

Japanese inter-regional migration patterns affected by 2011 Tohoku Disaster, analyzed with 2015 Japan Population Census

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Swift restoration gathers peoples attention, adding to the **direct impact** of the disaster

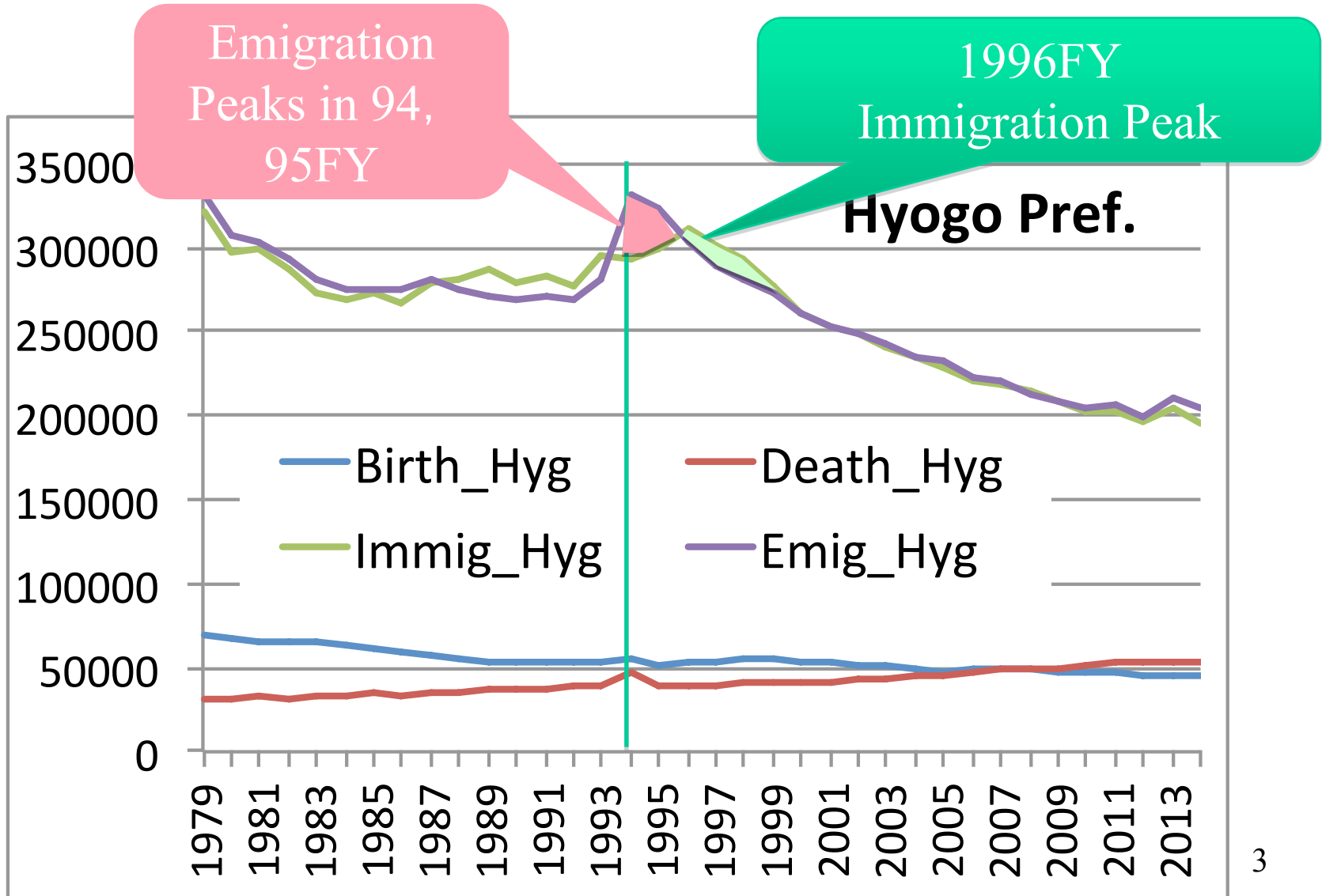


We conduct a research to **capture the restoration trend** through population change based on the **Annual migration statistics** (Quantitative Analysis)

➡ Presented at IDRiM 2017 in Reykjavik (Aug.25)

Migration flows to be enlarged after a disaster!

Hyogo Prefecture with Kobe Earthquake in 1995



Statistical Analysis of migration flows

Annual Emigration / Immigration
Numbers from/to each Prefecture

Inhabitant Registration Statistics (1973-2013)

||

Migration free from disaster
(Normal Migration Pattern)

+

Enlargements by Disaster(s)

regressed

Fixed Effect of
Panel Data Analysis

Disaster Size (measured by annual
R.I.A.: Relative Affected Inhabitants)

Disaster Statistics by Fire Agency

Categorization of Disaster Size ($D_{i,t}$)

- Disaster size is captured by annual relative affected inhabitants.
(Number of affected inhabitants / prefecture inhabitants)
- Variables are categorized in four different size.

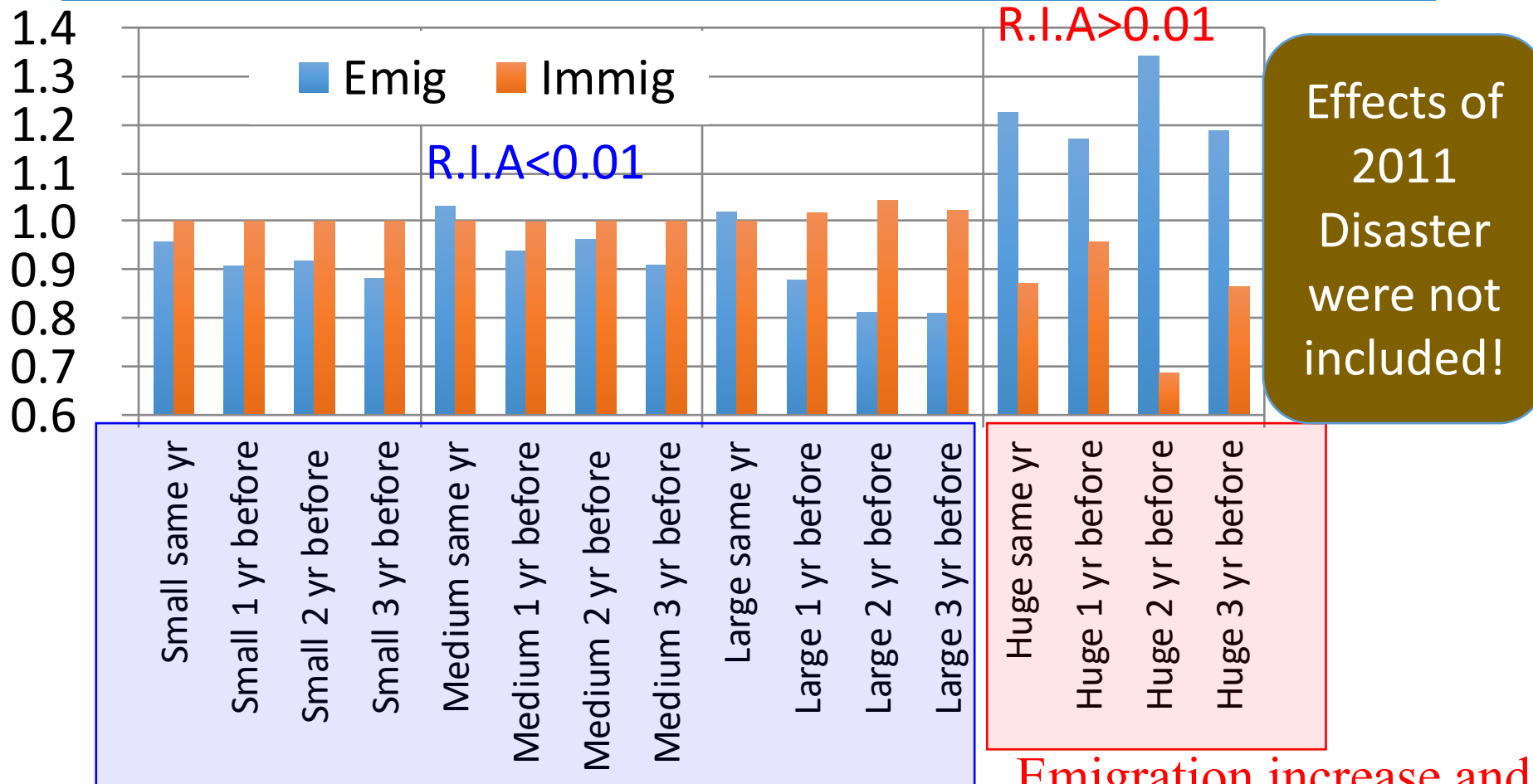
	Annual R.A.I	Number of cases	Cumulative %	
No Disaster	0	296	14.35%	
Small Size D.	$0 <$	<0.0001	857	55.89%
Medium Size D.	$0.0001 \leq$	<0.001	587	84.34%
Large Size D.	$0.001 \leq$	<0.01	276	97.77%
Huge Size D.	$0.01 \leq$		47	100.00%

R.A.I is prepared annually for each prefecture (1970-2013) excluding Okinawa before 1974.

We estimate the effect up to 3 years before.

We did not consider Tohoku 3 Prefectures, because of lack of reliable number of affected people in Fire Agency Statistics.

Estimated Enlargement effects by disaster of different size

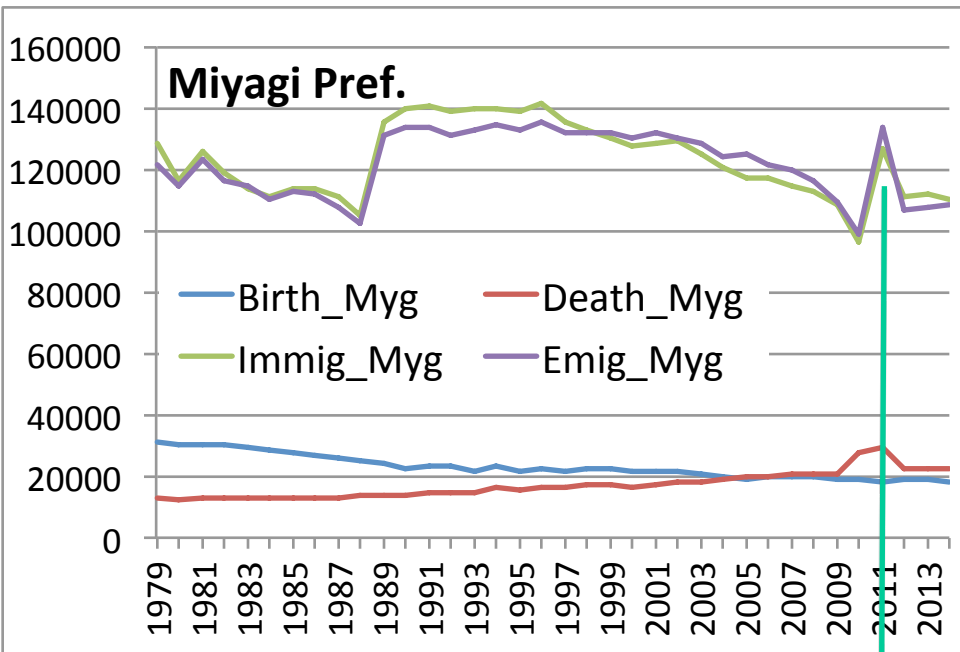


Emigration will shrink after one year
No negative effect on Immigration

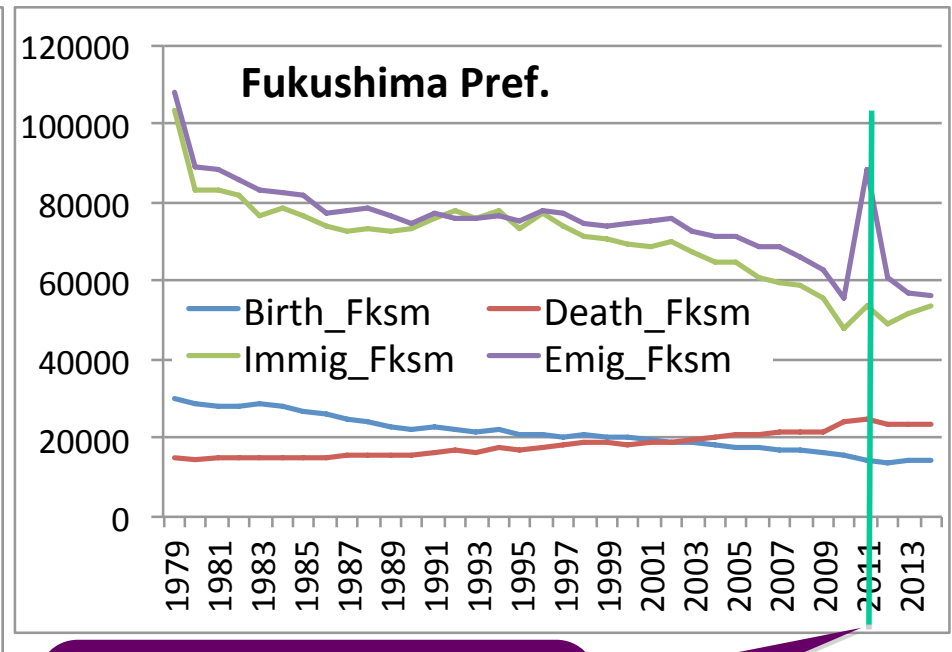
- No social decrease of Population

Emigration increase and
Immigration decrease
Social decrease of
population

Migration in Fukushima seems different after the Tohoku Earthquake, Tsunami and Nuclear Accident in 2011



Immigration Peak appeared, as well as Emigration



Only emigration Peak was appeared in Fukushima

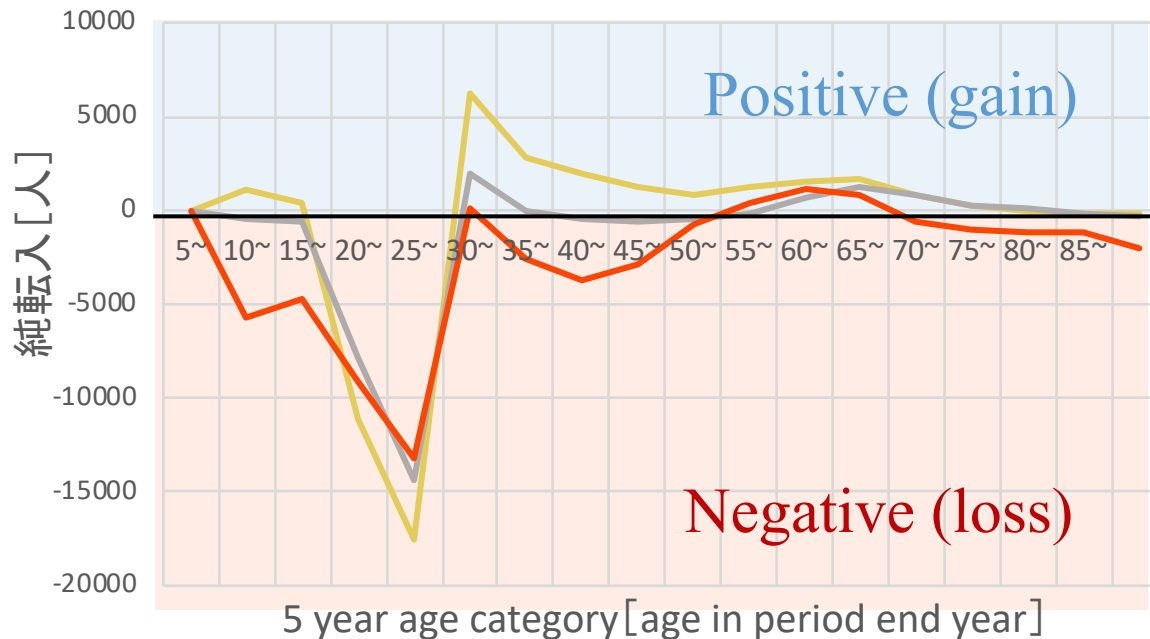
Let us investigate migration pattern **more qualitatively!**

TWO NATIONAL STATISTICS

	Migration Report by Residence Registration	Japan Population Census
Interval	Annual	5 years (Questions on migration: once in 10 years)
Published Contents	Quantitative Info: Numbers of total emigrants and Immigrants of each Prefecture or municipality.	Including Qualitative Info.: Age Structure Origin and Destination Prefectures
Source	Aggregate the residence registration from municipal governments	Exhaustive Survey to the people actually reside. (Direct distribution and collection)
Problem in Fukushima case	Many emigrants do not move registration , in order to keep rights to get support for the people affected by the Nuclear Accidents.	We cannot capture people's migrations who already return to Fukushima by Oct.2015.

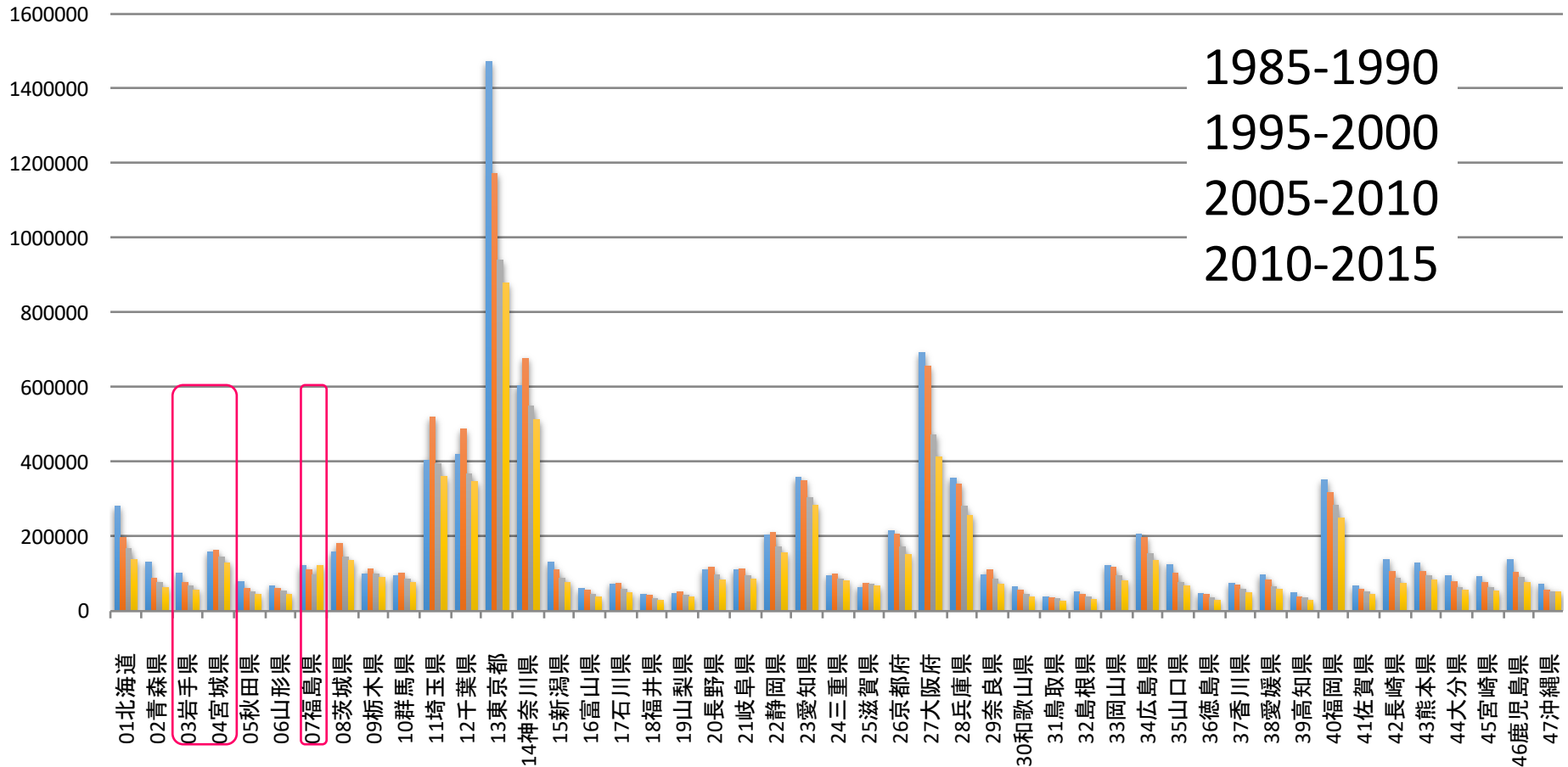
NET-MIGRATION ANALYSIS For Age-classes

Fukushima Prefecture
5 years net-migration
(Immigration – emigration)



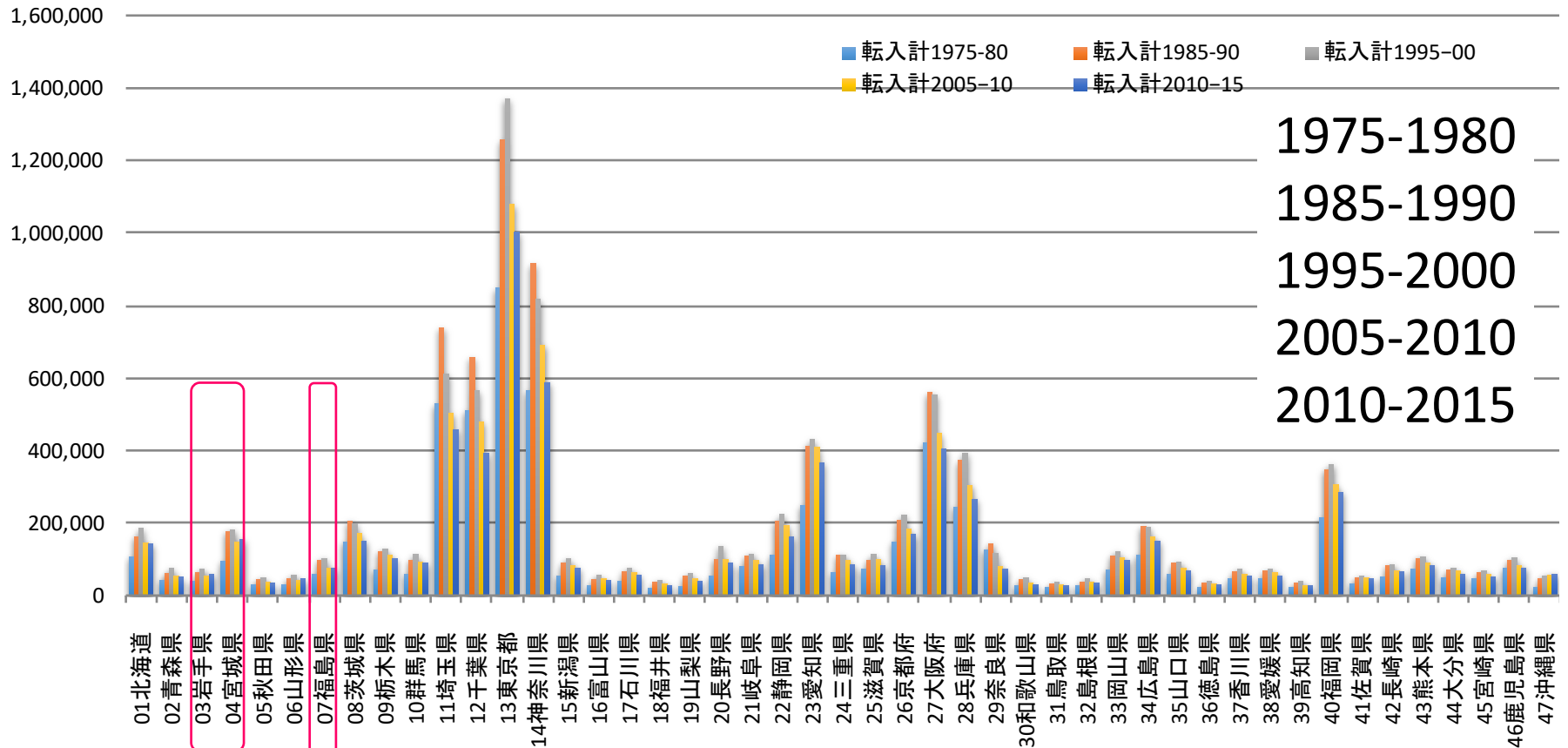
— 1995~2000年 — 2005~2010年 — 2010~2015年

Emigration from each Prefecture in the four intervals



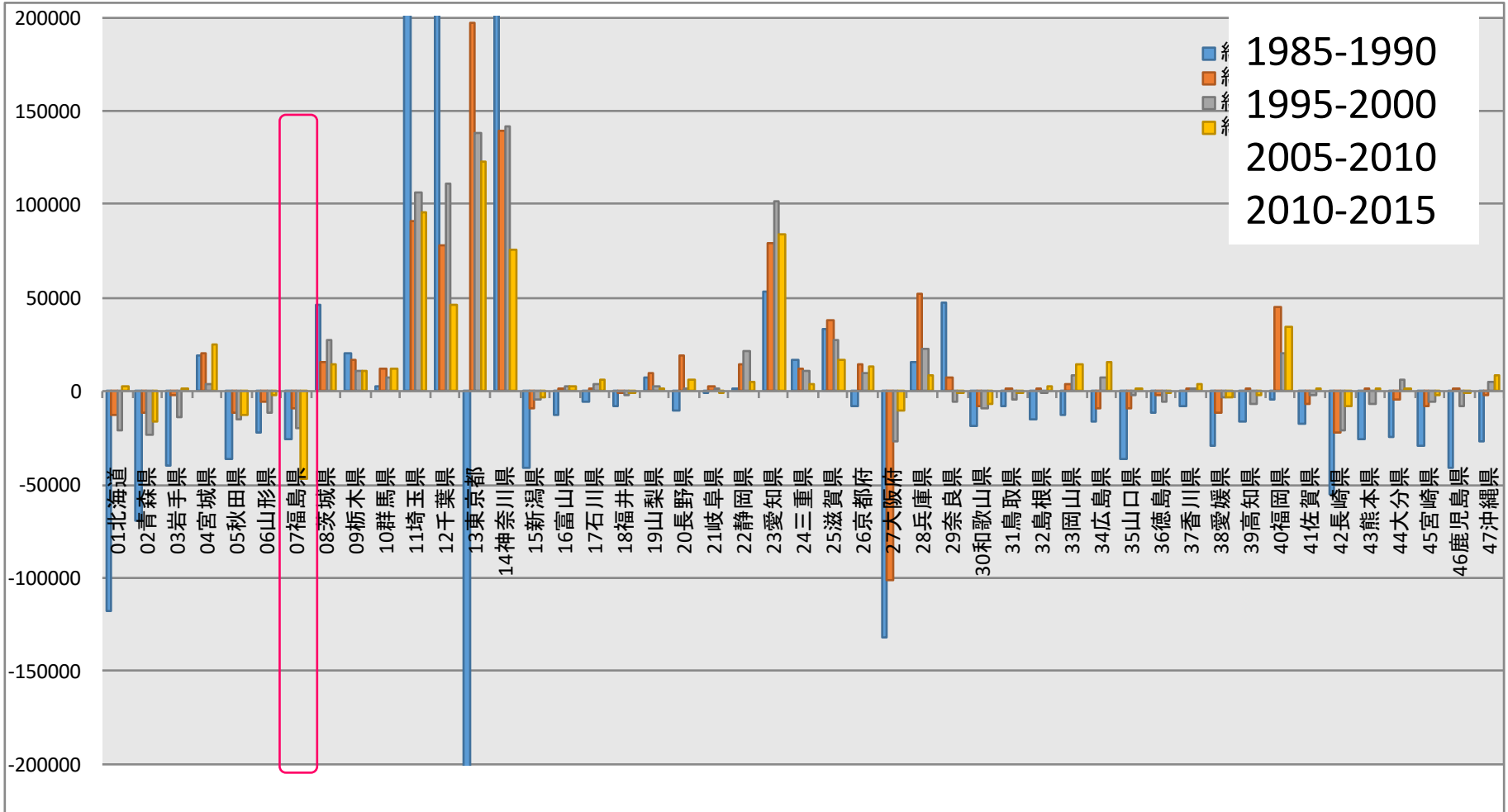
Fukushima is the only prefecture where number of emigrants grew in between 2010-2015.

Immigration to each Prefecture in the four intervals



There are no particular characteristics
in Tohoku Prefectures

Net Immigration to each Prefecture in the four intervals

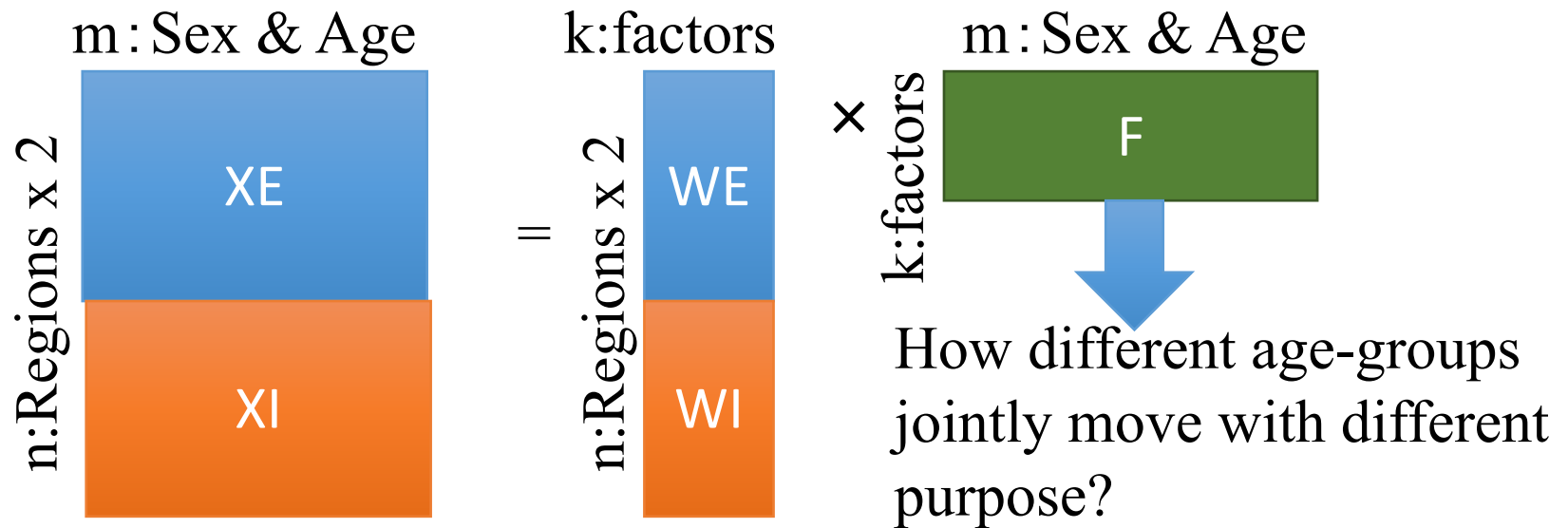


Fukushima is the only prefecture where net loss of migration grew in between 2010-2015.

Qualitative Analysis focusing on gender and age.

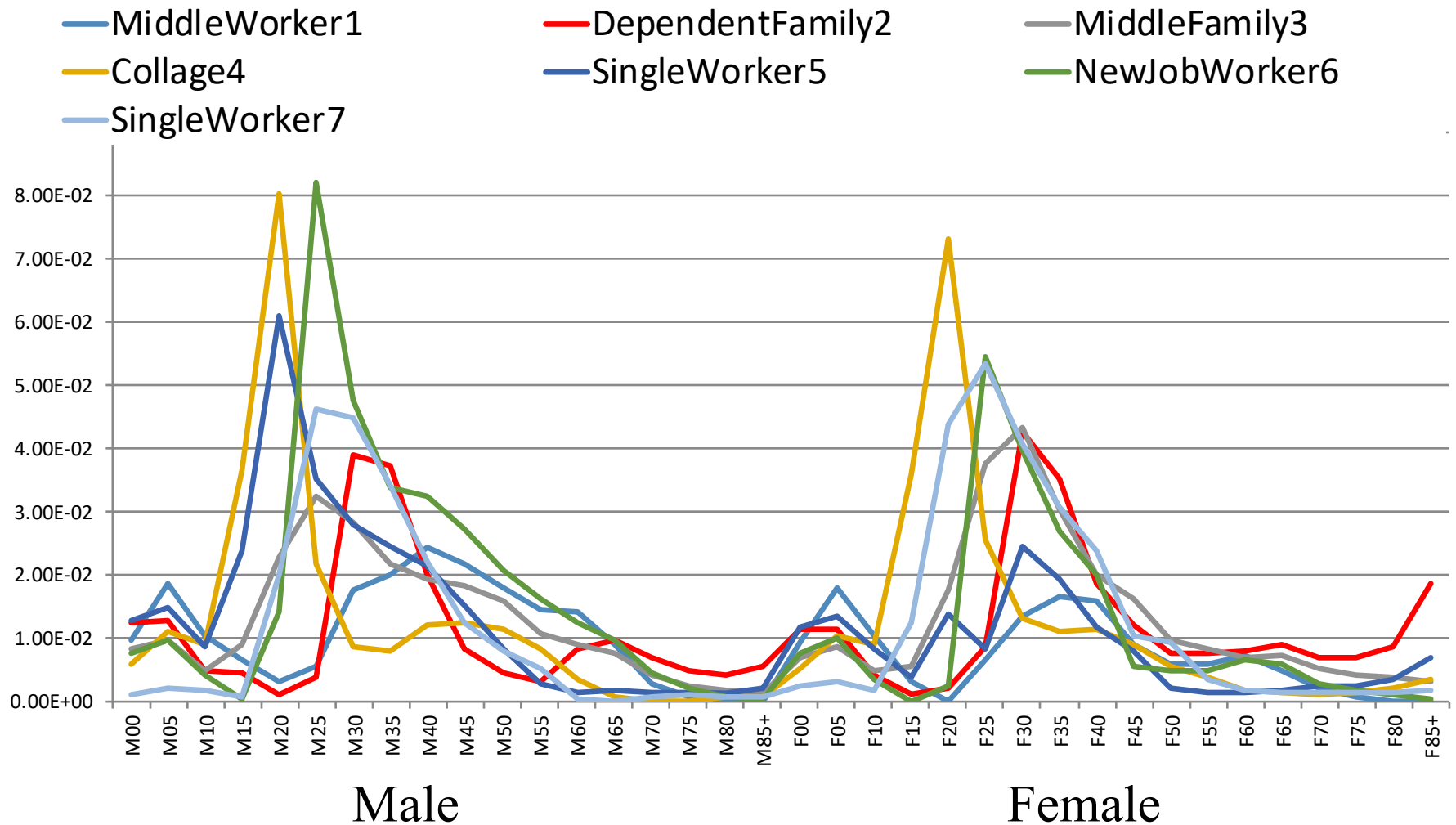
NMF: Non-negative Matrix Factorization

- Non negative factorization Method can show several sex-age migration patterns and give weightings for each region.
- Each factor may correspond to objective of migration, but we do not know the number of factors a priori.

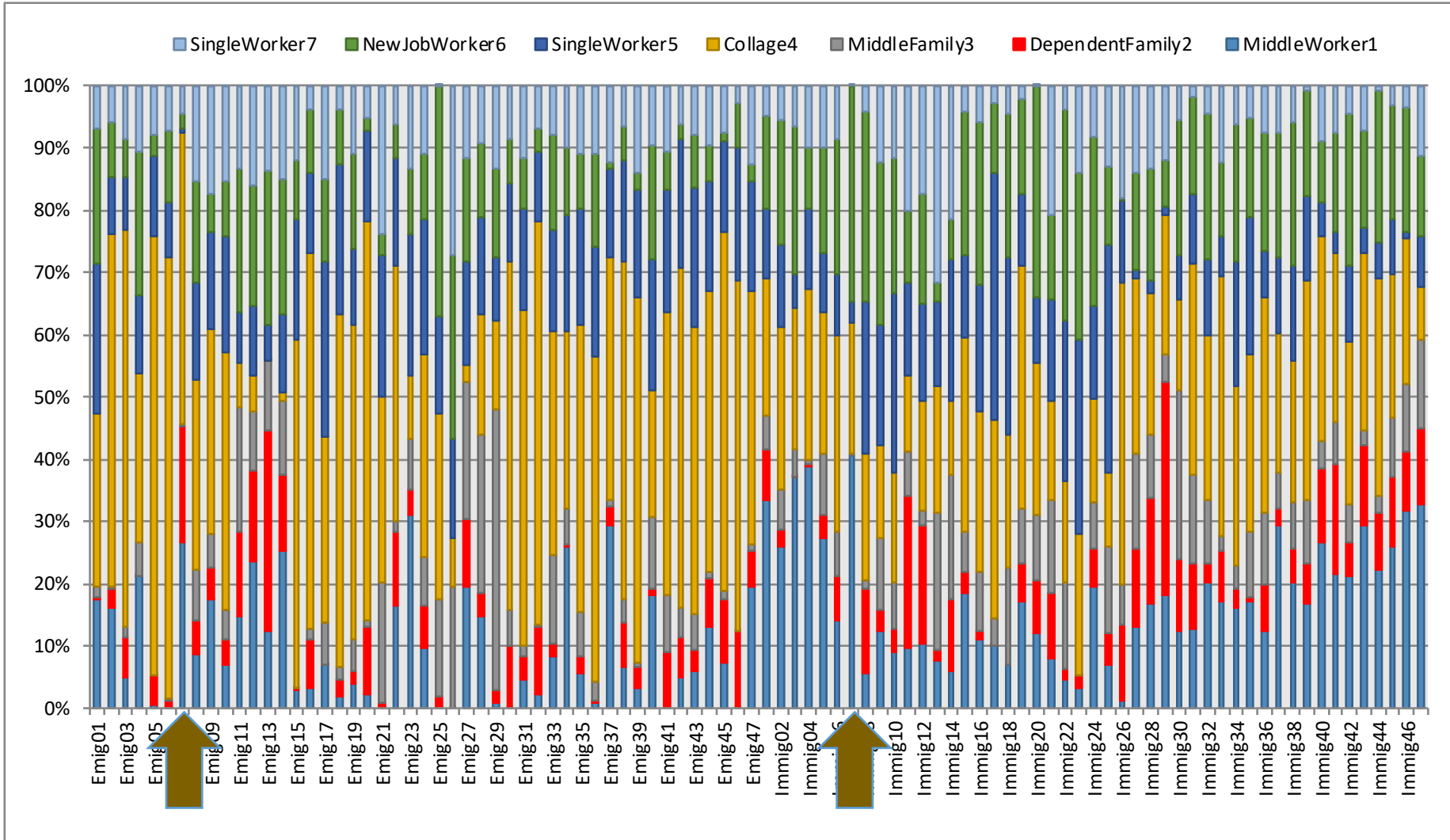


Next, I show the case of 7 factors division.

Factors: sex and age structure

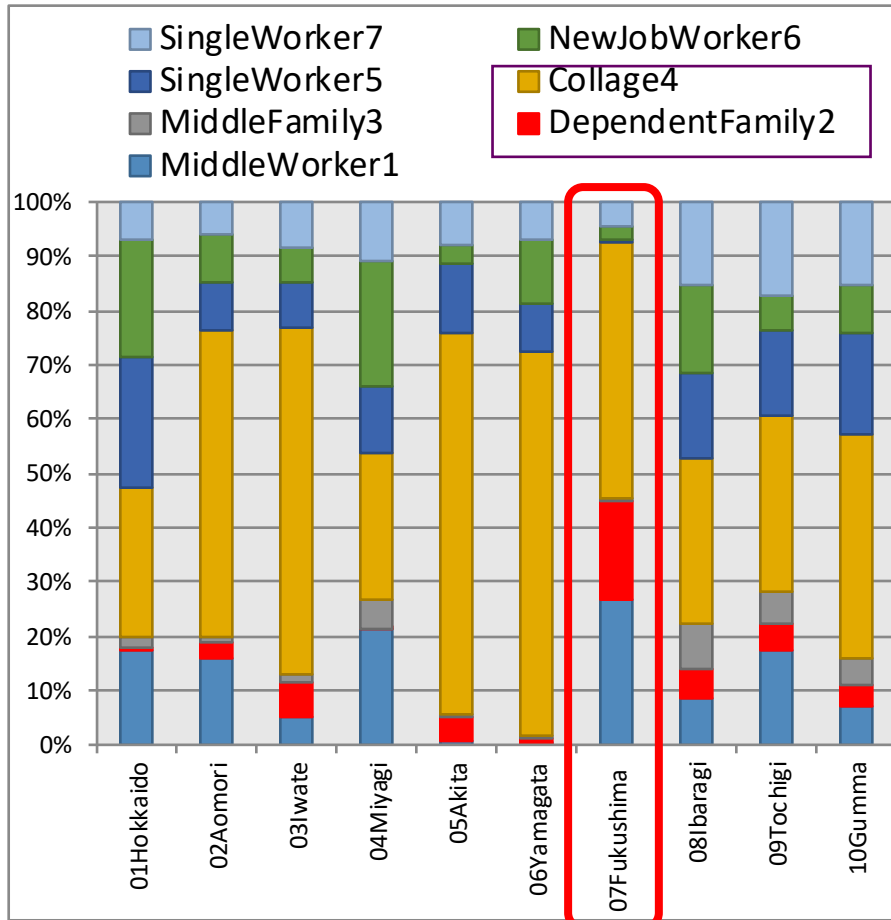


Weightings: What's happen in each prefecture?



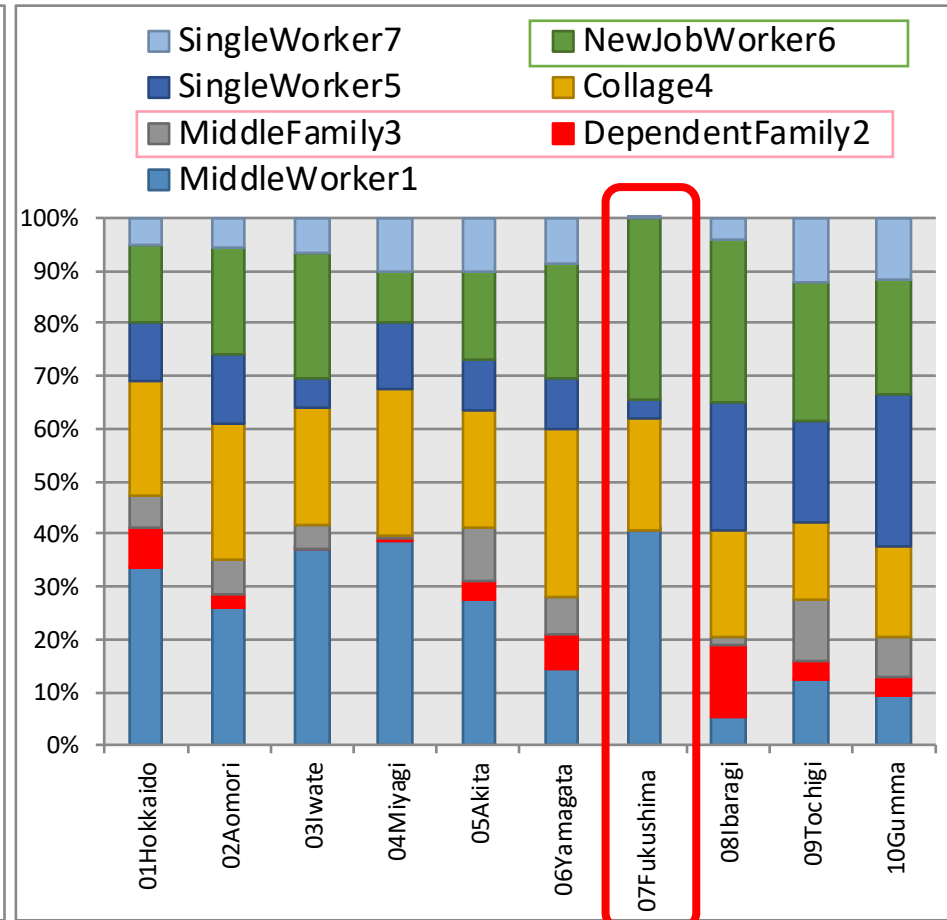
Weightings (relative) in Northeastern 10 prefectures

Emigration



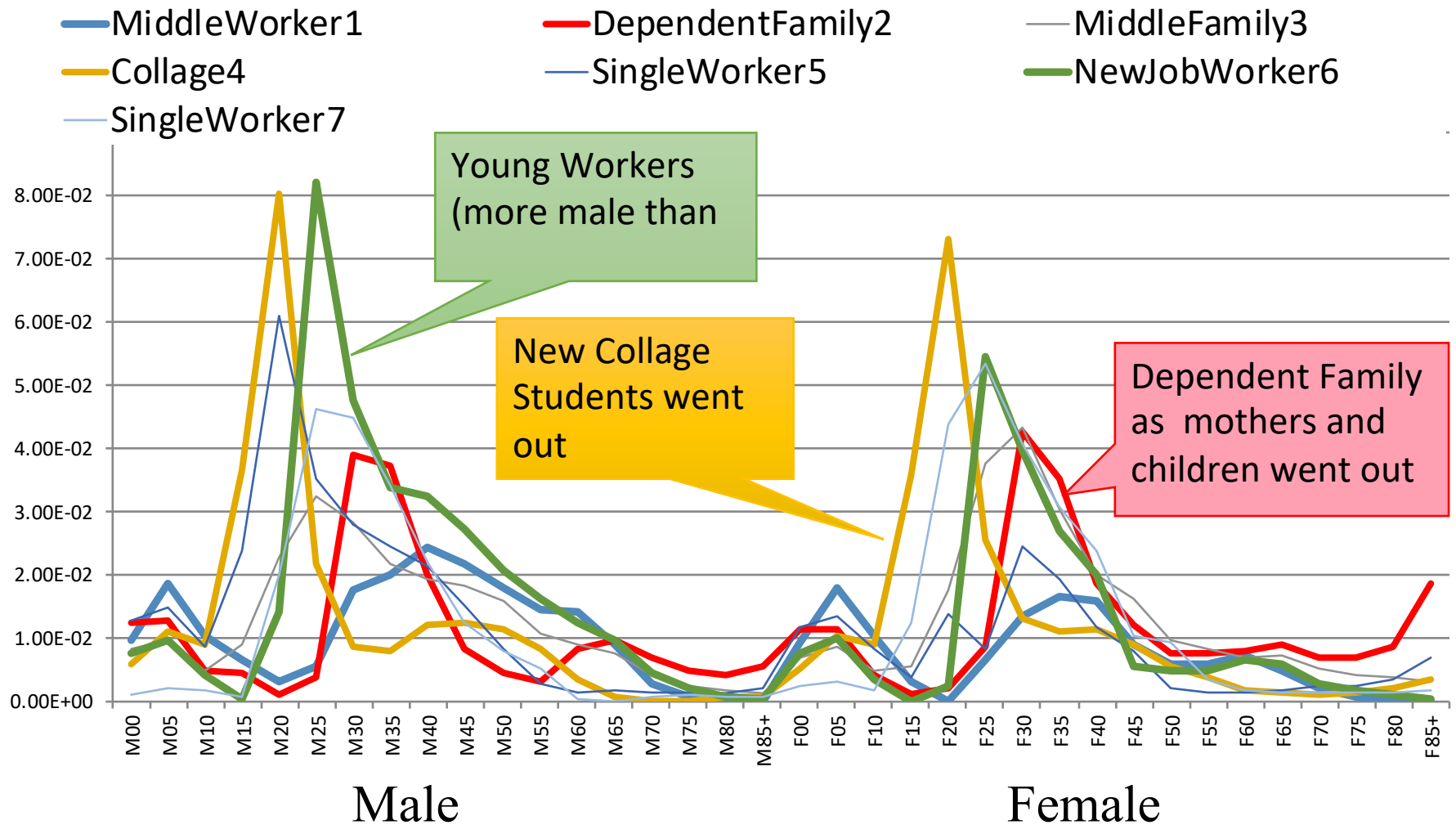
Dependent Family 2 moved out from Fukushima

Immigration



Middle Worker 1, New Job Worker 6 moved in to Fukushima

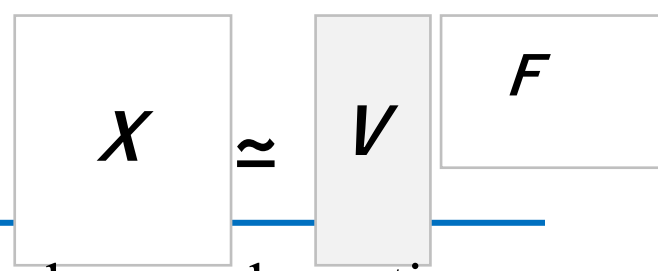
Strongly observed Factors in Fukushima



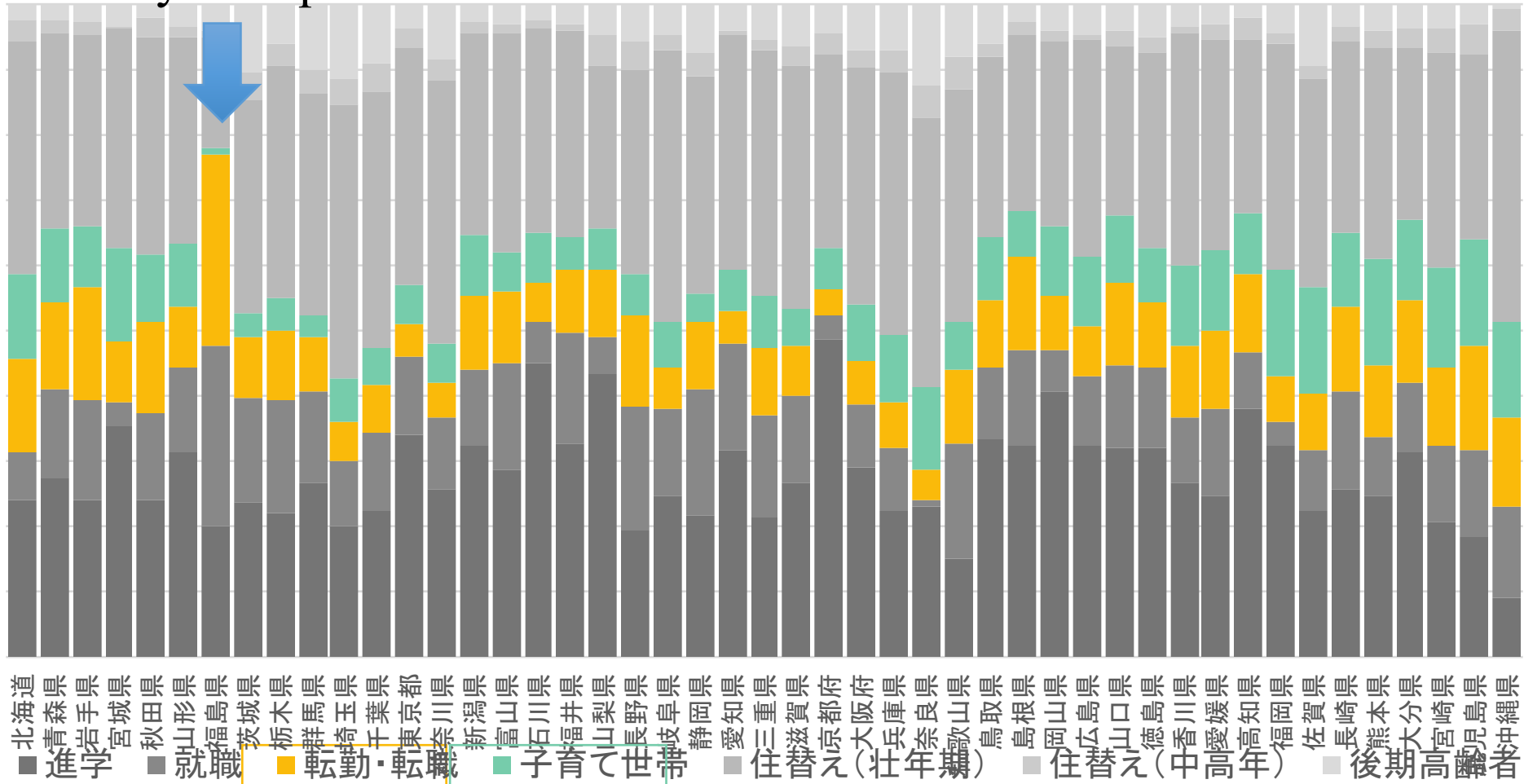
Fleshly gained results

- We adopt the NMF analysis on a dataset of age-sex matrix prefecture versus immigrants, emigrants and stay in three periods.
- 1995-2000 (including Kobe earthquake?)
- 2005-2010
- 2010-2015 (including effect of 2011)

2010-15 Immigration Factor Scores



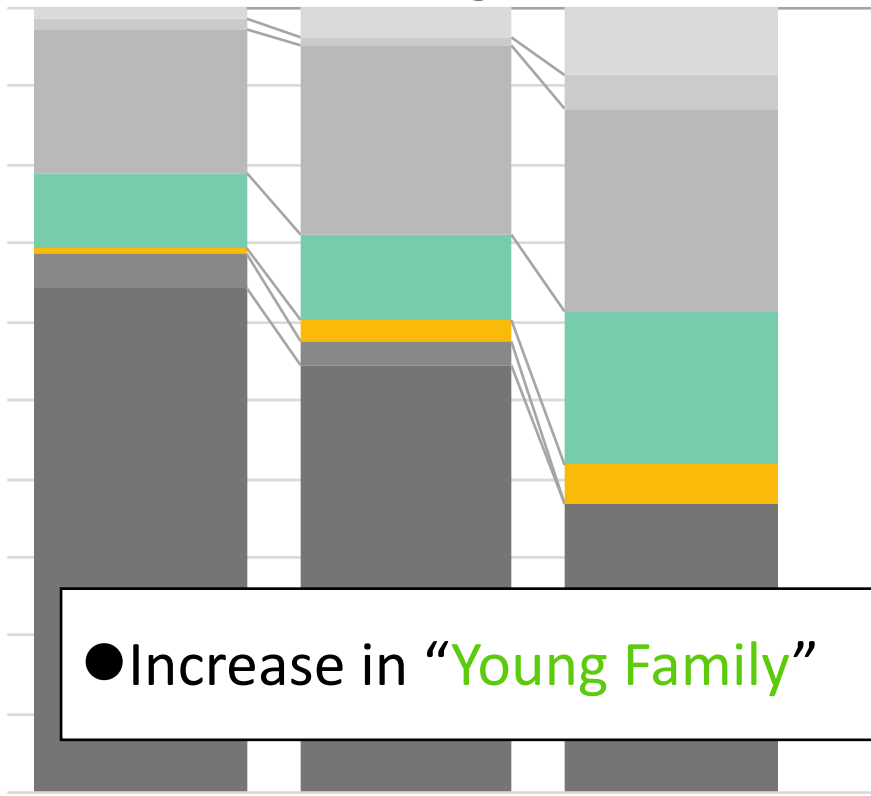
Young Family Immigrants are observed anywhere and any time,
Only Exceptional Case is Fukushima 2010-2015.



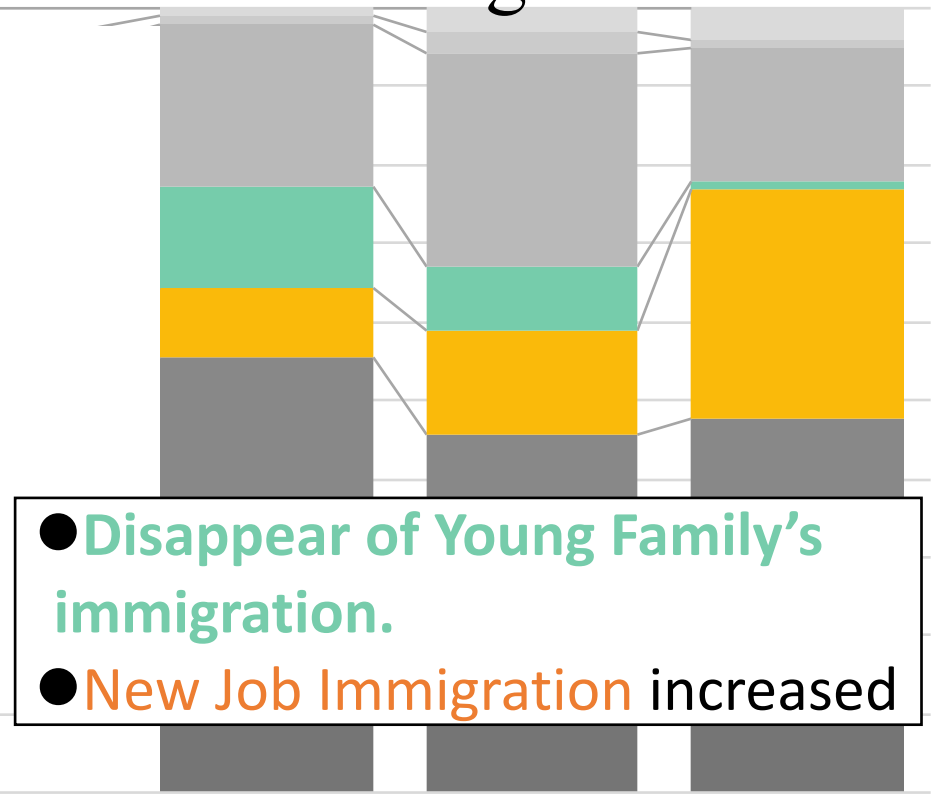
$$X \approx V F$$

Factor scores in Fukushima in 3 periods

Emigration



Immigration

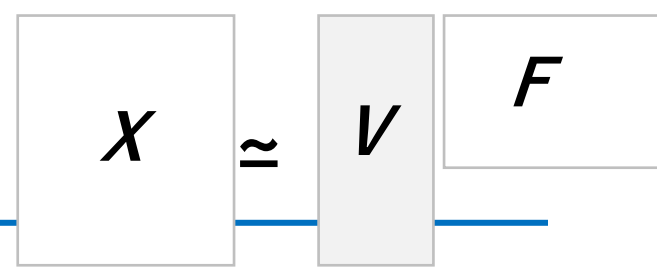


1995-00転出 2005-10転出 2010-15転出

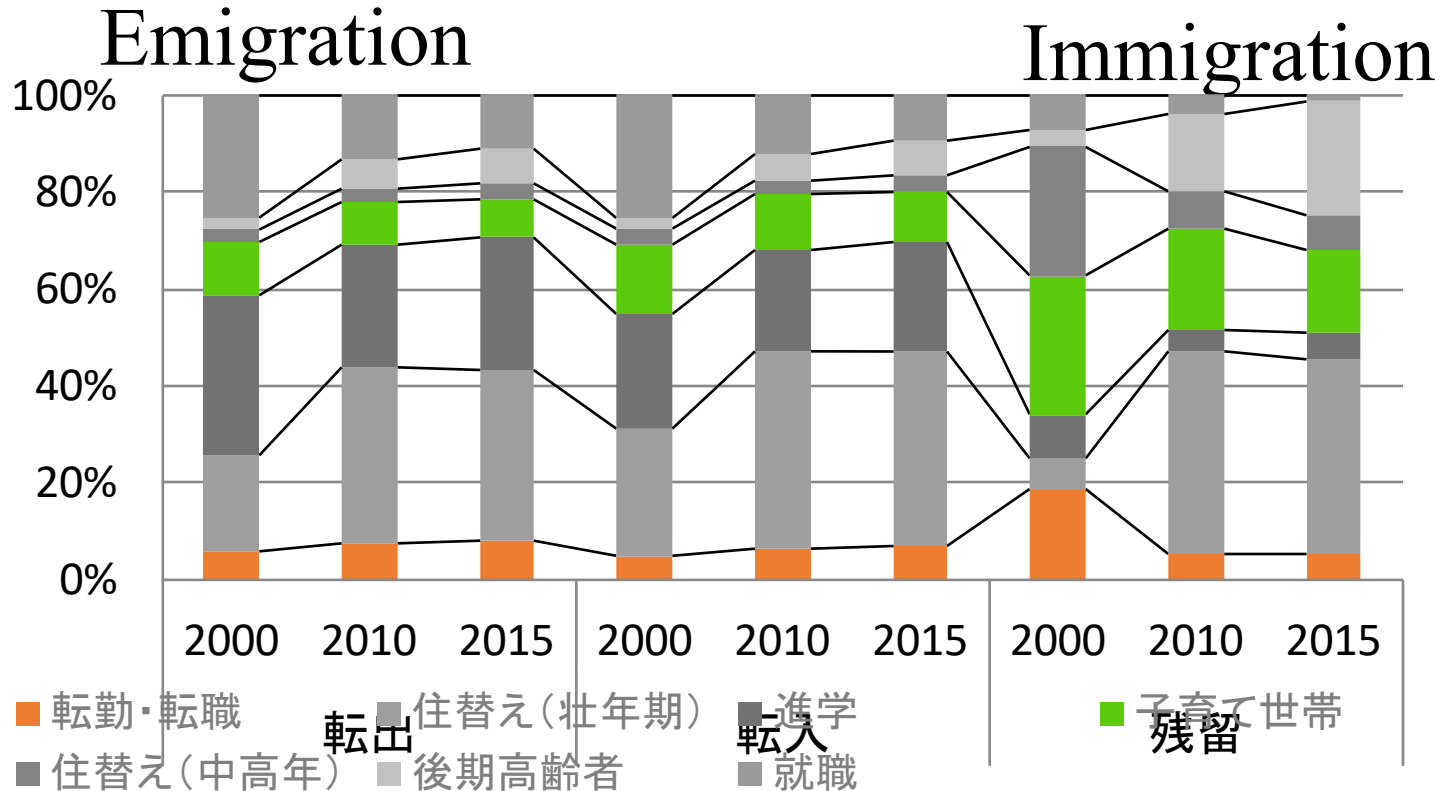
1995-00転入 2005-10転入 2010-15転入

■ 進学 ■ 就職 ■ 転勤・転職 ■ 子育て世帯 ■ 住替え(壮年期) ■ 住替え(中高年) ■ 後期高齢者

KOBE CASE 'HYOGO Pref.



Emigration Immigration Stay (not move)



New Job Workers, Mobility was relatively high in 1995-2000.

Discussion on the result

Unique patterns were observed in Fukushima.

- Young Mothers and children decided to emigrate from Fukushima (Dependent Family 2)
 - Fear of influence of radioactivity.
- Middle aged (mostly male) workers (Middle Worker1) and young single workers finding the job (New Job Workers6) moved in Fukushima
 - In order to have works such as disaster recovery or the radioactive decontamination.
- Middle Family and Dependent Family did not enter Fukushima
- Many households were dismantled.



FINDINGS

We investigated the effect of disaster on the inter-regional migration in the following 3 years, considering the disaster size.

Small, Medium, Large Disaster (R.I.A. < 0.01 : 98% cases)

Emigration will shrink after one year

No negative effect on Immigration

- No social decrease of Population

➡ External Assistance is not always necessary

Huge Disaster (R.I.A. > 0.01 : 2% of the total cases)

Emigration increase and Immigration decrease

- Social decrease of population

➡ External Assistance is strongly necessary

Future Research Issue

- Consider Disaster type categorization
- Consider the external monetary assistance or designation of “Serious Disaster to be supported”
- Closer investigations, based on the smaller local area data such as municipalities, or different age groups
- Analysis of the effect on economic performance indexes