FINC-672 – WORKSHOP IN FINANCE: EMPIRICAL RESEARCH

Julia Data Structures IV

Prof. Matt Fleckenstein
University of Delaware

mflecken@udel.edu

Goals

- ☐ Dates

Dates

- To work with dates in Julia, we import the `Dates` module from the Julia standard library.

```
julia> using Dates
```

- The `Dates` standard library module has two types for working with dates:
  - `Date`: representing time in days; and
  - `DateTime`: representing time in millisecond precision.
- We construct `Date` and `DateTime` with the default constructor by specifying an integer to represent year, month, day, hours and so on.
- Let's do a few examples.

Dates (cont'd)

```
julia> Date(1987) # year
1987-01-01

julia> Date(1987, 9) # month
1987-09-01

julia> Date(1987, 9, 13) # day
1987-09-13

julia> DateTime(1987, 9, 13, 21) # hour
1987-09-13T21:00:00

julia> DateTime(1987, 9, 13, 21, 21) # minute
1987-09-13T21:21:00
```

Dates (cont'd)

- In working with dates, it is useful to be able to use **Periods**.
- Julia defines the following types that we will use often in working with financial data.

```
julia> subtypes(Dates.DatePeriod)
```

Dates (cont'd)

- Next, we need to discuss *Parsing Dates*.
- This just means that when we are given a dataset where dates are written in a specific format (e.g. "20210131" or "01-31-2022"), we need to tell Julia how to interpret these date formats.
- Let's consider an example where our dataset has a date written as 20210131. How can we tell Julia that this number refers to January 31, 2021?

```
julia> Date("20210131","yyyymmdd")
2021-01-31
```

- We just use the `Date` constructor, and specify the date format as `"yyyymmdd`.
- Here, `yyyy` represents the year (i.e. 2021).
- `mm` represents the month (i.e. 01).
- `dd` represents the day (i.e. 31).

Dates (cont'd)

- We now know how to construct `Dates` in Julia.
- Next, we want to extract information such as the *year*, *month*, *day*, *weekday* etc. from a given `Date`.
- To illustrate some useful functions that Julia provides, let's suppose we have a Treasury bond with maturity date on May 15, 2025.

```
julia> maturityDate = Date("20250515",dateformat"yyyymmdd")
2025-05-15

julia> year(maturityDate)
2025

julia> month(maturityDate)
5

julia> day(maturityDate)
15
```

Dates (cont'd)

- We can also see the day of the week and other handy stuff.

```
julia> dayofweek(maturityDate)
4

julia> dayname(maturityDate)
"Thursday"
```

Dates (cont'd)

- We can perform operations in Dates instances.
- For example, we can add days to a `Date` or `DateTime` instance.
- Julias `Dates` will automatically perform the adjustments necessary for leap years, and for months with 30 or 31 days.

```
julia> maturityDate + Day(90)
2025-08-13

julia> maturityDate + Day(90) + Month(2) + Year(1)
2026-10-13
```

Dates (cont'd)

- To get **date duration**, we just use the subtraction - operator.
- To count the number of days between today and the maturity date of the bond, we can use the `today` function.

```
julia> maturityDate - today()
1180 days
```

Dates (cont'd)

- The last example, introduced the concept of **Date Intervals**.
- We can also easily construct date and time intervals.
- Suppose you want to create a `Day` interval. We do this with the colon `:` operator.

```
julia> Date("2022-01-01"):Day(1):Date("2022-01-07")
Dates.Date("2022-01-01"):Dates.Day(1):Dates.Date("2022-01-07")
```

Dates (cont'd)

- There is nothing special in using `Day(1)` as the interval.
- We can use whatever `Period` type as interval.
- For example, using 3 days as the interval

```
julia> Date("2022-01-01"):Day(3):Date("2022-01-07")
Dates.Date("2022-01-01"):Dates.Day(3):Dates.Date("2022-01-07")
```

Dates (cont'd)

- Months work just as well.

```
julia> Date("2021-01-01"):Month(1):Date("2021-03-01")
Dates.Date("2021-01-01"):Dates.Month(1):Dates.Date("2021-03-01")
```

Dates (cont'd)

- Note that in the previous examples, we created a `range` (actually a `StepRange`).
- We can convert this to a `vector` with the `collect` function.

```
julia> rng = Date("2021-01-01"):Month(1):Date("2021-03-01");

julia> vect = collect(rng)
3-element Vector{Dates.Date}:
 2021-01-01
 2021-02-01
 2021-03-01
```

Dates (cont'd)

- After we have materialized the `range` to a `Vector`, we have all the array functionalities available. For example, indexing:

```
julia> vect[end]
2021-03-01
```

- We can also broadcast date operations to our vector of `Date`s.
- We already know that we do this by using the dot-operator `.`

```
julia> vect .+ Day(10)
3-element Vector{Dates.Date}:
 2021-01-11
 2021-02-11
 2021-03-11
```

Dates (cont'd)

- This was just the tip of the iceberg...
- There are many more function available in Julia to work with dates.
- Best place to find out more is the manual: Julia Dates.

Wrap-Up

- ☑ Dates