Analysing migration between Germany and other EU countries

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Synopsis

The aim of this study is to analyse the data of migration between Germany and other EU countries in the time frame between 1974 to 2014. We will explore the data analyse change in time, and relative to countries, use the data to forecast mogration in years 2015 and 2016.

To summarize the result, we see a incresing pattern in the number of migrations both to and from Germany, specially from 2000's. The highest total number of departure from Germany to another country took place in 2014 to Poland with 138 thousand migrants. And the greatest number of people came to Germnay from another cuntry were also from Poland in 2014 with around 197 thousand. Finally we concluded a meanigful difference between the number of Female and Male migrants from Germany both in the years 2013 and 2014.

Data exploration

The dataset contains the number of people arrived to or departed from Germany for living from 1947 to 2014. It also gives these data based on the gender of migrants.

To have an understanding of the pattern here you can see the total number of arrivals and departures based on gender.
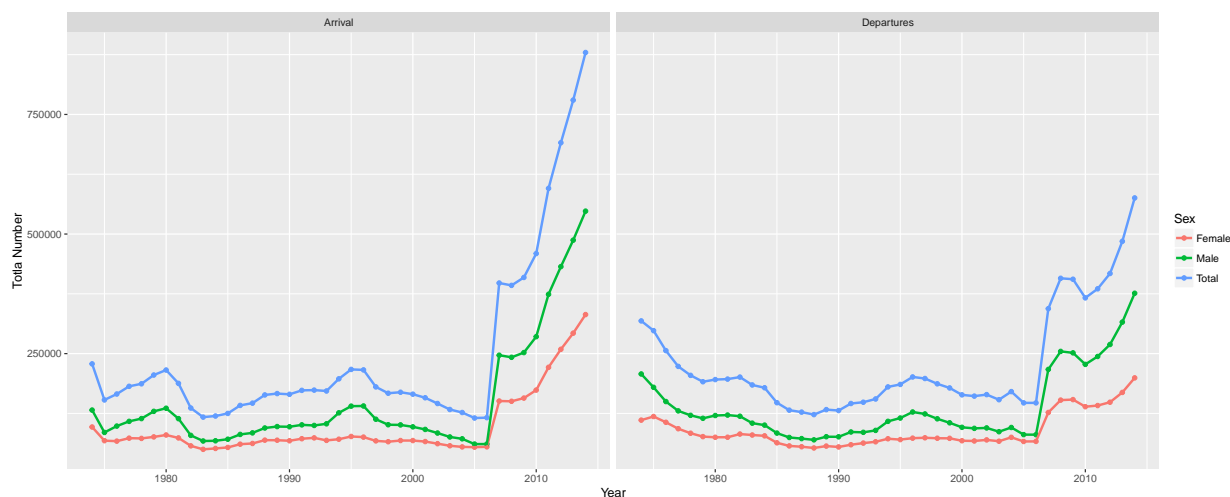
It can be seen that the trend in both arrivals and departures is roughly increasing specially from mid 2000's. Also till mid 2000's the number of departures is roughly equal and sometimes more that the number of arrivals. But from then the number of arrivals started increasing faster and gets higher than departures.

The maximum number of departures/Arrivals

We want to explore how many people came and left when and where the most. These can be seen the best in the plots below
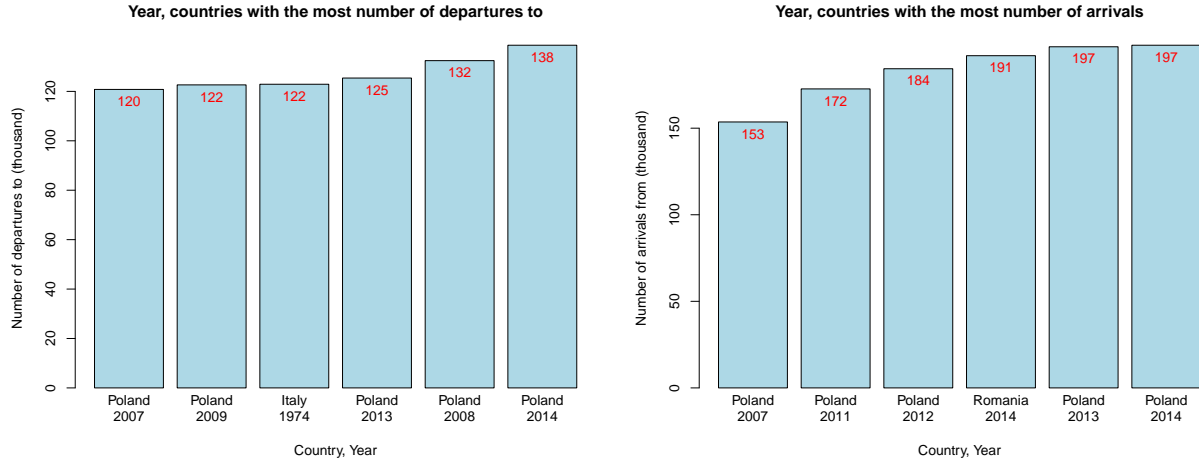
Based on the plots, in the yeras 2008 and 2014 respectively 132 and 138 thousand people have left Germany to Poland which are the most number of departures to a single country. Also in each of years 2013 and 2014, 197 thousand people came to Germany from again Poland.

Forecasting

As no seasonal pattern could be seen in the data but there are local trends in them, I decided to use the linear exponetial smoothing method for forecasting. The results of forecasting including 95 percent confidence intervals can be seen in the following charts and table.

Table 1: Forecast of the number of arrivals and departures to and from Germany

State	Arrival/Departure	2015	Conf. Interval	2016	Conf. Interval
Austria	Arrivals	19,557	(16806,22307)	19,821	(16806,22307)
Austria	Departures	21,293	(18661,23924)	21,148	(18661,23924)
Belgium	Arrivals	6,307	(6053,6560)	6,515	(6053,6560)
Belgium	Departures	5,344	(4953,5735)	5,359	(4953,5735)
Bulgaria	Arrivals	82,296	(77638,86954)	90,381	(77638,86954)
Bulgaria	Departures	49,162	(48179,50145)	54,110	(48179,50145)
Croatia	Arrivals	44,240	(NA,NA)	44,240	(NA,NA)
Croatia	Departures	17,327	(NA,NA)	17,327	(NA,NA)
Cyprus	Arrivals	1,182	(1036,1329)	1,307	(1036,1329)
Cyprus	Departures	521	(455,586)	545	(455,586)
Czech Republic	Arrivals	13,777	(12632,14923)	14,650	(12632,14923)
Czech Republic	Departures	9,086	(7833,10339)	9,342	(7833,10339)
Denmark	Arrivals	3,368	(3022,3714)	3,187	(3022,3714)
Denmark	Departures	3,668	(3153,4184)	3,695	(3153,4184)
Estonia	Arrivals	1,244	(988,1500)	1,309	(988,1500)
Estonia	Departures	991	(922,1060)	1,037	(922,1060)
Finland	Arrivals	2,620	(2137,3103)	2,636	(2137,3103)
Finland	Departures	2,416	(2044,2788)	2,411	(2044,2788)
France	Arrivals	23,399	(20383,26416)	23,492	(20383,26416)
France	Departures	19,551	(17806,21295)	19,584	(17806,21295)
Greece	Arrivals	31,273	(25057,37489)	30,859	(25057,37489)
Greece	Departures	16,273	(9933,22612)	15,483	(9933,22612)
Hungary	Arrivals	66,013	(60333,71692)	71,774	(60333,71692)

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State	Arrival/Departure	2015	Conf. Interval	2016	Conf. Interval
Hungary	Departures	43,965	(40658,47271)	46,906	(40658,47271)
Ireland	Arrivals	2,967	(2063,3872)	3,016	(2063,3872)
Ireland	Departures	2,388	(1510,3265)	2,429	(1510,3265)
Italy	Arrivals	75,500	(63036,87964)	77,640	(63036,87964)
Italy	Departures	36,700	(29475,43925)	37,098	(29475,43925)
Latvia	Arrivals	8,270	(6184,10356)	9,093	(6184,10356)
Latvia	Departures	6,520	(5804,7237)	7,215	(5804,7237)
Lithuania	Arrivals	11,279	(9517,13041)	12,232	(9517,13041)
Lithuania	Departures	6,700	(6368,7032)	7,204	(6368,7032)
Luxembourg	Arrivals	3,773	(3561,3985)	3,895	(3561,3985)
Luxembourg	Departures	2,884	(2725,3042)	2,986	(2725,3042)
Malta	Arrivals	317	(262,372)	339	(262,372)
Malta	Departures	300	(269,332)	322	(269,332)
Netherlands	Arrivals	14,384	(13389,15378)	14,472	(13389,15378)
Netherlands	Departures	11,724	(10793,12656)	11,772	(10793,12656)
Poland	Arrivals	211,756	(186892,236620)	222,109	(186892,236620)
Poland	Departures	139,631	(125660,153601)	140,583	(125660,153601)
Portugal	Arrivals	11,507	(6661,16353)	11,053	(6661,16353)
Portugal	Departures	7,990	(2532,13448)	7,377	(2532,13448)
Romania	Arrivals	187,227	(169502,204951)	207,227	(169502,204951)
Romania	Departures	128,557	(118760,138354)	140,387	(118760,138354)
Slovakia	Arrivals	15,942	(14340,17543)	16,899	(14340,17543)
Slovakia	Departures	11,568	(10375,12762)	11,851	(10375,12762)
Slovenia	Arrivals	7,685	(6751,8619)	8,493	(6751,8619)
Slovenia	Departures	4,377	(3976,4778)	4,751	(3976,4778)
Spain	Arrivals	43,862	(40892,46832)	46,633	(40892,46832)
Spain	Departures	27,393	(24462,30325)	30,636	(24462,30325)
Sweden	Arrivals	4,370	(3972,4768)	4,405	(3972,4768)
Sweden	Departures	4,609	(4208,5010)	4,644	(4208,5010)
United Kingdom	Arrivals	18,682	(16123,21240)	18,786	(16123,21240)
United Kingdom	Departures	19,506	(17450,21562)	19,780	(17450,21562)

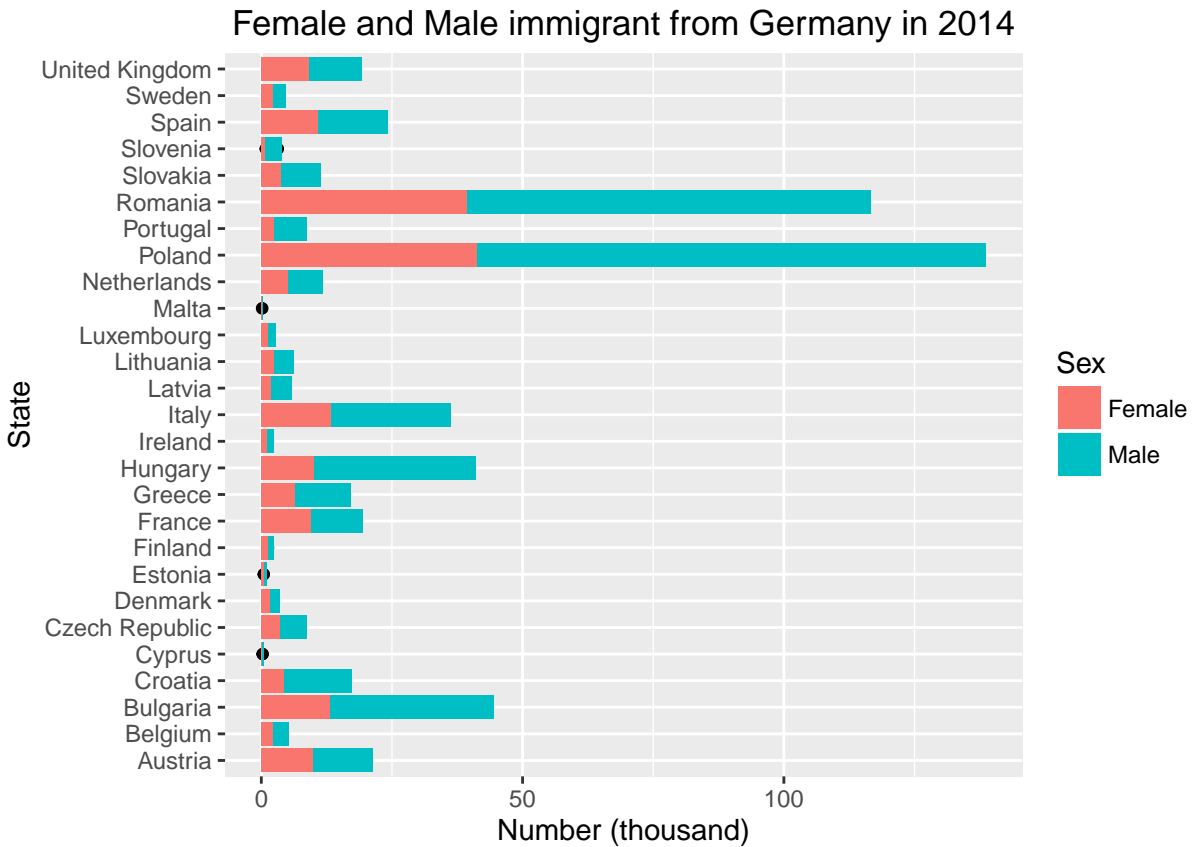## Difference between the number of male and female travelers

To test the significance of difference I tested the null hypothesis that the number of male and female travelers are equal against the alternative hyphothesis that they are different. As we are dealing with a contingency table of count data, I decided to use the χ^2 test.

I developed contingency tables of states vs sex for both years. Below is an interactive chart of the table for 2013.

Female and Male immigrant from Germany in 2013

And for 2014

Female and Male immigrant from Germany in 2014
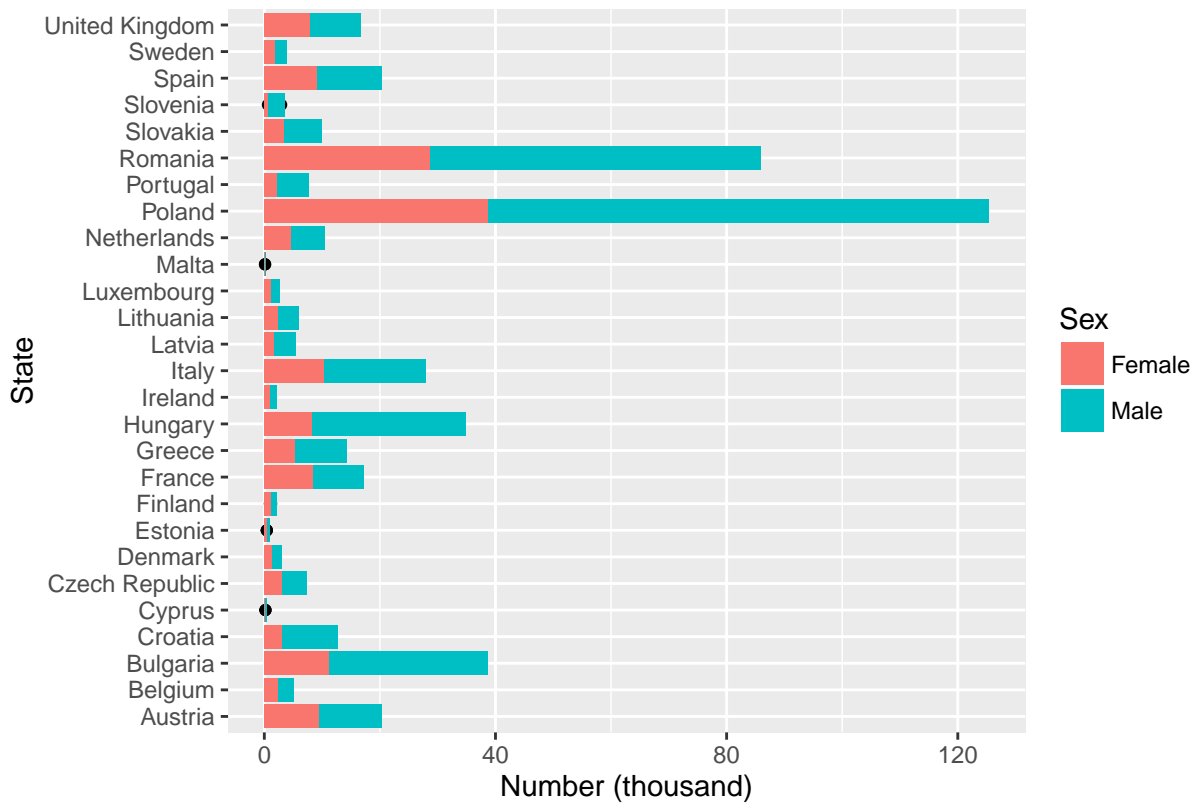
Then I ran a χ^2 test on the contingency tables assuming 50% probability for each sex. The P-value of the twat for both years are almost zero. So the null hypothesis is rejected and the number of male and female migrants are significantly different.

Reference

Statistisches Bundesamt, Wiesbaden 2016