Aix Marseille School of Economics

Final Evaluation in the course of Methodology in econometric and statistical studies

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Tender Proposal

County Level Economic Analysis of the Inflation Reduction Act 2022 (IRA)

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1 Introduction

1.1 Background and context

On August 16, 2022, the Inflation Reduction Act 2022 (IRA) was passed by the 117th United States Congress. The law is composed of both large investments and revenues increases for the federal governments. It is mainly composed of a tax reform to reinforce the progressive character of income taxation, reforms to reduce the costs of healthcare and large investments for the decarbonation of the American economy. Even if its name makes it a law to curb the global increase in prices seen since the Covid-crisis, Joe Biden himself regrets that the law's name doesn't pictures it as an investment plan for future growth.[1] Indeed beyond inflation, fostering economic growth and well paying jobs is a clear objective of the law stated by the communication of the White House.[2]

In terms of figures, and leaving aside the tax and healthcare reforms, the law provisions directly 394 billion dollars of federal funding to energy, manufacturing, environment or transportation investments. The majority of these investments will be received in form of tax cuts for companies investing in these sectors. Another side of the investments are realized in the form of federal loans and loan guarantees to companies investing in the energy and electric vehicles sectors. These loans should represent 367 billion dollars [3]. This represents a guaranteed 761 billion dollars of investments mainly targeted to help private companies to invest in critical sectors of the economy like energy, electric vehicules and manufacturing more broadly.

It has been already noted that most of the IRA manufacturing and energy investments are located in counties being on average poorer, more unemployed and having a lower share of the population being college educated [4]. Considering the impressive scale of the investments, the places receiving them most and the goals of socio-economic development stated by the Biden administration, one can wonder how much the IRA investments can improve the situation of these communities. This study will try to answer this question by investigating the effects on the employment, income and poverty at the county scale, of the IRA industrial and energy investments. Investigating this subject will help to make a better assessment of the efficiency of the IRA and the possible areas of improvement of the policy.

1.2 Scope of the mission

The objective of the study is to provide a quantitative assessment of the IRA investment's impact on socio-economic outcomes. To achieve this team will collect data about the location and amounts of the said investments, data on the economy, social development and labour markets of the place receiving it and other control variables necessary to the study. We chose to observe these variables and construct the model at the county level for two main reasons.

[1]Link : "I wish I hadn't called it that, because it has less to do with reducing inflation than it does to do with dealing with providing for alternatives that generate economic growth"

[2]Link : "One Year In, President Biden's Inflation Reduction Act is Driving Historic Climate Action and Investing in America to Create Good Paying Jobs and Reduce Costs"

[3]Link to a McKinsey financial breakdown of the IRA

[4]Link to a US treasury report on the socio-economic situation of counties receiving IRA investments

The first one is to measure the effects of the IRA on communities, as we have determined that more disenfranchised counties are in proportion receiving more investments than well-off counties. The second reason is for modeling purposes. By selecting the smallest level available, here the county, to observe IRA investments we can more easily construct a counter factual model. It is possible, and in large number, to find counties that did not receive any investments and that are similar in terms of socio-economic variables to counties that received some. At the state level, it wouldn't be possible to observe this as states are already a too large level to create this counter factual model and observe states that did not receive any investments. Overall this allows us to build a model that will create a much less biased estimate of the IRA effects.

After having better justified the scope of the study, we can mention the deliverables. This study will first produce a database regrouping all the necessary variables and observations to study the effects of the IRA. Next an econometric model measuring its effects will be provided. Based on it, a policy report on the IRA will be produced. All these steps will be made with control and discussions with the commissioning entity. The final goal of the study is, based on the estimation of the effects of the IRA on social and economic outcomes at the county level, to provide a policy evaluation suggesting improvements about the targeting of the policy, possible pitfalls and other unseen biases.

1.3 Literature review

I use this part to review some of the already existing studies assessing the economic and social impact of the IRA. We first observe that, to our knowledge, no study using the same tools than us and focusing on employment and social outcomes has been made. The closest assessment we can cite is a estimate of job creations following IRA investments made by the Political Economy Research Institute of the University of Massachusetts (Robert Pollin 2023). The IRA is estimated to create 9 millions new jobs. The model used here is the input output model IMPLAN for the American economy. An input output model can be thought as a spreadsheet representation of the economy where, from preexisting economic data [5] each industry of the economy is modeled dependently on the others based on some production inputs. This highly structural model is dependant on the assumptions we make about the amount of needed inputs and amount of produced outputs for each sector of the economy. This is why, even if this estimate can be a good rule of thumb, it cannot be taken as given.

Another estimate of the economic impacts of the IRA was made by the National Bureau of Economic Research in a working paper (Bistline, Mehrotra, and Wolfram 2023). This working paper investigates solely the effects of the energy investments of the IRA. This assessment is done at the national level using the FRB/US model (Brayton and Tinsley 1996). This model is a Dynamic Stochastic General Equilibrium model, being the reference of models for macroeconomic modeling. The study finds a modest reduction of unemployment following the IRA energy investments. However the authors acknowledge that the effects are undervalued because the FRB/US model does not capture some increases in manufacturing productivity

[5] Link to the input output estimates made by the Bureau of Economic Analysis for the American economy

and the positive effect of decreased energy prices.

Compared to the literature our study differs in not using a structural model. As this models are fully based on the economic relationships they account for, they cannot capture other effects. By using a model from the treatment effect literature, we believe that we will be more successful in capturing the effect of the IRA on employment and social outcomes.

2 Methodological approach : econometrics analysis

In this section, we outline the data collection process, the steps taken to ensure data quality, and the implementation details of the econometric analysis.

2.1 Data collection and data cleaning

Following the preparation and kickoff phase, the subsequent stage consists in the creation of the database. The initial step involves clearly defining the goals of data collection and identify essential information necessary to provide insights into the effects of the Inflation Reduction Act (IRA). To do so, we first need to know which specific aspects of the IRA's impact we want to investigate. This could include effects on the labor market, delving into variables such as employment rate, unemployment rate, wage growth, and the dynamics of job creation or loss directly linked to the IRA. Alternatively, our focus could extend to economic indicators like inflation rates, GDP growth. Given the longitudinal nature of our data, the data collection process extends both before and after the implementation of the IRA. Our focus is on obtaining data up to 5 years preceding the IRA intervention and 3 years post implementation. It enables us to discern and measure the midterm effects of this policy.

In our assessment of the IRA's impact, we aim to encompass a diverse set of outcome and control variables that may either exert influence on or be affected by the IRA. The following table provides a concise summary of the variables we intend to investigate in this analysis:

Table 1: Outcome and Control Variables for IRA Impact Analysis

Outcome Variables	**Control Variables**
Employment rate, wage growth, job creation/loss, business investments	Industry type, poverty rate, part-time employment, GDP, share of industrial employment in total employment, demographic factors, company size, government spending, geographic location

When we collect the data we need to make sure it is based on county level. However, most of the time it will not be the case. We will need to aggregate or disaggregate the data to match the county level. This process involves combining or breaking down data points from the state level to the county level. Aggregation typically involves summing or averaging state-level values to derive county-level values, while disaggregation involves allocating state-level values

proportionally to individual counties. The choice between aggregation and disaggregation depends on the nature of the data. Aggregation may be appropriate when the state-level data accurately represents the county-level trends. Disaggregation, on the other hand, is more suitable when there are variations within the state that need to be captured at the county level. It is crucial to carefully document and justify the chosen method to ensure transparency in our analysis. Additionally, we need to be mindful of any potential data quality issues introduced during this process and address them accordingly.
Once we have determined the essential variables, we can proceed to collect the data online through reliable sources, such as official government records. Specifically, details regarding IRA investments can be accessed through the official White house website House 2024. Additionally, the Bureau of Economic Analysis Economic Analysis 2024 (BEA) website provides access to the majority of variables we need. For certain variables, the Bureau of Labor Statistics website Labor Statistics 2024 (BLS) is another reliable source.

A subsequent meeting is scheduled to delve into discussions regarding data quality and imputation strategies. Event though the sources are reliable, emphasizing the importance of data quality is crucial during the data collection process. The primary objective is to anticipate and mitigate potential issues that could arise in data collection. Assessing data quality stands as a critical step in ensuring the reliability and validity of the collected information. To this end, various essential considerations and steps are outlined. Beginning with the verification of accuracy through cross-referencing and validation checks, the process extends to ensuring completeness by checking out if there is any missing values, maintaining consistency in data format, units, and coding, addressing timeliness concerns, optimizing relevance by excluding unnecessary variables, scrutinizing validity, evaluating reliability, and appraising precision in numerical data. Diligently attending to these considerations fortifies the data's quality and integrity, establishing a robust foundation for deriving meaningful and accurate insights.

2.2 Difference-in-Difference analysis

After collecting the data from various sources, and assessing its quality, our objective is to accurately estimate the true effect of the IRA. This is the phase 3, which consists in the implementation of the econometrics model. Proven to be an effective identification strategy for policy evaluation Callaway 2023, we want to use a difference-in-difference model, where the IRA corresponds to the treatment. This approach will help us to assess the causal effect by comparing changes over time in the treatment group and the control group. Subsequently, we will examine the treatment heterogeneity and if the IRA investments change based on the industry, past industrial history of the county, education level of the labour force.

2.2.1 Identification of the treatment and control groups

Because the impact of the IRA is to be measured at the county level, we need a good strategy to form our control and treatment group. Before implementing the difference-in-difference model, we first need to identify which companies received the IRA and how much they received before splitting into treatment and control groups. The following map helps with that

and displays the companies that benefited from the IRA.

Figure 1: Map of companies benefiting from the Inflation Reduction Act (IRA)

Since the impact assessment is at the county level, we must pay careful attention to the geographic distribution of companies. We need a representation from various counties to capture diverse regional effects. We also need some counties where no companies benefited from the IRA in order to have a control group. The first step will be to make a list of all counties that have company(ies) that received the IRA. We must also take into account the magnitude of the IRA received by individual companies. This entails categorizing companies into various tiers according to the extent of their IRA allocations. Subsequently, we assign weights to each county based on the amount received by the companies within that county.

The observation that industries benefiting from the IRA are predominantly situated on the east and west coasts could introduce several potential problems or challenges. This regional concentration may lead to regional bias, limiting the external validity of our findings and hindering a comprehensive understanding of the IRA's nationwide effects. Economic disparities may be exacerbated, and policymakers might formulate regionally skewed policies based on incomplete information. Industry-specific factors influencing regional concentration may confound analyses, and spatial spillover effects in neighboring regions could be overlooked. Data limitations or reporting biases might contribute to the observed pattern, and public perception may question the fairness and equity of the IRA, impacting stakeholder opinions. To address these challenges, sub-analyses for different regions, exploration of reasons for regional disparities, balance test across treatment and control groups, and transparent acknowledgment of limitations are crucial for a nuanced interpretation of the IRA's impact.

Therefore, the treatment group will correspond to those counties in which companies received funds from the IRA program. Vice versa, the control group consists of all counties in which no company received the IRA subsidy. We want to compare both groups, before and after the treatment period. Moreover, to enhance the precision of our evaluation, we want to introduce a weighting mechanism for counties based on the amount of financial resources received

by companies within each county. This approach acknowledges that not all companies may receive the same level of funds from the IRA program. By assigning weights according to the monetary assistance, we aim to account for variations in the magnitude of the IRA's impact across different regions.

2.2.2 Modelisation

We are in the framework of a panel data with two-time periods. We can first model our problem as following:

$$Y_{i,t} = \beta_0 + \beta_1 Post_t + \beta_2 Treatment_i + \beta_3 Treatment_i * Post_t + \beta_4 X_{i,t} + \epsilon_{i,t} \quad (1)$$

Where:

- $Y_{i,t}$: is the outcome variable in county i, at time t.
- β_0: represents the intercept.
- $\beta_1 Post_t$: Post is a dummy variable that indicates 0 for the pre-treatment period in year t (2017-2022) and 1 for the post-treatment period in year t (2022-2025).
- $\beta_2 Treatment_i$: Treatment is a dummy variable, and it indicates in which group the county belongs to, if treatment is 1, these are the county belonging to the treatment group, and if the treatment is 0, these are the counties in the control group.
- $\beta_3 Treatment_i * Post_t$: represents the interaction effect between being in the treatment group and being in the post-intervention period.
- $\beta_4 X_{i,t}$: X constitutes the matrix of all of the control variables.
- $\epsilon_{i,t}$: corresponds to the error term, we do not observe it.

The coefficient of interest is β_3, it measures the strength and direction of the interaction between being in the treatment group and being in the post-intervention period. In the context of a difference-in-difference analysis, this term helps assess whether the treatment effect varies between the pre-intervention and post-intervention periods, providing insights into the dynamic impact of the treatment over time.

In order to evaluate the impact of the IRA, we need to consider that there maybe other state-specific factors that could be affecting our outcome variable. To deal with this issue, we include time and county fixed effects in the difference-in-difference regression model. Fixed effects allow to control for unobserved heterogeneity between treatment and control groups, such as difference in pre- existing characteristics. By including fixed effects, we can isolate the effect of the treatment from other sources of variation in the data. Thus, we take into account that the counties do not necessarily have the same laws, the same public expenditures. It is the same for time fixed effects, we introduce this effect to consider the differences through years and the hazards that characterize them. The equation is the following:

$$Y_{i,t} = \alpha + \gamma_1 Year_t + \gamma_2 County_i + \beta_3 Treatment_i * Post_t + \beta_4 X_{i,t}\, \epsilon_{i,t} \quad (2)$$

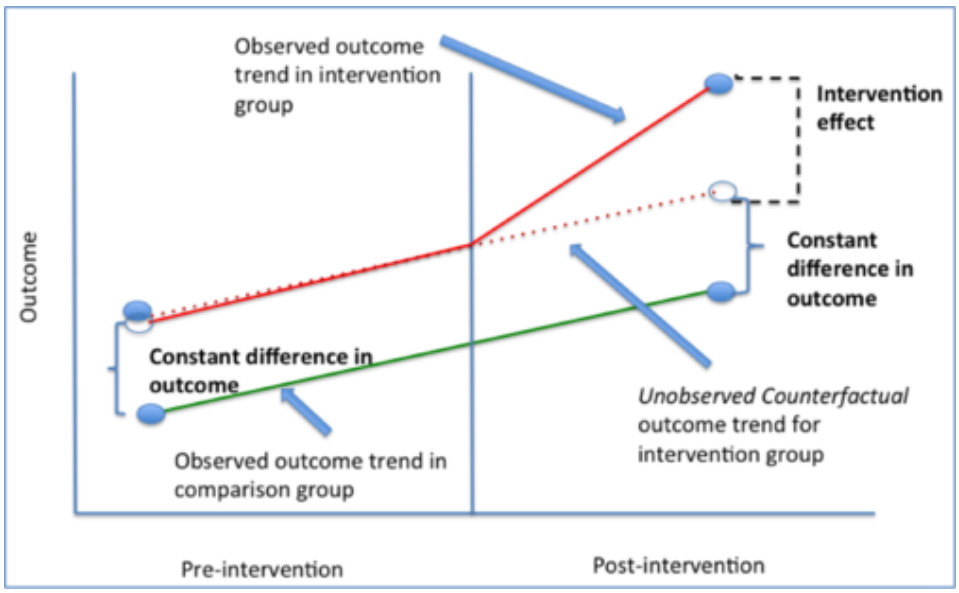
Where:

- $Y_{i,t}$: is the outcome variable in county i, at time t.
- α: represents the intercept.
- $\gamma_1 Year_t$: is the fixed effect for time t.
- $\gamma_2 County_i$: represents the county fixed effect.
- $\beta_3 Treatment_i * Post_t$:represents the interaction effect between being in the treatment group and being in the post-intervention period.
- $\beta_4 X_{i,t}$: X constitutes the matrix of all of the control variables.
- $\epsilon_{i,t}$: corresponds to the error term, we do not observe it.

2.2.3 Parallel trend assumption

When using difference-in-difference design, it is crucial to verify the parallel trend assumption in order to have a valid analysis. It is a key assumption that must hold in order to obtain unbiased estimates of the treatment effect, and thus know the true effect of the IRA. The parallel trend assumption means that, in the absence of the treatment (IRA), the outcome variable for the treatment group would have followed the same trend as the outcome variable for the control group over time. If this assumption holds, any difference in the outcome variable for the treatment and control groups after the implementation of the treatment can be attributed to the treatment itself. Therefore, we must check for the parallel trend assumption before drawing any conclusion on the effects of the IRA. The following figure illustrates this assumption.

Figure 2: Parallel Trend Assumption



3 Organizational management approach

To successfully implement the presented empirical study, we require an organizational management approach encompassing the planning of human and financial resources as well as the development of a project roadmap.

3.1 Presentation of the team

In line with your Terms of References, we suggest a diverse team providing different qualifications and expertise. The project head is taken by the experienced project manager and the econometrician. Together they are able to navigate through the project, define as well as assign tasks and make sure to meet all deadlines. Besides keeping track of all tasks and planning the project phases, the project manager will be your first contact person. With an excellent background in Data Science, the econometrician will manage all task regarding data collection, database creation and model estimations. In collaboration with the first project head, the econometrician helps with assigning tasks and scheduling the project milestones. Having worked on more than 10 projects for different supranational organizations, our economic policy analyst will focus on evaluating the IRA based on the empirical findings as well as derive recommendations for actions based on state-of-the-art academic research and models. To complete our team, a PhD Candidate will mainly support in data research, creating the econometric model, policy analysis and creating all content pieces. All our team members are based in the United States and are ready to relocate temporarily if necessary. Table 2 summarizes our human resource proposal.

Table 2: Human Resources - Team members

Team member	Qualification	Experience
Project manager	M.Sc. Business & Economics Scrum Master	Public Sector Consulting (5 years) Freelance Project Manager (4 years)
Econometrician	M.Sc. Econometrics & Data Science PhD in Econometrics	Official at US Ministry (5 years) Freelance Data Scientist (5 years)
Economic Policy Consultant	M.Sc. Economic Policy Analysis PhD in Fiscal Policy	Employee at World Bank (5 years) Freelance Consultant (4 years)
PhD Candidate	M.Sc. Data & Economics for Public Policy	Project staff at OECD (1.5 years)

3.2 Work plan proposal

As defined in your Terms of References, we suggest to split the IRA analysis project into three main phases. To make the collaboration even more efficient and ensure the successful communication of the results, we suggest the following project phases.[6]

Preparation and kickoff
The preparation and kickoff phase aims at forming the cornerstone of the project by further defining the project milestones and a general work plan in close cooperation with the commissioning entities and relevant stakeholders. All results will be provided in a first deliverable.

Creation of the database
In this phase our econometrician as well as PhD candidate will take the lead and consolidate necessary county-level data from the Beaureu of Economic Analysis and the White House. In a next step, we will present the consolidated data, discuss its quality and present as well as discuss possible imputing strategies. As the data is the foundation of this project, we offer additional (optional) follow-up meetings to make sure to fulfill your expectations. We expect this phase to take around 9 months which gives us a puffer of 3 month when facing any difficulties. At the end of this phase we will hand in the second deliverable, namely the finalized database necessary to conduct the empirical analysis at hand.

Creation of the econometric model
After having created the necessary database, the next phase aims at creating the difference-in-difference model. To do so, we suggest to subdivide this phase into two sub-phases: In a first step, we will develop a solid baseline DID model capturing the main effects of the IRA policy (third deliverable). Based on this model, we can anticipate the final results and discuss further research directions. This strategy follows a more agile approach and makes sure to

[6]Figure 3 in the Appendix contains an even more detailed roadmap of the above-explained project phases.

obtain the best results. By including this additional iteration, we create room for additional findings and modifications. Our ambition is to offer you the opportunity to gain as much insights as possible from this analysis. In the second stage of this phase, we will finalize the econometric model and provide it as fourth deliverable. During this time our econometrician as well as the assisting PhD Candidate will be your direct contact persons.

IRA Policy Analysis[7]
To optimize efficiency, our economic analyst will already start evaluating the IRA policy based on the baseline model results. As already mentioned, this gives us the opportunity to explore related research questions and refine the empirical study. Having included your feedback on this first draft, i.e. the fifth deliverable, we will create the final IRA policy evaluation report. The duration of this phase is estimated to last 4 month and will be mainly lead by our Economic Analyst.

Project Handover and Communicating Results
The last project phase contains the debriefing as well as the project handover. More concretely, we will prepare a presentation of the database, econometric model, policy analysis report and handover all created project files. This debriefing gives you the opportunity to reflect on the results and the collaboration, develop further questions of interest, and maybe ask some remaining open questions. In conclusion, our mission is to successfully communicate the study's results, provide answers to all of your questions, and go even beyond by providing you the opportunity and tools to further elaborate on these findings.

3.3 Financial proposal

Given the outlined work plan proposal and the more detailed roadmap (Figure 3), we created the financial proposal to conduct this empircal study. The total expenses mainly arise from the cost of staff, and travel expenses. Besides offering an experienced and interdisciplinary team of highly skilled professionals, we have all required equipment to conduct the IRA Policy Analysis. That said, we do not have to procure any other additional materials such as software or hardware at your expense. The following tables show our financial proposal in detail.

Since we are following a more agile approach to meet your expectations to the fullest, we offer to do the kickstart and debriefing event onsite. Table 4 contains the related cost including transportation and per diem rates (three days per trip).
Based on these costs, I estimate the total cost of the project for our team to be EUR 293,436.00.

[7]Please note that we plan to include the cost analysis in the policy analysis report
[8]Per Diem rates based on U.S. General Services Administration 2024

Table 3: Cost of staff

Team member	**Num. of Days**	**Daily Fees**	**Cost in EURO**
Project Manager	61	700.00	42,700.00
Econometrician	130	700.00	97,500.00
Economic Policy Consultant	115	600.00	69,000.00
PhD Candidate	142	300.00	42,600.00
Total	448	2,350.00	**251,800.00**

Table 4: Reimbursable expenses

Description	**Quantity**	**Unit price**	**Cost in EURO**
Plane/Train Tickets	8.00	500.00	4,000.00
Taxi	10	100	1,000.00
Per Diem[8]	24	415	9,960.00
Total			**14,960.00**

Table 5: Total project costs

Cost Component	**Cost in EURO**
Staff	251,800.00
Reimbursable expenses	14,960.00
Overhead	26,676.00
Total	**293,436.00**

4 Appendix

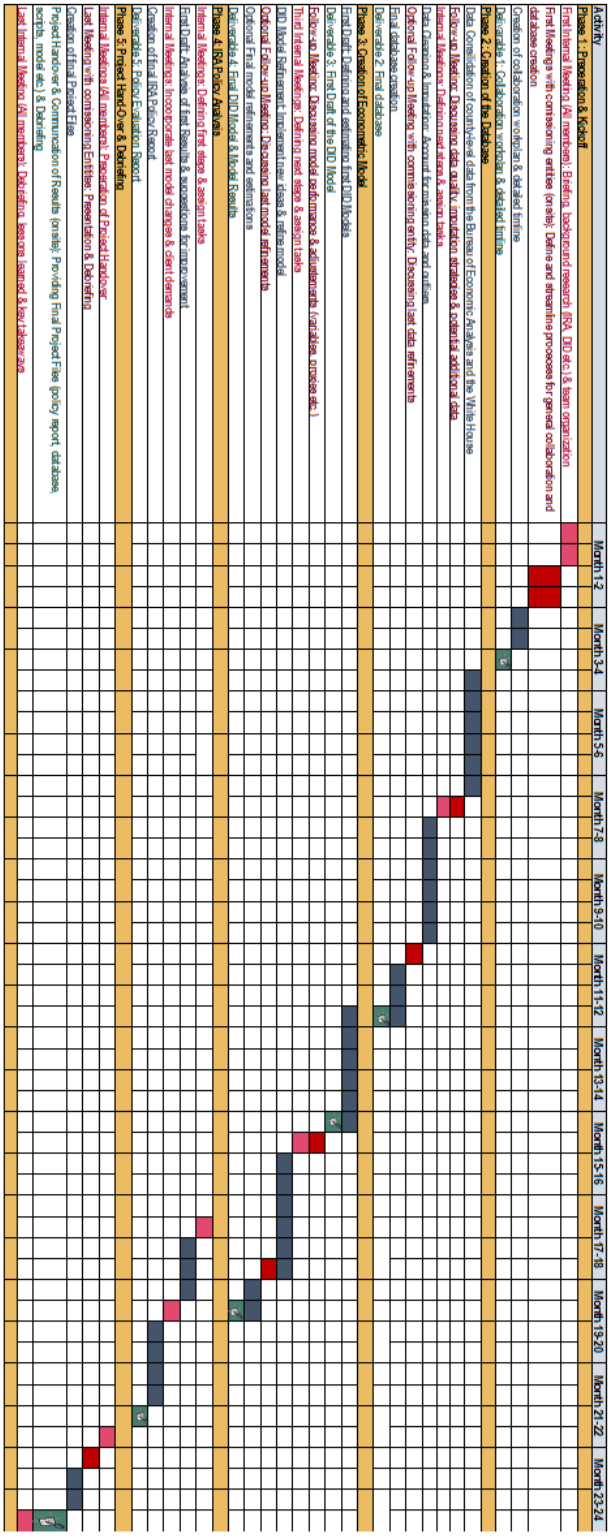


Figure 3: Project Roadmap

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