Implementing Logistic Regression Models in Python

Overview

Set up a logistic regression to predict whether a stock will rise or fall

Solve this logistic regression in Python

Extend the logistic regression to include multiple explanatory variables

“Make the common use-case easy and the difficult use-case possible.”

Regression: Excel, R or Python?

Excel

Create a regression slide for an important presentation

R

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Python

Build trading model that scrapes websites, combines sentiment analysis and regression

Regression: Excel, R or Python?

Excel

Presentations

R

Seminars

Python

Trading models

R for Regression

R

Presentations

R

Seminars

R

Trading models

Demo

Implement Logistic Regression in Python

Logistic Regression in Python

Cause

Changes in S&P 500

Effect

Changes in price of Google Stock

Logistic Regression in Python

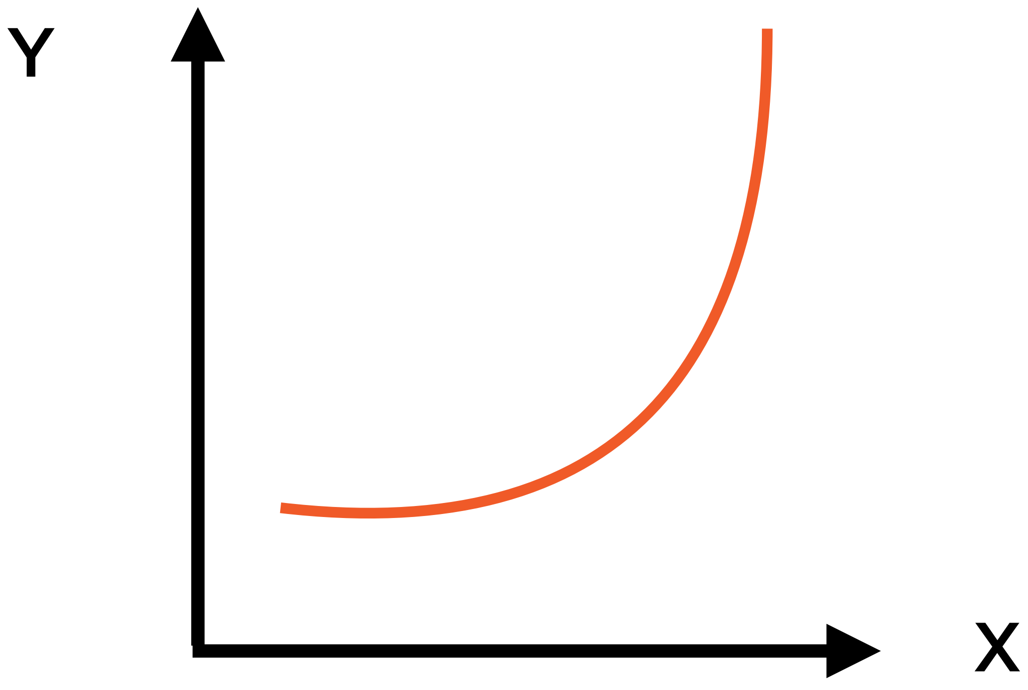
y = Returns on Google stock

(GOOG)

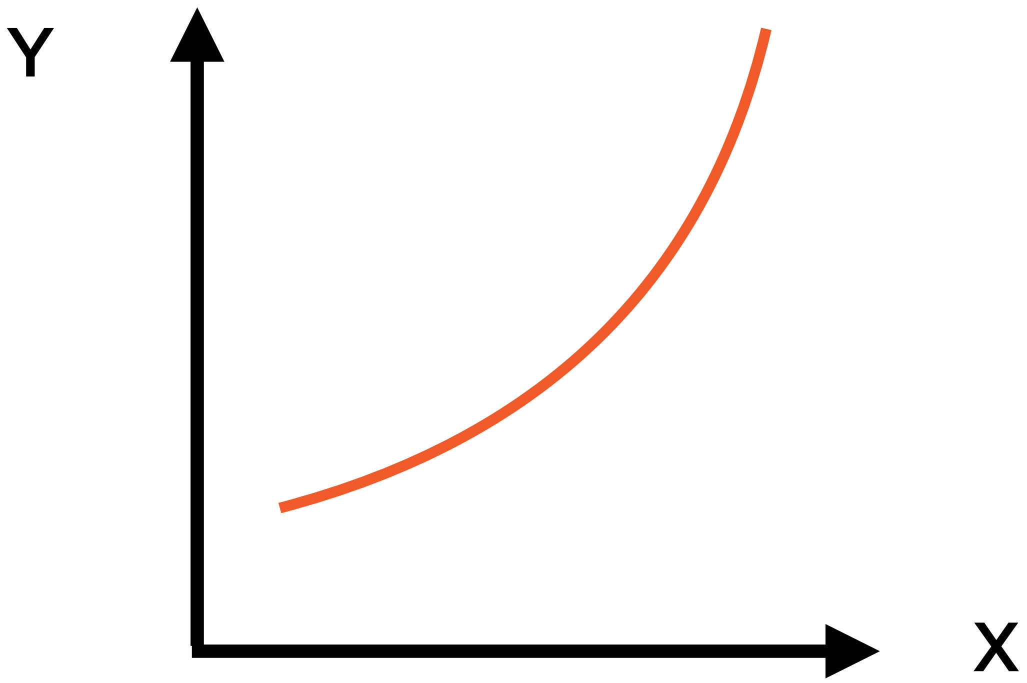
x = Returns on S&P 500

(S&P500)

Never Regress Non-Stationary Data



Exponential



Polynomial

Smoothly trending data will lead to poor quality regression models

First Differences

$y'_{12} = \log y_2 - \log y_1$

$x'_{12} = \log x_2 - \log x_1$

Regress y' and x'

Log Differences

$y'_{12} = (y_2 - y_1)/y_1$

$x'_{12} = (x_2 - x_1)/x_1$

Regress y' and x'

Returns

Take first differences of smooth data converting either to log differences or returns

Negative Indices in R

goog

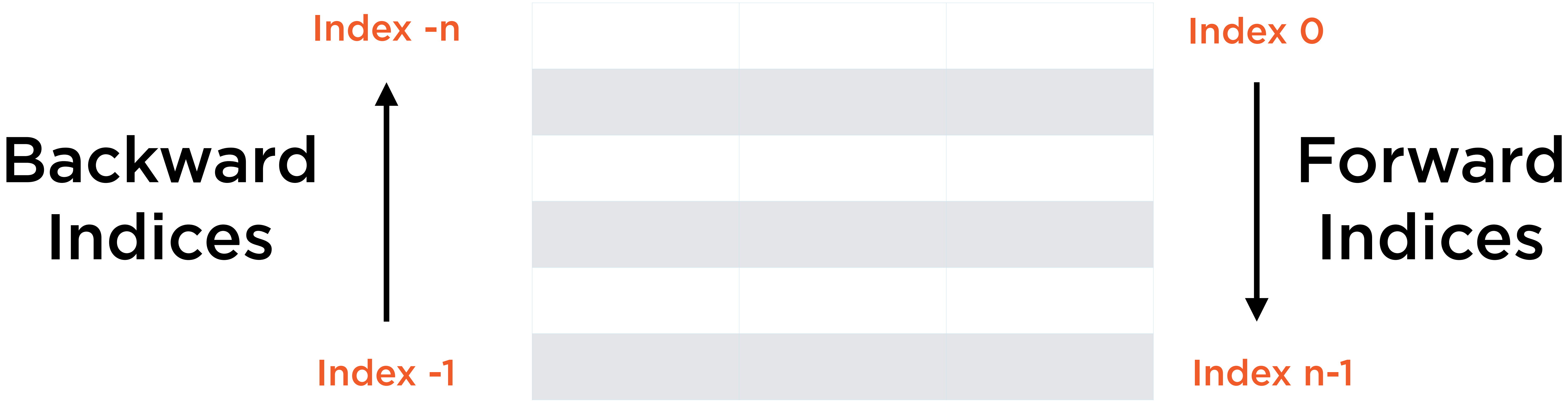
DATE	GOOG. PRICE	NASDAQ. PRICE	
2016-12-01	779	5550	Row 1
2016-11-01	747	5324	
2006-01-01	309	1900	Row nrow(goog)

Exclude

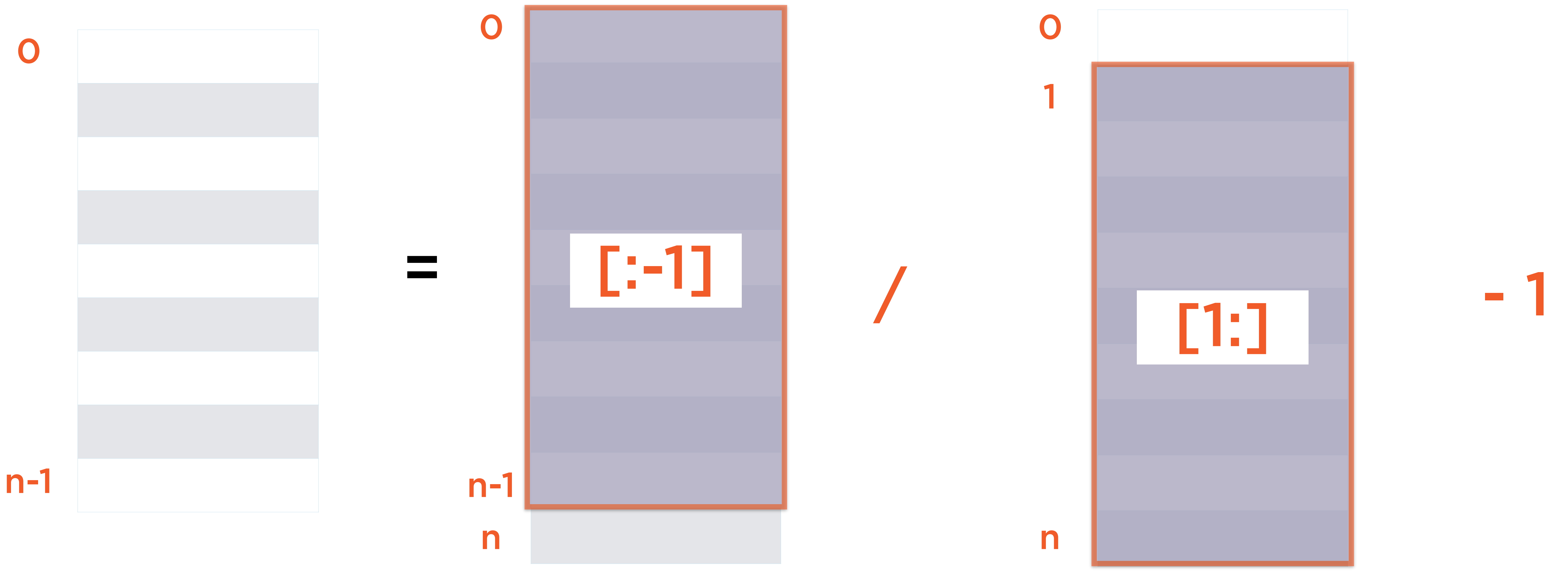
Column 1

goog[-nrow(goog),-1]

Negative Indices In Python



Prices to Returns



Returns = Prices[:-1] / Prices[1:] - 1

Using Logistic Regression

$$p(y_i) = \frac{1}{1 + e^{-(A+Bx_i)}}$$

P(y) = Probability of Google going up in the current month i

x = Returns on S&P 500 for current month

```
logit = sm.Logit(yData,xData)
```

A Much Harder Problem

$$p(y_i) = \frac{1}{1 + e^{-(A + B^{GOOG} x^{GOOG}_{i-1} + B^{SP500} x^{SP500}_{i-1})}}$$

P(y) = Probability of Google going up in the current month i

x^{GOOG} = Returns on GOOG for previous month

x^{SP500} = Returns on S&P 500 for previous month

```
logit = sm.Logit(yData,xData)
```

Two Approaches to Deadlines

Start 5 minutes before deadline

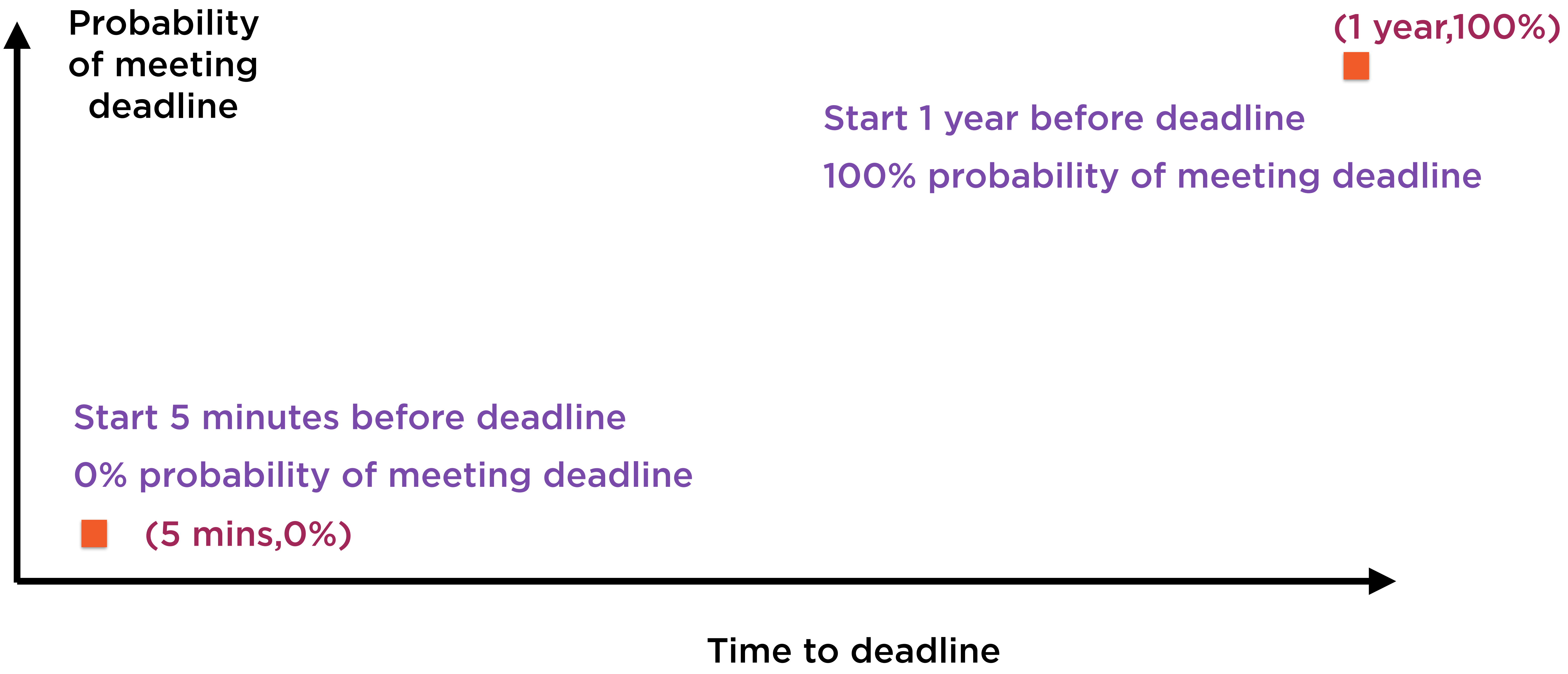
Good luck with that

Start 1 year before deadline

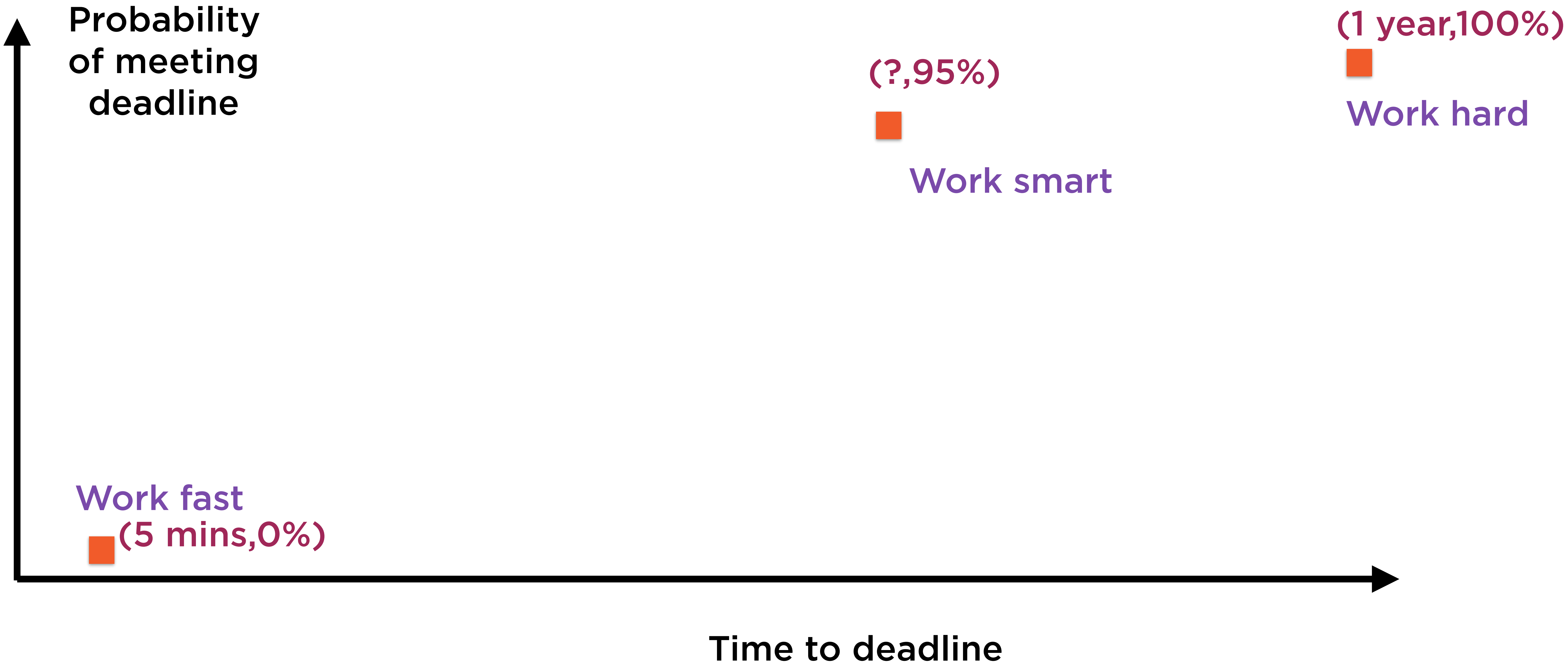
Maybe overkill

Neither approach is optimal

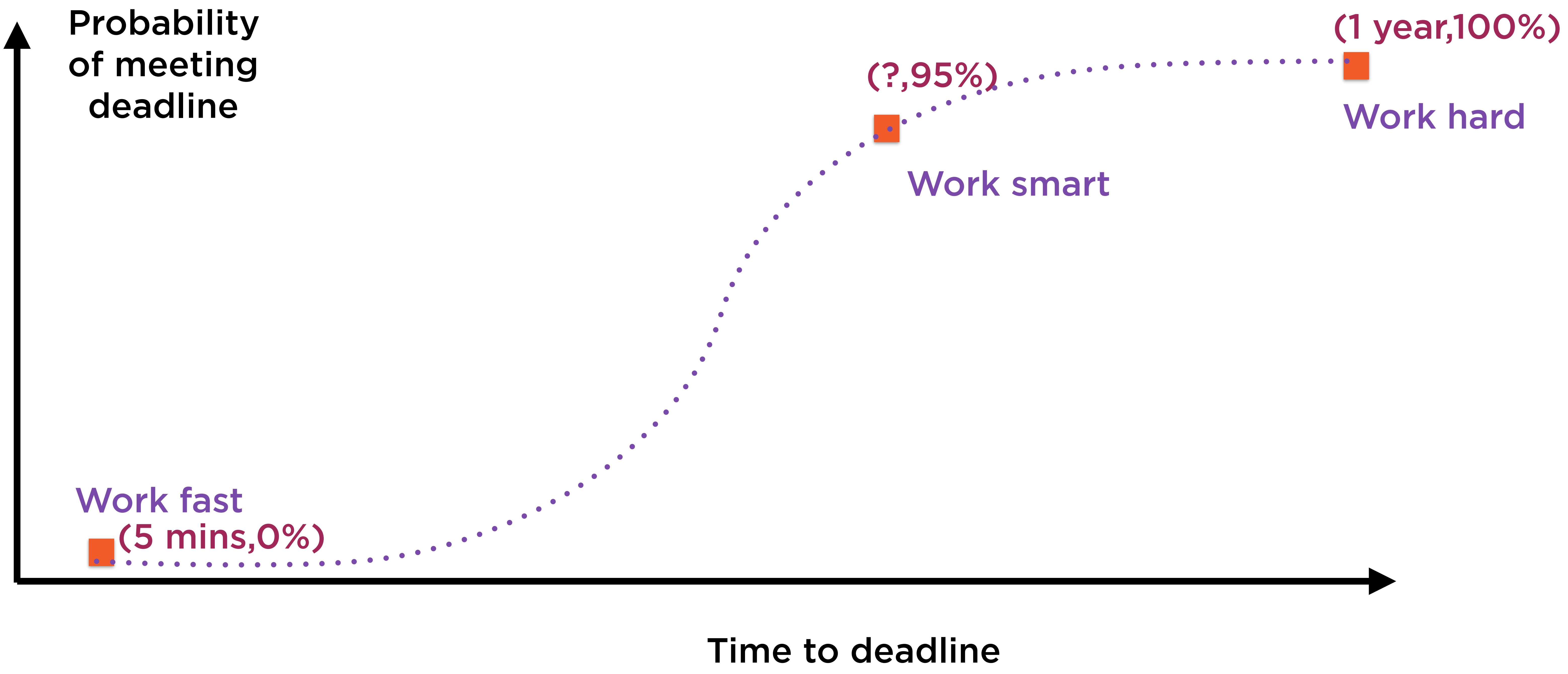
Working Hard, Fast, Smart



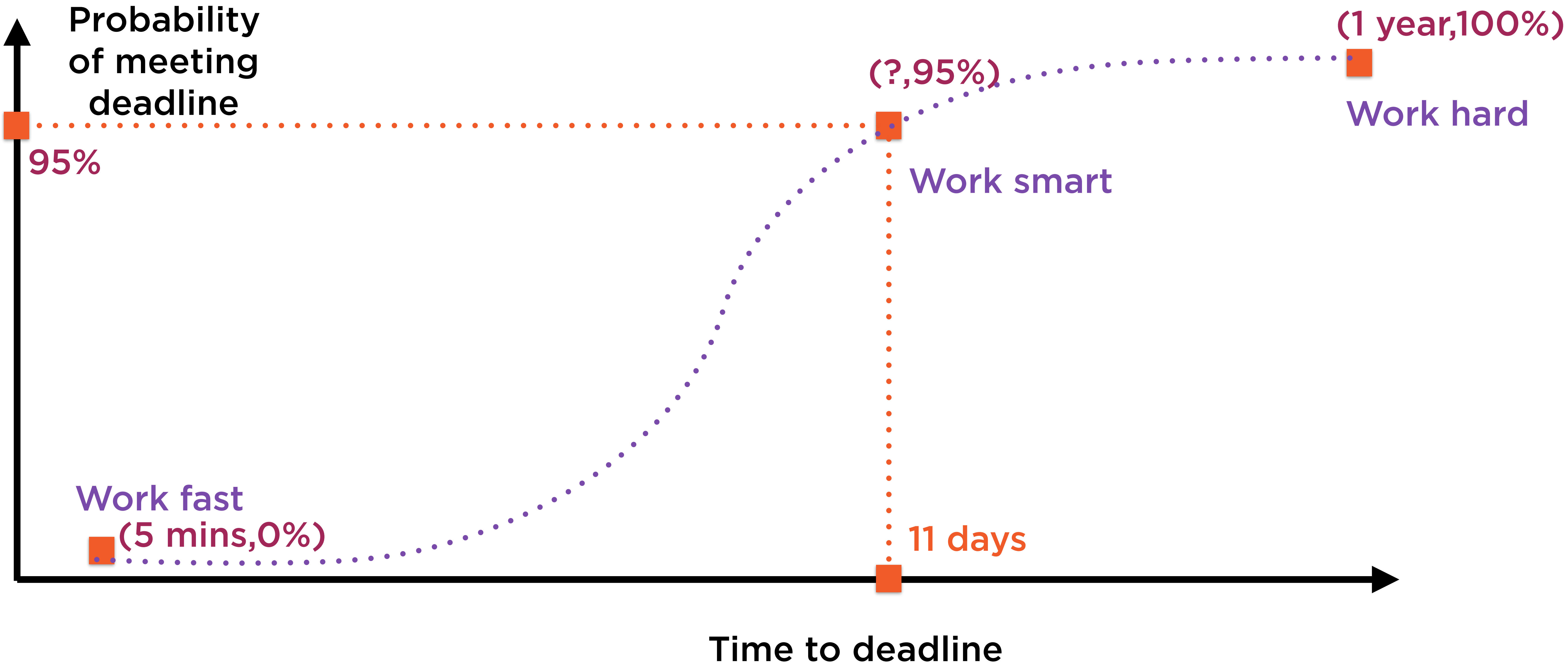
Working Hard, Fast, Smart



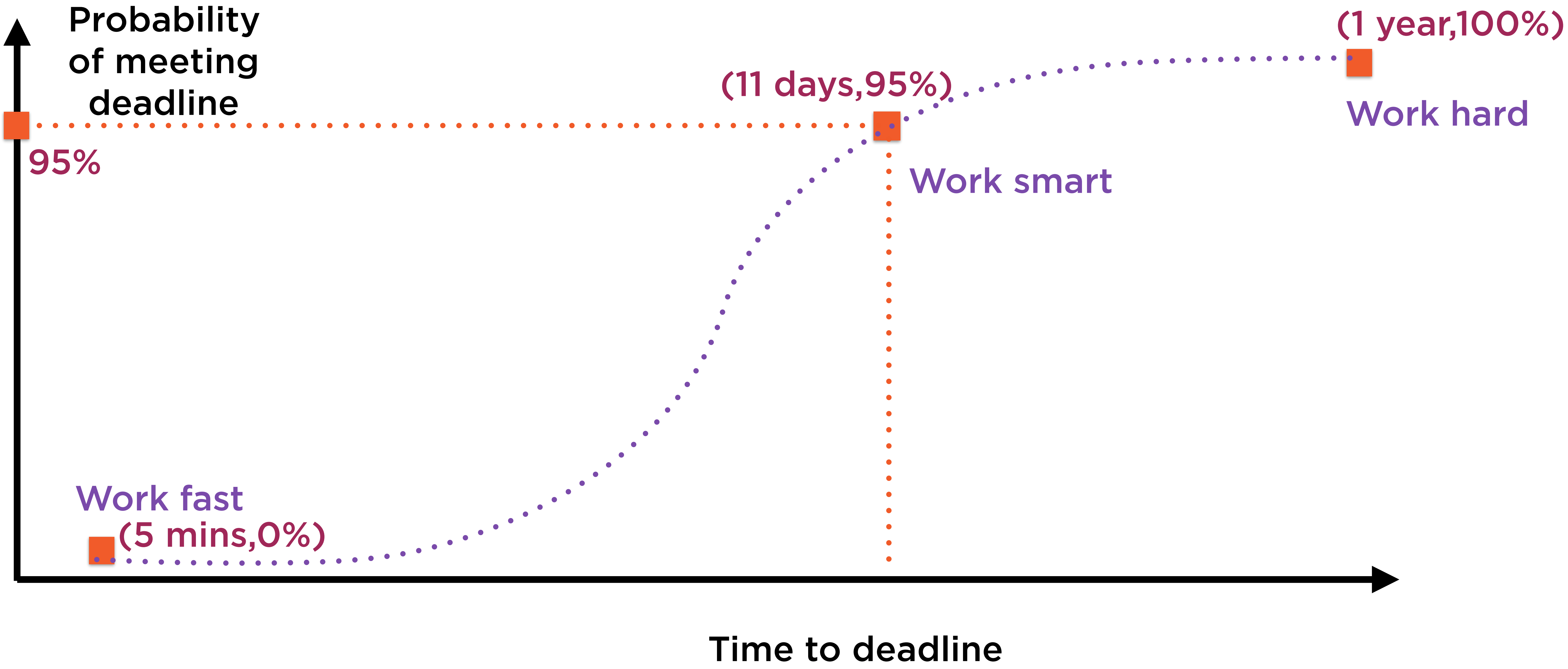
Working Hard, Fast, Smart



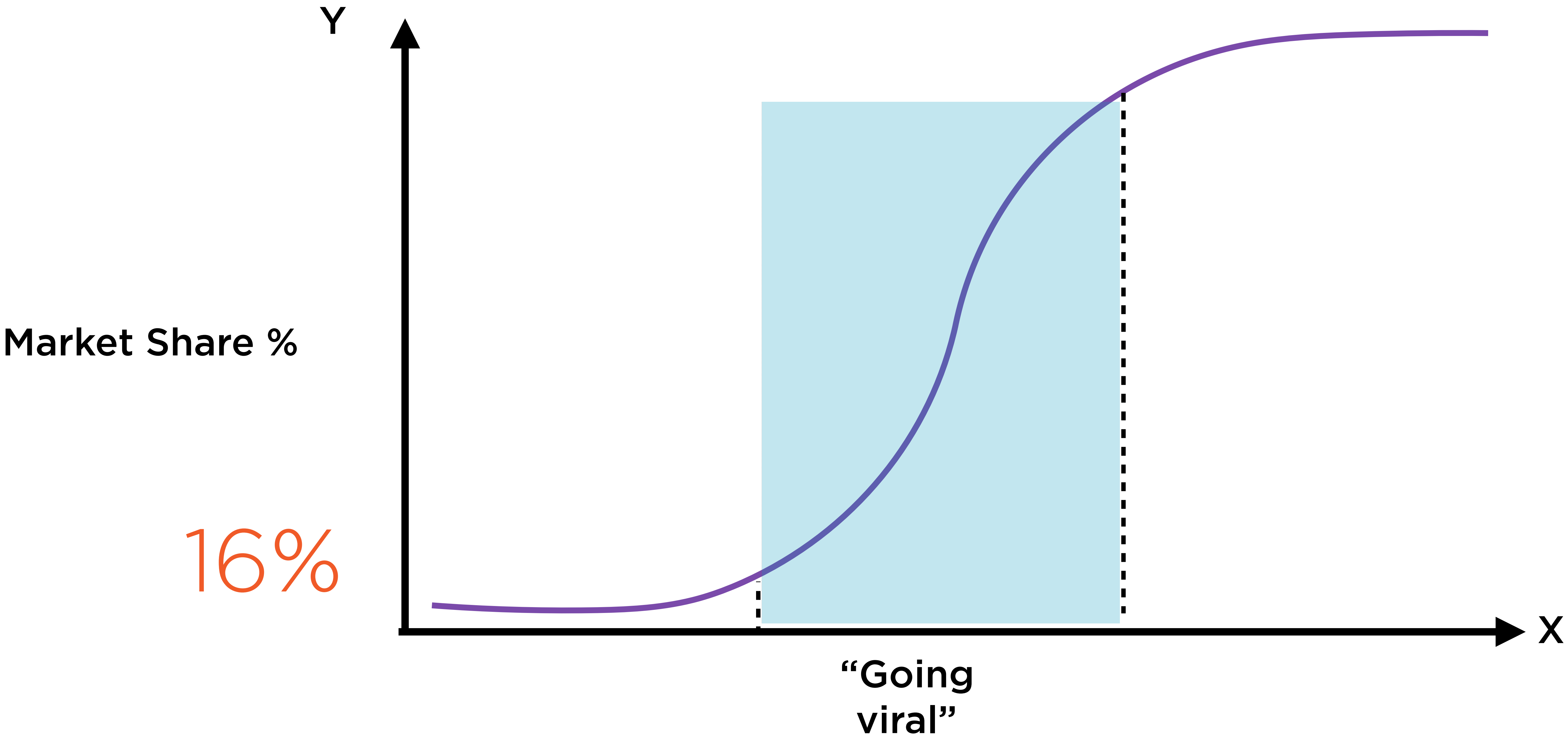
Working Hard, Fast, Smart



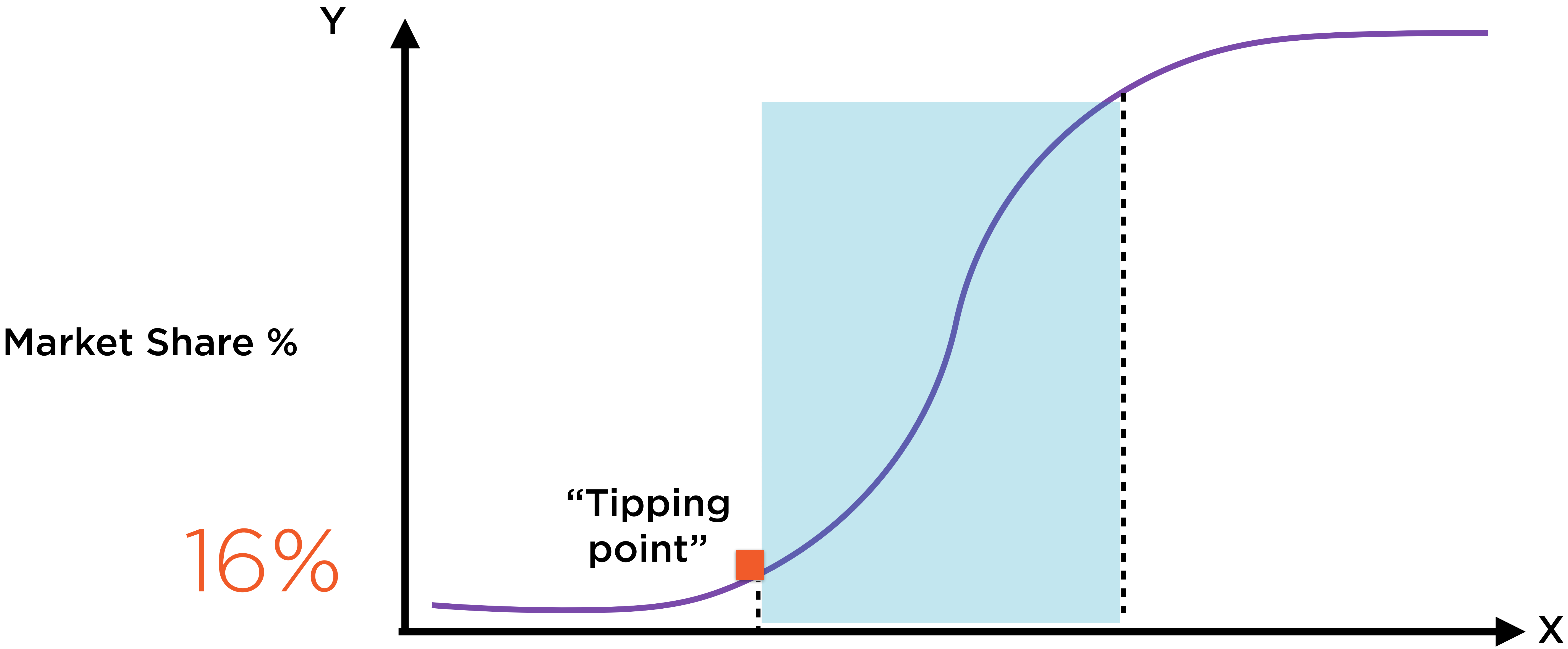
Working Hard, Fast, Smart



Diffusion of Innovation



Diffusion of Innovation



$$p(y_i) = \frac{1}{1 + e^{-(A+Bx_i)}}$$

Logistic regression involves finding the "best fit" such curve

- A is the intercept
- B is the regression coefficient

(e is the constant 2.71828)

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Summary

Logistic regression can be very easily implemented in Python