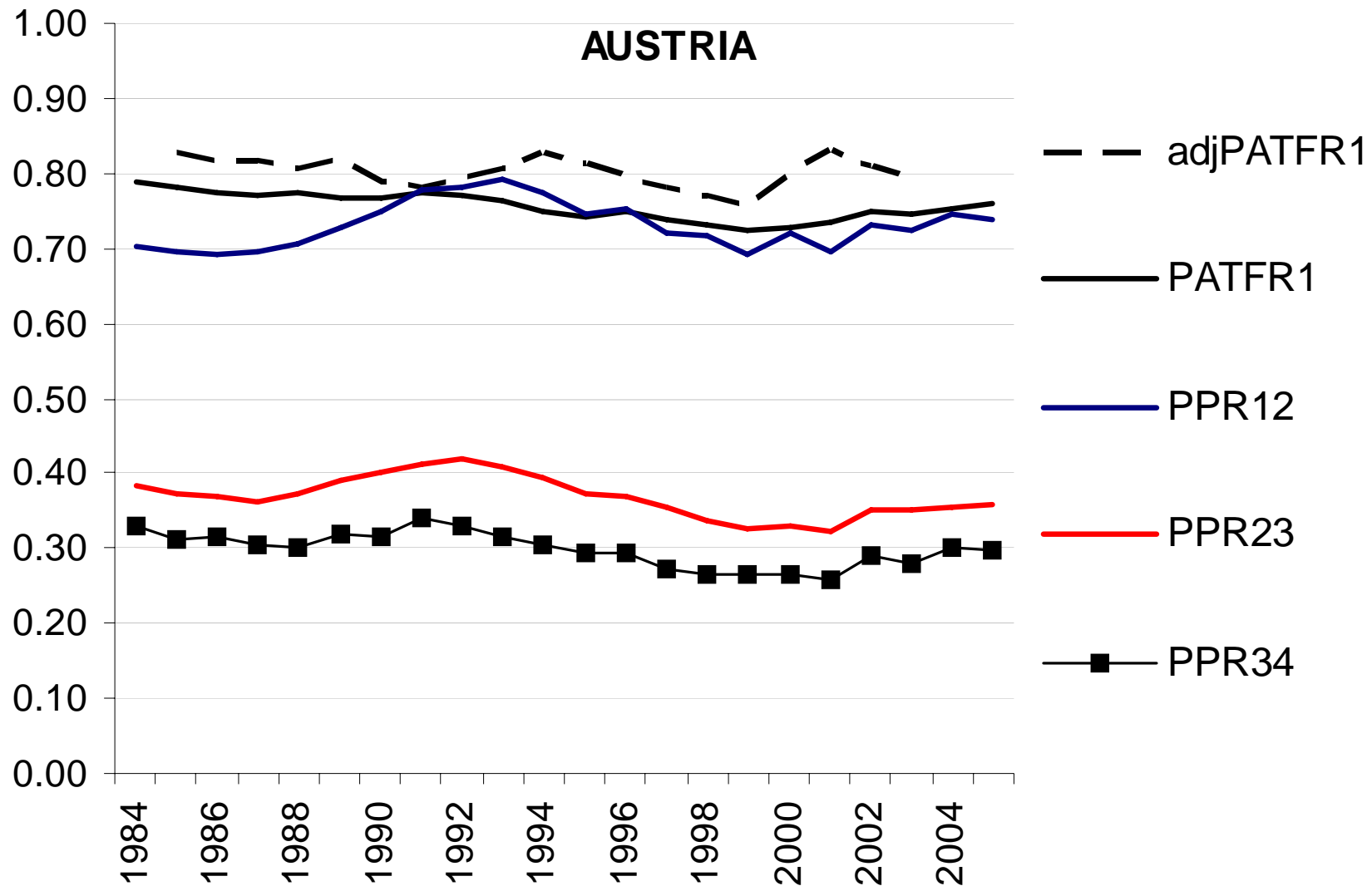


Mean age at of mothers at birth of first child



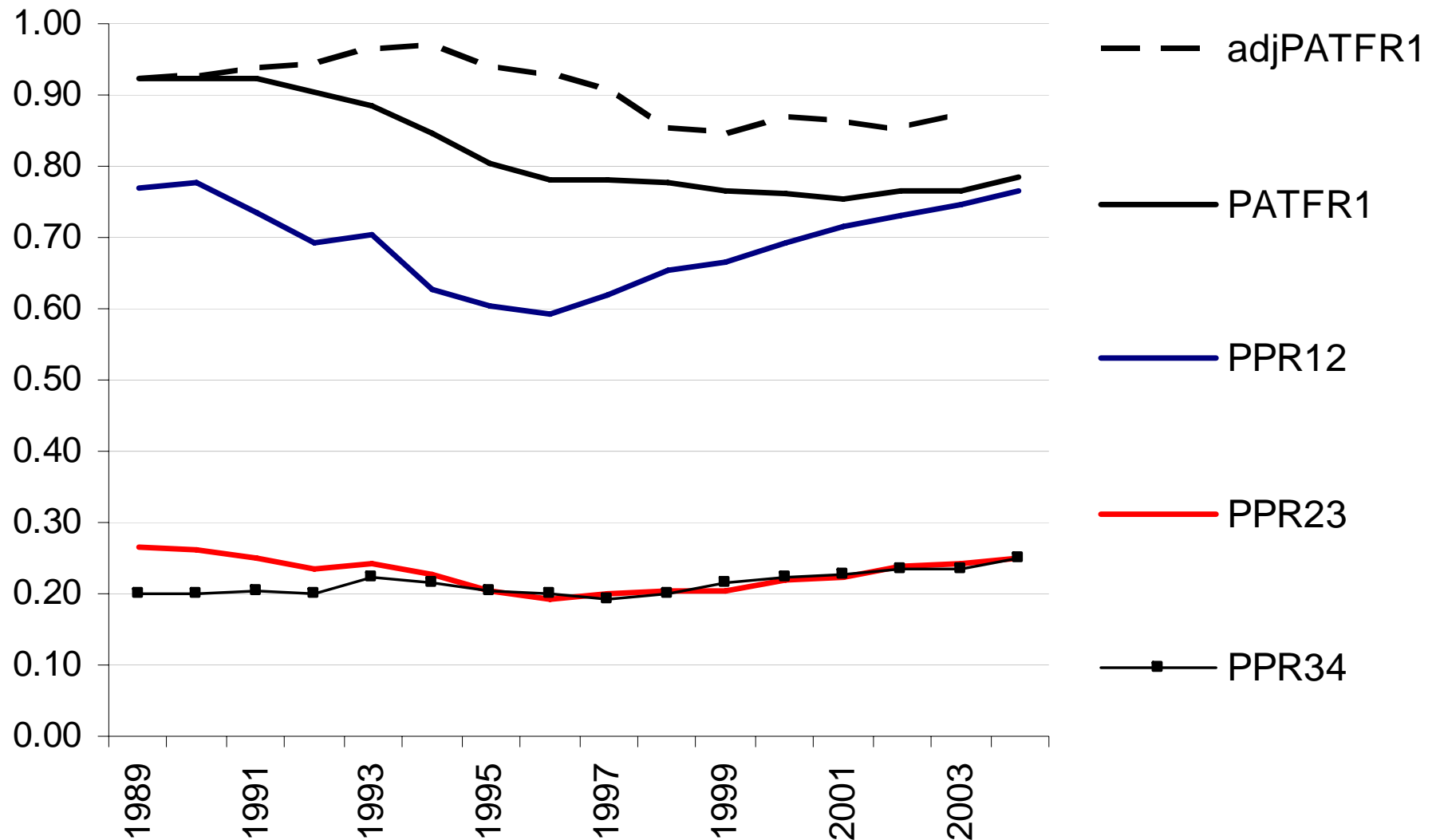
Full line represents usually used mean age based on first birth incidence rates; patterned line is based on first birth fertility table

ANALYSIS: (1) Parity-Progression Ratios

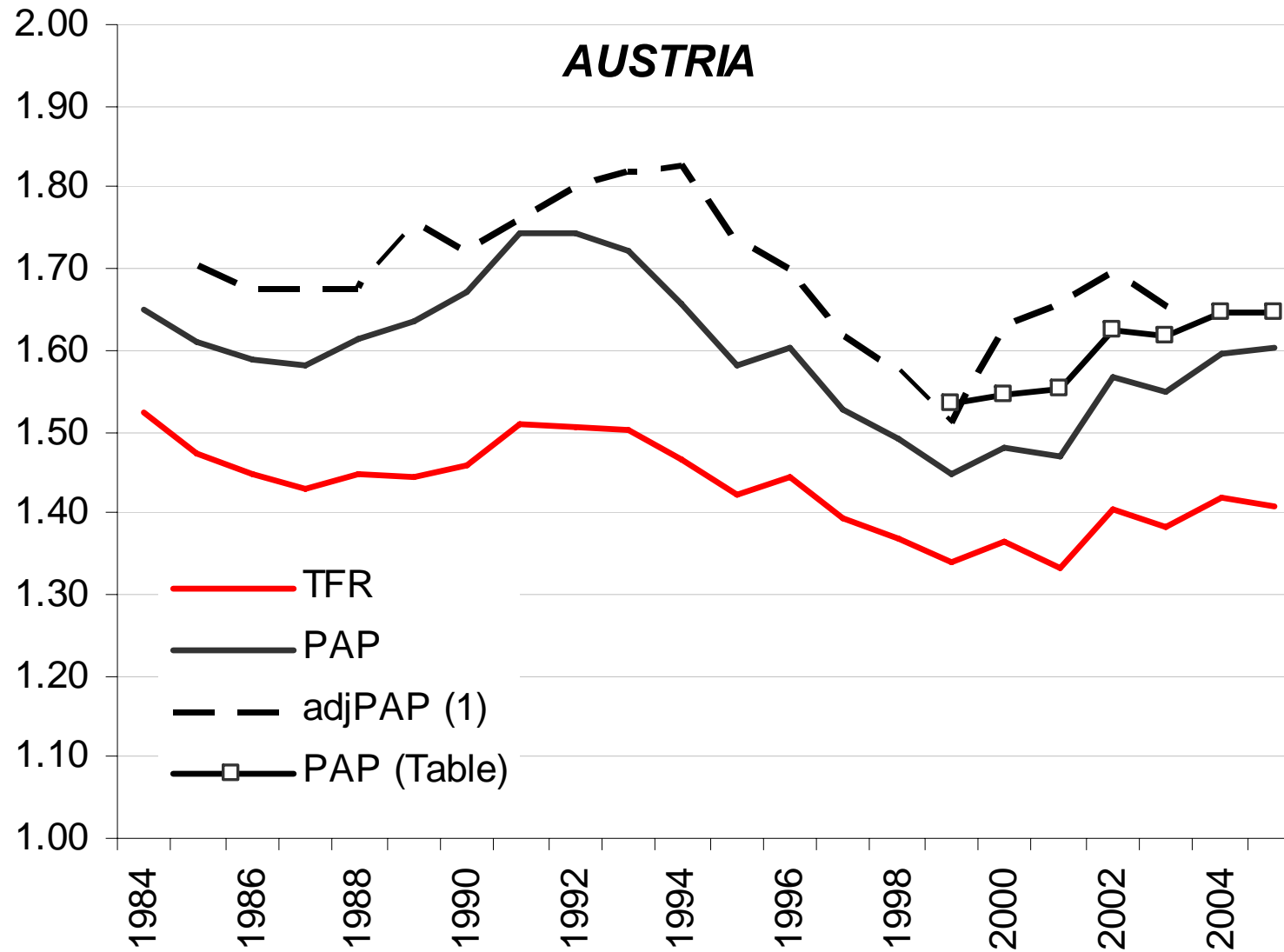


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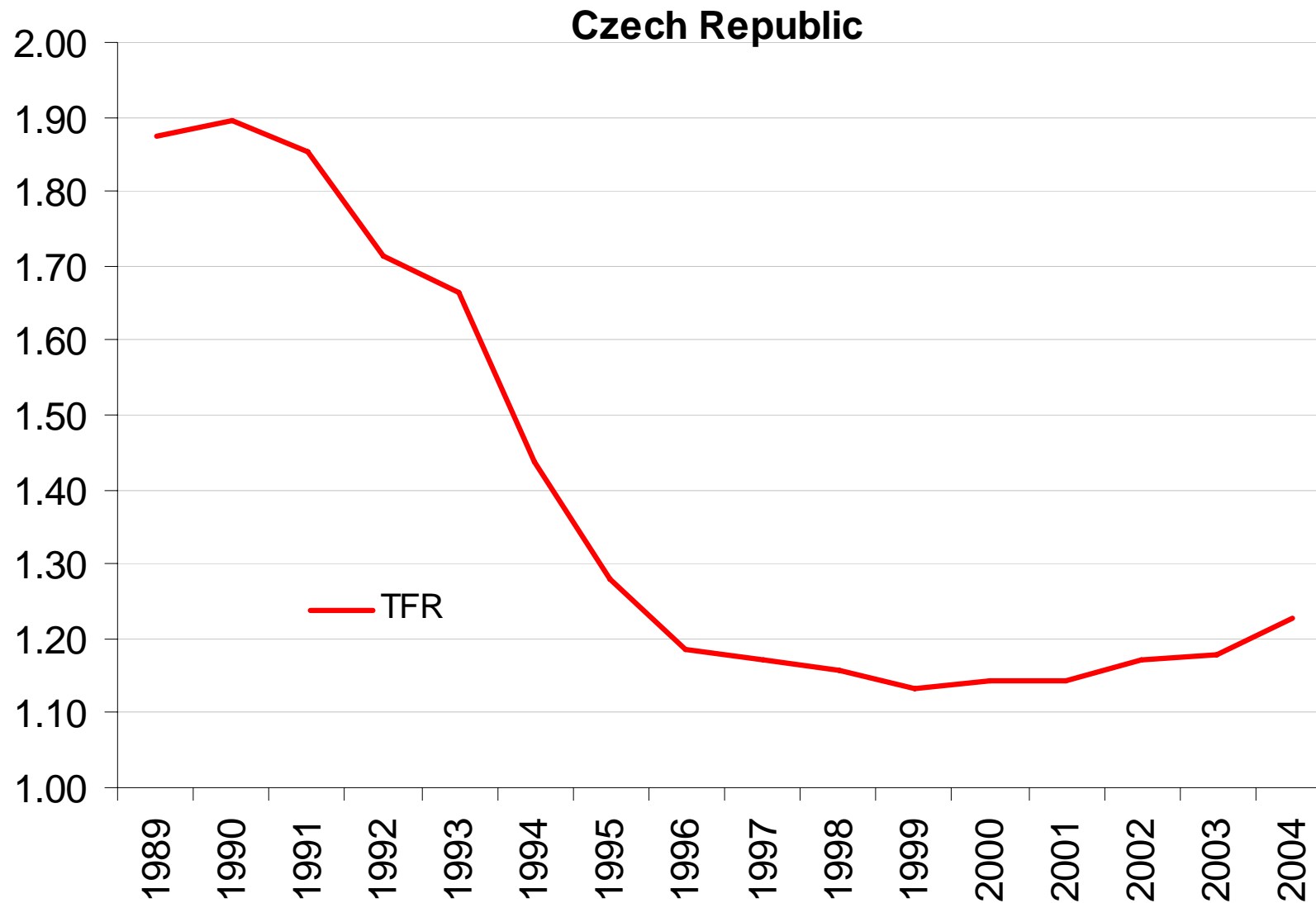
CZECH REPUBLIC



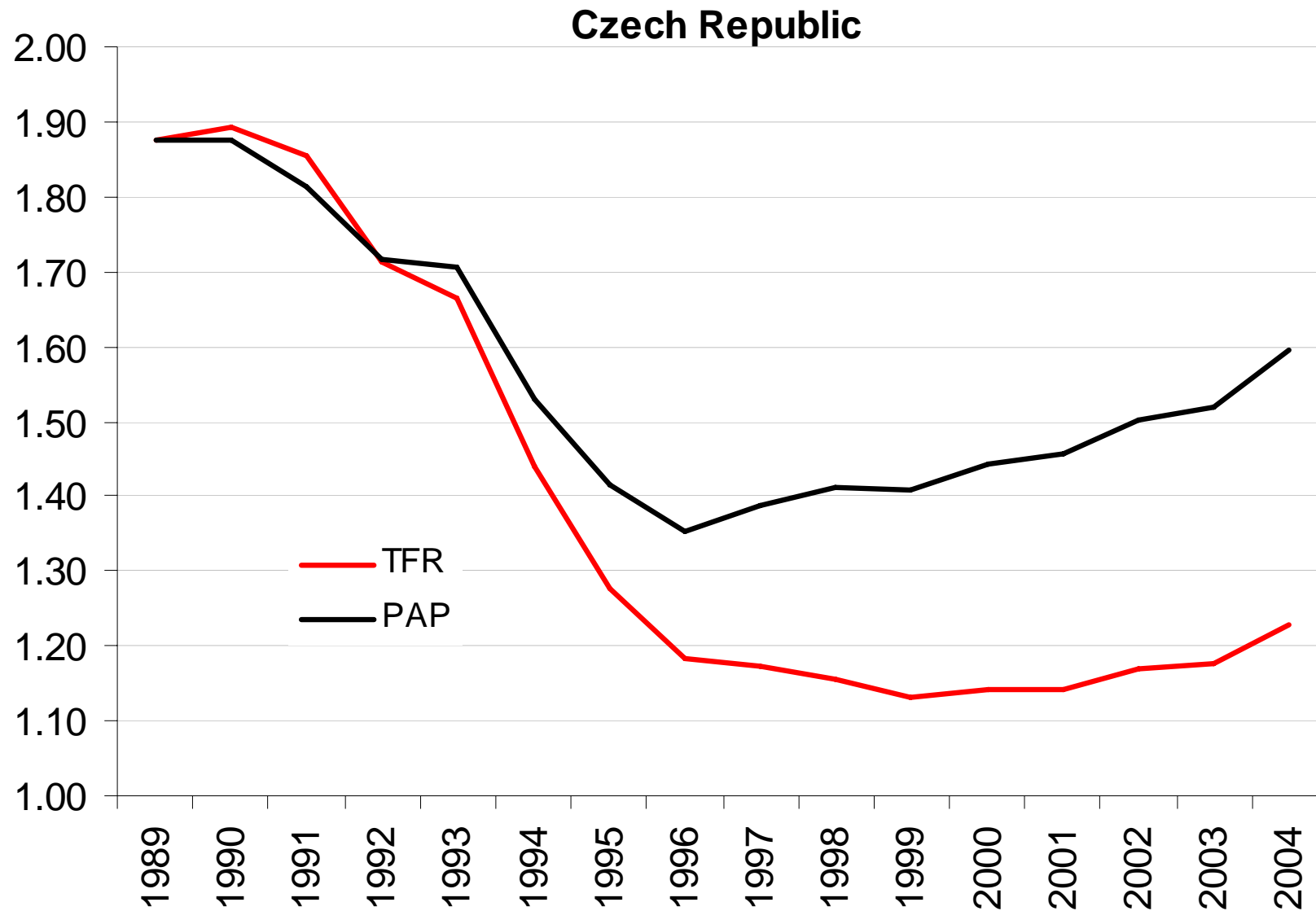
ANALYSIS (2): PAP



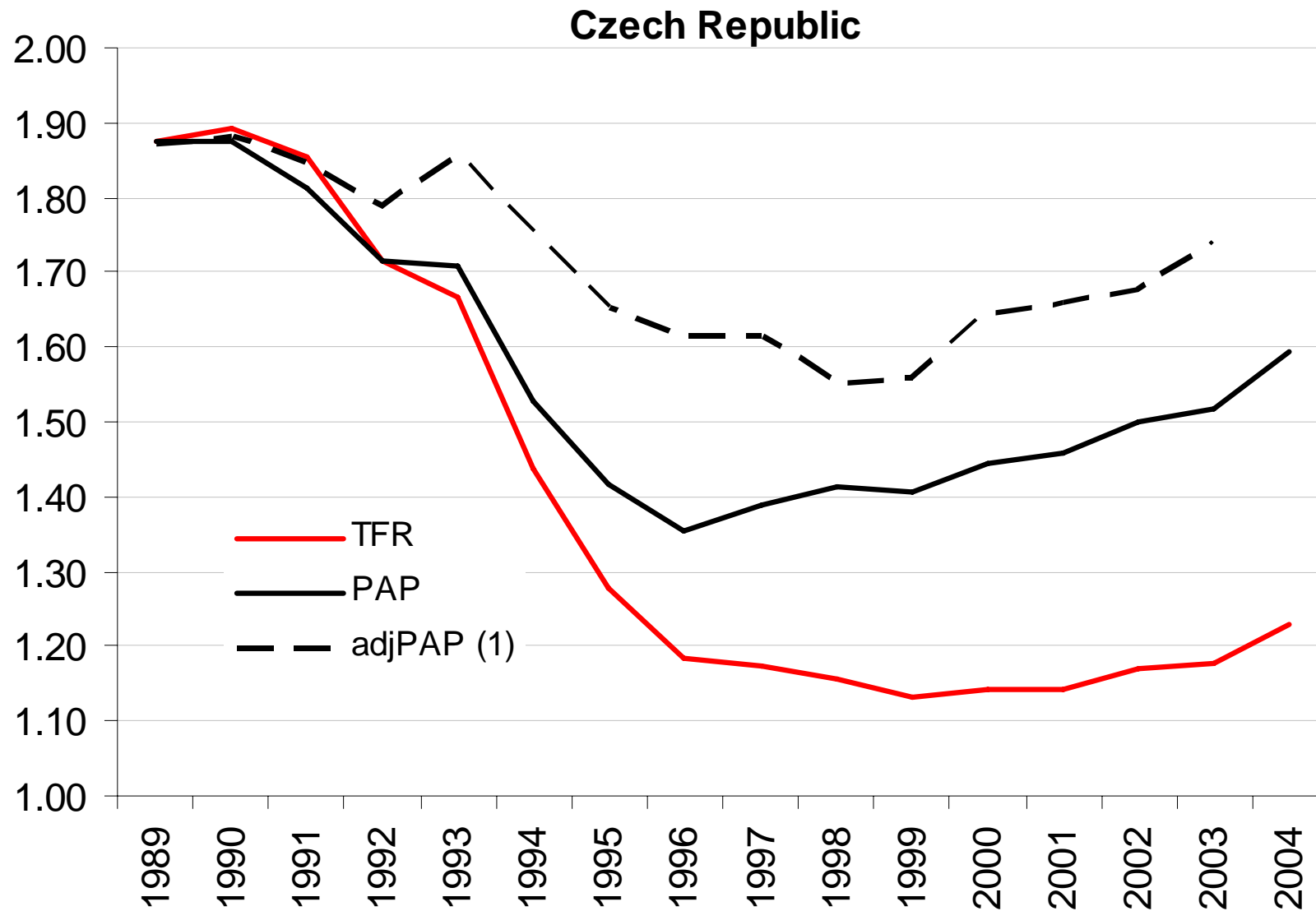
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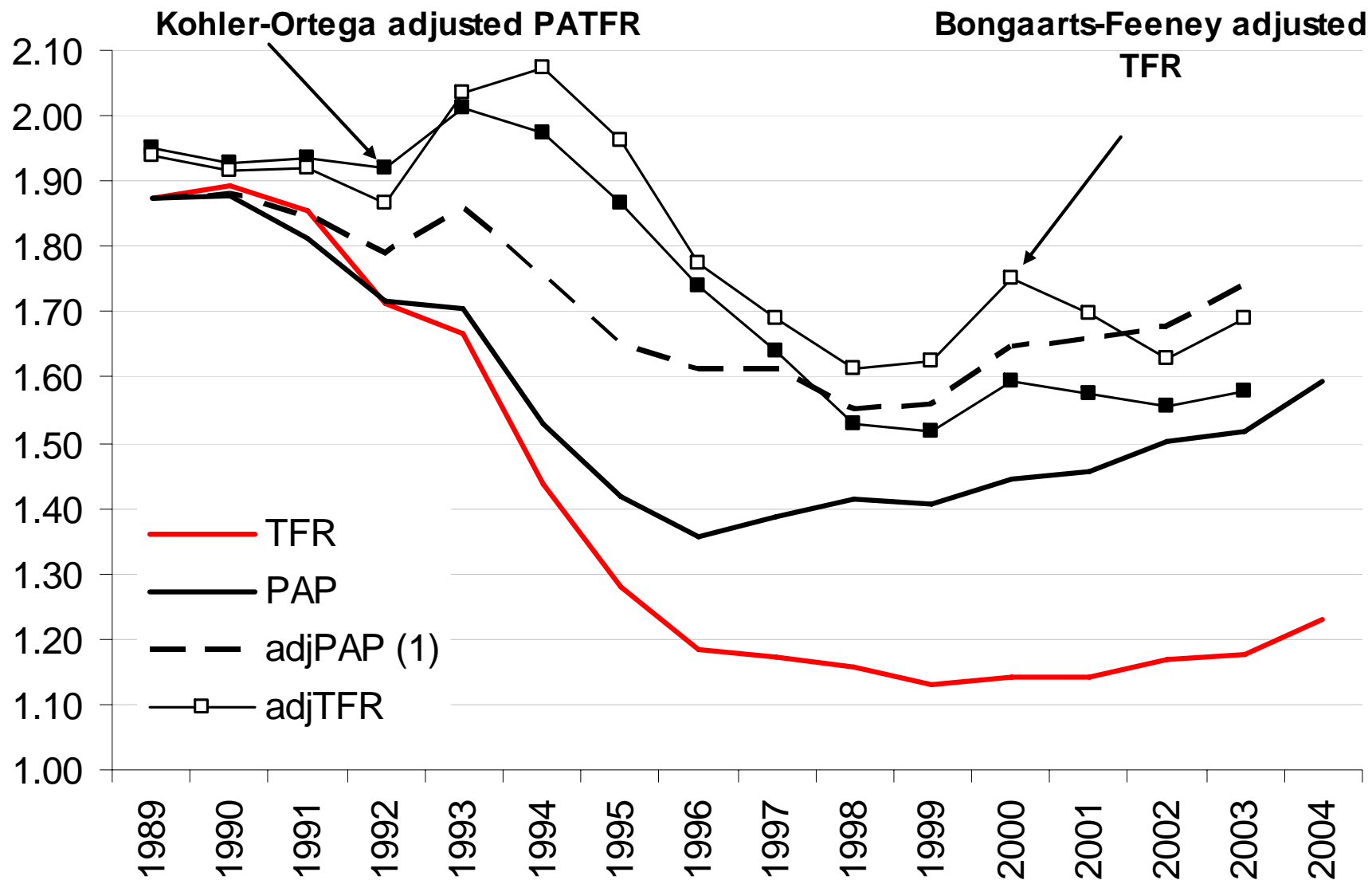
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ANALYSIS (3): PAP and adjusted indicators (Czech Republic)



Interpretation of results (1)

AUSTRIA:

- PAP higher than the TFR, but similar trends
- In 2000-2003: TFR=1.37, PAP=1.52 (Life table PAP = 1.59), adjPAP=1.66
- PAP values also close to the adjusted KO PATFR (1.60) and BF TFR (1.62)

CZECH REPUBLIC:

- PAP displays not only different levels, but also different trends in period fertility than the TFR
- In 1989, TFR = PAP = adjPAP = 1.87
- 1989-96: TFR dropped to 1.18 (-37%), PAP to 1.35 (-28%), adjPAP to 1.61 (-14%)
- 1996-2003: TFR unchanged at 1.18, PAP increased to 1.52 (+20%), and adjPAP to 1.74 (+8%)

PUZZLING results:

- Was there a strong increase in fertility between 1996 and 2003?
- Was the overall fertility decline between 1989 and 2003 so huge (TFR) or so small (adjPAP)
- If the adjPAP correct, the TFR is particularly misleading!

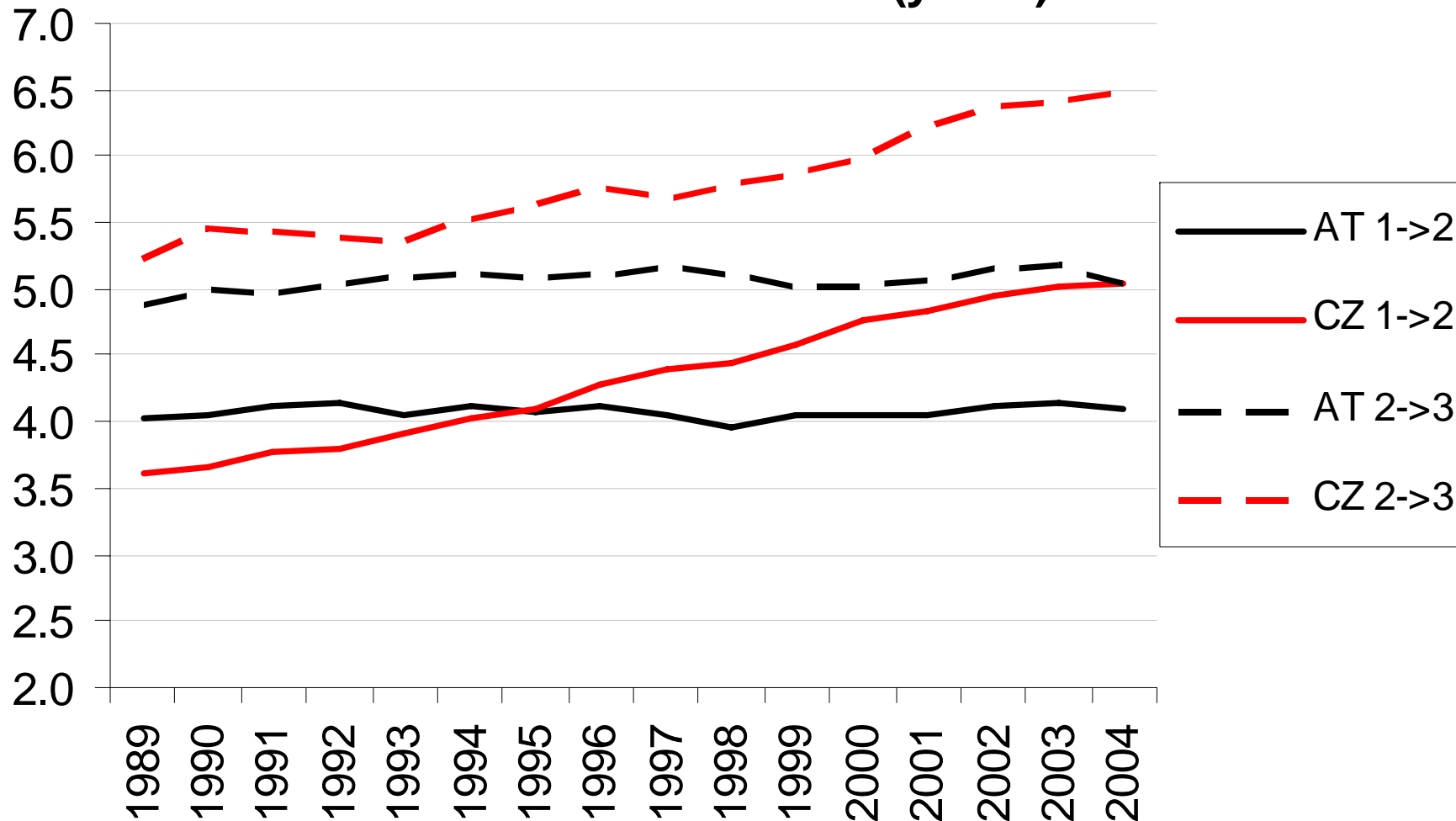
Tempo effects in the PAP and PPRd

Are the results for the Czech Republic spurious?

- The use of *PAP* hinges on the assumption of no tempo effects in the *PPRd*
- The *PPRd can be distorted* by tempo effects in a similar way as the TFR indicators:
 - If the birth intervals increase, the *PPRd* as well as the resulting *PAP* deflated by tempo effects and *vice versa*

Tempo effects in the PAP and PPRd

Birth interval between the 1st and 2nd and between the 2nd and 3rd child (years)



Re-interpretation of results

AUSTRIA:

- Almost no changes in birth intervals -> no tempo effects

CZECH REPUBLIC:

- Increasing birth intervals; negative tempo distortions
- Need to adjust *PPRd* for tempo effects?

Reinterpretation of the *PAP* results:

- Fertility increase between 1996 and 2003 probably spurious
- High fertility level in 2003 correct: It would be even higher after tempo adjustment of the *PPRd*!
- *TFR* appears to be strongly misleading: the *PAP* does not indicate anything close to the “low fertility crisis”

DISCUSSION: advantages and drawbacks of the PAP

Possible drawbacks:

- First-order component (PATFR) frequently distorted (although less than the TFR) – tempo adjustment may be necessary
- Parity progression ratios may be distorted by tempo effects as well – need to check the data
- Migration may affect the results. Difficult to incorporate migration into the estimates of “exposure population”
- ? Does not show ‘fertility ageing’ effects (Kohler-Ortega 2002)?
- ? Duration less important determinant of fertility than age?

Main advantages

- PPRd indicators considerably reduce (Czech Republic) or even eliminate (Austria) tempo distortions
- Parity progression measures constitutes a natural approach to fertility analysis – reflects fertility behaviour as a sequential process

CONCLUSIONS

- PAP constitutes a viable alternative to the conventional TFR as well as to the adjusted fertility indicators
 - Especially if the “no tempo effects” assumption holds for the *PPRd*, it may be methodologically preferable to the adjustment
- Trends and values of the PAP may be in sharp contrast to the usually used TFR
- A ‘diffusion’ of this ‘neglected’ indicator strongly recommended!
 - Austria: Continuous monthly computation of the TFR, *PPRd*, and PAP possible due to collaboration of Vienna Institute of Demography with Statistics Austria

Questions?

Comments?

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