Global Workforce Modeling for South Korea

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01

Business Value

1.1 Background

Employment rates vary across countries due to multiple factors
(e.g., economic growth, health crises, demographic shifts)

Key structural factors include:

- Aging populations
- Education levels
- Healthcare infrastructure

Understanding global employment strategies can provide useful policy insights for South Korea

Objectives

Compare employment-related factors across multiple countries using data-driven methods

Evaluate how key factors influence employment outcomes

Analyze policy responses to recent global challenges (e.g., pandemics, automation)

Goal

Implications for South Korea

Derive insights to enhance Korea’s employment environment

Propose strategic, data-informed policy directions

Support sustainable and resilient workforce development

1.2 Problem Definition

Problem Definition

- South Korea is facing persistently low employment rates
- This threatens economic and social stability
- Key contributing factors:
    - Aging population
    - Declining birth rates
    - Global uncertainties (e.g., pandemics, market volatility)

1.2 Problem Definition & Value Proposition

Why Comparative Analysis?

- Advanced economies offer valuable lessons in labor market resilience

- Studying countries with higher employment rates helps identify:

    - Best practices

    - Adaptable strategies for Korea

1.2 Problem Definition & Value Proposition

Project Goals

- Perform comparative analysis of labor market factors across countries
- Extract actionable insights for South Korea
- Provide policy recommendations to:
    - Boost workforce participation
    - Reduce youth unemployment
    - Strengthen labor market resilience

02

Data Overview

Data Acquisition

- Collected on Kaggle
- Source: World Bank – World Development Indicators (WDI)
- Scope: 19 advanced economies (2011–2021)

- Key variables include:
  - Employment rates
  - Education levels
  - Health infrastructure
  - Population trends
  - Youth engagement

03

Techniques

Data Preprocessing

1. Change object types to int types

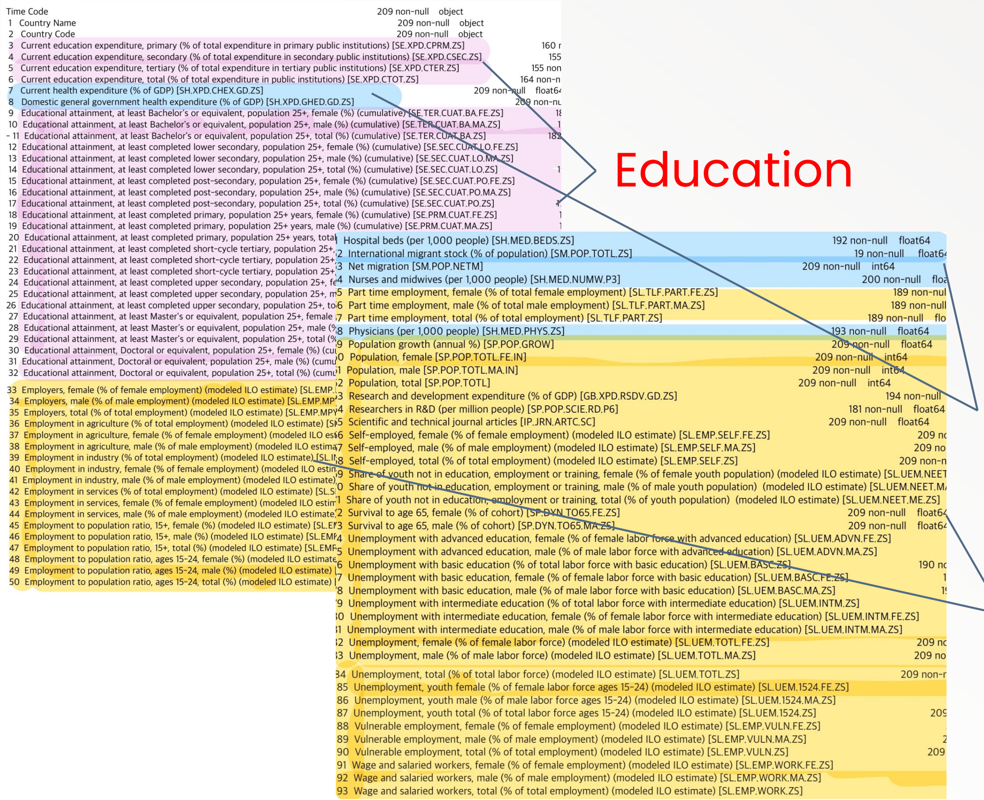
```
print(df_org['Time Code'].head())
print(df_org['Time Code'].dtype)
```

```
Time
2011    YR2011
2011    YR2011
2011    YR2011
2011    YR2011
2011    YR2011
Name: Time Code, dtype: object
object
```

```
df_org['Time Code'] = df_org['Time Code'].astype(str).str.extract('(₩d+)', expand=False).astype(int)
print(df_org['Time Code'].dtype)
```

```
int64
```

2. Sort columns order



Education

The order of the columns corresponding to employment, health, and medical care were mixed.

Medical care & development investment

Employment

```python
new_order = (
    list(range(0, 3)) + #교육
    list(range(3, 7)) +
    list(range(9, 33)) +
    list(range(69, 72)) +
    list(range(63, 66)) +
    list(range(7, 9)) + #건강
    list(range(51, 55)) + [58] +
    list(range(33, 51)) + #고용
    list(range(55, 58)) +
    list(range(66, 69)) +
    list(range(74, 94)) +
    list(range(59, 63)) + #기타
    [72, 73]
)
```

New order : Education - Medical care & development investment - Employment

3. Summarize column names

```python
# 열 이름 바꾸기 코드

# 열 이름에서 괄호 속 코드만 추출 후 열 이름을 코드로 바꾸기
df_org.columns = [
    col.split('[')[-1].replace(']', '') if '[' in col else col
    for col in df_org.columns
]


df_org = df_org.rename(columns={

    'Time': 'Year',
    'Country Code': 'cty_code',


    'SE.XPD.CPRM.ZS': 'primary_public_edu_exp',
    'SE.XPD.CSEC.ZS': 'secondary_public_edu_exp',
    'SE.XPD.CTER.ZS': 'tertiary_public_edu_exp',
    'SE.XPD.CTOT.ZS': 'T_public_edu_exp',


    'SH.XPD.CHEX.GD.ZS': 'health_exp',
    'SH.XPD.GHED.GD.ZS': 'gov_health_exp',


    'SE.TER.CUAT.BA.FE.ZS': 'F_bachelor_25p',
    'SE.TER.CUAT.BA.MA.ZS': 'M_bachelor_25p',
    'SE.TER.CUAT.BA.ZS': 'T_bachelor_25p',
    'SE.TER.CUAT.MS.FE.ZS': 'F_master_25p',
    'SE.TER.CUAT.MS.MA.ZS': 'M_master_25p',
    'SE.TER.CUAT.MS.ZS': 'T_master_25p',
    'SE.TER.CUAT.DO.FE.ZS': 'F_doctoral_25p',
    'SE.TER.CUAT.DO.MA.ZS': 'M_doctoral_25p',
    'SE.TER.CUAT.DO.ZS': 'T_doctoral_25p',

    'SL.EMP.MPYR.FE.ZS': 'F_employers',
    'SL.EMP.MPYR.MA.ZS': 'M_employers',
    'SL.EMP.MPYR.ZS': 'T_employers',
```

```python
'SL.AGR.EMPL.ZS': 'T_agriculture_emp',
'SL.AGR.EMPL.FE.ZS': 'F_agriculture_emp',
'SL.AGR.EMPL.MA.ZS': 'M_agriculture_emp',

'SL.IND.EMPL.ZS': 'T_industry_emp',
'SL.IND.EMPL.FE.ZS': 'F_industry_emp',
'SL.IND.EMPL.MA.ZS': 'M_industry_emp',

'SL.SRV.EMPL.ZS': 'T_service_emp',
'SL.SRV.EMPL.FE.ZS': 'F_service_emp',
'SL.SRV.EMPL.MA.ZS': 'M_service_emp',

'SL.EMP.TOTL.SP.FE.ZS': 'F_emp_ratio_15P',
'SL.EMP.TOTL.SP.MA.ZS': 'M_emp_ratio_15P',
'SL.EMP.TOTL.SP.ZS': 'T_emp_ratio_15P',
'SL.EMP.1524.SP.FE.ZS': 'F_emp_ratio_15_24',
'SL.EMP.1524.SP.MA.ZS': 'M_emp_ratio_15_24',
'SL.EMP.1524.SP.ZS': 'T_emp_ratio_15_24',

'SH.MED.BEDS.ZS': 'hospital_beds',


'SH.MED.NUMW.P3': 'nurse_midwife_per_1K',

'SL.TLF.PART.FE.ZS': 'F_PT_emp',
'SL.TLF.PART.MA.ZS': 'M_PT_emp',
'SL.TLF.PART.ZS': 'T_PT_emp',

'SH.MED.PHYS.ZS': 'physicians_per_1K',

'SP.POP.GROW': 'annual_population_growth',
'SP.POP.TOTL.FE.IN': 'F_population',
'SP.POP.TOTL.MA.IN': 'M_population',
'SP.POP.TOTL': 'T_population',

'GB.XPD.RSDV.GD.ZS': 'RD_expenditure',
'SP.POP.SCIE.RD.P6': 'RD_researchers_per_1M',
'IP.JRN.ARTC.SC': 'sci_tech_journals',
```

```python
    'SL.EMP.SELF.FE.ZS': 'F_self_employed',
    'SL.EMP.SELF.MA.ZS': 'M_self_employed',
    'SL.EMP.SELF.ZS': 'T_self_employed',

    'SL.UEM.NEET.FE.ME.ZS': 'F_youth_NEET',
    'SL.UEM.NEET.MA.ME.ZS': 'M_youth_NEET',
    'SL.UEM.NEET.ME.ZS': 'T_youth_NEET',

    'SP.DYN.TO65.FE.ZS': 'F_survival_to_65',
    'SP.DYN.TO65.MA.ZS': 'M_survival_to_65',

    'SL.UEM.ADVN.FE.ZS': 'F_adv_edu_unemp',
    'SL.UEM.ADVN.MA.ZS': 'M_adv_edu_unemp',

    'SL.UEM.BASC.ZS': 'T_basic_edu_unemp',
    'SL.UEM.BASC.FE.ZS': 'F_basic_edu_unemp',
    'SL.UEM.BASC.MA.ZS': 'M_basic_edu_unemp',

    'SL.UEM.INTM.ZS': 'T_int_edu_unemp',
    'SL.UEM.INTM.FE.ZS': 'F_int_edu_unemp',
    'SL.UEM.INTM.MA.ZS': 'M_int_edu_unemp',

    'SL.UEM.TOTL.FE.ZS': 'F_unemp',
    'SL.UEM.TOTL.MA.ZS': 'M_unemp',
    'SL.UEM.TOTL.ZS': 'T_unemp',

    'SL.UEM.1524.FE.ZS': 'F_youth_Unemp',
    'SL.UEM.1524.MA.ZS': 'M_youth_Unemp',
    'SL.UEM.1524.ZS': 'T_youth_Unemp',

    'SL.EMP.VULN.FE.ZS': 'F_vuln_emp',
    'SL.EMP.VULN.MA.ZS': 'M_vuln_emp',
    'SL.EMP.VULN.ZS': 'T_vuln_emp',

    'SL.EMP.WORK.FE.ZS': 'F_paid_workers',
    'SL.EMP.WORK.MA.ZS': 'M_paid_workers',
    'SL.EMP.WORK.ZS': 'T_paid_workers'
})
df_org.info()
```

3. Summarize column names

#	Column	Non-Null Count	Dtype
0	Time Code	209 non-null	int64
1	Country Name	209 non-null	object
2	cty_code	209 non-null	object
3	primary_public_edu_exp	160 non-null	float64
4	secondary_public_edu_exp	155 non-null	float64
5	tertiary_public_edu_exp	155 non-null	float64
6	T_public_edu_exp	164 non-null	float64
7	F_bachelor_25p	181 non-null	float64
8	M_bachelor_25p	181 non-null	float64
9	T_bachelor_25p	182 non-null	float64
10	SE.SEC.CUAT.LO.FE.ZS	192 non-null	float64
11	SE.SEC.CUAT.LO.MA.ZS	192 non-null	float64
12	SE.SEC.CUAT.LO.ZS	193 non-null	float64
13	SE.SEC.CUAT.PO.FE.ZS	178 non-null	float64
14	SE.SEC.CUAT.PO.MA.ZS	178 non-null	float64
15	SE.SEC.CUAT.PO.ZS	179 non-null	float64
16	SE.PRM.CUAT.FE.ZS	189 non-null	float64
17	SE.PRM.CUAT.MA.ZS	189 non-null	float64
18	SE.PRM.CUAT.ZS	190 non-null	float64
19	SE.TER.CUAT.ST.FE.ZS	191 non-null	float64
20	SE.TER.CUAT.ST.MA.ZS	191 non-null	float64
21	SE.TER.CUAT.ST.ZS	192 non-null	float64
22	SE.SEC.CUAT.UP.FE.ZS	192 non-null	float64
23	SE.SEC.CUAT.UP.MA.ZS	192 non-null	float64
24	SE.SEC.CUAT.UP.ZS	193 non-null	float64
25	F_master_25p	181 non-null	float64
26	M_master_25p	181 non-null	float64
27	T_master_25p	182 non-null	float64
28	F_doctoral_25p	184 non-null	float64
29	M_doctoral_25p	184 non-null	float64
30	T_doctoral_25p	185 non-null	float64
31	F_youth_NEET	209 non-null	float64
32	M_youth_NEET	209 non-null	float64
33	T_youth_NEET	209 non-null	float64
34	RD_expenditure	194 non-null	float64
35	RD_researchers_per_1M	181 non-null	float64
36	sci_tech_journals	209 non-null	float64
37	health_exp	209 non-null	float64
38	gov_health_exp	209 non-null	float64
39	hospital_beds	192 non-null	float64
40	SM.POP.TOTL.ZS	19 non-null	float64
41	SM.POP.NETM	209 non-null	int64
42	nurse_midwife_per_1K	200 non-null	float64
43	physicians_per_1K	193 non-null	float64
44	F_employers	209 non-null	float64
45	M_employers	209 non-null	float64
46	T_employers	209 non-null	float64
47	T_agriculture_emp	209 non-null	float64
48	F_agriculture_emp	209 non-null	float64
49	M_agriculture_emp	209 non-null	float64
50	T_industry_emp	209 non-null	float64
51	F_industry_emp	209 non-null	float64
52	M_industry_emp	209 non-null	float64
53	T_service_emp	209 non-null	float64
54	F_service_emp	209 non-null	float64
55	M_service_emp	209 non-null	float64
56	F_emp_ratio_15P	209 non-null	float64
57	M_emp_ratio_15P	209 non-null	float64
58	T_emp_ratio_15P	209 non-null	float64
59	F_emp_ratio_15_24	209 non-null	float64
60	M_emp_ratio_15_24	209 non-null	float64
61	T_emp_ratio_15_24	209 non-null	float64
62	F_PT_emp	189 non-null	float64
63	M_PT_emp	189 non-null	float64
64	T_PT_emp	189 non-null	float64
65	F_self_employed	209 non-null	float64
66	M_self_employed	209 non-null	float64
67	T_self_employed	209 non-null	float64
68	F_adv_edu_unemp	198 non-null	float64
69	M_adv_edu_unemp	198 non-null	float64
70	T_basic_edu_unemp	190 non-null	float64
71	F_basic_edu_unemp	190 non-null	float64
72	M_basic_edu_unemp	190 non-null	float64
73	T_int_edu_unemp	198 non-null	float64
74	F_int_edu_unemp	198 non-null	float64
75	M_int_edu_unemp	198 non-null	float64
76	F_unemp	209 non-null	float64
77	M_unemp	209 non-null	float64
78	T_unemp	209 non-null	float64
79	F_youth_Unemp	209 non-null	float64
80	M_youth_Unemp	209 non-null	float64
81	T_youth_Unemp	209 non-null	float64
82	F_vuln_emp	209 non-null	float64
83	M_vuln_emp	209 non-null	float64
84	T_vuln_emp	209 non-null	float64
85	F_paid_workers	209 non-null	float64
86	M_paid_workers	209 non-null	float64
87	T_paid_workers	209 non-null	float64
88	annual_population_growth	209 non-null	float64
89	F_population	209 non-null	int64
90	M_population	209 non-null	int64
91	T_population	209 non-null	int64
92	F_survival_to_65	209 non-null	float64
93	M_survival_to_65	209 non-null	float64

dtypes: float64(87), int64(5), object(2)

The column name was too long
=> extracted the part of the column name in [] and summarized them

4. Delete columns and rows

```python
# 열 삭제 코드
df_org = df_org[[col for col in df_org.columns if not ('.' in col and col == col.upper())]]
df_org = df_org.drop(columns=['Country Name'])
df_org = df_org.drop(columns=['primary_public_edu_exp'])
df_org = df_org.drop(columns=['secondary_public_edu_exp'])
df_org = df_org.drop(columns=['tertiary_public_edu_exp'])
df_org = df_org.drop(columns=['RD_researchers_per_1M'])

df_org.info()
```

```python
# 행 삭제 코드
#delete ARE, JPN

df = df_org[~df_org['cty_code'].isin(['ARE', 'JPN'])]


unique_codes = df['cty_code'].unique()
print(unique_codes)
```

<Columns>
Country Name was removed because it was judged to overlap with cty_code
Other four columns were dropped because of high proportion of NaN values compared to other variables

<Rows>
For ARE and JPN, rows were excluded due to significant missing values in key variables.

5. Handling NaN values

If intermediate value is NaN : Linear interpolation

–estimating an unknown value between two known points by assuming the change between them is proportional and lies on the straight line connecting those points.

Country N	Country C	Current ed	Current ed	Current ed
Australia	AUS	82.07	91.2	85.8
Australia	AUS	92.54	93.41	85.8
Australia	AUS	91.62	93.55	nan
Australia	AUS	93.77	94.53	87.02
Australia	AUS	95	95.2	88.57
Australia	AUS	94.65	94.81	88.94
Australia	AUS	92.87	93.03	88.61
Australia	AUS	90.68	91.08	87.65
Australia	AUS	88.07	nan	nan
Australia	AUS	88.07275	89.6356	88.90058
Australia	AUS	88.25725	90.01973	91.07644

Ex : Australia

List of columns need to be interpolated

```
#linear interpolation
interpolation_cols = [ 'T_public_edu_exp', 'F_bachelor_25p', 'T_bachelor_25p',
        'M_bachelor_25p', 'F_master_25p', 'M_master_25p', 'T_master_25p', 'F_doctoral_25p', 'M_doctoral_25p', 'T_doctoral_25p',
        'RD_expenditure',  'hospital_beds', 'F_PT_emp', 'M_PT_emp', 'T_PT_emp']
df_AUS[interpolation_cols] = df_AUS[interpolation_cols].interpolate(method='linear', limit_direction='both')
```

Linear interpolate

Update to original df

```
# df에 update
mask = df['cty_code'] == 'AUS'
df_subset_sorted = df.loc[mask].sort_values(by='Time Code')
df.loc[df['cty_code'] == 'AUS', interpolation_cols] = df_AUS[interpolation_cols].values
```

5. Handling NaN values

If consecutive values are NaN :

Values that do not exist consecutively

Belgium	BEL			96.95709	96.38167
Belgium	BEL				
Belgium	BEL	91.94972	96.62653	95.64908	94.40839
Belgium	BEL	94.19771	96.02022	95.57105	95.17557
Belgium	BEL	94.31854	96.11328	95.01249	94.96034
Belgium	BEL	93.75147	95.20866	95.0459	94.44009
Belgium	BEL	93.9427	96.27853	95.09343	94.87132
Belgium	BEL	93.32632	96.67049	94.50184	94.55085
Belgium	BEL	94.57438	96.71211	92.54103	94.64889
Belgium	BEL	95.05326	96.2519	93.39079	94.85588
Belgium	BEL	95.60983	96.38616	93.65329	95.2353

First, we fill in the missing values consecutively using ffill (forward fill) and bfill (backward fill). This step is used to first fill in the default values for long missing intervals where linear interpolation is difficult to work with.

After that, use polynomial interpolation with order=2 is used to interpolate the values that are interrupted in the middle, more naturally.

```
df_BEL[interpolation_cols] = df_BEL[interpolation_cols].replace(0, np.nan)
df_BEL[interpolation_cols] = df_BEL[interpolation_cols].fillna(method='ffill').fillna(method='bfill')
df_BEL[interpolation_cols] = df_BEL[interpolation_cols].interpolate(method='polynomial', order=2)
```

Visualization by Key Items

```python
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

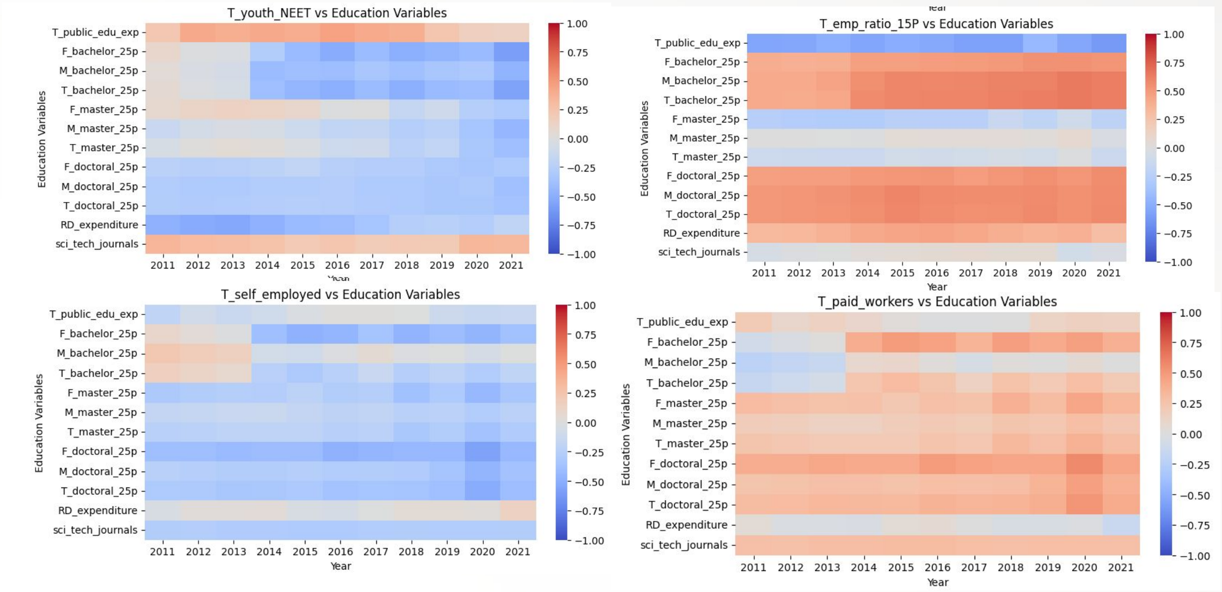
```python
# 고용 변수
employment_vars = [
    'F_employers', 'M_employers', 'T_employers',
    'T_agriculture_emp', 'F_agriculture_emp', 'M_agriculture_emp',
    'T_industry_emp', 'F_industry_emp', 'M_industry_emp',
    'T_service_emp', 'F_service_emp', 'M_service_emp',
    'F_emp_ratio_15P', 'M_emp_ratio_15P', 'T_emp_ratio_15P',
    'F_emp_ratio_15_24', 'M_emp_ratio_15_24', 'T_emp_ratio_15_24',
    'F_PT_emp', 'M_PT_emp', 'T_PT_emp',
    'F_self_employed', 'M_self_employed', 'T_self_employed',
    'F_unemp', 'M_unemp', 'T_unemp',
    'F_adv_edu_unemp', 'M_adv_edu_unemp',
    'F_basic_edu_unemp', 'M_basic_edu_unemp', 'T_basic_edu_unemp',
    'T_int_edu_unemp', 'F_int_edu_unemp', 'M_int_edu_unemp',
    'F_unemp', 'M_unemp', 'T_unemp',
    'F_youth_Unemp', 'M_youth_Unemp', 'T_youth_Unemp',
    'F_vuln_emp', 'M_vuln_emp', 'T_vuln_emp',
    'F_paid_workers', 'M_paid_workers', 'T_paid_workers',
    'F_youth_NEET', 'M_youth_NEET', 'T_youth_NEET',

]
```

```python
# 교육 변수
education_vars = [
    'T_public_edu_exp', 'F_bachelor_25p', 'M_bachelor_25p', 'T_bachelor_25p',
    'F_master_25p', 'M_master_25p', 'T_master_25p',
    'F_doctoral_25p', 'M_doctoral_25p', 'T_doctoral_25p',
    'RD_expenditure', 'sci_tech_journals'
]

# 건강 변수
health_vars = [
    'health_exp', 'gov_health_exp', 'hospital_beds',
    'physicians_per_1K', 'nurse_midwife_per_1K'

]

# 인구 변수
ppl_vars = [
    'annual_population_growth', 'F_population', 'M_population', 'T_population',
    'F_survival_to_65', 'M_survival_to_65'
]
```

By categorizing variables, the relationship between employment and key indicators – education, health, and population structure – is visualized in a heat map.

Based on insights from the heat map, we also created bar chart to make clearer comparison of the relationships.

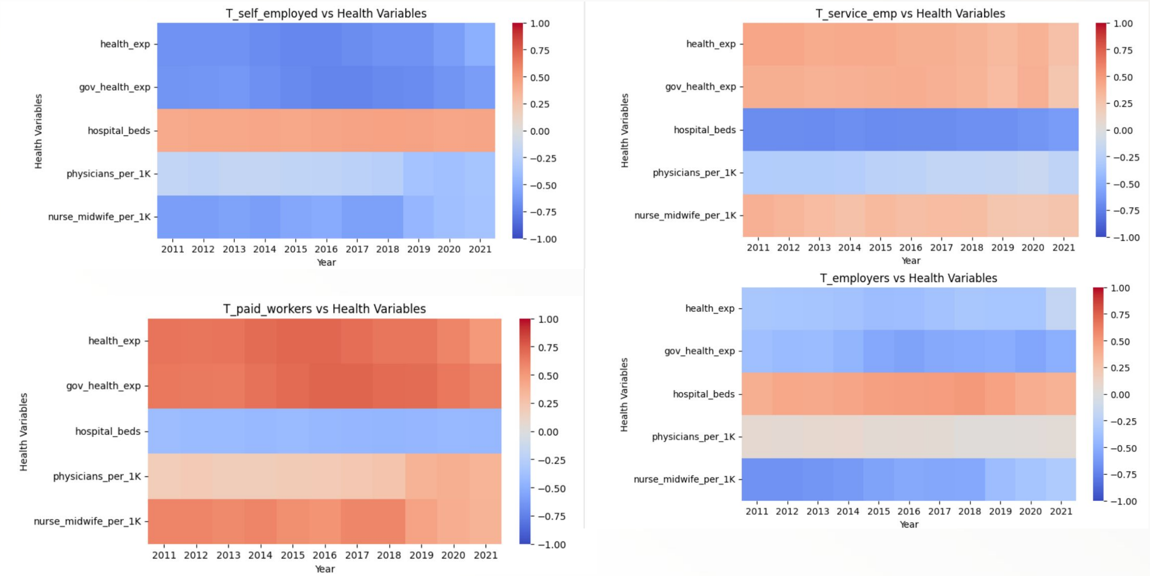
Visualization by Key Items
: education and employment



<Part of Heatmap>

T_bachelor and T_doctoral showed positive correlation with T_emp_ratio_15P and T_paid_workers but negative correlation with T_self_employed and T_youth_NEET.

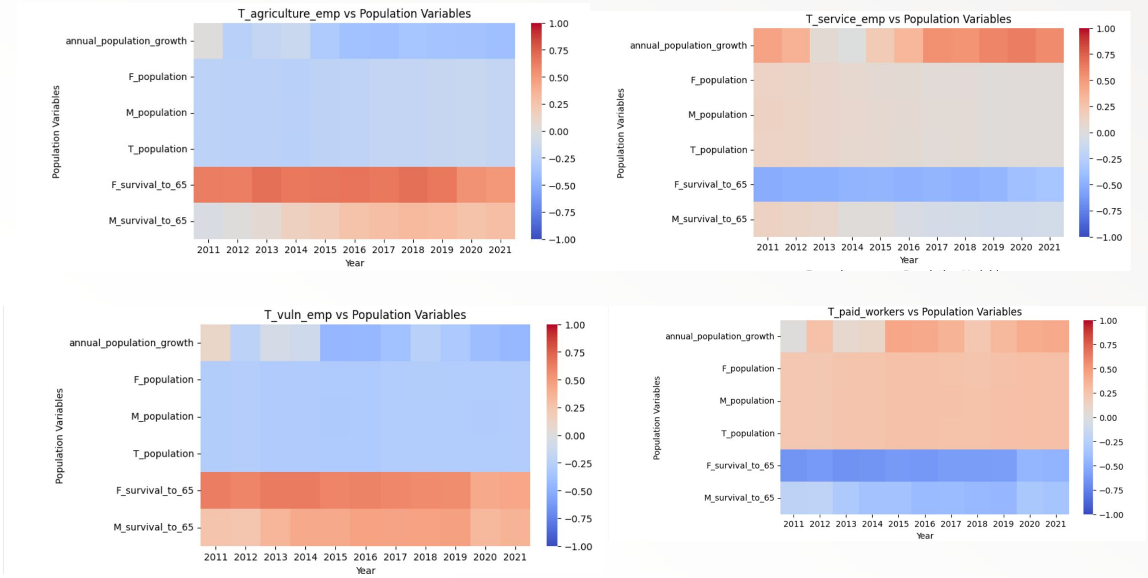
Visualization by Key Items : health and employment



<Part of Heatmap>

Health_exp, gov_health_exp, nurse_midwife_per_1k showed positive correlation with T_paid_workers and T_service_emp but negative correlation with T_self_employed and T_employers.

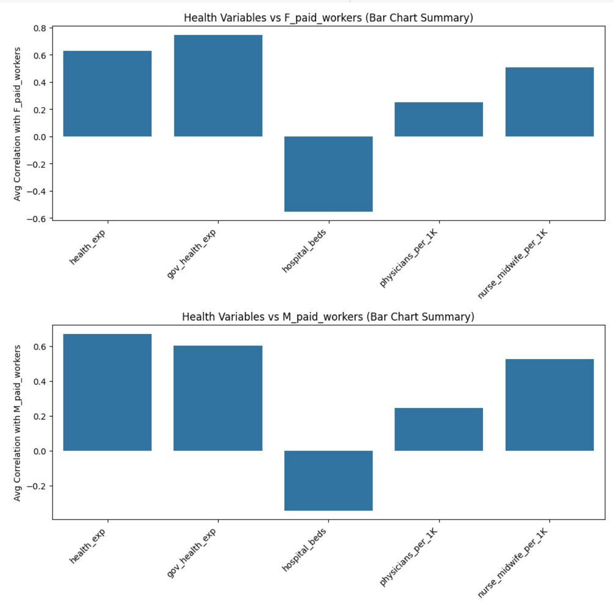
Visualization by Key Items : population structure and employment

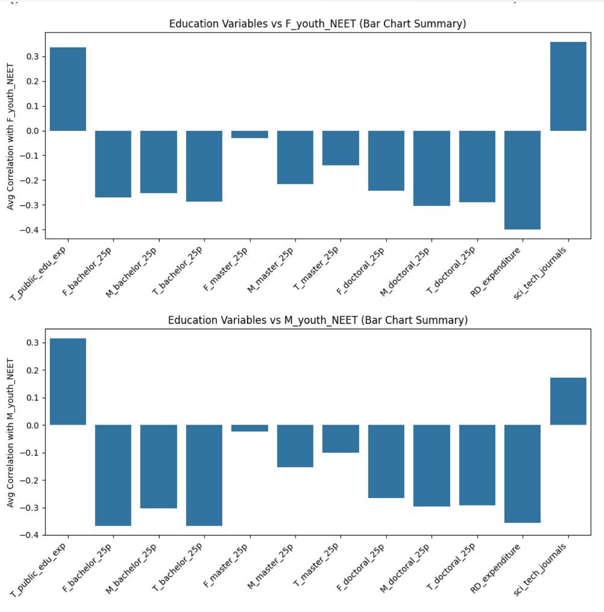


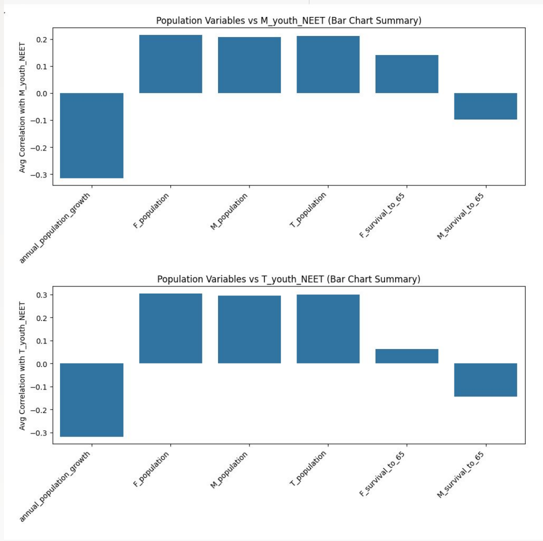
<Part of Heatmap>

F_survival_to_65 showed positive correlation with T_agriculture_emp and T_vuln_emp while negative correlation with T_service_emp and T_paid_workers.

Visualization by Key Items : bar chart







<Par of bar chart>

Based on heatmaps,
we generated a correlation bar chart.

04

Model Training

Input Variables

- T_public_edu_exp
- F_bachelor_25p
- M_bachelor_25p
- T_bachelor_25p
- F_master_25p
- M_master_25p
- T_master_25p
- F_doctoral_25p
- M_doctoral_25p
- T_doctoral_25p
- RD_expenditure
- sci_tech_journals
- health_expgov_health_exp
- hospital_beds
- physicians_per_1K
- nurse_midwife_per_1K
- annual_population_growth
- F_population
- M_population
- T_population
- F_survival_to_65
- M_survival_to_65

Output Variable

- Employers, total

Modeling Overview

A regression analysis model was used to predict and analyze the number of employees using multinational data to predict the employment rate.

Modeling Used

☑️ XGBoost Regressor

Evaluation metrics

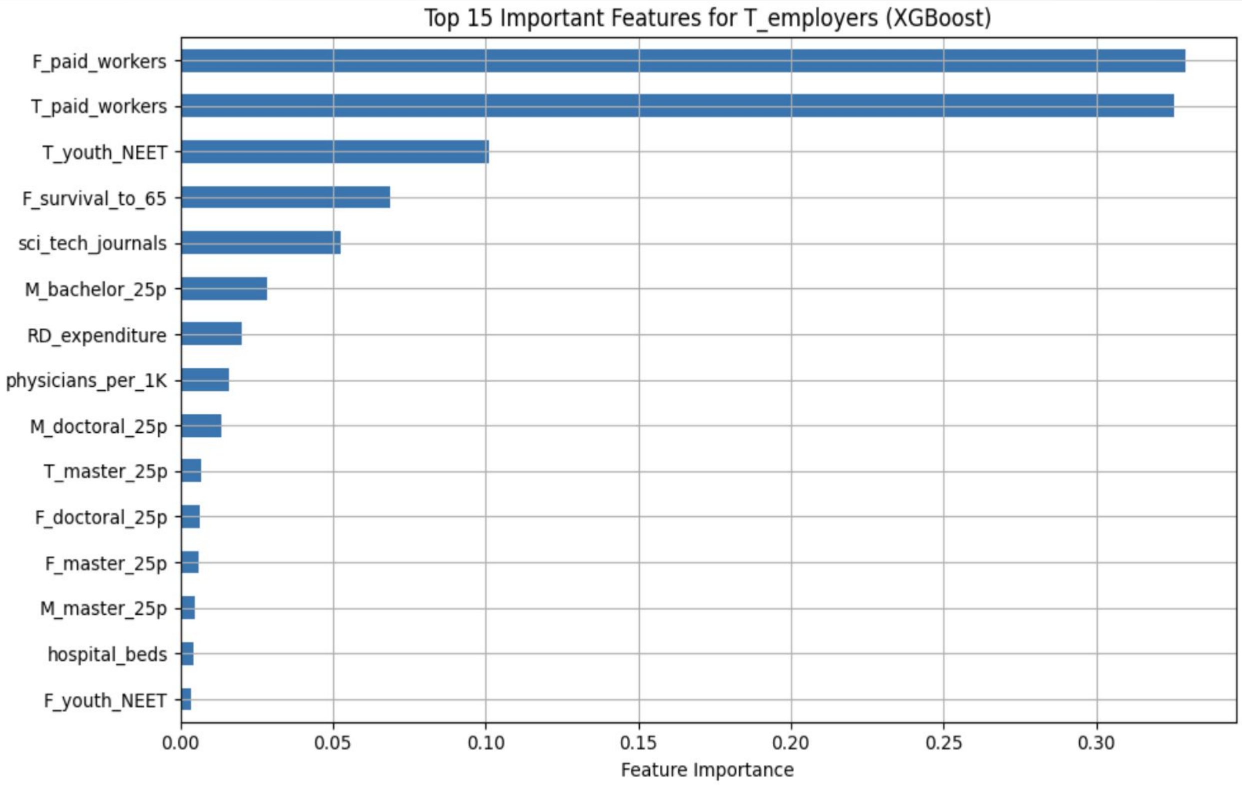
- R2: Coefficient of determination
- MSE: Mean squared error
- RMSE: Root mean squared error

```
📌 XGBoost 결과
 R²   : 0.9274
 MSE  : 0.1754
 RMSE : 0.4188
```

Result of evaluation

- R2: 0.9274
- MSE: 0.1754
- RMSE: 0.4188

Visualization feature importance



Top 3

1. **F_paid_workers**

   (the percentage of female paid workers)
2. **T_paid_workers**

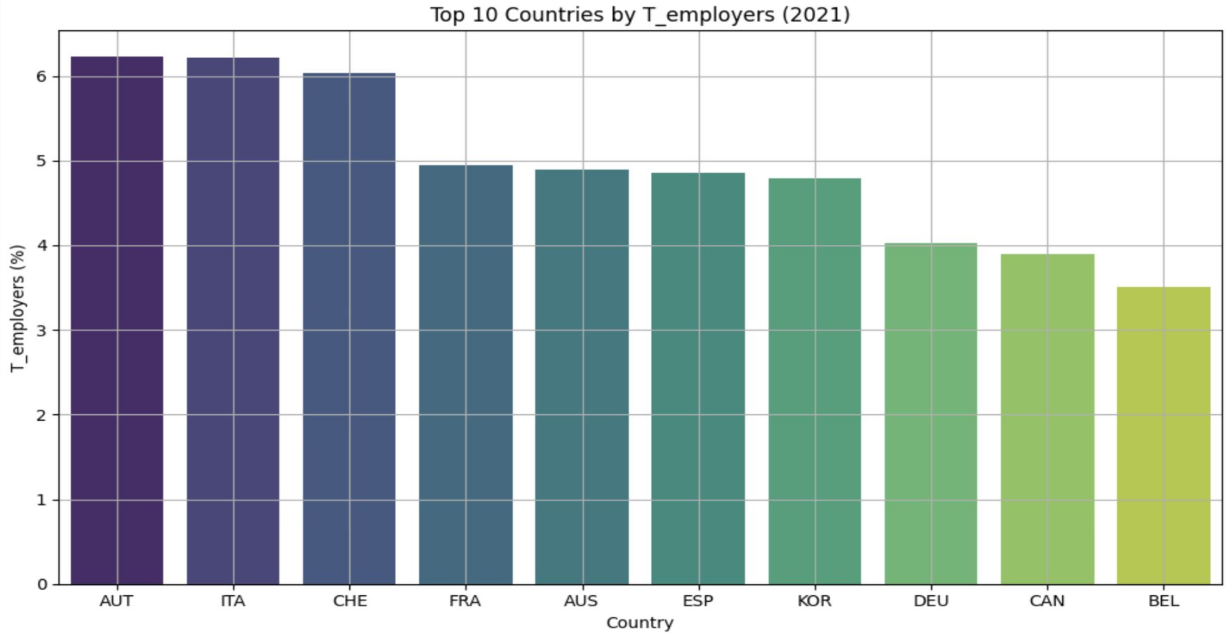
   (the total percentage of paid workers)
3. **T_youth_NEET**

   (the proportion of young people not in education, employment, or training)

Top 3 comparison
with High Employment Rate Countries

Countries with high employment

	cty_code	T_employers
171	AUT	6.223794
178	ITA	6.212315
184	CHE	6.029100
176	FRA	4.941700
170	AUS	4.890054
182	ESP	4.858276
179	KOR	4.792589
177	DEU	4.027615
173	CAN	3.891236
172	BEL	3.501276



Top10

1. Austria
2. Italia
3. Switzerland
4. France
5. Australia
6. Spain
7. Korea
8. Germany
9. Canada
10. Belgium

1. F_paid_workers(the percentage of female paid workers)

📌The number of female paid workers is the lowest compared to other top countries. This can be seen from statistical data that Korea's female employment rate has been ranked 31st in the OECD for 20 years, that is, in the lower ranks.

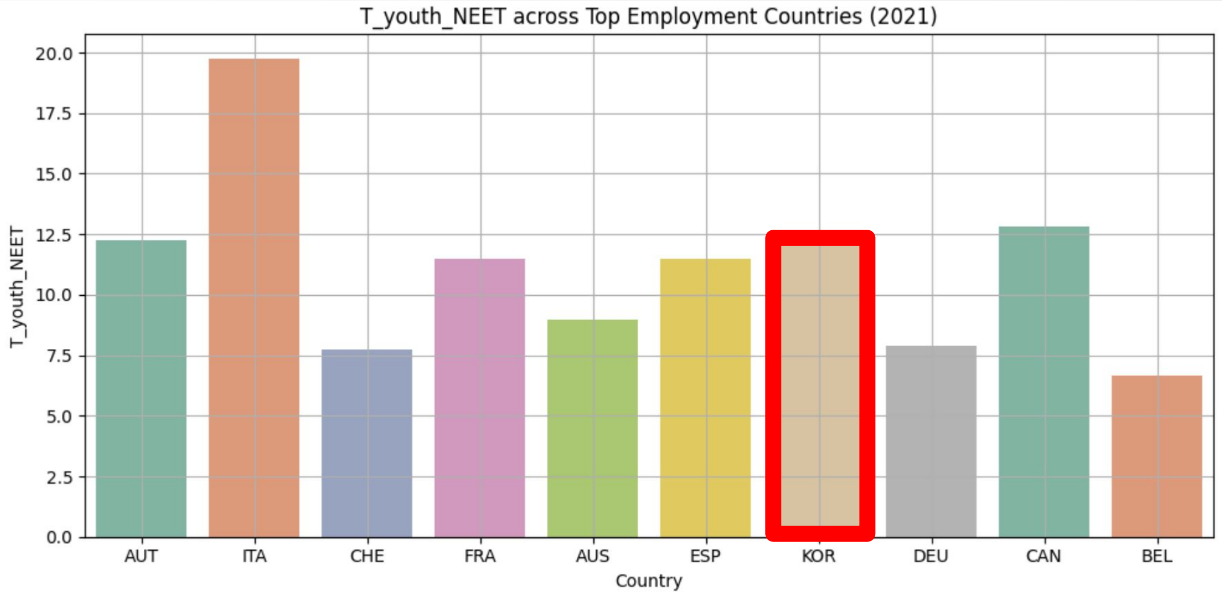
📌**Policy implications:** Policy efforts to address this include minimizing career breaks for women, promoting their return to work after childbirth and childcare, and implementing flexible work systems to create a more stable labor market for women.

2. T_paid_workers(the total percentage of paid workers)

📌 The lowest compared to other top countries. The low rate can be seen as a large proportion of self-employed and non-wage workers.

📌**Policy Implications**: To expand the number of paid workers, policies such as increasing regular employment opportunities and offering incentives to companies for hiring should be implemented.

3. T_youth_NEET (the proportion of young people in NEET)



📌 Higher than average. Higher knit rates mean weaker future labor market inflows, which have a long-term negative impact on T_employers.

📌**Policy Implications**: Need to induce employment of young people and strengthen career education, internships, and vocational training

Final Conclusion

<Policy Recommendations to Improve Korea’s Employment Rate>

☑️ Low ratio of paid female workers **->** Create policies to support women's postpartum career breaks and guarantee parental leave

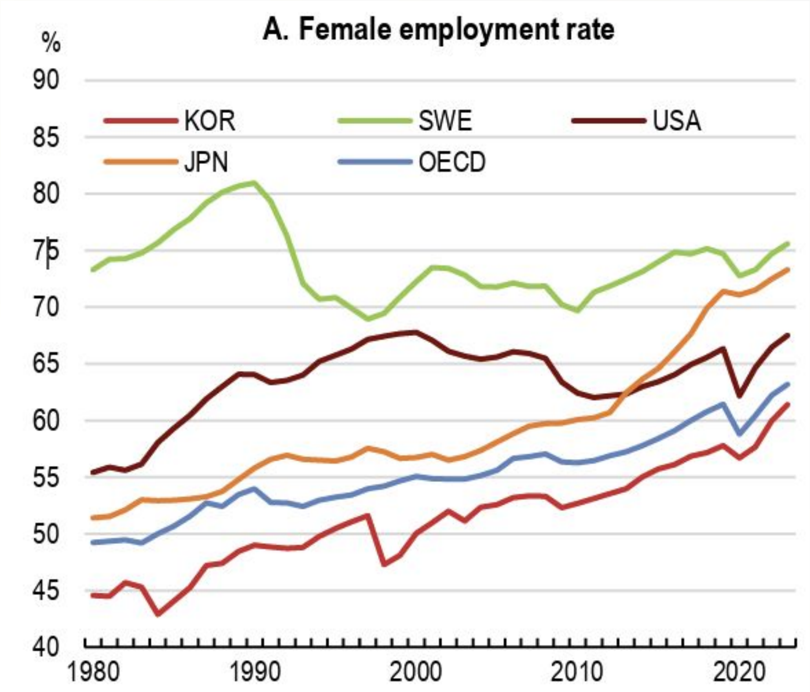
☑️ Low ratio of paid workers **->** Promote full-time employment and introduce corporate incentives

☑️ High youth NEET rate **->** Strengthen career education and vocational training programs

05

Insights

F_paid_workers



Note: Employment rates for 15-64-year-olds. Source: OECD, Labour Force Statistics (database).

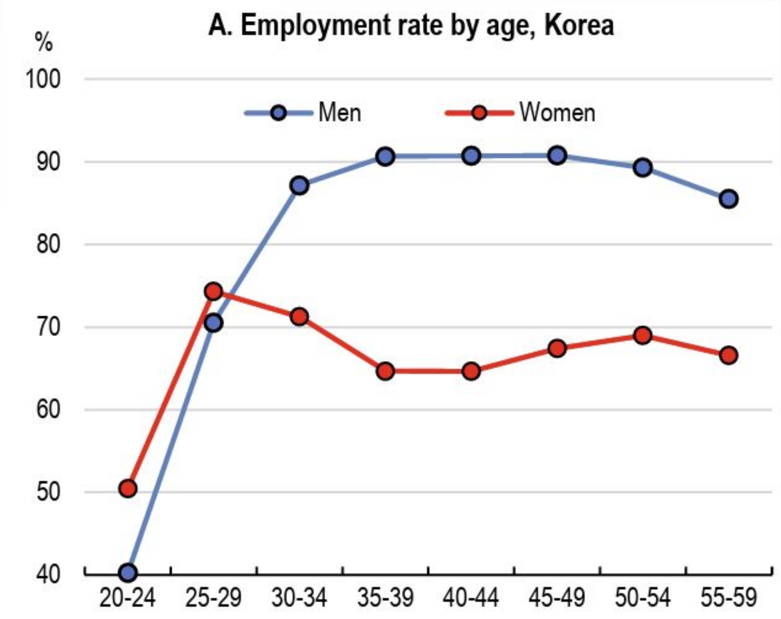
Female employment has increased over time in South Korea and most OECD countries

However,

According to the OECD, South Korea ranked 31st out of 38 OECD countries in female employment rate in 2023, with a rate of 61.4%, compared to the OECD average of 63.2%.

F_paid_workers

Marriage and childbirth reduce women’s employment



Source: OECD, Labour Force Statistics (database).

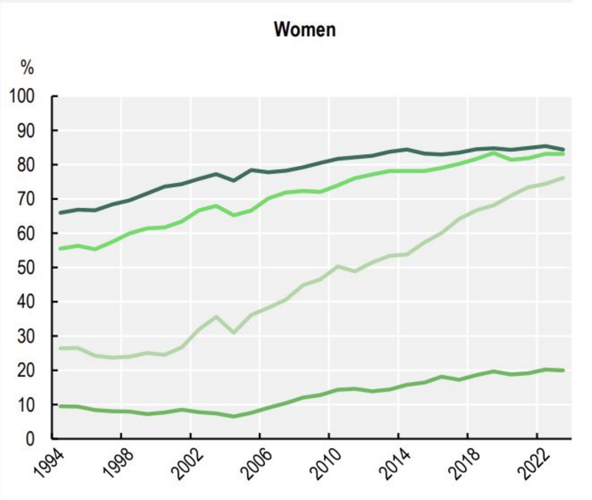
Studies analyzing women's employment from a life-course perspective indicate that, unlike the OECD average, South Korea's female employment pattern continues to follow a traditional '**M-shaped**' curve. This pattern is largely attributed to women exiting the workforce due to **marriage and childcare responsibilities.**

“To expand female employment to the levels seen in advanced nations, it is necessary to focus policy efforts on enabling women to better balance work and family life, allowing them to participate more actively in the economy.”

F_paid_workers in Austria

Employment rate (%)		2019	2020	2021	2022	2023
Total	Austria	73.6	72.4	72.4	74	74.1
	EU 27	68.4	67.5	68.3	69.8	70.4
Male	Austria	78	76.5	76.7	78	77.9
	EU 27	73.8	72.8	73.3	74.7	75.1
Female	Austria	69.2	68.3	68.1	70	70.3
	EU 27	63.1	62.2	63.3	64.9	65.7

Source: Eurostat (European Union statistics)



Source: OECD, Labour Force Statistics (database).

Female employment rate in Austria for individuals aged 15–64 is 70.3% and approximately 66.6% as of 2023, according to the Eurostat and OECD respectively.

Austria's relatively high female employment is supported by **strong family policies** ; parental leave, childcare facilities, and part-time work options, which aim to **support women returning from career breaks.**

Studying how these policies enhance female employment can provide lessons for South Korea.

Austrian Policies Supporting Women Returning from Career Breaks

1. Wiedereingliederungsteilzeit (Phased Reintegration Part-Time Scheme)

- A time-limited part-time work scheme to support gradual return to work after long-term sick leave
- Working hours can be reduced by 25–50%, for up to 9 months
- Particularly useful for women returning after health issues, childbirth, or childcare leave

🔵**Korean Relevance:**

- Similar policies exist in Korea, such as flexible work hours and part-time job options
- The concept of "phased return" could be integrated with childcare-related return-to-work programs
- Expected impact: reduces re-entry burden, prevents labor market exit, lowers turnover

2. Qualifizierungsförderung für Beschäftigte (Training Support for Employees)

- Subsidy program for companies to cover up to 50% of training and wage costs
- Targets low-skilled workers and women aged 50+
- Helps employed women improve skills and access promotion opportunities

🔵**Korean Relevance:**

- Korea already runs similar programs via the employment insurance fund, e.g., employer-led training and National Learning Cards (내일배움)
- Could be restructured to specifically support women and mid-career workers
- Expected impact: prevents career break during employment, enables job transition, strengthens women's career development

3. Fachkräftestipendium (Skilled Worker Scholarship)

- Financial support for full-time retraining (up to 4 years) in shortage occupations (e.g., nursing, technical fields)
- Includes both tuition and living costs
- Especially beneficial for women seeking long-term stable employment and income growth

🔵Korean Relevance:

- Similar programs: National Strategic Industry Training, K-Digital Training, nursing assistant programs
- However, living cost support is still limited in Korea
- Could help low-income and career-break women transition into professional roles and address aging workforce needs

Implications for South Korea's Women Returning from Career Breaks Policies

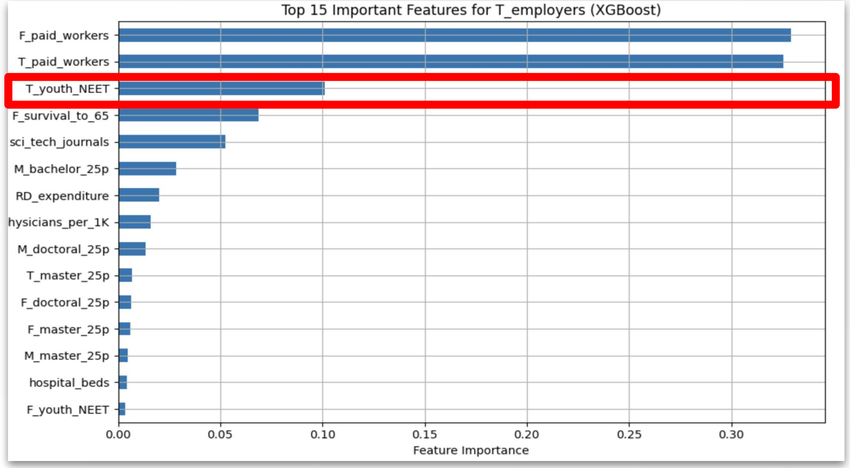
Given that Korea already has partial equivalents, the focus should be on strategic restructuring, not full replication:

1. Institutionalize phased return-to-work schemes, with incentives for companies to participate

2. Restructure training subsidies to be targeted at women and mid-career employees

3. Enhance professional retraining scholarships to include living expense support

T_youth_NEET

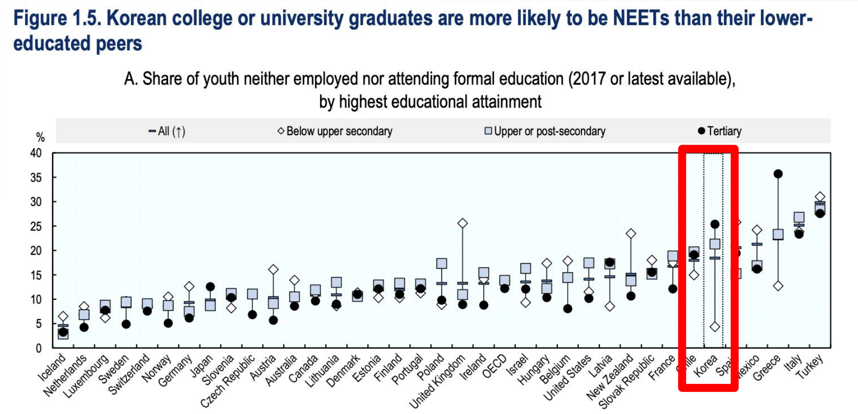


According to the Feature Importance Plot, T_youth_NEET(Not in Employment, Education, or Training) which is a Labor Market Efficiency Indicator was the third highest important feature.

Why does high youth NEET rate matter?

- It signals poor school-to-work transitions and inefficiencies in labor and education systems.
- Long-term NEETs risk falling into poverty, social isolation, and mental health issues.
- It also burdens public welfare and reduces national economic potential.
- Weakens trust in social mobility and delays life transitions (marriage, home, children).

Characteristics of NEET in Korea



Characteristics:

- NEET rate in Korea: 20% (2019), well above the OECD average (13.4%).
- 45% of NEETs are university graduates where In most countries, it is centered on the low-educated class
- Particularly high among youth aged 25–29 and women.

Key Causes:

- Prolonged job preparation (e.g., public sector exams, extra credentials)
- Mismatch between education and job market needs
- Overconcentration in higher education and large firm preference

Shift in NEET Composition & Policy Implications

Characteristics:

- According to Korea Employment Information Service (KEIS)'s report [계간]2025 봄호 고용이슈, it categorized NEET youth into six types: job seekers, education preparers, caregivers, non-job-seekers, those with physical or mental health issues, and those awaiting military enlistment.
- Of these, only the **"non-job-seeking" group** increased in size, suggesting that many youth are not actively engaged in career planning or training at all.
- The challenge is not only helping NEET youth find jobs, but also **re-engaging those who have stopped looking entirely**
- Government should develop integrated, personalized **policies to build psychological resilience and strengthen career readiness.**

Key Lessons from the UK NEET Re-engagement Pilots

Characteristics:

- The UK Department for Education's report, *"What Works Re-engaging Young People Who Are Not in Education, Employment or Training (NEET)"* (DFE-RR065), provides valuable insights into effective strategies for re-engaging NEET youth

Personalized Support with Dedicated Advisers

- Each participant was assigned a dedicated adviser who provided continuous guidance and support throughout the program.
- This individualized approach helped build trust and address specific barriers faced by each young person

Focus on 'Soft Outcomes'

- Beyond employment or educational placements, the programs aimed to improve participants' confidence, motivation, and social skills.
- These soft outcomes were crucial in preparing youth for sustained engagement in work or education.

Flexibility and Tailored Interventions

- The programs were designed to be flexible, allowing for adjustments based on individual needs and circumstances.
- This adaptability ensured that interventions remained relevant and effective for diverse participants.

Implications for South Korea's NEET Policies

- While the UK's NEET Re-engagement Pilots focused primarily on youth aged 16–18, applying the same model directly to South Korea may be ineffective, as approximately 45% of NEETs in South Korea are university graduates. Therefore, any intervention must be tailored to address the specific characteristics of the older, more educated NEET population.

Implement Personalized Support Systems

- Assign dedicated advisers or mentors to NEET youth to provide continuous, individualized guidance.
- Develop personalized action plans that address specific barriers and goals for each participant.
- Establish integrated mental health and career support systems such as services centers at universities or community hubs to provide psychological counseling, career coaching, and employment services in a single location

Implications for South Korea's NEET Policies

Emphasize Soft Skill Development

- Incorporate activities that build confidence, communication skills, and resilience.
- Recognize and measure improvements in soft skills as key indicators of program success.

Strengthen Industry-academia partnerships

- Expanding Field Internships to Shorten Job Preparation Time
- Financial incentives and recognition in university evaluations are necessary to encourage company participation.

THANK YOU FOR LISTENING !

Do you have any questions?

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