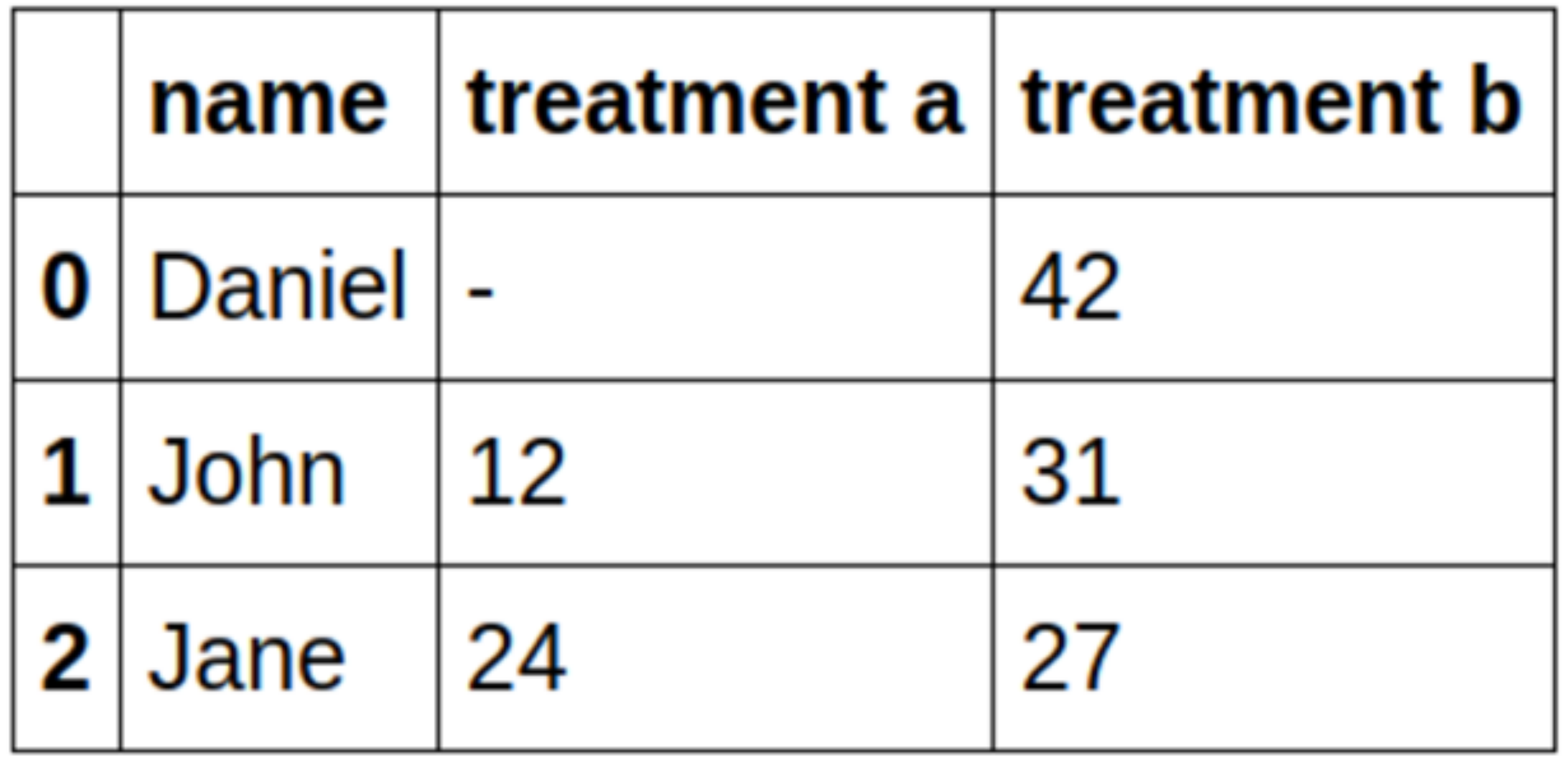
CLEANING DATA IN PYTHON

Tidy data

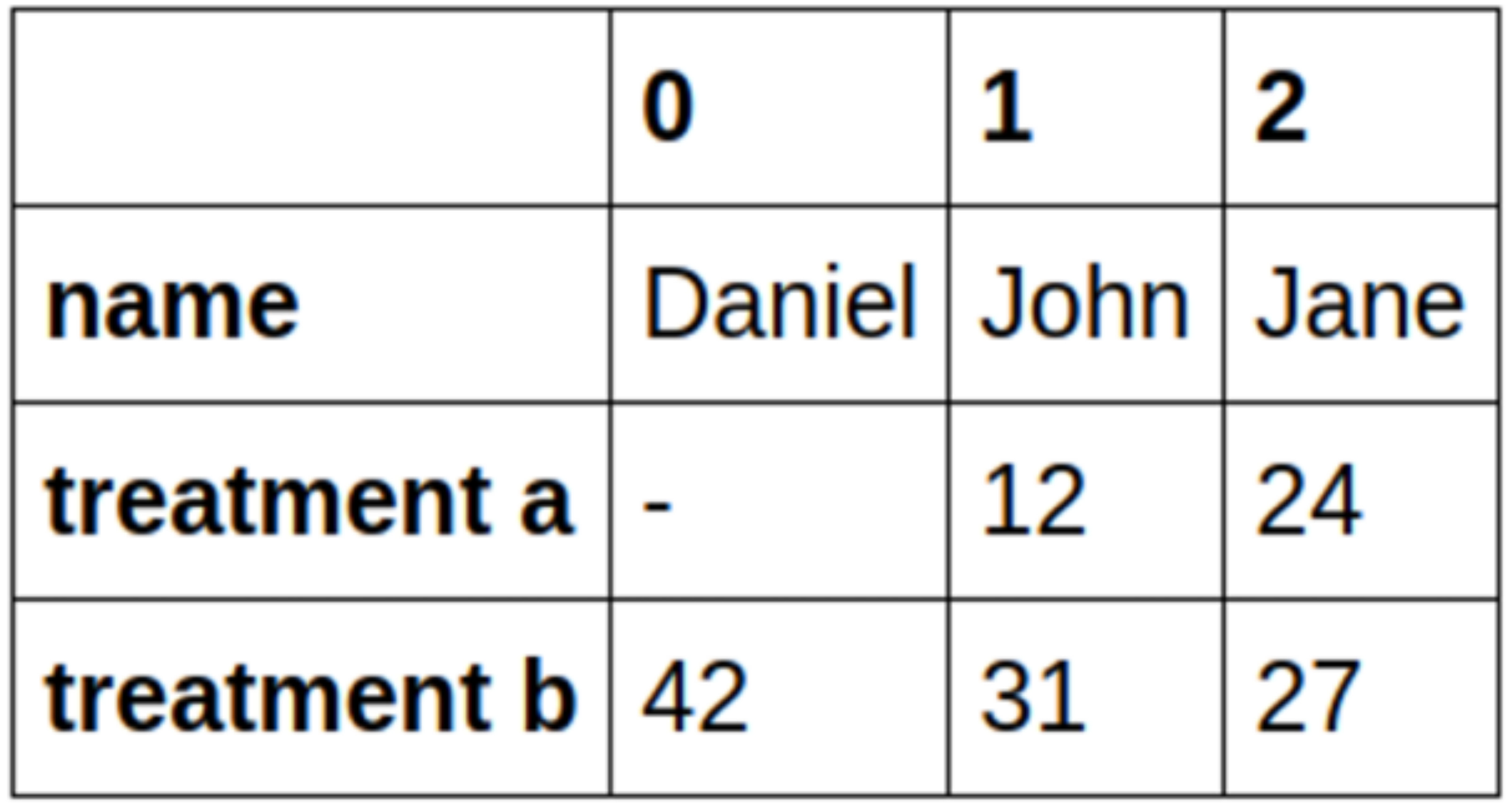
Tidy data

- “Tidy Data” paper by Hadley Wickham, PhD
- Formalize the way we describe the shape of data
- Gives us a goal when formatting our data
- “Standard way to organize data values within a dataset”

Motivation for tidy data



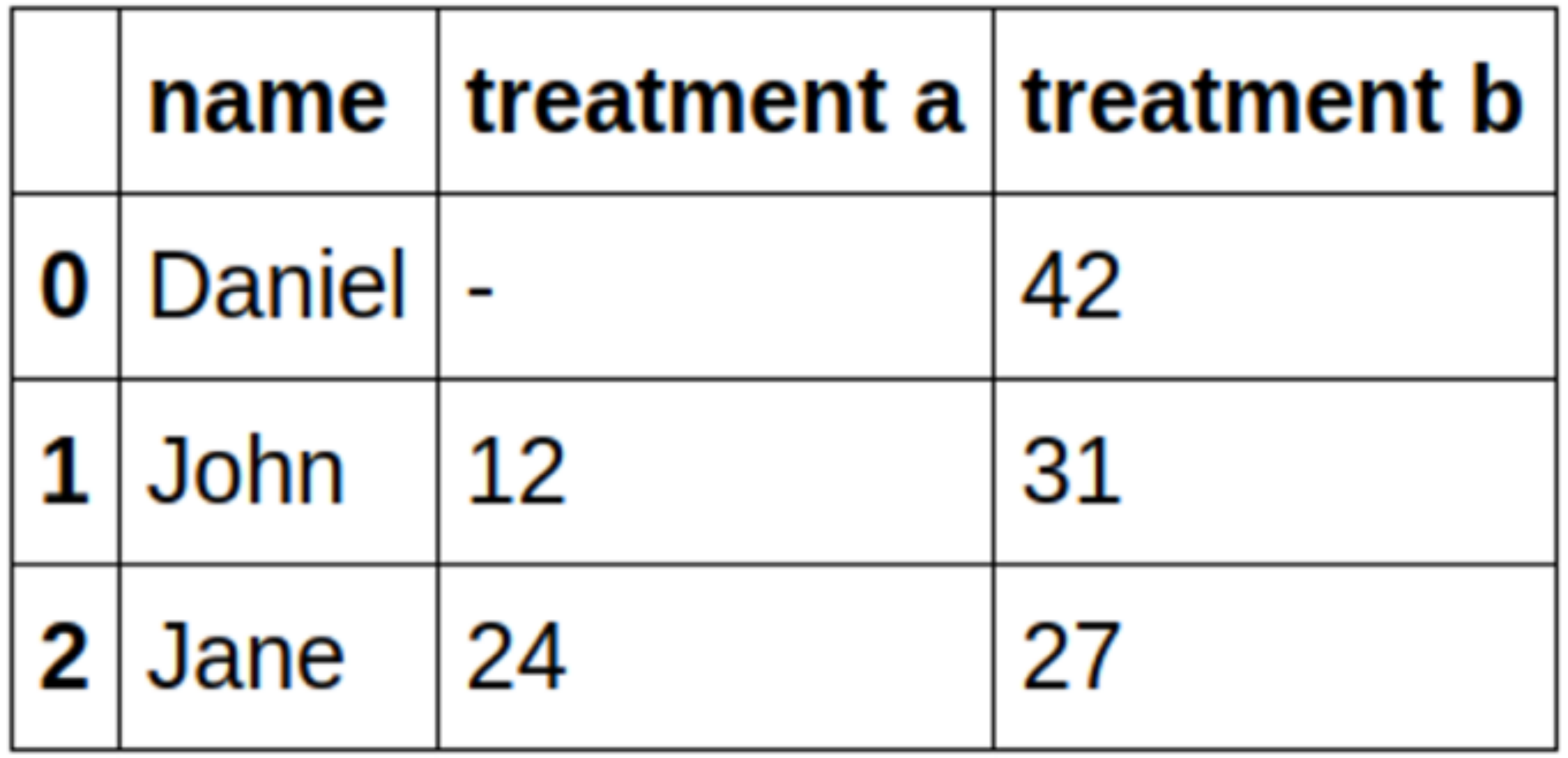
	name	treatment a	treatment b
0	Daniel	-	42
1	John	12	31
2	Jane	24	27



	0	1	2
name	Daniel	John	Jane
treatment a	-	12	24
treatment b	42	31	27

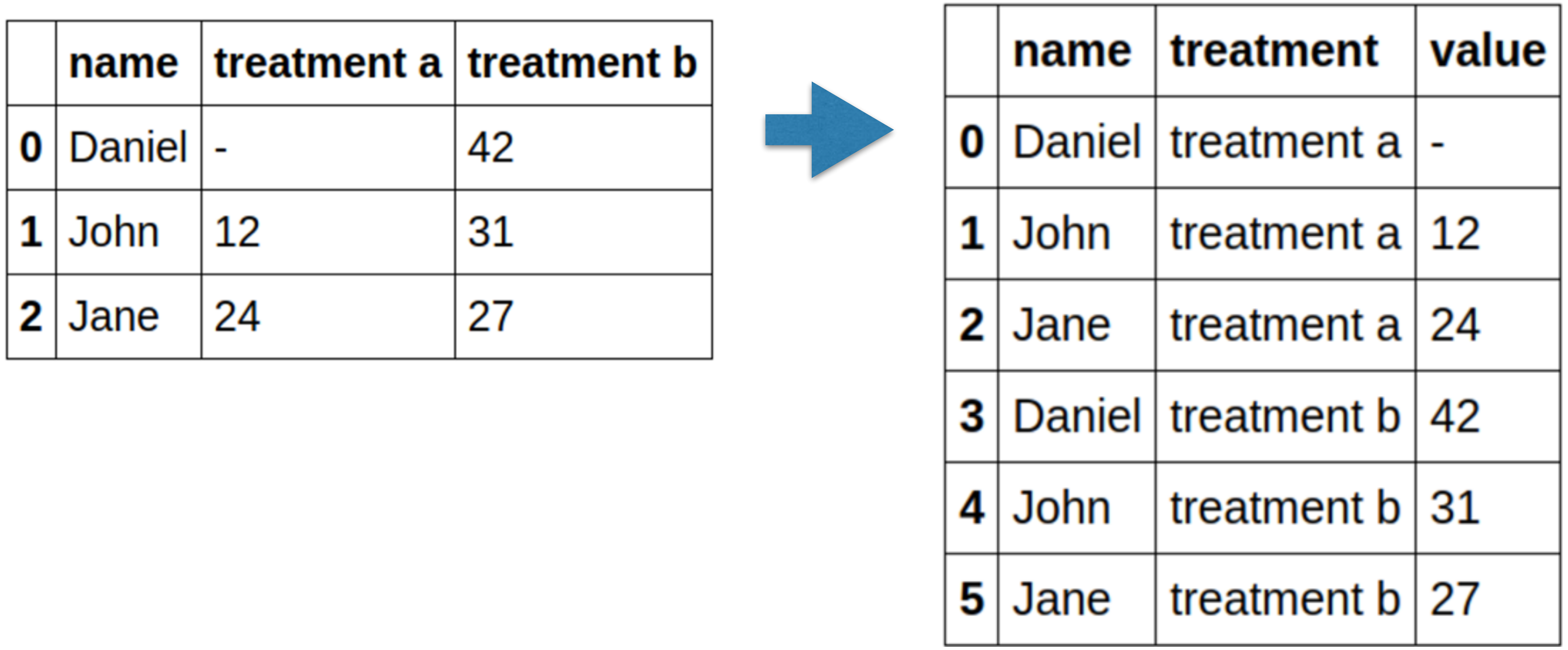
Principles of tidy data

- Columns represent separate variables
- Rows represent individual observations
- Observational units form tables



	name	treatment a	treatment b
0	Daniel	-	42
1	John	12	31
2	Jane	24	27

Converting to tidy data



	name	treatment a	treatment b
0	Daniel	-	42
1	John	12	31
2	Jane	24	27

	name	treatment	value
0	Daniel	treatment a	-
1	John	treatment a	12
2	Jane	treatment a	24
3	Daniel	treatment b	42
4	John	treatment b	31
5	Jane	treatment b	27

- Better for reporting vs. better for analysis
- Tidy data makes it easier to fix common data problems

Converting to tidy data

- The data problem we are trying to fix:
    - Columns containing values, instead of variables
- Solution: pd.melt()

Melting

```
In [1]: pd.melt(frame=df, id_vars='name',
   ...:         value_vars=['treatment a', 'treatment b'])
Out[1]:
    name     variable  value
0 Daniel  treatment a      _
1   John  treatment a     12
2   Jane  treatment a     24
3 Daniel  treatment b     42
4   John  treatment b     31
5   Jane  treatment b     27
```

Melting

```
In [2]: pd.melt(frame=df, id_vars='name',
   ...:         value_vars=['treatment a', 'treatment b’],
   ...:         var_name='treatment', value_name='result')
Out[2]:
    name    treatment  result
0  Daniel  treatment a      _
1    John  treatment a     12
2    Jane  treatment a     24
3  Daniel  treatment b     42
4    John  treatment b     31
5    Jane  treatment b     27
```

CLEANING DATA IN PYTHON

Let’s practice!

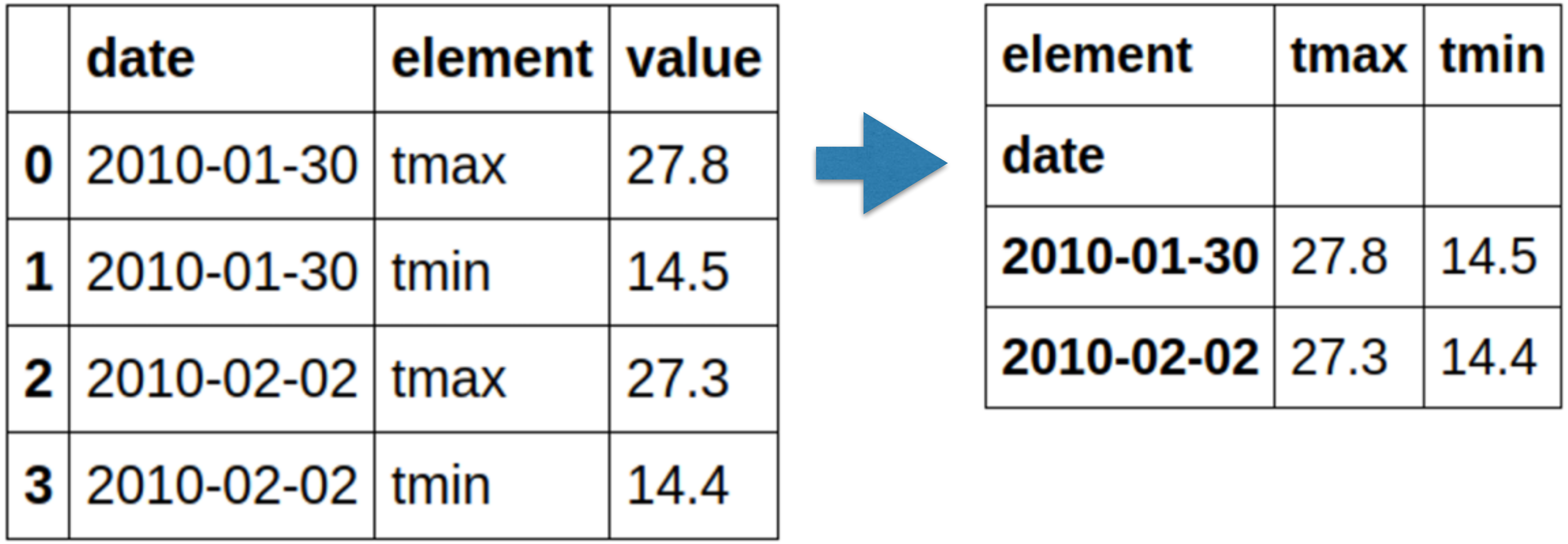
CLEANING DATA IN PYTHON

Pivoting data

Pivot: un-melting data

- Opposite of melting
- In melting, we turned columns into rows
- Pivoting: turn unique values into separate columns
- Analysis friendly shape to reporting friendly shape
- Violates tidy data principle: rows contain observations
    - Multiple variables stored in the same column

Pivot: un-melting data



	date	element	value
0	2010-01-30	tmax	27.8
1	2010-01-30	tmin	14.5
2	2010-02-02	tmax	27.3
3	2010-02-02	tmin	14.4

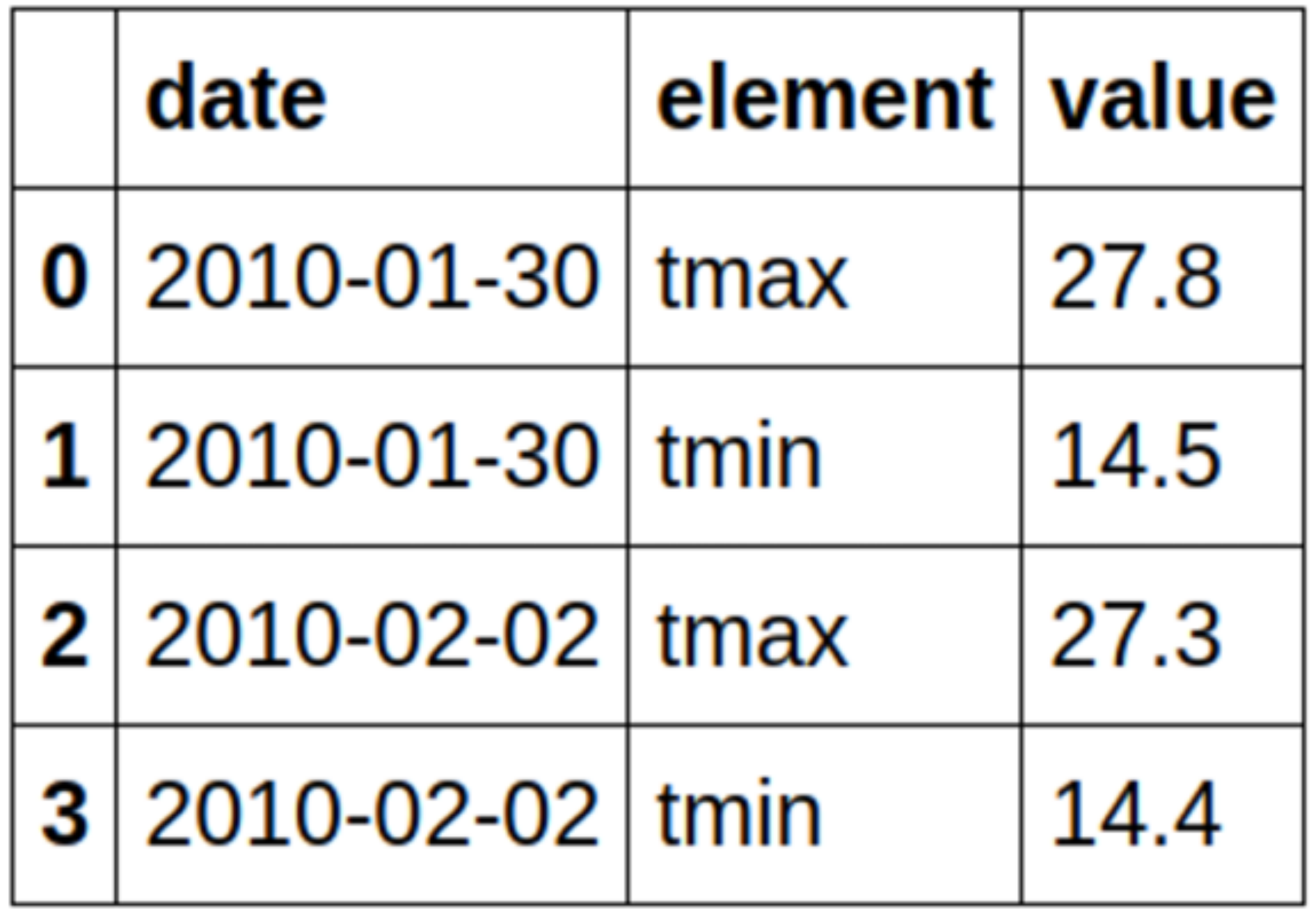
element	tmax	tmin
date		
2010-01-30	27.8	14.5
2010-02-02	27.3	14.4

Pivot

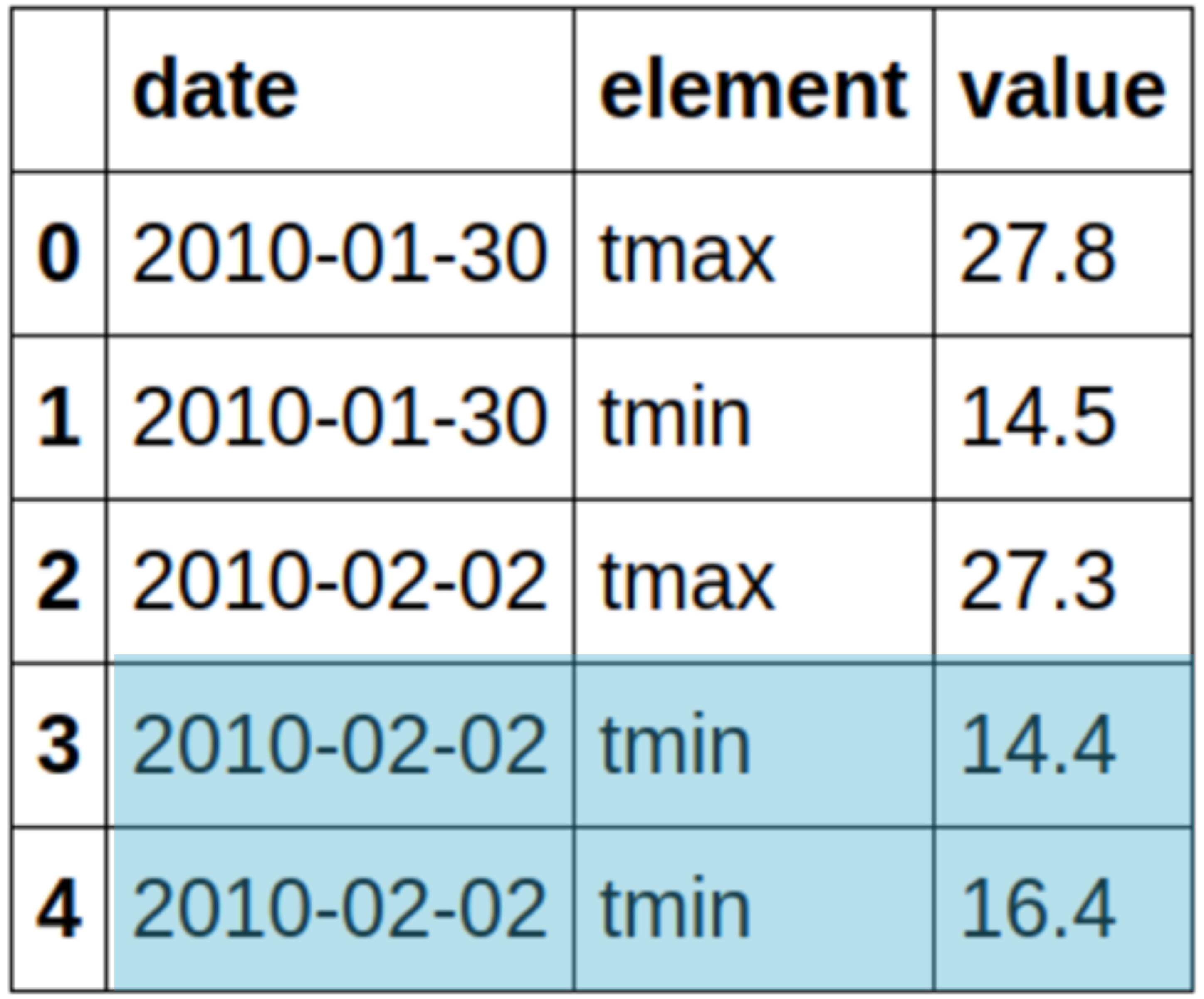
```
In [1]: weather_tidy = weather.pivot(index='date',
   ...:                              columns='element',
   ...:                              values='value')

In [2]: print(weather_tidy)
element     tmax tmin
date
2010-01-30  27.8 14.5
2010-02-02  27.3 14.4
```

Pivot



	date	element	value
0	2010-01-30	tmax	27.8
1	2010-01-30	tmin	14.5
2	2010-02-02	tmax	27.3
3	2010-02-02	tmin	14.4



	date	element	value
0	2010-01-30	tmax	27.8
1	2010-01-30	tmin	14.5
2	2010-02-02	tmax	27.3
3	2010-02-02	tmin	14.4
4	2010-02-02	tmin	16.4

Using pivot when you have duplicate entries

```
In [3]: import numpy as np

In [4]: weather2_tidy = weather.pivot(values='value',
   ...:                               index='date',
   ...:                               columns='element')
Out[4]:
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-9-2962bb23f5a3> in <module>()
      1 weather2_tidy = weather2.pivot(values='value',
      2                                index='date',
----> 3                                columns='element')
ValueError: Index contains duplicate entries, cannot reshape
```

Pivot table

- Has a parameter that specifies how to deal with duplicate values
- Example: Can aggregate the duplicate values by taking their average

Pivot table

```
In [5]: weather2_tidy = weather.pivot_table(values='value',
   ...:                                     index='date',
   ...:                                     columns='element',
   ...:                                     aggfunc=np.mean)
Out[5]:
element     tmax tmin
date
2010-01-30  27.8 14.5
2010-02-02  27.3 15.4
```

Let’s practice!

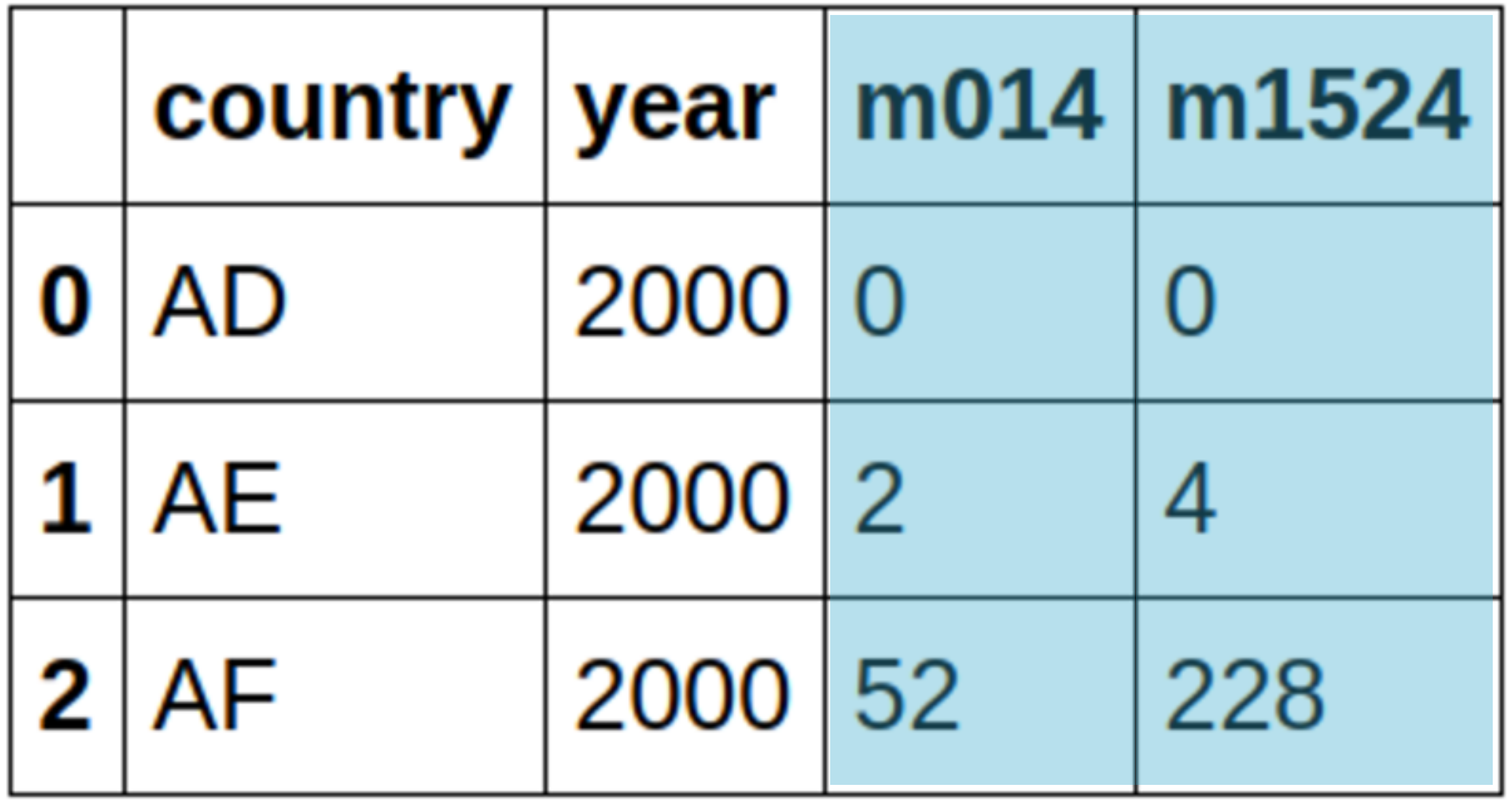
CLEANING DATA IN PYTHON

Beyond melt and pivot

Beyond melt and pivot

- Melting and pivoting are basic tools
- Another common problem:
    - Columns contain multiple bits of information

Beyond melt and pivot



	country	year	m014	m1524
0	AD	2000	0	0
1	AE	2000	2	4
2	AF	2000	52	228

Melting and parsing

```
In [1]: pd.melt(frame=tb, id_vars=['country', 'year'])
Out[1]:
   country   year variable value
0       AD   2000     m014     0
1       AE   2000     m014     2
2       AF   2000     m014    52
3       AD   2000    m1524     0
4       AE   2000    m1524     4
5       AF   2000    m1524   228
```

- Nothing inherently wrong about original data shape
- Not conducive for analysis

Melting and parsing

```
In [2]: tb_melt['sex'] = tb_melt.variable.str[0]

In [3]: tb_melt
Out[3]:
   country   year variable value  sex
0       AD  2000      m014    0    m
1       AE  2000      m014    2    m
2       AF  2000      m014   52    m
3       AD  2000     m1524    0    m
4       AE  2000     m1524    4    m
5       AF  2000     m1524  228    m
```

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Let’s practice!