Creating a Repository of Economic Models

For Research and Education

We are Team Repository.

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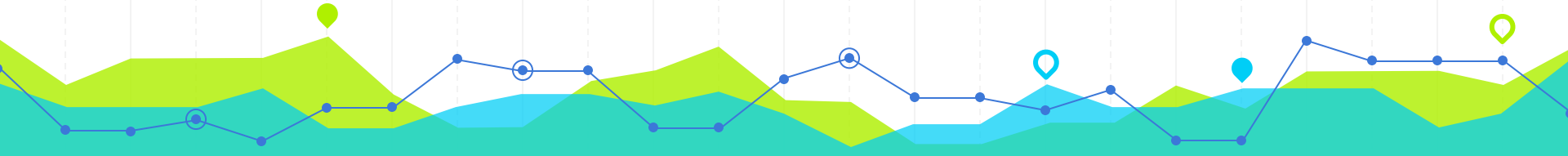
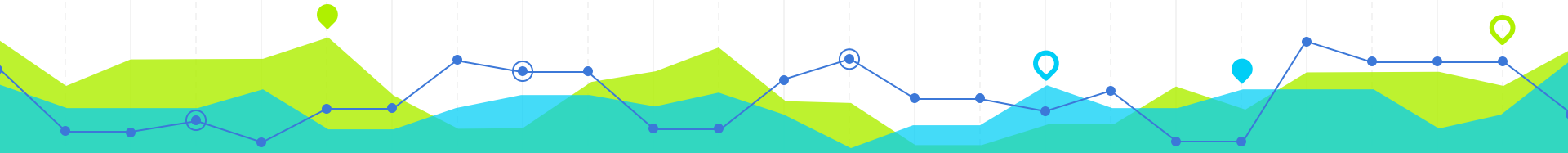
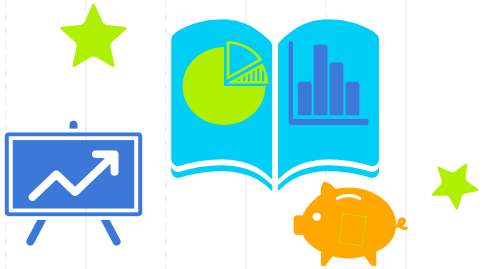
Mark Karpukhin, Artemii Maksimenko, Yaofeng Wang





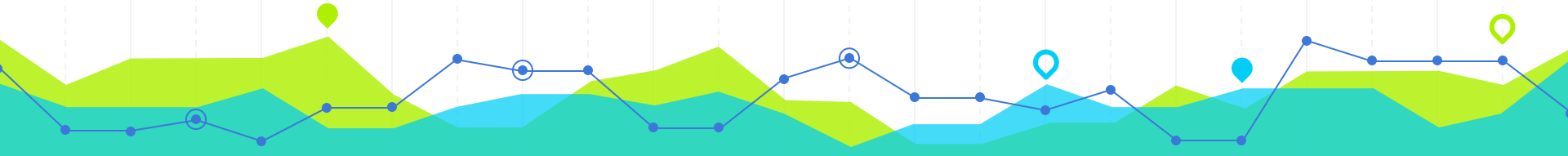
Project Mission 1

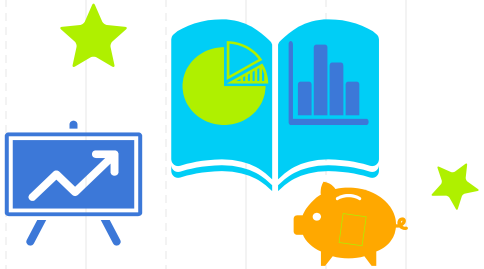


Economic data and analysis tools are becoming digitized.

MITIGATING ECONOMIC CRISIS SITUATIONS

- **Track economic trends** to learn how the economy works.
- **Monitor behavior** to predict future behavior.



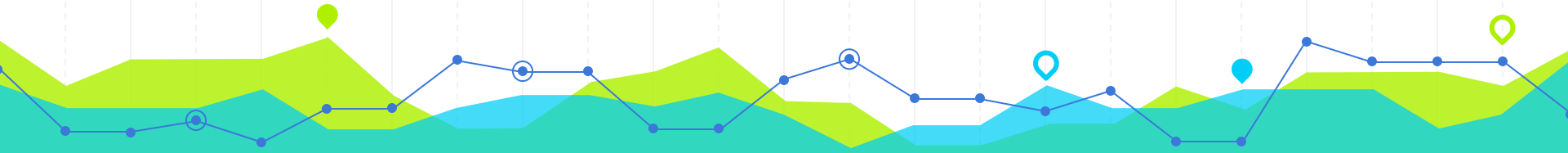


The Russian economy needs to be **studied** to maximize its **potential.**

OUR PLAN OF ACTION

Create a **centralized** digital repository of economic models.

Make the repository available for **education** and **research.**

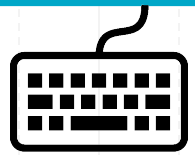


Methodology 2

OUR OBJECTIVES

Identify major economic models and research methods to create these models

Program the models in an intuitive and interactive fashion



Create a framework for a website that will implement the educational platform.

IDENTIFYING MODELS

WHAT IS AN ECONOMIC MODEL?

WHAT DO WE USE FOR THE INPUT?

WHAT QUALIFIES AS A MEANINGFUL RESULT FROM EACH MODELS?

WHAT IS OUR TARGET DELIVERABLE?

WHO WILL BE HOSTING THE DELIVERABLE SITE?

HOW WILL WE GAUGE OUR AUDIENCE?

WHICH MODELS ARE WE GOING TO BE USING?

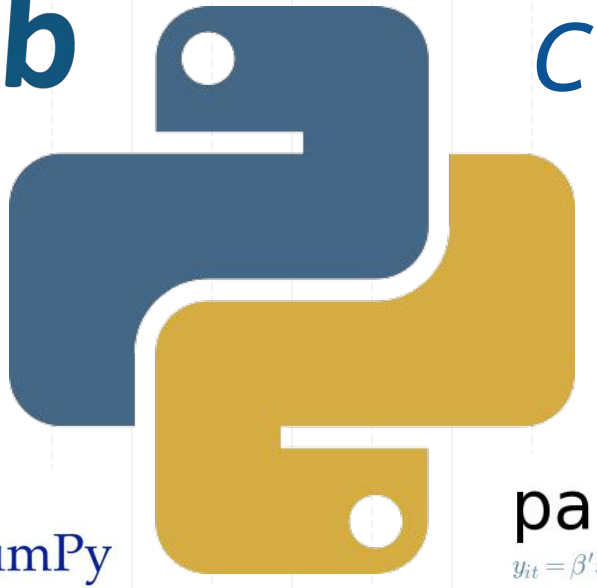
HOW MANY MODELS CAN WE IMPLEMENT IN 7 WEEKS?

HOW WILL WE BE COLLABORATING WITH EACH OTHER INTERNATIONALLY?

WHERE DO WE GET DATA FOR EACH MODEL?

OUR TOOLS


matplotlib




CVXOPT
Ps
ANACONDA


spyder

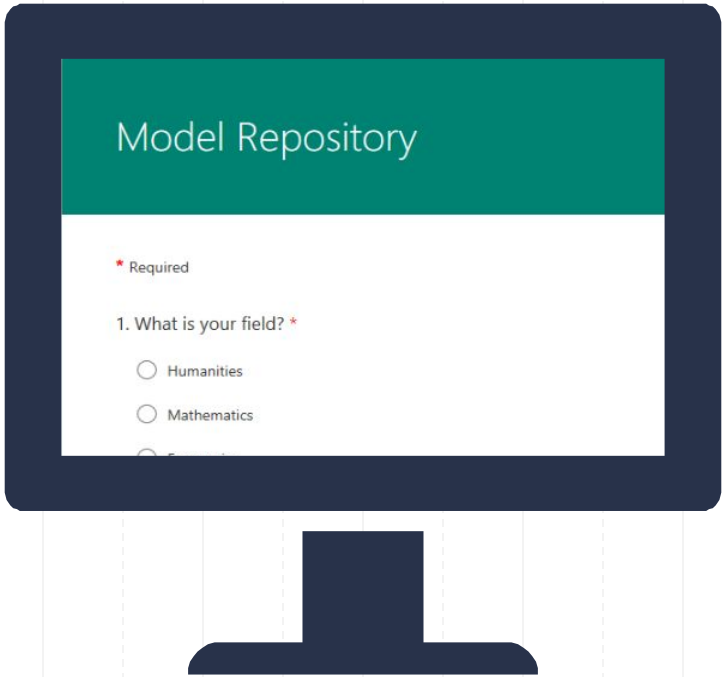

NumPy


pandas
$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$

ADVANTAGES OF PYTHON

1. **FAST** TO CODE ON
2. **EASY** TO SHARE
3. HAS MAJOR THIRD PARTY PACKAGES FOR **DATA SCIENCE**
4. BETTER THAN R FOR **BIG DATA**
5. SYNTAX NATURALLY ALLOWS **STREAMLINED DEBUGGING**

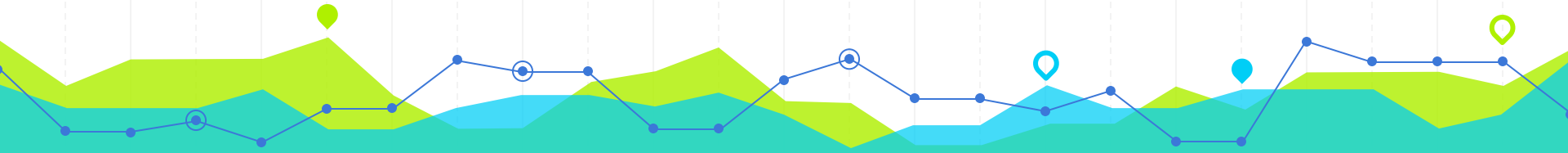
DETERMINING OUR AUDIENCE



Survey Demographic*

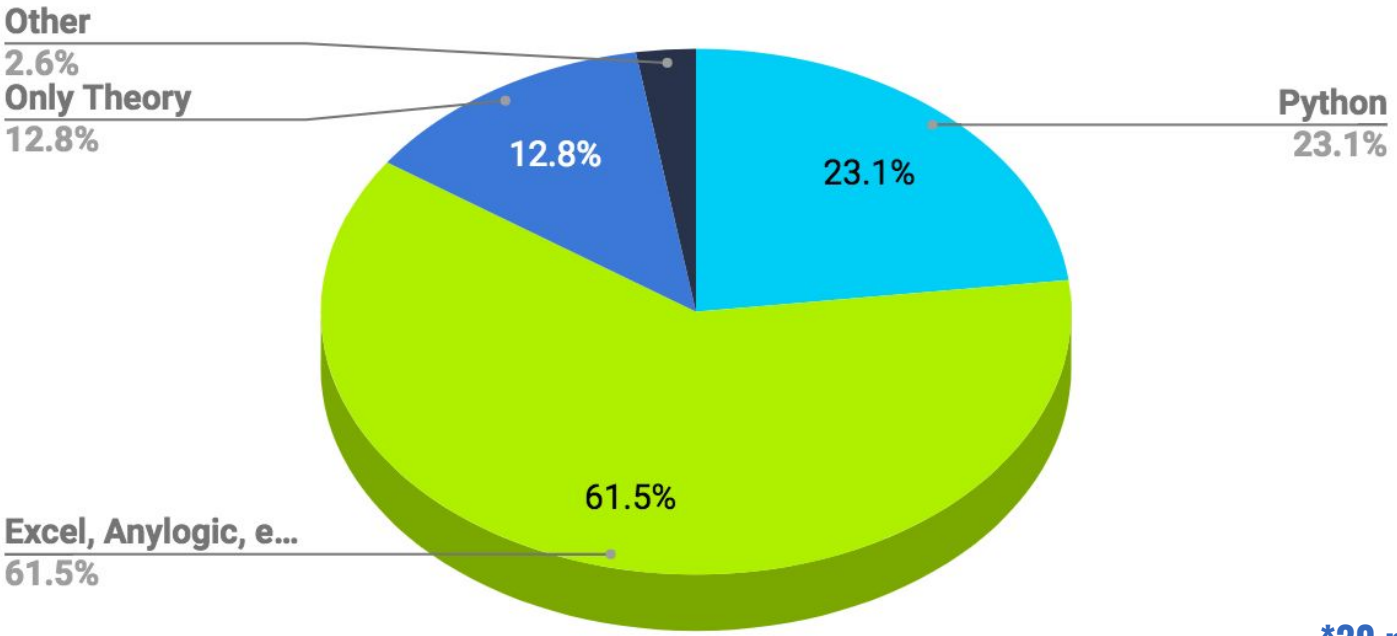
1. Students
2. Teachers
3. Faculty Members
4. Recruiters
5. Businessmen

*Ranked by importance



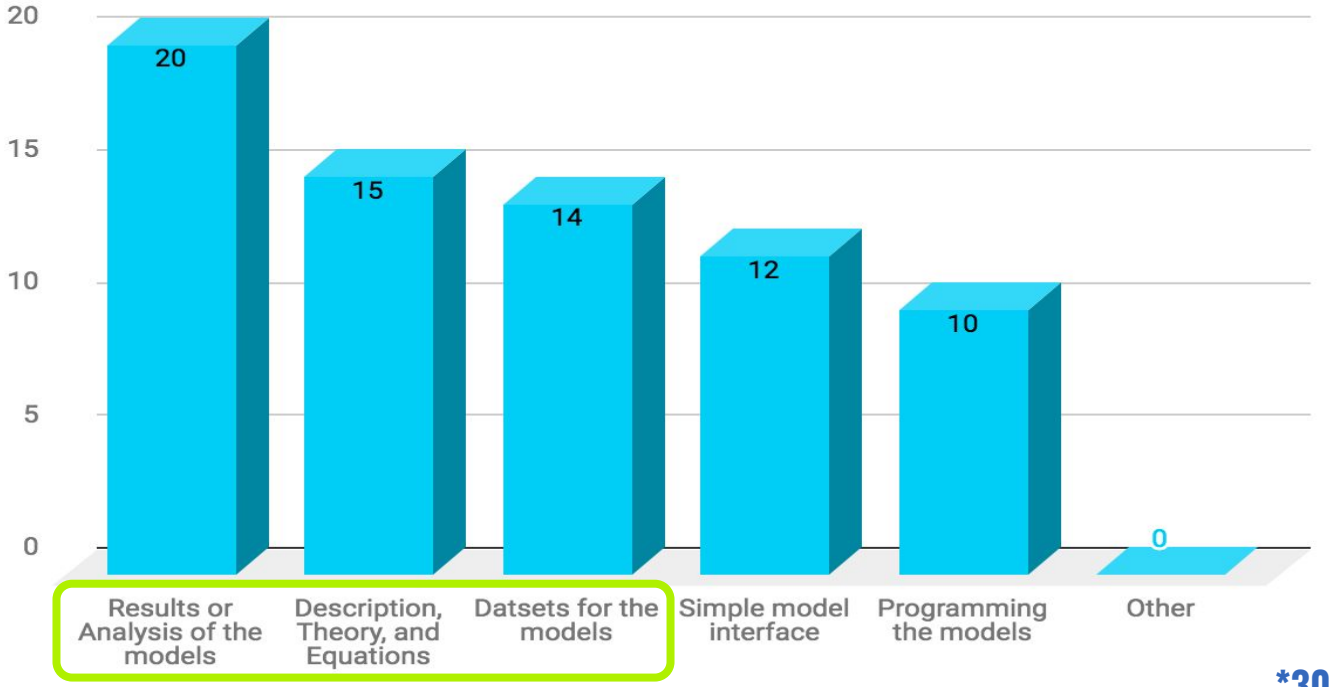
Results 3

“HOW DO YOU CURRENTLY CONDUCT RESEARCH?”



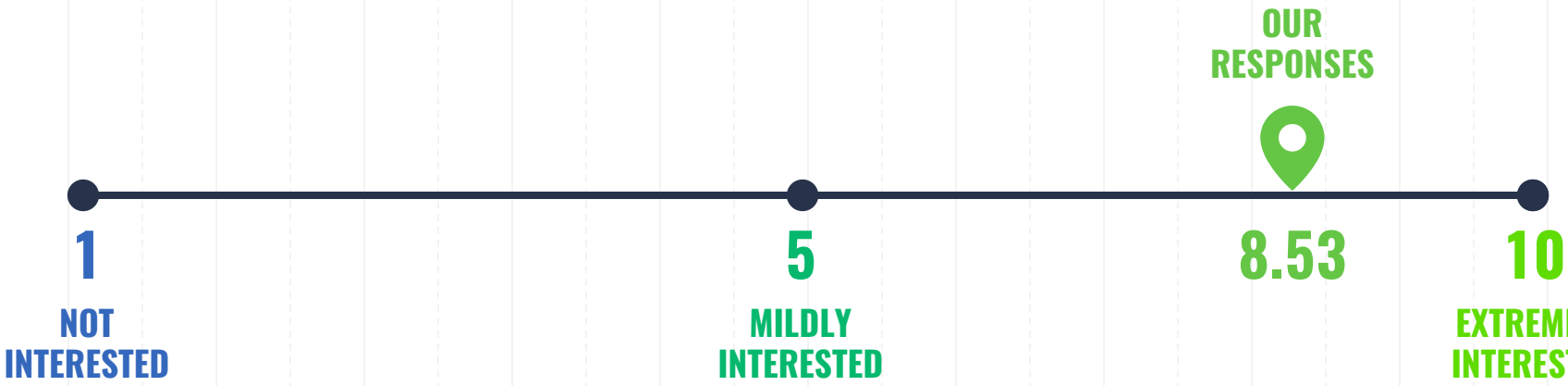
*30 respondents

“WHAT WOULD YOU BENEFIT FROM THE MOST IN THE PLATFORM?”



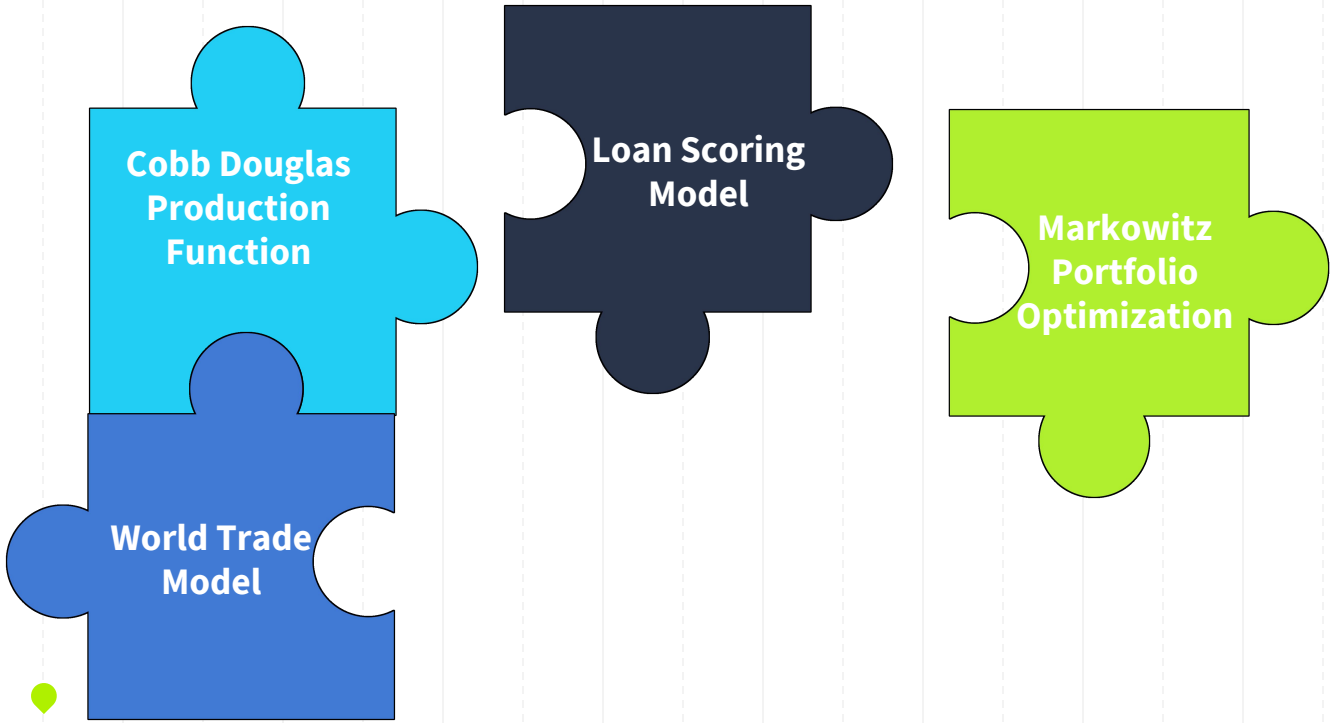
*30 respondents

“WOULD YOU BE INTERESTED IN THIS PLATFORM?”

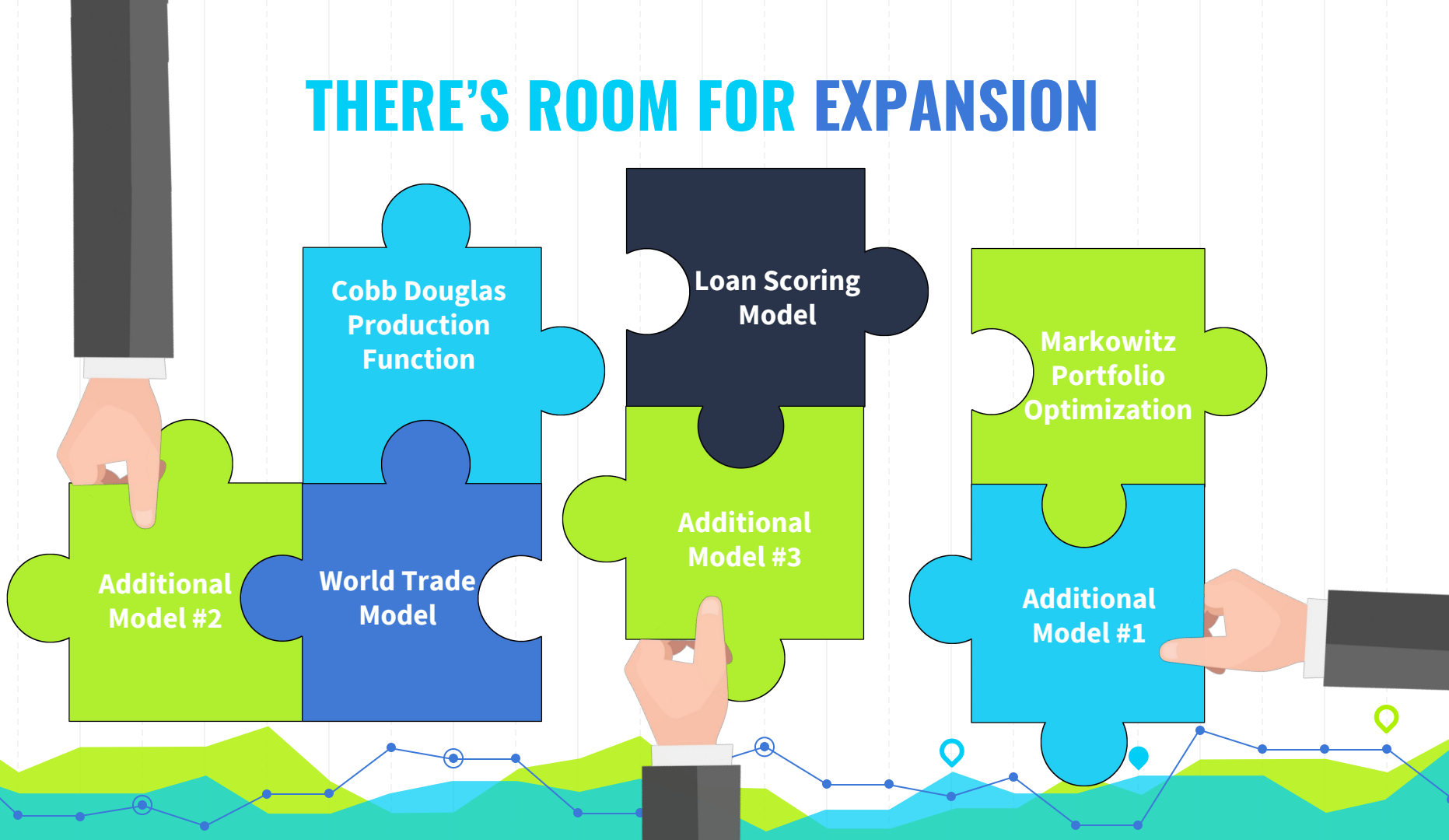


*30 respondents

WE CHOSE FOUR MODELS TO IMPLEMENT



THERE'S ROOM FOR EXPANSION



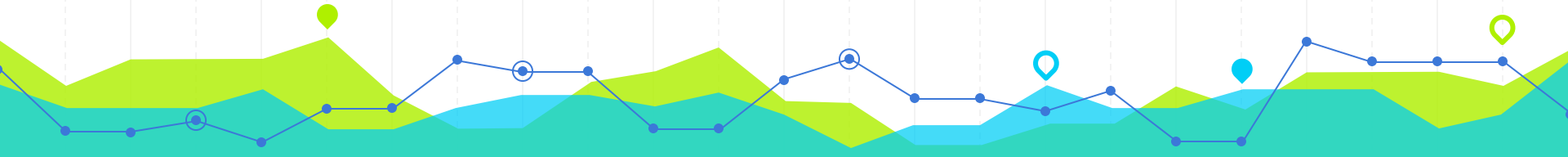

PORTFOLIO
OPTIMIZATION

MARKOWITZ PORTFOLIO OPTIMIZATION MODEL

- Aimed at assembling an optimal portfolio of assets
- Serves as the basis of modern portfolio theory
- Can be applied for non-financial assets

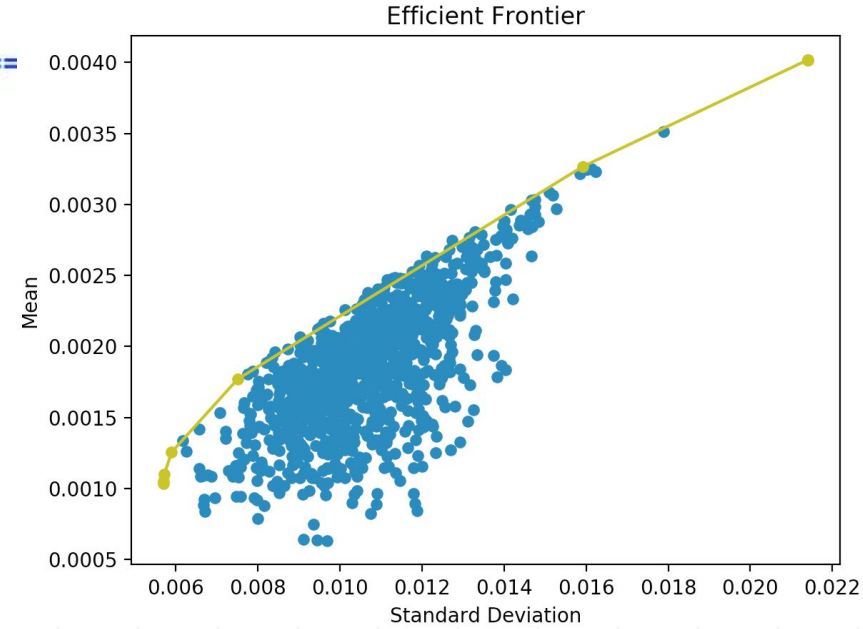
INPUT DATA FOR THE MODEL

ASSET	RETURN VALUES									
Gazprom	0.0114	-0.0037	-0.0335	0.0164	-0.0168	-0.0034	-0.0440	-0.0040	0.0111	...
Aeroflot	-0.0311	-0.0073	-0.0368	0.0229	0.0329	-0.0255	-0.0302	-0.0304	0.0329	...
Sberbank	0.0090	-0.0206	-0.0601	0.0075	-0.0023	0.0168	-0.0620	-0.0128	0.0062	...
Nornickel	0.0183	-0.0105	-0.0434	-0.0055	0.0071	-0.0174	-0.0489	0.0298	0.0302	...
Mechel	0.0024	-0.0007	-0.0421	0.0022	0.0017	-0.0308	-0.0555	-0.0131	-0.0062	...

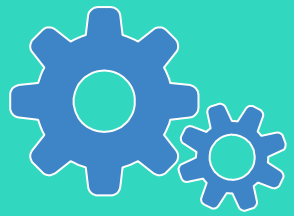


OUTPUT DATA AND GRAPH

```
========================================
OPTIMAL WEIGHTS:
Gazprom:    0.070264
Aeroflot:   0.357837
Sberbank:   0.162885
Nornickel:  0.268870
Mechel:     0.142125
```



Coding the Models



CONVEX OPTIMIZATION (CVXOPT)

$$\text{Minimize: } P * x^T + q^T * x$$
$$\text{Subject to: } Gx \leq h$$
$$Ax = b$$

Quadratic Programming:

```
Solver.qp(P, q, G, h, A, b)['x']
```

VARIABLES & CALCULATION

Minimize: $P * x^T + q^T * x$

Subject to: $Gx \leq h$

$Ax = b$

Markowitz Portfolio Model

```
P = RISK
q = opt.matrix(0.0, (n, 1))
G = Expect Return
h = Target Return
A = opt.matrix(1.0, (1, n))
b = opt.matrix(1.0)
```

Tangency Portfolio Model

```
P = RISK
q = opt.matrix(0.0, (n, 1))
G = Expect Return
h = opt.matrix(np.vstack((-1.0,
np.zeros((n, 1))))
```

THE MAIN FUNCTION

```
def Markowitz_portfolio(returns):
    ...
     weight = solvers.qp(P, q, G, h, A, b)['x']
    ...
    return weight
```

```
def Tangency_portfolio(returns):
    ...
     weight = solvers.qp(P, q, G, h)['x']
    ...
    return weight
```

Markowitz Portfolio Model

Gazprom:	0.070264
Aeroflot:	**0.357837**
Sberbank:	0.162885
Nornickel:	0.266887
Mechel:	0.142125

Tangency Portfolio Model

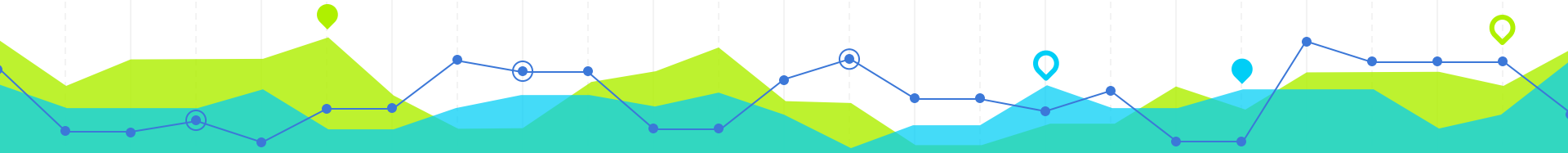
Gazprom:	0.000000
Aeroflot:	**0.586451**
Sberbank:	0.242607
Nornickel:	0.000000
Mechel:	0.170940

Impact 4

STREAMLINED ECONOMIC EDUCATION

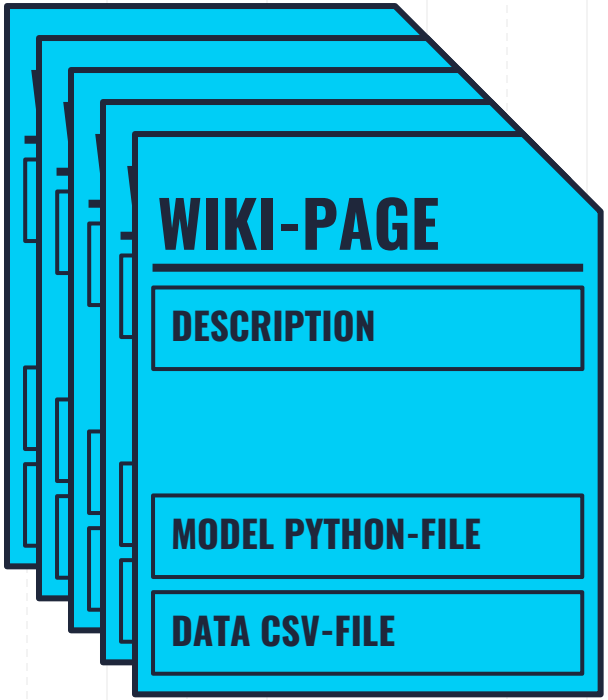
Students can learn how to...

- **Apply** problem solving to real world issues
- **Visualize** varying results with Data
- **Analyze** code to understand the logic



Future Use 5

CURRENT STRUCTURE OF THE PLATFORM



READ AND LEARN ABOUT THE MODEL

USER

DOWNLOAD AND RUN THE MODEL

WIKI-PAGE EXAMPLE

Instruction

To work with the Cobb-Douglas model you need to follow this steps:

1. Download and install python-interpreter from here.
2. Download CobbDouglas.py file
3. In order to run the model additional python packages need to be installed: matplotlib, NumPy
4. Download example data.csv file or provide your own file in the same format
5. Put data file into the same folder as the .py file
6. Run Cobb_Douglas.py script
7. Enter your CSV file name into the command line
8. Choose if linearization of the initial data should be applied

Model

The algorithm of the model uses the provided data and computes the corresponding coefficients of the Cobb-Douglas production function with the respect to constant and variable returns to scale cases using the simple linear regression.

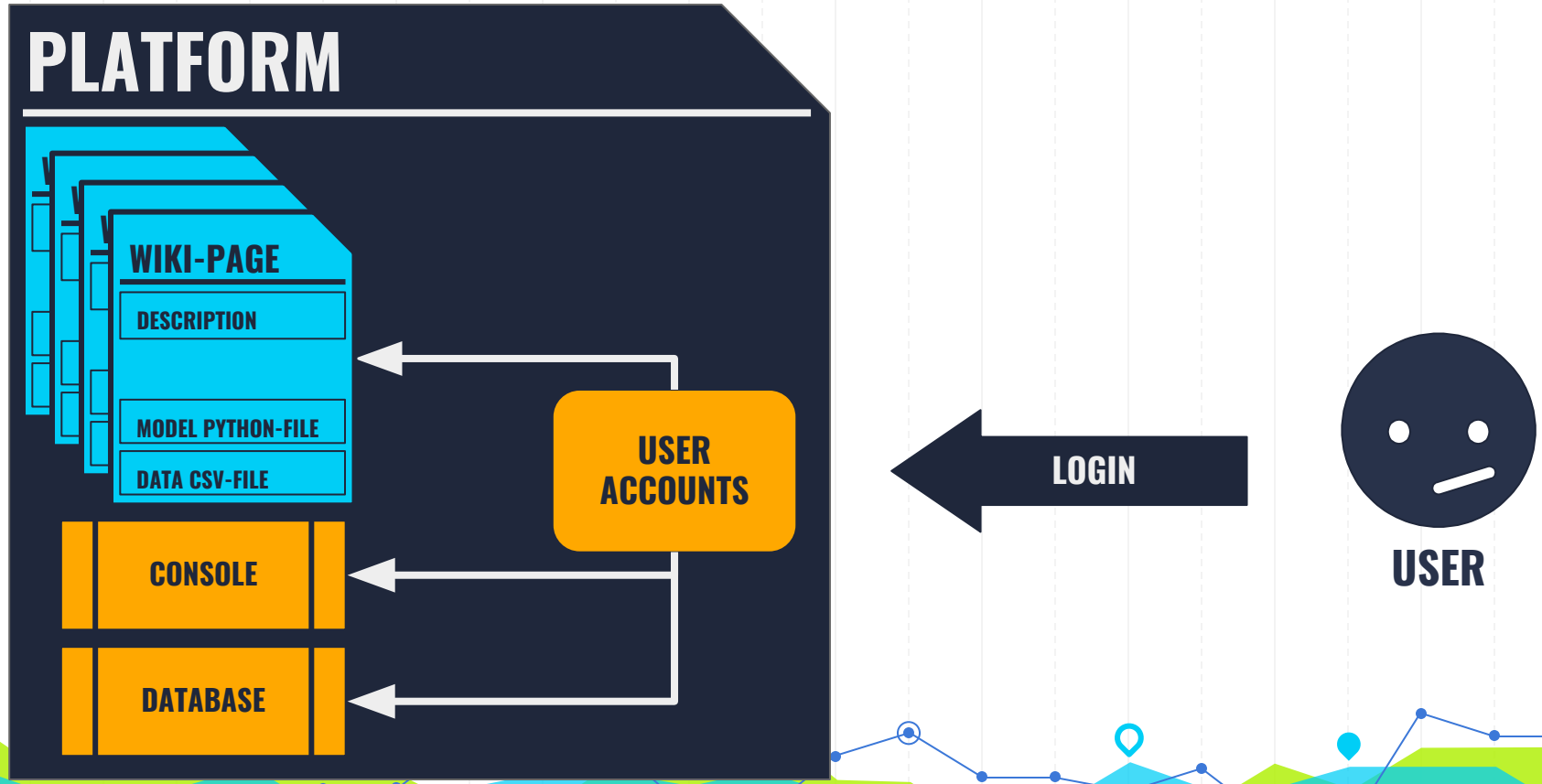
For applying the linear regression calculation, the initial Cobb-Douglas function is linearized by applying the natural logarithm to the equation, which results in: **ln(Y) = ln(A) + ln(K)α + ln(L)β.**

For more than one variable, regression model in the algorithm has a matrix formulation which is represented as follows:

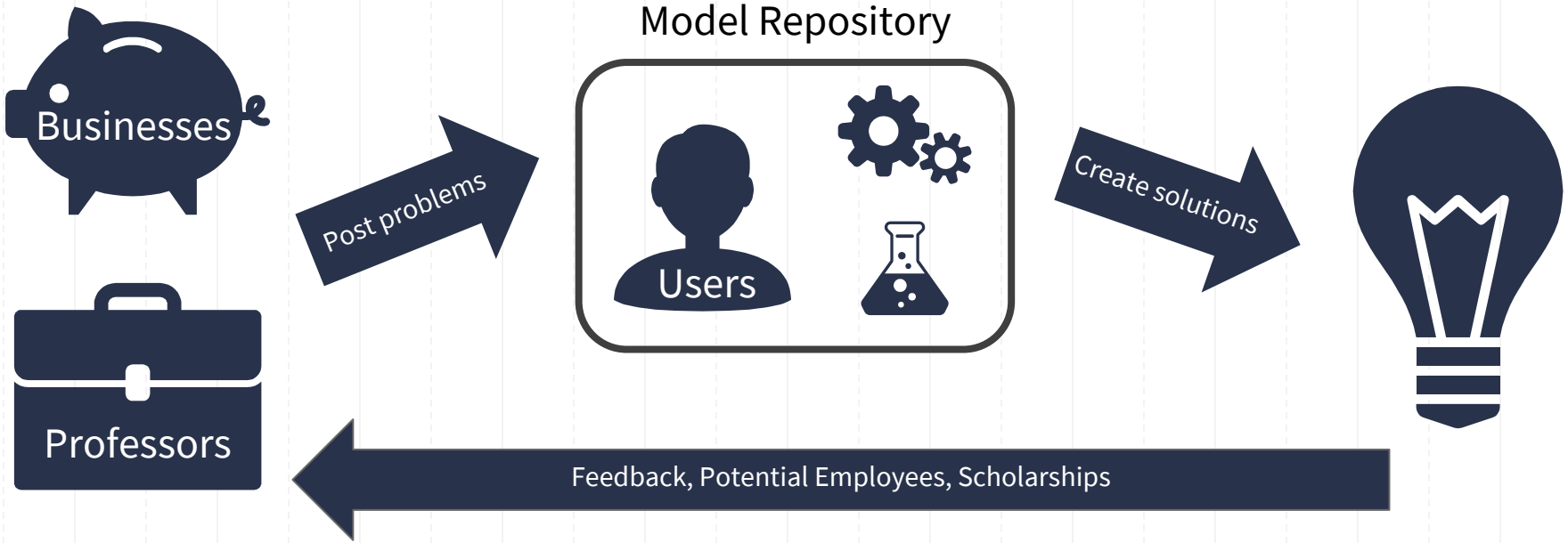
$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_1 \\ 1 & x_2 \\ \vdots & \vdots \\ 1 & x_n \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \end{bmatrix}$$

$$Y = X\beta$$

FUTURE STRUCTURE OF THE PLATFORM

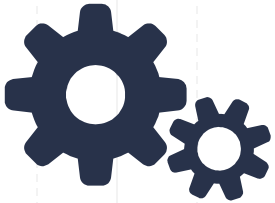


POSSIBLE OPPORTUNITIES



SUMMARY

What did we accomplish?

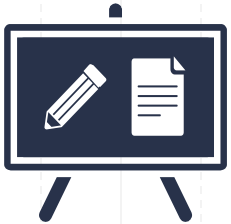


Made Economic Models

Developed a Website Framework

Who does this affect?

Students who want hands-on learning



Businesses can consult the repository for problem solving

What is the impact?

Streamlined Education

Potential Employment or Grant Opportunities

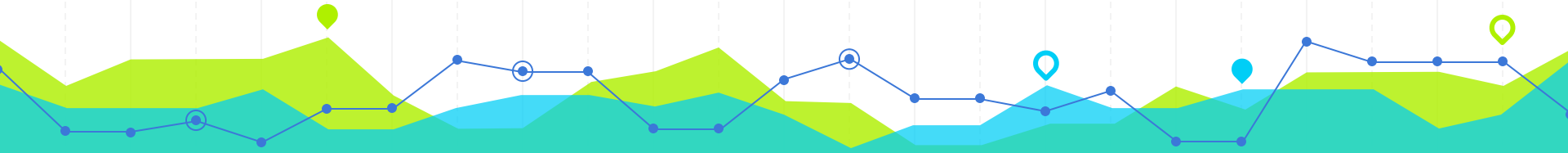
Спасибо!

Any Questions?

repository@wpi.edu

SOURCES

- 4 tips to create a good knowledge repository. (2014, July 31). Retrieved September 29, 2017, from https://blogs.iadb.org/abierto-al-publico/2014/06/26/4-tips-create-good-knowledge-repository/
- Russia in figures. (2017). Retrieved September 29, 2017, from http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/main/
- UN Comtrade | International Trade Statistics Database. (2017). Retrieved September 29, 2017, from https://comtrade.un.org/
- Sharpe, W. F., Bailey, J. V., & Alexander, G. J. (1995). *Investments*. Englewood Cliffs, NJ: Prentice Hall International



End of presentation