

# Homework on Bass Model | Ararat Kazarian

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The selected product is “Solving the Warehouse Puzzle” - <https://time.com/collection/best-inventions-2023/6323154/arcbest-vaux/>

A look-alike innovation similar to the ArcBest Vaux system from the past is the forklift track, as it reflects a historical shift in material handling and logistics efficiency. Traditionally, warehouses and freight operations heavily relied on manual labor and basic equipment for loading and unloading goods. The forklift, when introduced, revolutionized this process by enabling the swift movement of heavy loads with minimal human effort. Its invention streamlined supply chain operations and significantly reduced the time and labor required for material handling.

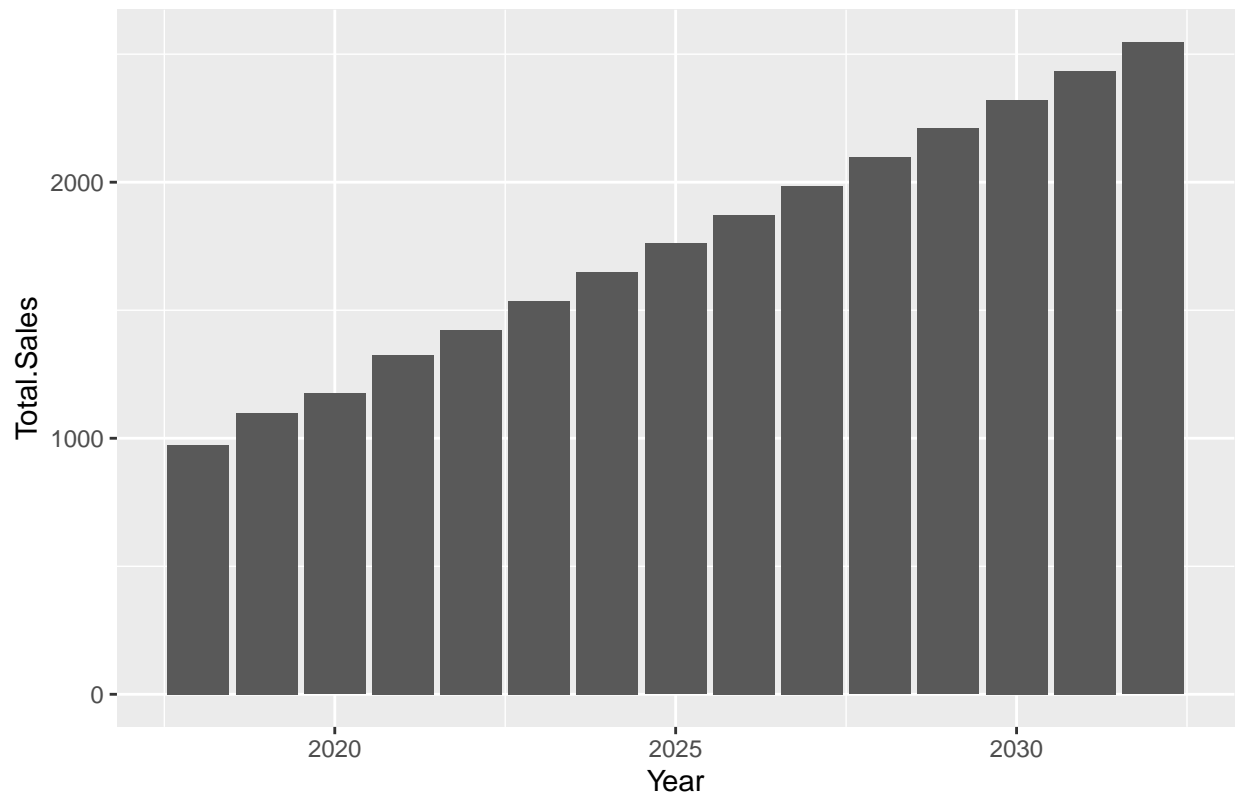
Similar to the ArcBest Vaux system, the forklift addressed inefficiencies by introducing a mechanized solution to a labor-intensive process. Both innovations share a common goal of optimizing the logistics and supply chain industry by leveraging technological advancements. The forklift, like the Vaux system, represented a paradigm shift towards automation and efficiency, paving the way for smoother and faster freight handling. Thus, drawing parallels between these innovations is apt, as they underscore the ongoing effort to modernize and improve traditional processes within the supply chain domain.

The dataset, downloaded from Statista, contains data on the global forklift market volume from 2018 to 2022, with forecasts up to 2032. The source file contains information separately for the following regions: North America, Europe, Asia-Pacific, Rest of the World. Modified\_data.csv is a cleaned and modified version of the original data. A new Total Sales column has been added, which is the sum of the four regional columns and represents total sales.

##	Year	North.America	Europe	Asia.Pacific	Rest.of.the.world	Total.Sales
## 1	2018	165.79	330.77	418.19	59.89	974.64
## 2	2019	185.42	371.00	476.40	66.66	1099.48
## 3	2020	196.26	393.86	513.65	70.21	1173.98
## 4	2021	219.40	441.61	584.88	78.10	1323.99
## 5	2022	233.84	472.08	634.93	82.81	1423.66
## 6	2023	250.03	506.32	691.50	88.07	1535.92

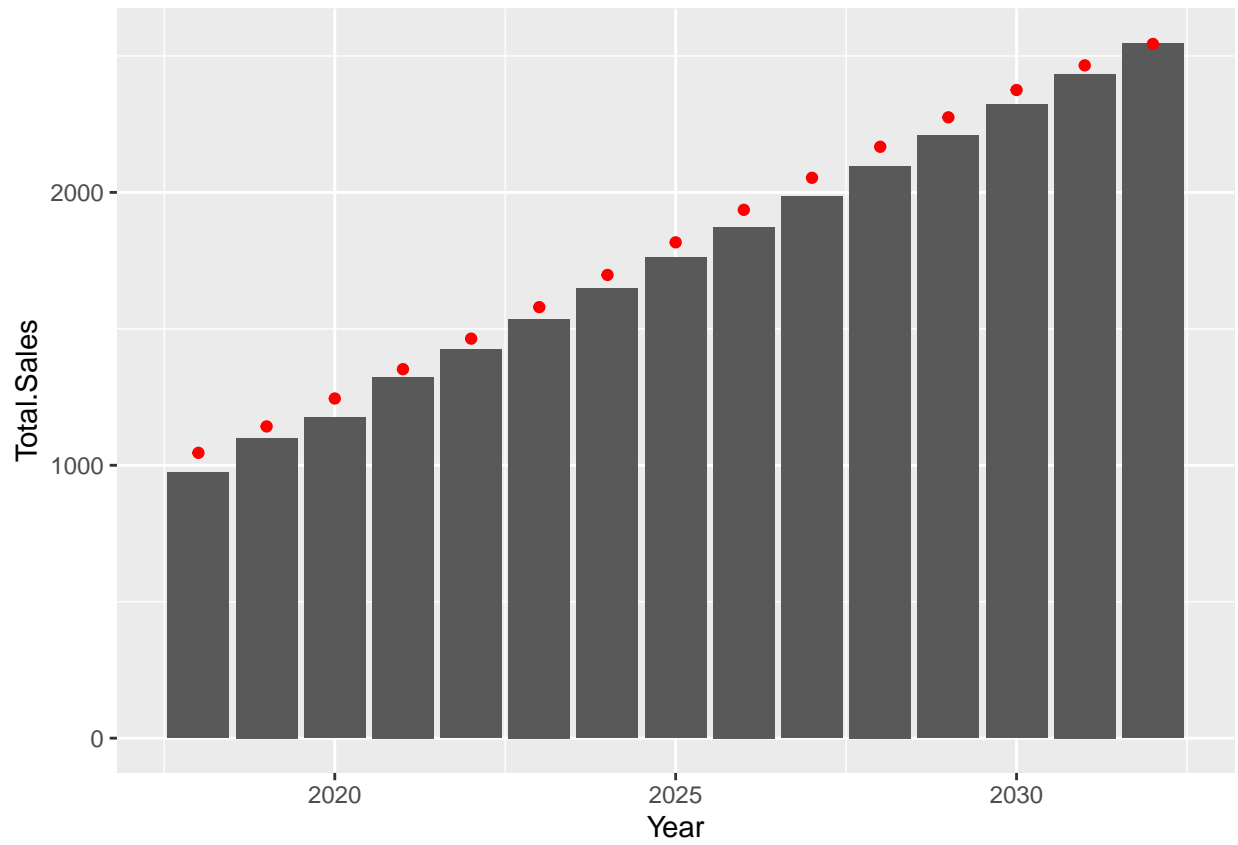
Estimating Bass model parameters for the look-alike innovation.

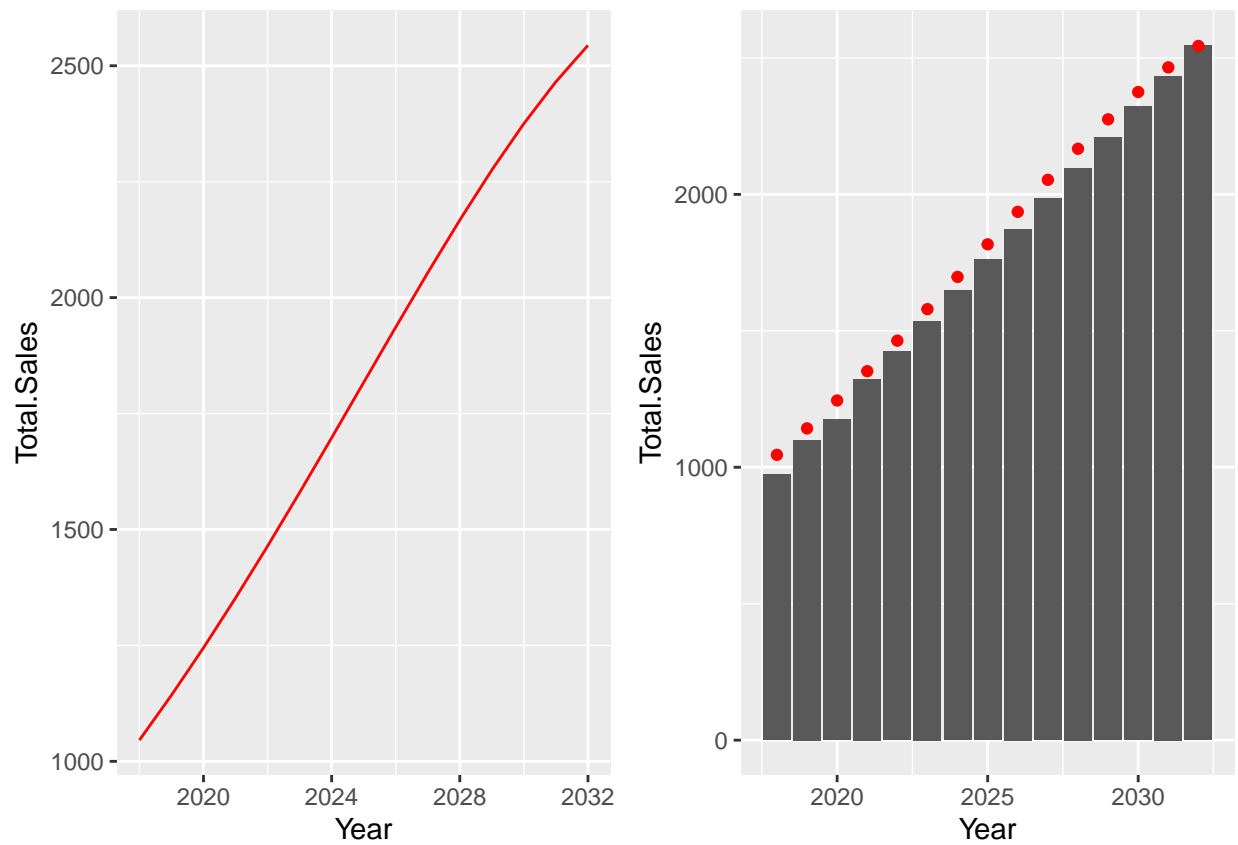
Forklift truck sales, in thousand units



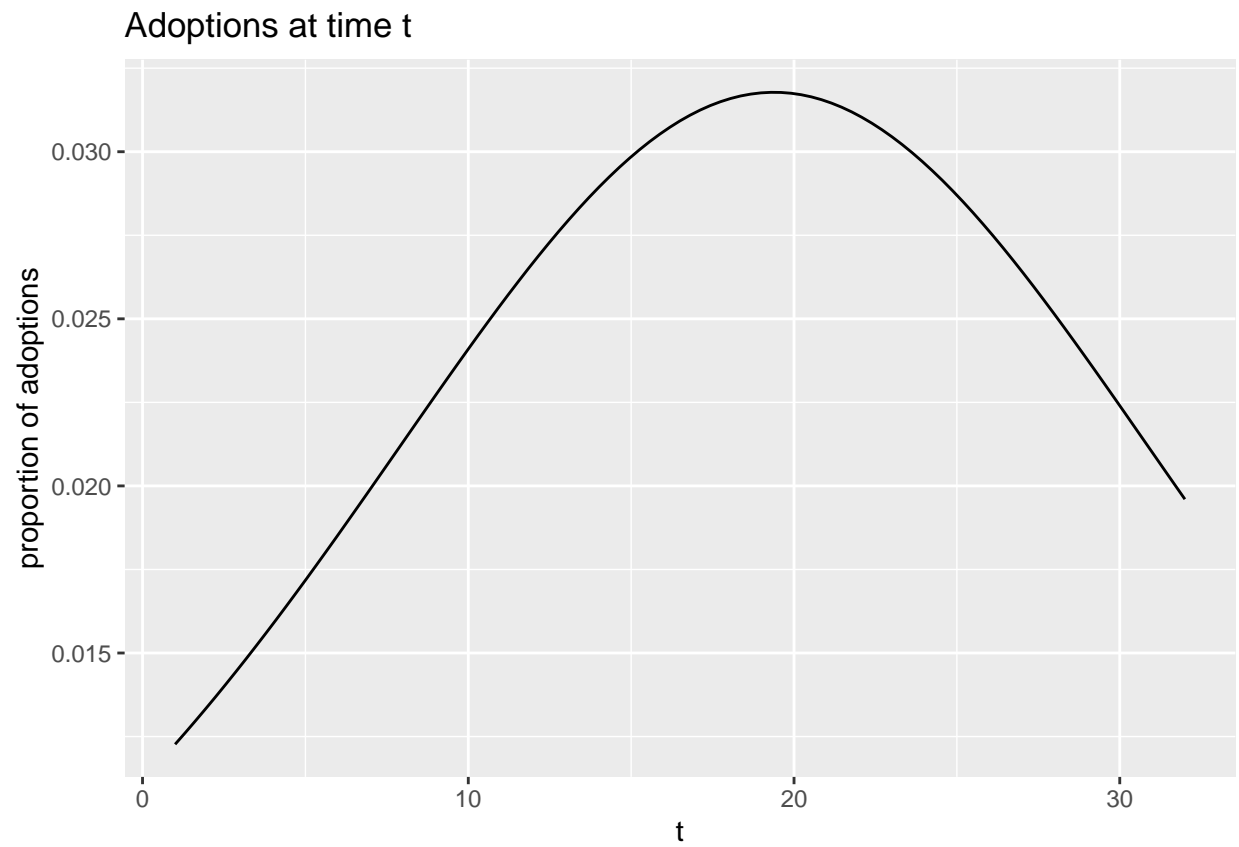
```
## bass model
##
## Parameters:
##
##               Estimate p-value
## p - Coefficient of innovation    0.0112    NA
## q - Coefficient of imitation     0.1035    NA
## m - Market potential             85229.6905    NA
##
## sigma: 17.2945
```

We see that innovator's rate is 0.0112, immitator's rate is 0.1035, and market share is 85229.6905.

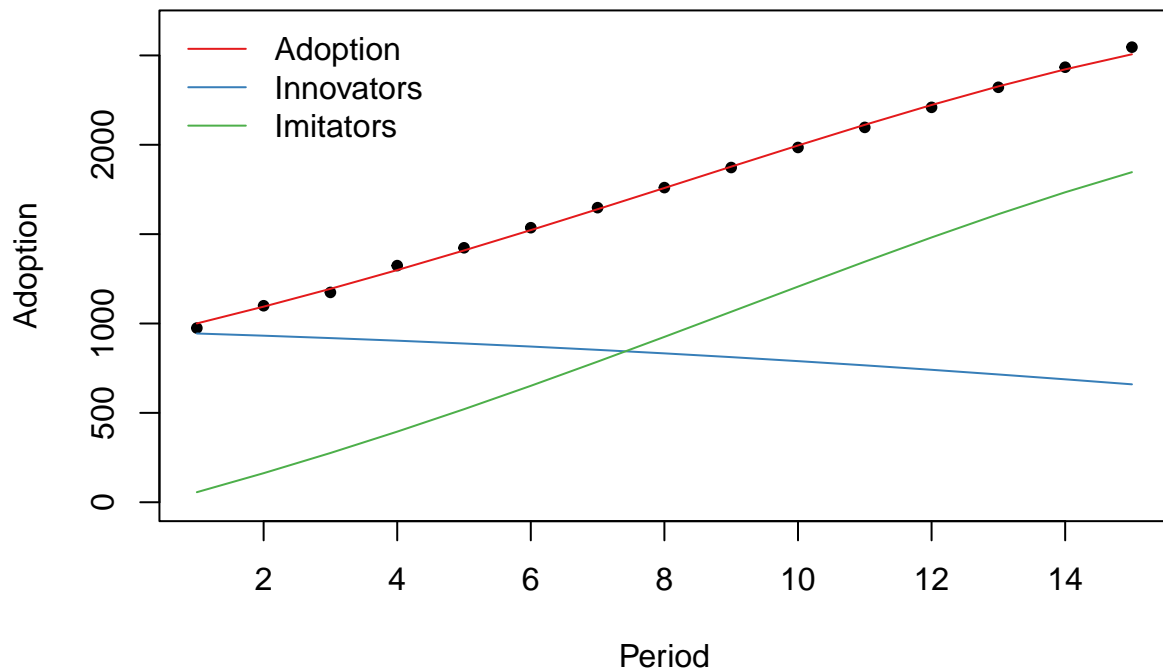




Below we see the proportion of adoptions change over time.



Making predictions of the diffusion of the innovation



Prediction of the period when sales reached to their peak

```
## Predicted Actual
## 1 19.38673 15
```

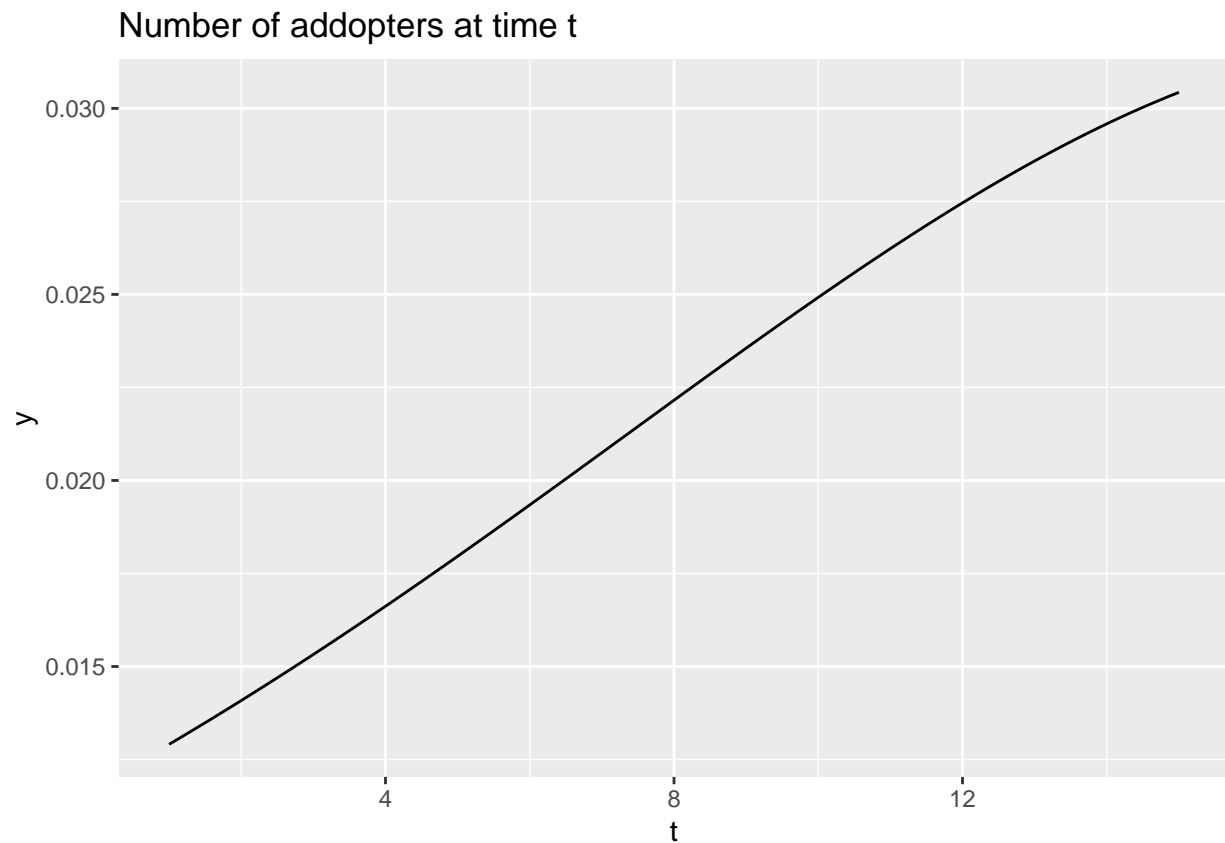
Calculating the number of adopters.

```
## Year North.America Europe Asia.Pacific Rest.of.the.world Total.Sales
## 1 2018 165.79 330.77 418.19 59.89 974.64
## 2 2019 185.42 371.00 476.40 66.66 1099.48
## 3 2020 196.26 393.86 513.65 70.21 1173.98
## 4 2021 219.40 441.61 584.88 78.10 1323.99
## 5 2022 233.84 472.08 634.93 82.81 1423.66
## 6 2023 250.03 506.32 691.50 88.07 1535.92
## 7 2024 265.89 540.12 749.01 93.16 1648.18
## 8 2025 281.42 573.48 807.47 98.06 1760.43
## 9 2026 296.63 606.41 866.88 102.77 1872.69
## 10 2027 311.50 638.90 927.24 107.30 1984.94
## 11 2028 326.05 670.95 988.54 111.65 2097.19
## 12 2029 340.27 702.56 1050.80 115.81 2209.44
## 13 2030 354.16 733.74 1114.01 119.79 2321.70
## 14 2031 367.73 764.48 1178.17 123.58 2433.96
## 15 2032 380.96 794.79 1243.28 127.19 2546.22
## pred_sales num_of_adopters
## 1 1045.623 1045.623
## 2 1142.452 1142.452
```

```
## 3    1244.787    1244.787
## 4    1352.194    1352.194
## 5    1464.051    1464.051
## 6    1579.533    1579.533
## 7    1697.599    1697.599
## 8    1816.982    1816.982
## 9    1936.198    1936.198
## 10   2053.556    2053.556
## 11   2167.194    2167.194
## 12   2275.117    2275.117
## 13   2375.256    2375.256
## 14   2465.543    2465.543
## 15   2543.989    2543.989
```

```
## bass model
##
## Parameters:
##                                     Estimate p-value
## p - Coefficient of innovation      0.0118      NA
## q - Coefficient of imitation        0.1029      NA
## m - Market potential                84759.7634    NA
##
## sigma: 0.0061
```

Now, as we notice the rate of innovators is 0.0118, the rate of imitators is 0.1029, and the market size for the new product at this point of time is 84759.7634.



Number of addopters by the time  $t$

