

Climate Variability and Human Migration in the 19th Century Netherlands

Extended Abstract for PAA 2013

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Introduction

Human migration and involuntary displacement are frequently identified as likely social outcomes of climate change and variability (Black et al. 2011). A handful of recent studies have linked population and climate data to directly test these effects, with results that are not consistent with common Malthusian narratives of large-scale, long-term displacement (Dillon et al. 2011; Fussell et al. 2010; Gray & Mueller 2012a & 2012b). These effects are often presumed to have been even stronger in the past, and climate variability is frequently invoked to explain historical population movements (Eriksson et al. 2012; Zhang et al. 2011). To date, however, few studies of the historical past have directly tested the effects of climate variability on human migration, in part due to data limitations (for an exception see Gutmann et al. 2005). To address this issue, we combine historical climate data with a unique dataset capturing the migration of 78,000 individuals in the Netherlands spanning the period 1812-1922. This will allow the estimation of a discrete-time event history model of migration as influenced by climatic, social and economic variables. This work responds to calls for additional quantitative studies of climate and migration (Gemenne 2011), and as well as calls for research on the vulnerability of past societies to climate variation (Pfister 2010).

The Historical Sample of the Netherlands

The Historical Sample of the Netherlands (HSN)¹ is a representative random sample of all people born in the Netherlands between 1812 and 1922 (Mandemakers 2002). A total of 78,105 individuals,

¹ Historical Sample of the Netherlands (HSN) Data Set Life Courses Release 2010.01.

known as research persons (RPs), are included in the database. 1812 marked the beginning of standardized civil registration of births, deaths, and marriages in the Netherlands. While the exact information varies by type of certificate, civil records typically include the name, age, occupation, literacy (can sign or not), place of birth, and marital status of individuals, as well as information on their spouse, parents, and witnesses. These certificates have been linked together to provide both static (birth date) and dynamic (marital status, occupation, place of residence) information about RPs. The state of data preservation in the Netherlands is excellent, as two copies of all certificates were made, one for local (municipal) officials and one for the province. Thus, nearly every civil record of birth, death, or marriage filed in the Netherlands remains available to researchers.

In addition to information gathered from certificates of birth, death, and marriage, the HSN has also collected, standardized, and linked all instances in which a RP was found in a population register, making it possible to draw upon all of these sources to reconstruct the life history of an individual. Population registers, begun in the Netherlands in 1850, are continuous records of households (and by 1930, individuals). Household (or population) registers record relationship to the household head, date and place of birth, sex, marital status, occupation, literacy, and religion. The date of entry and exit into the municipality is recorded, and all changes to the household are updated as they occur, usually within a month. Typically, these updates are dated, but in some instances the timing of the event must be inferred through the order of events or by crosschecking with vital registers. Each household is listed on a page or two of the register, and as changes occurred, the page was updated. For example, if a household member died, their entry would be crossed out of the register and a note would detail the date of death. If a household member moved out of the household, their entry would be crossed out and a note would detail when they left and where they migrated. New household members were added to the end of the household list, with notes about when and how they came to be in the household. Comparable systems of household registration were rare in the past (Mandemakers 2002), but are a

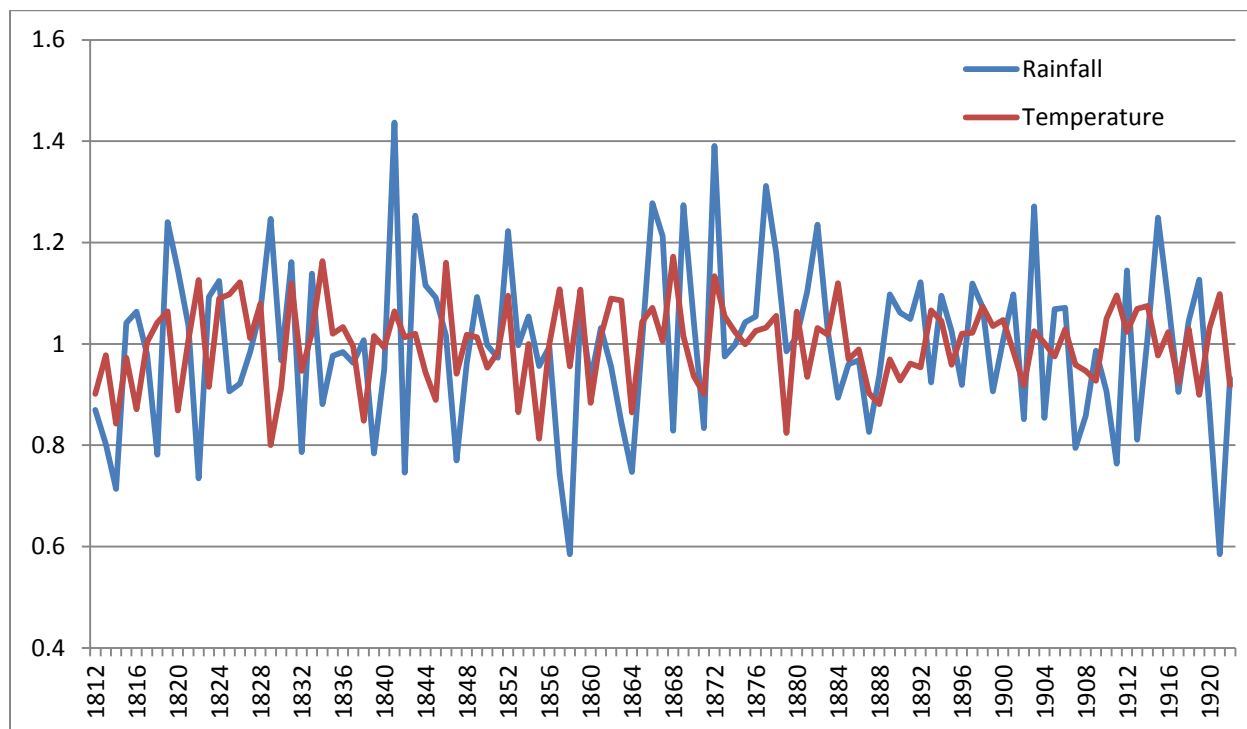
valuable source of demographic data, as they combine many of the characteristics of vital registration (timing of events) and census data (household location and composition) in a longitudinal form, yet did not replace these more traditional types of recording-keeping. In most regions, a household register began during a census year and was updated until the next census year, after which the information was transferred to a new register book.

Household registers have several advantages over linked birth, death, and marriage records, and linked census micro-data (see Campbell 2004 for a comparison of historical demographic data types). First, the continuous nature of population registers allows for more precise dating of events, such as entry and exit from a household, which improves data analysis, including the estimation of event-history models, which must be interval-censored in the case of linked decennial censuses. Continuous population registers also provide greater information about the changing nature of household composition, much of which could not otherwise be observed between census years. Finally, population registers give some indication about the nature of entries and exits from the household. Thus, it is possible to know whether an individual exited the household because of death, marriage, or migration, while with linked census records, these distinctions may be inferred in only the best cases.

The population registers and civil records included in the HSN allow researchers to track RPs over the life course. With detailed information on moves into and out of households and into and out of municipalities, this dataset is well suited to the study of migration in the past. In cases when the RP moved within the Netherlands, the HSN has found their subsequent entries in the population registers. Therefore, researchers can track the distance (calculated between the centroids of municipalities) and the nature (rural-urban, etc) of the move. If the RP leaves the Netherlands, it is often noted in the register. In addition, the HSN database provides time-varying information on covariates relevant to the study of migration including occupation, marital status, fertility, and household composition.

Climate Data

Monthly data on precipitation and mean temperature, from the cities of Hoofddorp and De Bilt respectively, are available from the Royal Netherlands Meteorological Institute for the entire period covered by the HSN data. The figure below shows total annual precipitation and mean annual temperature divided by the mean over this period, revealing a number of years of drought as well as flooding. In addition to examining the effects of temperature and precipitation separately, we will also combine these values into a drought index, specifically the Standardized Precipitation-Evapotranspiration Index (Vicente-Serrano et al. 2010).



Analysis

These data will be combined into a person-year dataset with time-varying variables at individual, household and contextual levels. The primary migration outcome will be defined as a change of municipality, though we will also examine moves between households. To analyze these data, we will

estimate a multilevel discrete-time event history model with random effects at the household and municipal scale. Various specifications of precipitation, temperature and the drought index will be tested for their effects on migration, and a standard set of demographic, economic and social variables will be included as controls. Municipality-level fixed effects and various specifications of the underlying migration trend will account for the local and temporal contexts of migration. These analyses will allow us to test multiple key hypotheses about climatic effects on migration in this context, including that (1) climatic variability increased migration, especially for the poor, and (2) the strength of these effects declined over the 100-year study period as the Netherlands modernized and developed.

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