



# Reconstruction of the 1971-2011 population by religion<sup>1</sup> and data visualization<sup>2</sup>

Anne Goujon<sup>1</sup> and Ramon Bauer<sup>2</sup>



# Aim & Objective

- Reconstruct the yearly population since 1971 until 2011 by age (single), sex, and 7 religious categories (Catholics, Protestants, Jews, Muslims, Orthodox, Others, No religion)
- Learn about the past to inform the future

# Main available inputs for Vienna

- Census population by religion (5 out of 7 religious categories in 1971, 6 in 1981 and 1991, 7 in 2001), by age (5 year age groups) and by sex.
- Register based census data(2011) by age and sex
- Total births by religion of the mother by year
- Total deaths by sex
- Net-migration to Vienna by age and sex
- Religious mobility by age (until 1983) and sex (only for exits)



# Methodology: Trial and Error

- Main idea 1: Project yearly from 1971 to 2011 by estimating all parameters (fertility, mortality, migration, secularization) by religion and checking/adjusting at each census step (81, 91, 01) for correctness
  - Failed mostly because of migration/religion/age/sex
- Main idea 2: Project in 5 year steps between censuses
  - Failed because of migration/religion/age/sex



# Alternative methodology

- Until 2001:
  - Step 1: Estimate the missing religious categories in the 4 censuses;

# Missing religious categories in census

- **1971**: Catholics, Protestants, Muslims, Other, no religion, unknown
  - Missing: Jews (MA23) and Orthodox (old Catholics, nationality of the **other** religion population – all European are assumed to be Orthodox: 93 M—99 F).
- **1981 and 1991**: Catholics, Protestants, Jews, Muslims, Other, no religion, unknown.
  - Missing: Orthodox (92 M – 95 F)
- **2001**: Catholics, Protestants, Jews, Muslims, Other, no religion, unknown.
  - No missing categories



# Overall methodology

- Until 2001:
  - Step 1: Estimate the missing religious categories in the 4 censuses;
  - Step 2: Estimate the population by age/sex/religion in the missing years (1972, 73, ..., 79, 80, ...82...) using linear or exponential interpolation by age (not by cohort).

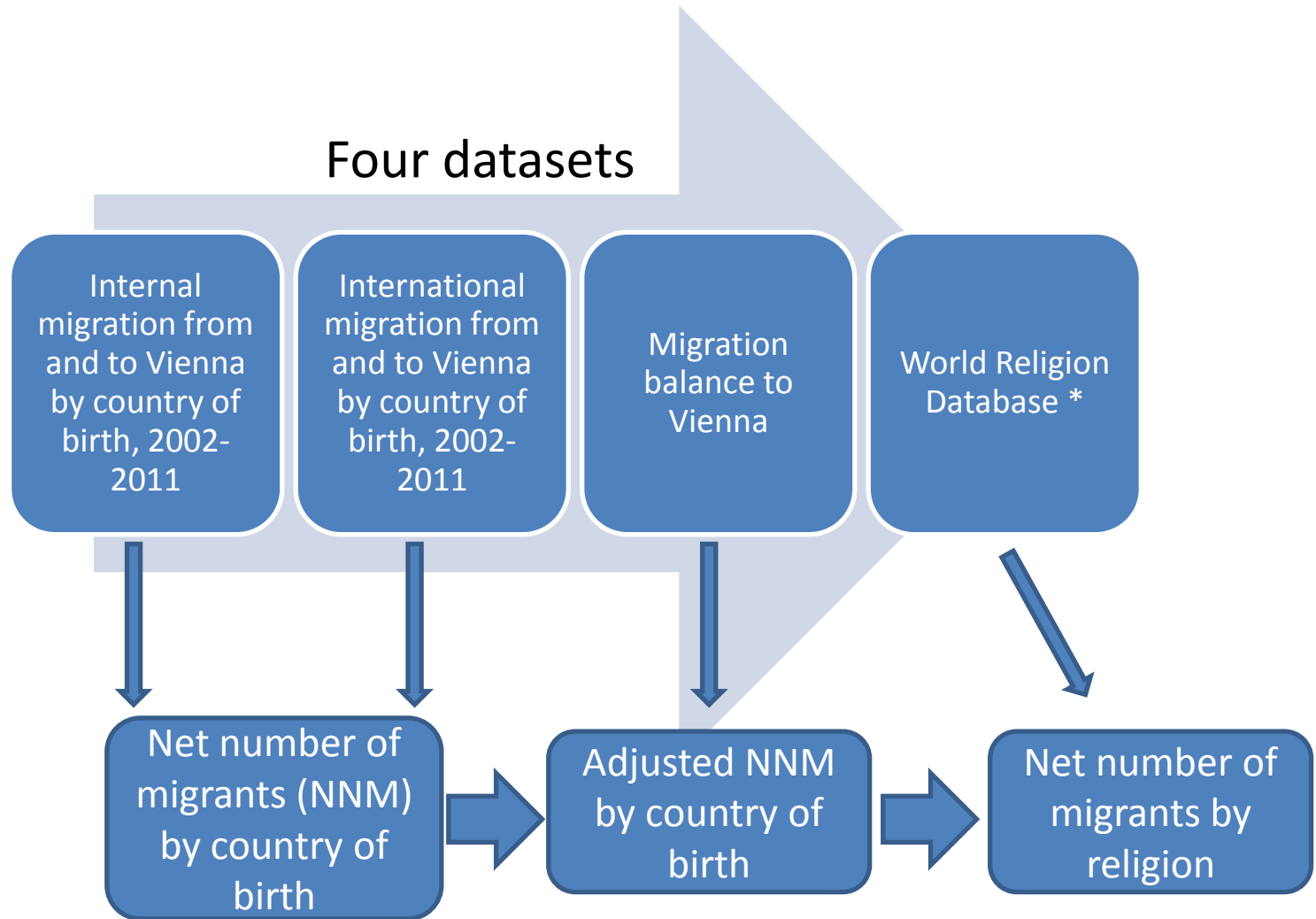


# Overall methodology

- Until 2001:
  - Step 1: Estimate the missing religious categories in the 4 censuses;
  - Step 2: Estimate the population by age/sex/religion in the missing years (1972, 73, ..., 79, 80, ...82...) using linear or exponential interpolation by age (not by cohort).
  - Step 3: Use splines to transform 5-year age groups/sex/religion to single years of age/sex/religion.
- Between 2001 and 2011:
  - Step 4: Project the population by age (5-year age groups), sex, and religion using available statistics on births by religion, deaths (randomly distributed), secularization, and estimated migrant statistics.

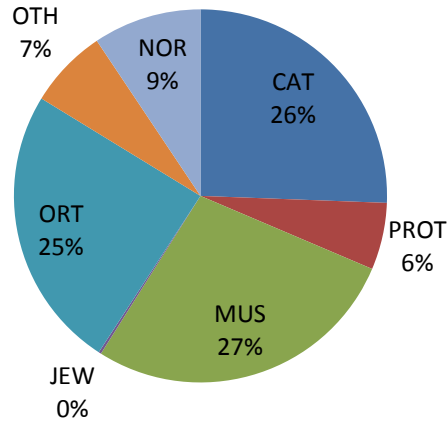


# Estimated migrant statistics by country of birth and random religious distribution

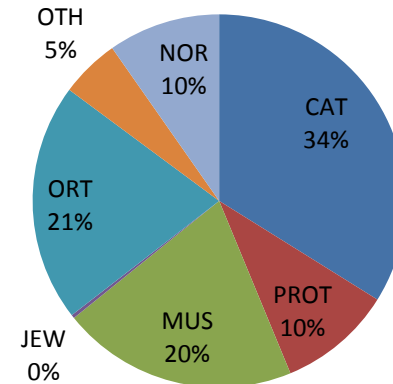


# Share of total migrants by religion in 2001-05 and 2006-11

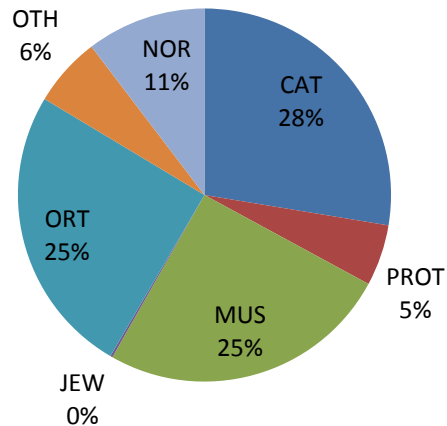
## Male 2001-05



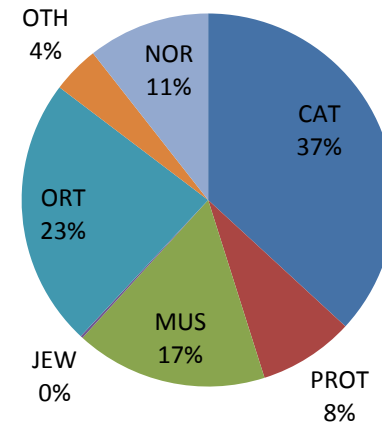
## Male 2006-11



## Female 2001-05

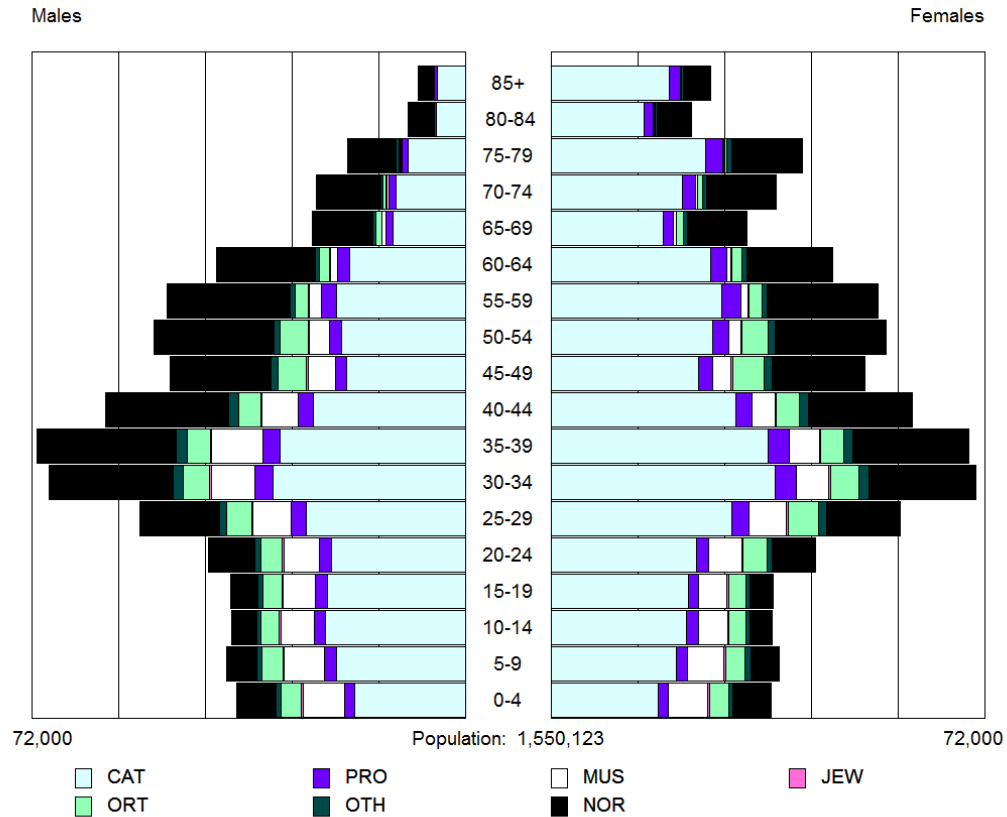


## Female 2006-11



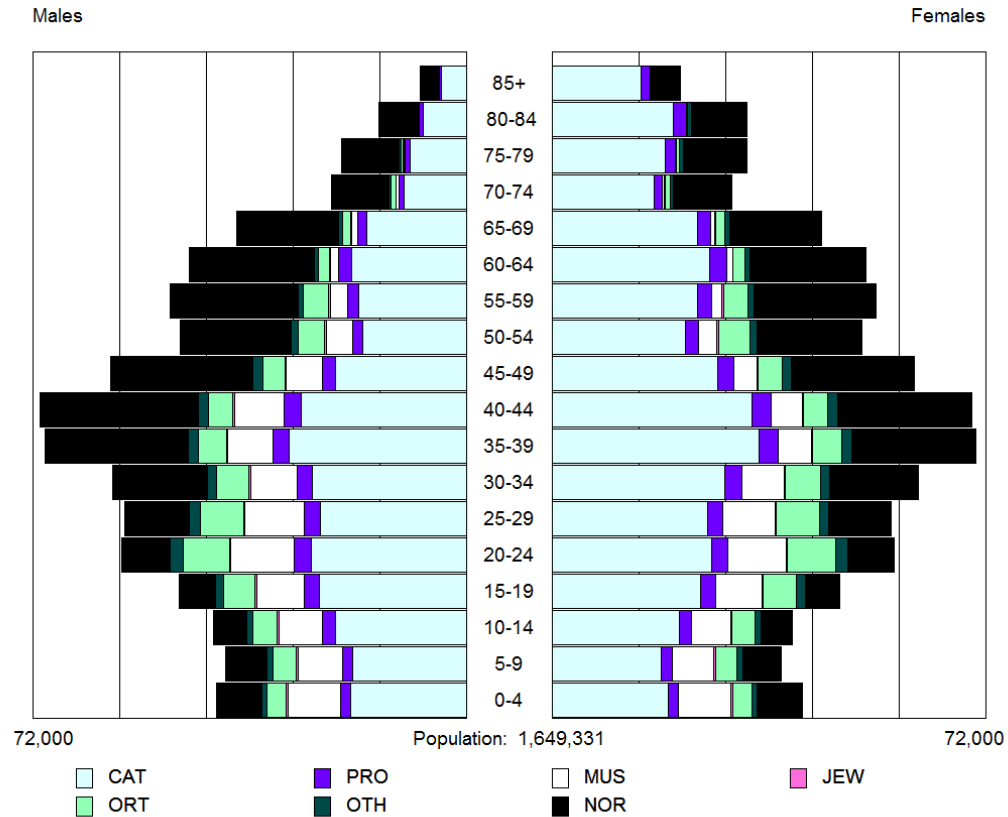


# Population and religion pyramid in 2001

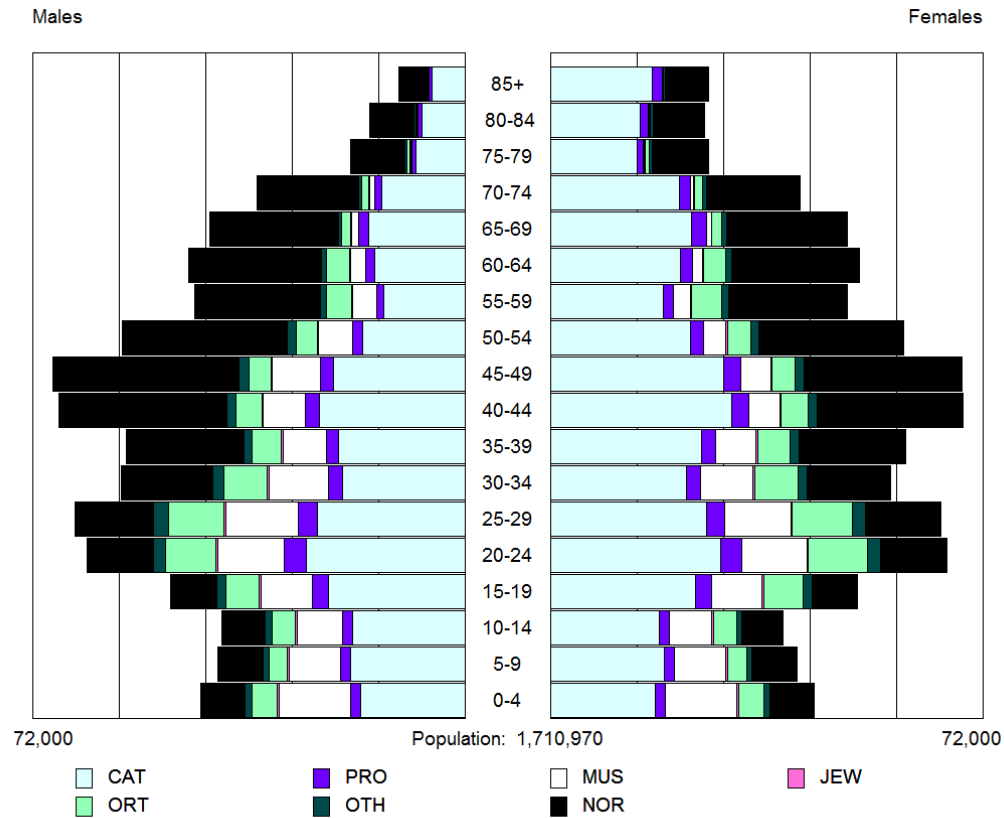




# Population and religion pyramid in 2006



# Population and religion pyramid in 2011



# Overall methodology

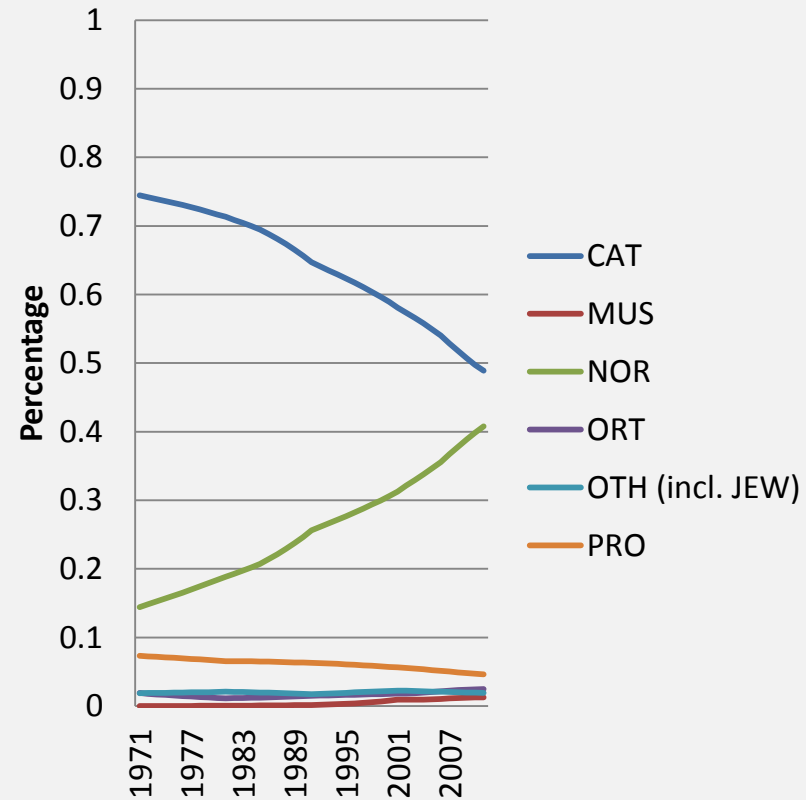
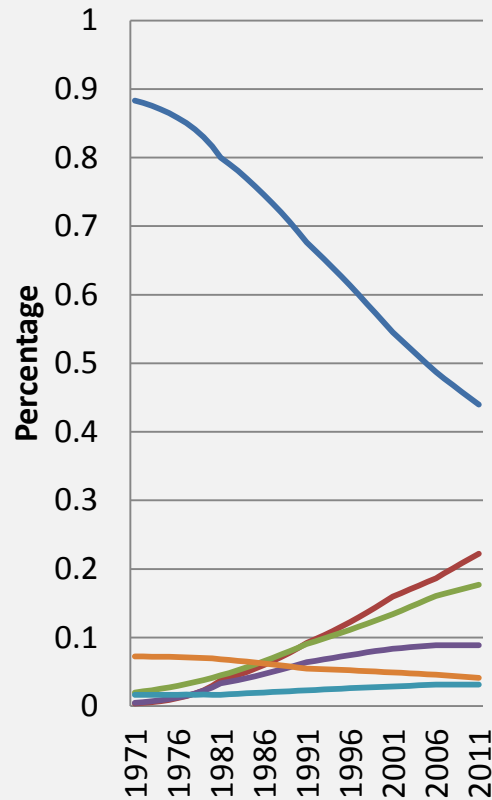
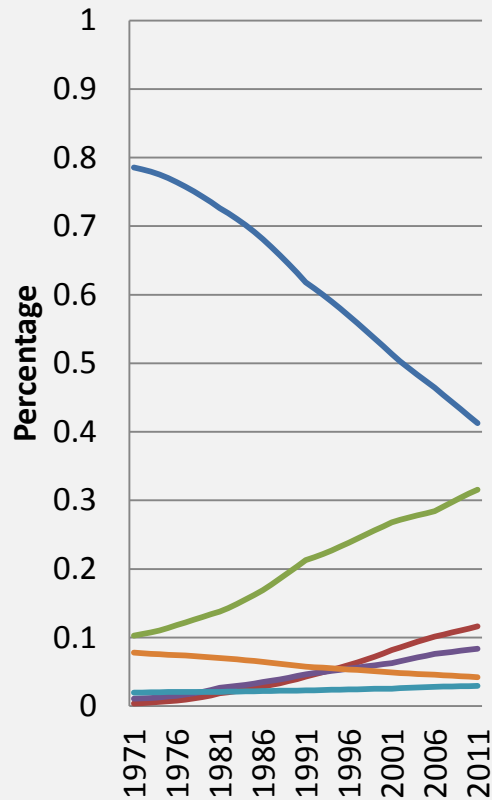
- Until 2001:
  - Step 1: Estimate the missing religious categories in the 4 censuses;
  - Step 2: Estimate the population by age/sex/religion in the missing years (1972, 73, ..., 79, 80, ...82...) using linear or exponential interpolation by age (not by cohort).
  - Step 3: Use splines to transform 5-year age groups/sex/religion to single years of age/sex/religion.
- Between 2001 and 2011:
  - Step 4: Project the population by age (5-year age groups), sex, and religion using available statistics on births by religion, deaths (randomly distributed), and secularization, and estimated migrant statistics.
  - Steps 5 & 6: Same as steps 2 & 3.

# Share of the population by religion and age groups (total, 0-14, 65+)

## Total population

## Population 0-14

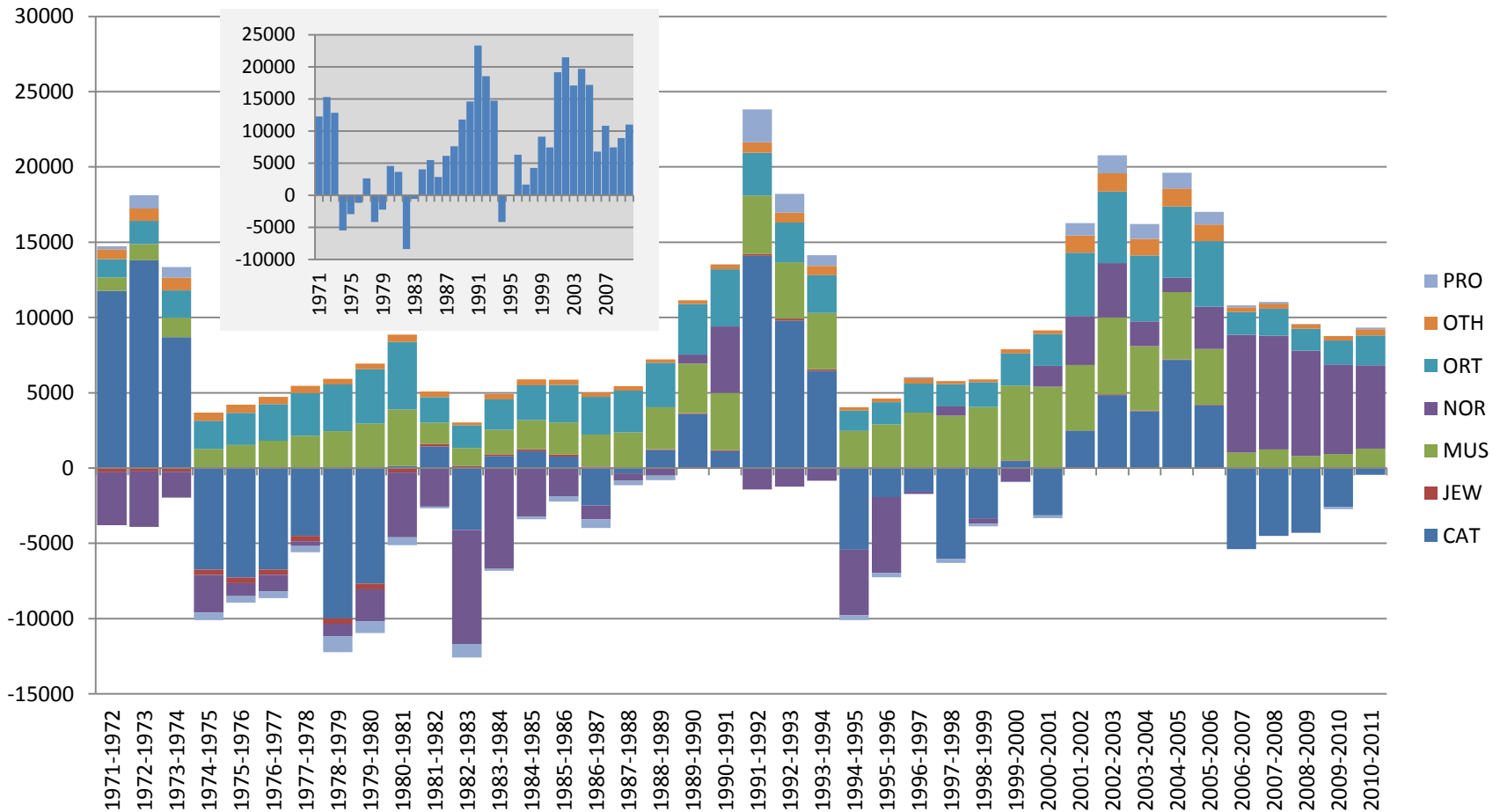
## Population 65+



- CAT
- MUS
- NOR
- ORT
- OTH (incl. JEW)
- PRO



# Total net number of migrants\* to Vienna by religion



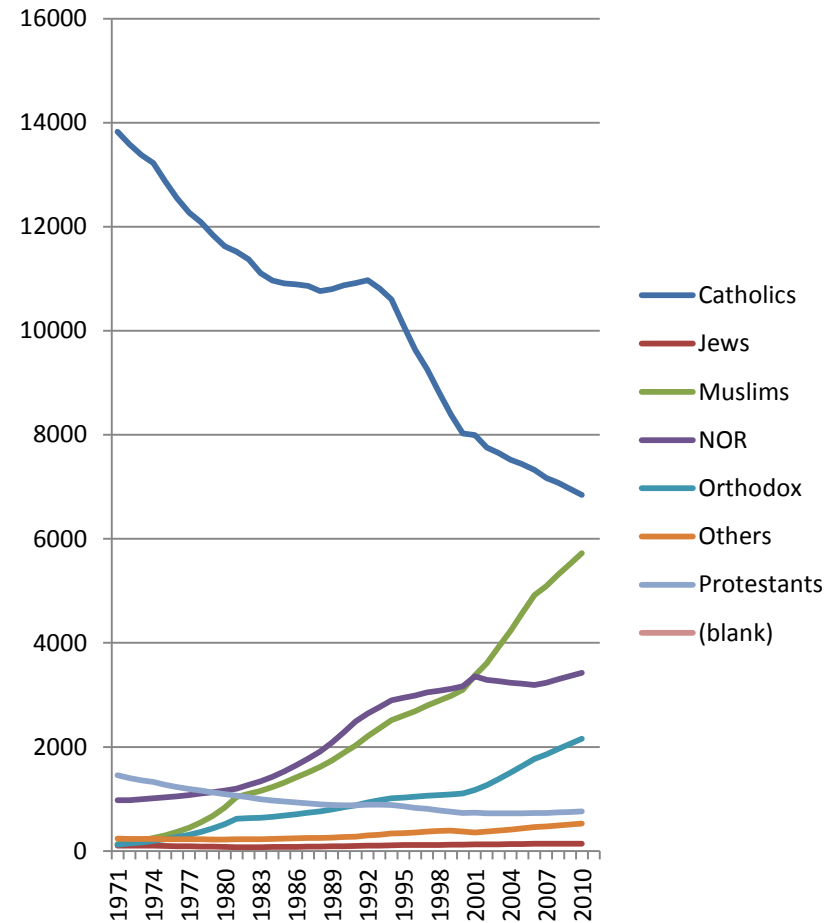
\* Note: Including internal and international migrants; Small graph: Net migration balance of Vienna (Statistics Austria)





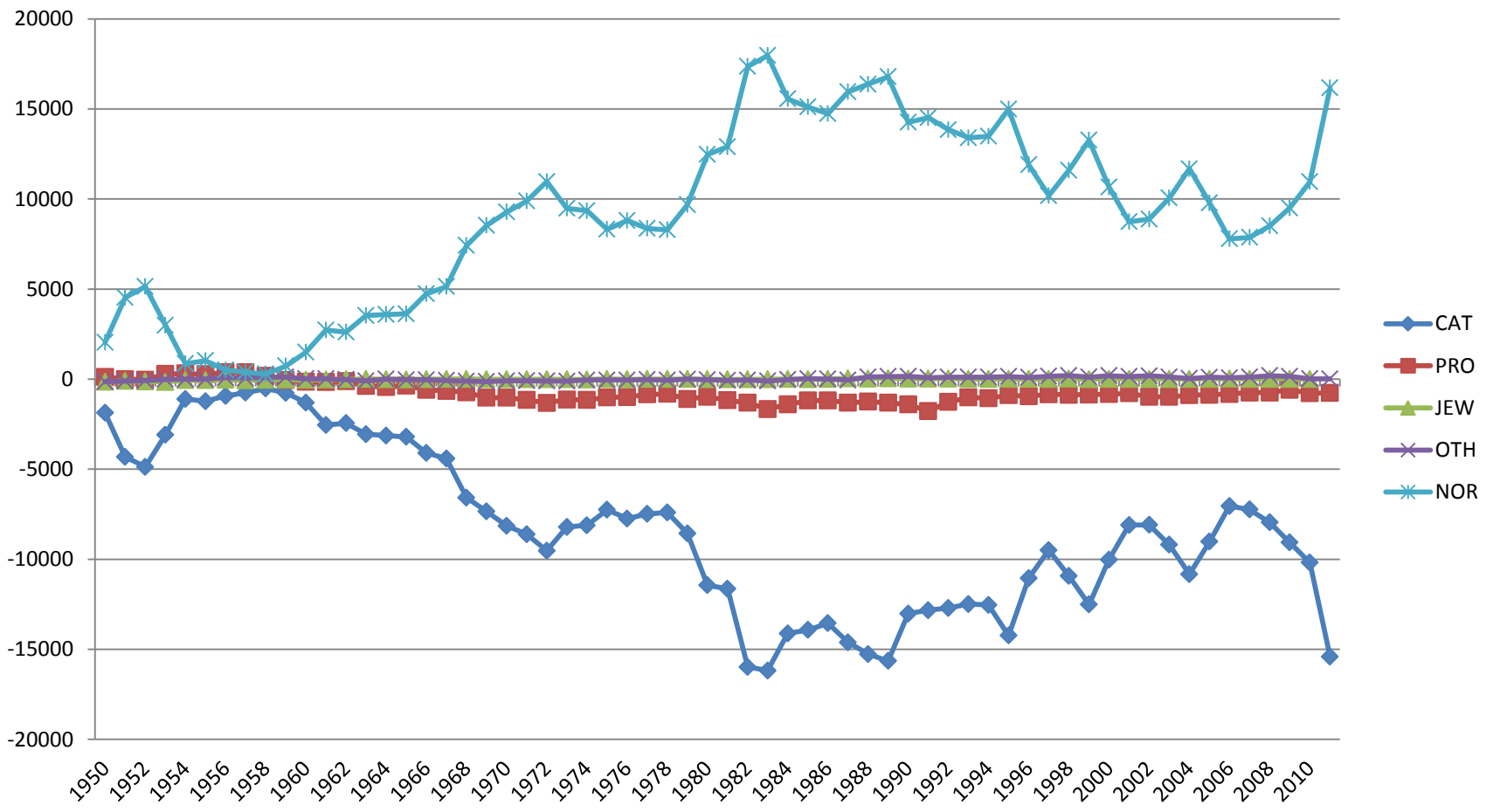
# Reconstruction of fertility

- Births and number of women





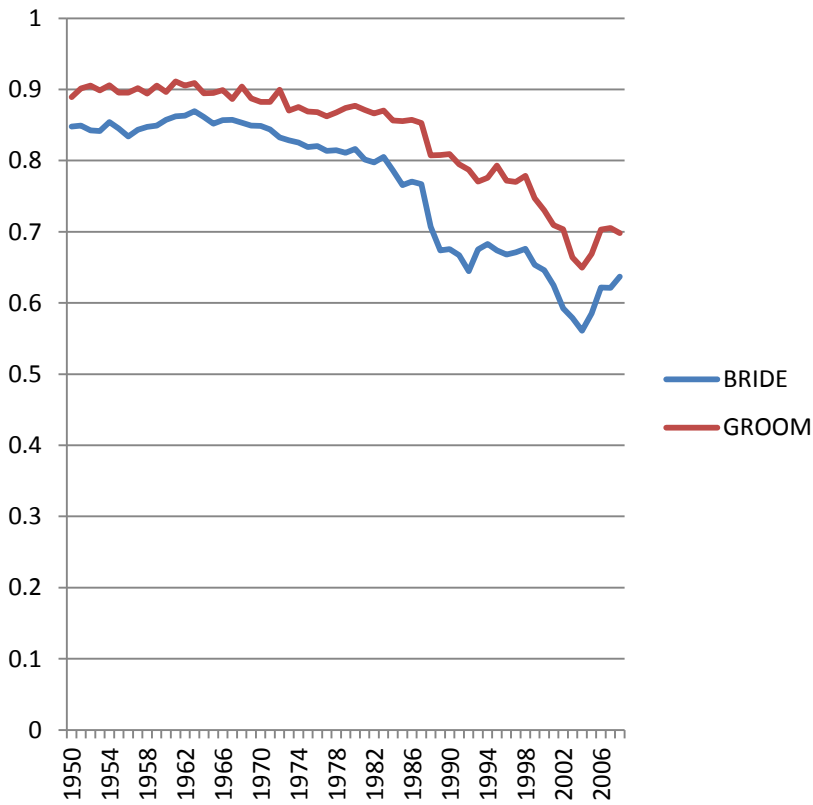
# Reconstruction of net-secularization



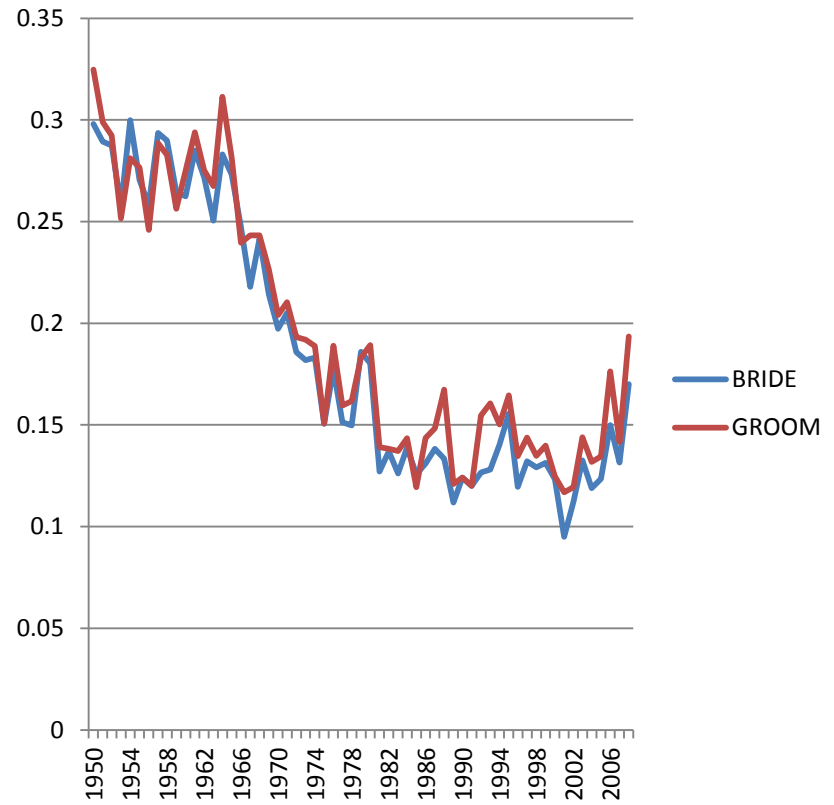


# Endogamy of Marriages

## Catholics



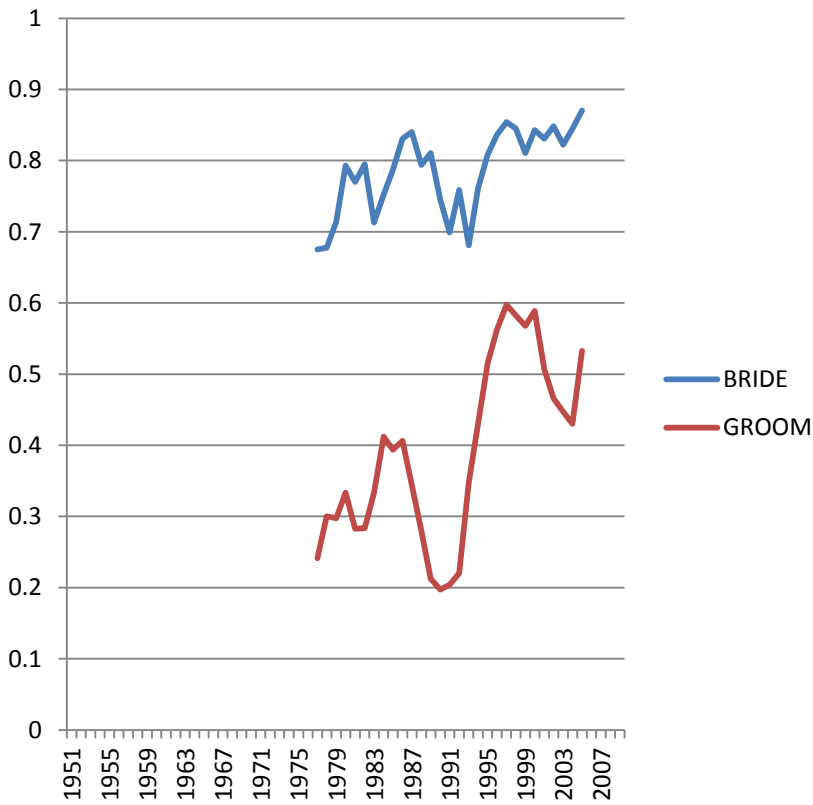
## Protestants



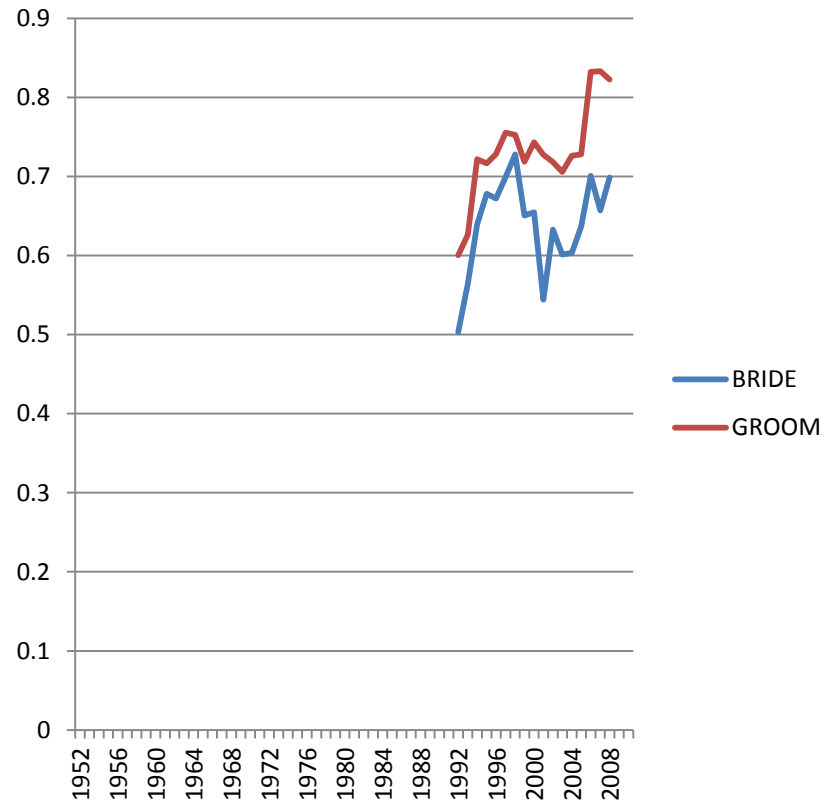


# Marriages

## Muslims



## Orthodox



# Outlook

- Check and recheck the data
- Inputs from Tomas and Krystof to adjust fertility in last 10 years
- Move forward to 2013?

# By product: Population balance equation

$$P_{t+1} = P_t + \text{Births} - \text{Deaths} + \text{InMigflow} - \text{outMigflow}$$

Known or  
estimated by  
religion

Known //  
random  
deaths

Internal +  
international  
migration to  
Vienna by  
country of  
nationality

Internal +  
international  
migration to  
Vienna by  
country of  
nationality

Net number of  
migrants by  
country of  
nationality