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The Externalities of ChatGPT in Labor Markets, Productivity, and Resource Allocation

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Abstract:
Purpose: *The rapid development and widespread adoption of artificial intelligence (AI) technologies, particularly ChatGPT, have significantly influenced various sectors of the economy by reshaping labor markets, productivity, and resource allocation. This study aims to examine the extent to which the widespread use of ChatGPT generates both positive and negative externalities in these three areas and to provide a multifaceted assessment of its broader economic impact.*
Design/Methodology/Approach: *The study adopts a secondary-data research approach based on a systematic evaluation of academic studies, institutional reports, and other credible sources concerning ChatGPT and generative AI. The analysis examines the changes associated with ChatGPT in labor markets, productivity, and resource allocation. Economic models, theoretical reasoning, and the concept of externalities are employed to identify and evaluate the positive and negative consequences associated with the adoption and use of technology.*
Findings: *The findings indicate that ChatGPT generates important positive externalities by increasing productivity through the rapid generation of ideas and solutions and by facilitating more efficient and streamlined communication. It also improves the utilization of labor by automating repetitive tasks and supporting decision-making processes. In addition, ChatGPT can contribute to more efficient resource allocation by reducing certain forms of waste and inefficiency and by facilitating rapid access to relevant information. However, the analysis also identifies significant negative externalities. These include potential productivity losses resulting from inaccurate information and quality concerns, job displacement associated with automation and skills mismatches, challenges related to worker retraining and labor-market adjustment, and environmental pressures arising from the increasing resources required to support AI technologies.*
Practical Implications: *The findings highlight the need for firms, workers, and policymakers to adopt a balanced approach to the implementation of ChatGPT. Organizations should establish appropriate mechanisms for verifying AI-generated information, invest in employee training and reskilling, and use AI in ways that complement rather than unnecessarily replace human capabilities. Policymakers should strengthen AI literacy, support labor-market adaptation and retraining, and develop appropriate measures to address the social and environmental costs associated with large-scale AI adoption. Such measures can help maximize the economic benefits of ChatGPT while reducing its negative externalities.*
Originality/Value: *This study contributes to the emerging literature on the economic implications of generative AI by analyzing ChatGPT through the theoretical framework of*

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externalities and by integrating three closely interconnected dimensions of its economic impact: labor markets, productivity, and resource allocation. The study moves beyond an assessment based solely on productivity or employment effects and provides a broader economic perspective that considers both private benefits and social costs. The findings emphasize the importance of balancing technological innovation with appropriate organizational and public-policy responses.

Keywords: *Artificial Intelligence, ChatGPT, Generative AI, Externalities, Labor Markets, Productivity, Resource Allocation, Technological Change, Economic Impact.*

JEL Classification: *D61, D62, J23, J24, O33, O38, Q55.*

Paper type: *Research article.*

1. Introduction

New and innovative technology has often impacted and changed the global economic landscape, as well as the fundamental way societies interact and utilize their resources. However, it is not necessary that technology always be beneficial for people and economies, creating only positive externalities. As with every innovation and change, negative consequences and externalities also arise. An externality occurs when the actions of consumers or producers cause negative or positive side effects on other people (third parties) who are not a part of the actions and whose interests are not taken into consideration.

There are two types of externalities, positive and negative. A positive externality benefits the third party, and a negative externality harms the third party (Tragakes, 2009). ChatGPT is an artificial intelligence (Al) chatbot that simulates human speech through natural language processing. The AI can write emails, articles, essays, code, social media posts, and other written content in addition to responding to questions with thorough explanations (Helter, 2023). With ChatGPT possessing such remarkable capabilities, it raises questions about its potential impact on labor markets, productivity, and resource allocation.

Hence, this paper aims to answer the question of: To what extent does the widespread usage of ChatGPT contribute to externalities (both negative and positive) in labor markets, productivity, and resource allocation? In terms of the labor market, there has been a widespread fear of how ChatGPT may have the potential to increase unemployment as a drastic change in demand for skills occurs (structural unemployment).

However, although that is possible, it has also created new job opportunities and demand for labor in other sectors. Additionally, in terms of productivity, quick and easy access to information enhances the speed of labor; however, productivity can be negatively impacted by potential misinformation and a decline in human critical thinking skills and judgment, which are not possible with AI.

Finally, ChatGPT can improve resource allocation by reducing labor costs, which in turn increases efficiency in information processing and customer service, leading to a more productive use of human capital. Conversely, ChatGPT might contribute to greater income inequality and require significant investment in retraining programs.

This essay examines the widespread adoption of ChatGPT and its introduction of significant externalities in labor markets, productivity, and resource allocation, manifesting in both positive impacts, such as enhanced efficiency, and negative consequences, including unemployment and potential misallocation of resources.

2. Overview on ChatGPT

ChatGPT stands for "Generative Pre-trained Transformer," referring to its ability to process requests and generate responses.

It is trained using reward models that rate the best answers and human feedback for reinforcement learning. Input responses are constantly improving due to their machine learning and specialized algorithms, which find patterns and data sequences to collect substantial amounts of data from the web and formulate responses. The initial 3.5 model was an older and simpler version of ChatGPT, which often generated text responses with outdated and sometimes inaccurate information (Helter, 2023).

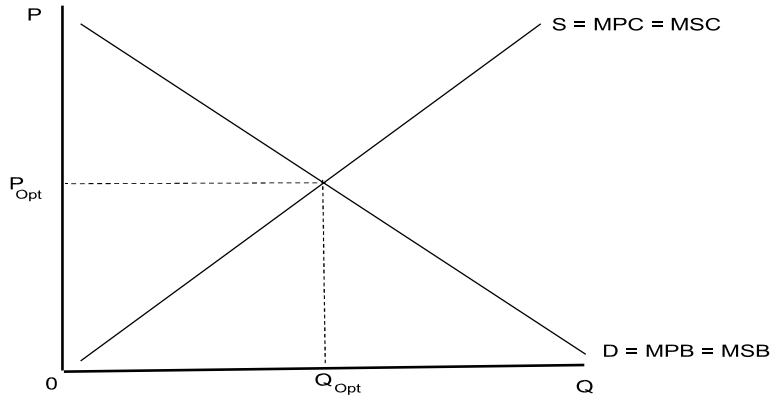
The current GPT-5 model is a significantly upgraded version that generates faster responses and handles complex tasks, such as describing photos, creating responses consisting of up to 25,000 words, creating images and videos, and responding to multi-layered prompts with several questions that require a single answer. Primarily, by utilizing advanced neural networks and natural language processing techniques, ChatGPT-5 is capable of generating more accurate and nuanced language (Bresser, 2024).

It is essential to note that while the 4 and 5-mini models are free, the 5.0 model incurs a usage fee; therefore, the 4.0 and 5-mini models are most commonly used by the majority of people.

ChatGPT is owned by the company OpenAI, which was founded in December 2015 by Sam Altman, Greg Brockman, Elon Musk, Ilya Suctskeve, Wojciech Zaremba, and John Schulman. The founding of the company had the main goal of creating an organization focusing on advancing AI in a way that benefits humanity. Currently,

Elon Musk is no longer involved in the company, and Sam Altman is the CEO (Marr, 2023).

Figure 1. *Allocative Efficiency With No Externalities*



Source: *Own study.*

When externalities occur, MPB (marginal private benefit) and MPC (marginal private cost) change to MSC (marginal social cost) and MSB (marginal social benefit). The third person is the society, the "social" in MSB and MSC. In the free market, an externality causes $MSB \neq MSC$, and this results in allocative inefficiency as the demand and supply curves no longer intersect; there is a difference in the quantity of the goods demanded and supplied.

When there is a negative externality, the costs to society (MSC) are greater than the private cost to producers (MPC), this causes an overproduction of the good than the socially optimum. Conversely, when there is a positive externality, the benefit to the society (MSB) is greater than the private benefit to consumers (MPB), causing underproduction of the good in relation to the socially optimum level (Tragakes, 2009).

The allocative inefficiency causes a market failure; market failure is when the market fails to allocate resources efficiently and there is allocative inefficiency. The market fails to provide the quantity and combination of goods and services most wanted by society. Too little (underallocation) or too much (overallocation) of the good or service is produced or consumed from what is socially desirable (Tragakes, 2009).

The Q Opt is determined by calculating the costs or benefits that spill over to the society and creating a MSB or MSC curve above or below the MPC or MPC. The intersection of the MSB with MSC shows the new Q Opt .

3. Research Methodology

3.1 Sources and Data

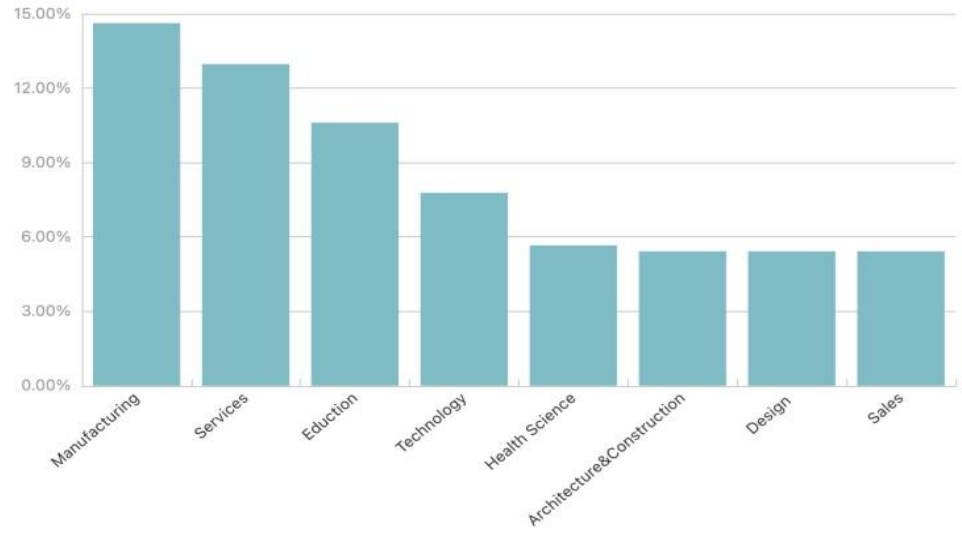
This study is based on secondary data selected from the evaluation of several sources to ensure only the most credible studies and information were used. After conducting research and obtaining changes that ChatGPT has caused on the labor market, productivity, and resource allocation, an economic analysis uses models and reasoning to explain the externalities this technology causes in the stated sectors.

3.2 Results of Changes in Labor Markets

The labor market is also referred to as the job market, which is the supply and demand for labor. Employees and those unemployed provide the supply and employers provide the demand in the labor market.

The labor market is both a macro and micro economic concept. In microeconomics, wages and the number of hours worked are prominent factors of the labor market, while in macroeconomics, unemployment rates are related to labor markets (Kenton, 2023).

Figure 2. *New Occupations enabled by ChatGPT*



Source: *Chen, Lan, et al. Fig. 5: Distribution of new occupations enabled by ChatGPT. 4 Nov. 2023. The Future of ChatGPT-Enabled Labor Market: A Preliminary Study in China, https://arxiv.org/pdf/2304.09823.*

Figure 2 from the study called The Future of ChatGPT-Enabled Labor Market: A Preliminary Study in China , shows that ChatGPT has great potential to create new opportunities for employment in selected sectors of the labor market, especially

occupations related to computer technology, such as algorithm engineers who are required to have a strong understanding of developing models that can analyze and generate human language (Chen *et al.,* 2023).

Moreover, a study conducted by Aghion, Antonin, Bunel, & Jaravel called The Effects of Automation on Labor Demand shows the two contrasting views on the impact of ChatGPT on the labor market; the first view suggests that automation destroys jobs, while on the other hand, the second view contradicts by supporting the idea that due to greater productivity, there will be an increase in demand for labor and lead to lower unemployment. In the end, however, the authors deduce that the overall impact of automation would be positive by making firms more competitive (Zarifhonarvar, 2023).

However, as many examples have shown in the past, greater competition often leads to greater inequality and a negative impact on workers. For example, a study called Governing the work-related risks of AI: implications for the German government and trade unions by Hassel, Özkiziltan, and Weil, showed that by analyzing literature from the past 20 years in OECD countries, different skill groups that were impacted differently by the automation of employment.

According to the study, middle-skilled people experience negative employment consequences from automation, highly skilled workers benefit, and there are conflicting results for low-skilled workers. In total, poor employment outcomes are observed (Zarifhonarvar, 2023).

Contrary to this, a study by Hirvonen, Stenhammar, and Tuhkuri in 2022 called "New Evidence on the Effect of Technology on Employment and Skill Demand" focuses on a technology subsidy program in Finland and demonstrates that advanced technologies induce an increase in employment with no change in the demand for skill in the labor market. The authors tracked businesses and employees and measured certain technology advancements using text analysis and machine learning techniques.

Contrary to the notion that technologies inevitably replace humans or are skill-biased, the data show that enterprises exploited new technology to produce new forms of output rather than replace workers (Zarifhonarvar, 2023).

Overall, the analysis and accountation of diverse research concludes that an intricate and complex relationship between automation, such as ChatGPT, and the labor market is dependent on a number of variables, including the rate and scope of automation adoption, the kinds of employment, industries it affects, and the availability of chances for workers to reskill and upskill (Zarifhonarvar, 2023).

4. Results of Changes in Productivity

Productivity compares the output of a product with the inputs used in the production of the good or service. The inputs include the resources required to produce the output and may include labor, equipment, or capital. Productivity is also measured in terms of efficiency and in business, it is calculated by measuring the number of units produced of a product relative to the labor hours (Kenton, 2024).

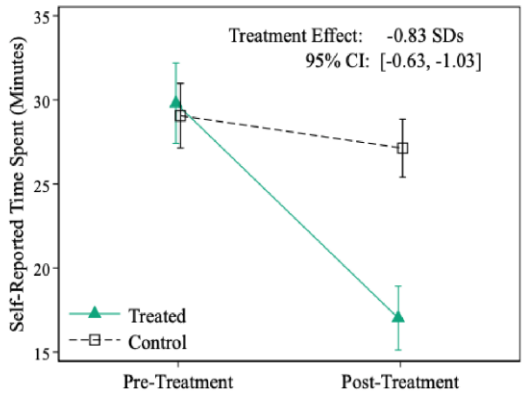


Figure 3: Decrease In Time to Perform Tasks by Employing ChatGPT

Source: Noy, Shakked, and Whitney Zhang. Figure 1: Treatment Effects on Productivity (a) Time Taken Decreases. 2 Mar. 2023. Experimental Evidence on the Productivity Effects of Generative Artificial Intelligence, Economics MIT, https://economics.mit.edu/sites/default/files/inline-files/Noy_Zhang_1.pdf. Accessed 2024.

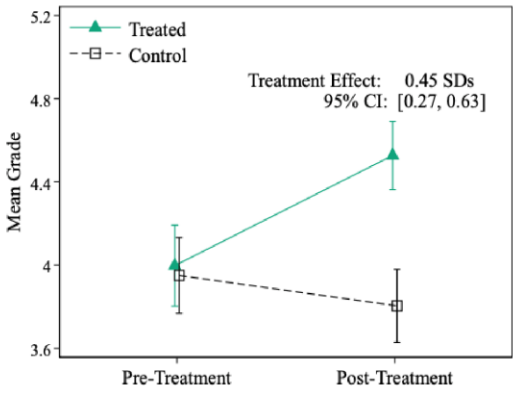


Figure 4: Increase In Performance (Grades) by Employing ChatGPT

Source: Noy, Shakked, and Whitney Zhang. Figure 1: Treatment Effects on Productivity (b) Average Grades Increase. 2 Mar. 2023. Experimental Evidence on the Productivity Effects of Generative Artificial Intelligence, Economics MIT, https://economics.mit.edu/sites/default/files/inline-files/Noy_Zhang_1.pdf. Accessed 2024.

In a study conducted by economists Zixuan Zhang of Stanford University and Shoji Noy of Harvard University, over 450 professionals with college degrees were given writing assignments that were realistic and reflective of their real-world jobs. Marketers, consultants, data analysts, and other professionals who frequently produce written documents were among the participants (Southern, 2023). Figure 3 and Figure 4 show that the study's findings demonstrated that those who had access to the AI tool finished assignments 40% faster and with output that was 18% better (Noy and Zhang, 190).

Additionally, a study conducted by Brynjolfsson and Raymon in 2023 called "Generative AI at Work" used data from 5,179 customer support agents and showed that when they had access to AI, such as ChatGPT, there was an increased productivity by 14%, as measured by issues resolved in each hour. In detail, there was a 34% improvement for low-skilled workers with minimal impact on experienced and highly skilled workers. Furthermore, the study suggests that AI support enhances customer satisfaction, boosts employee retention, and promotes worker learning (Bry Njolfsson *et al.,* 2023).

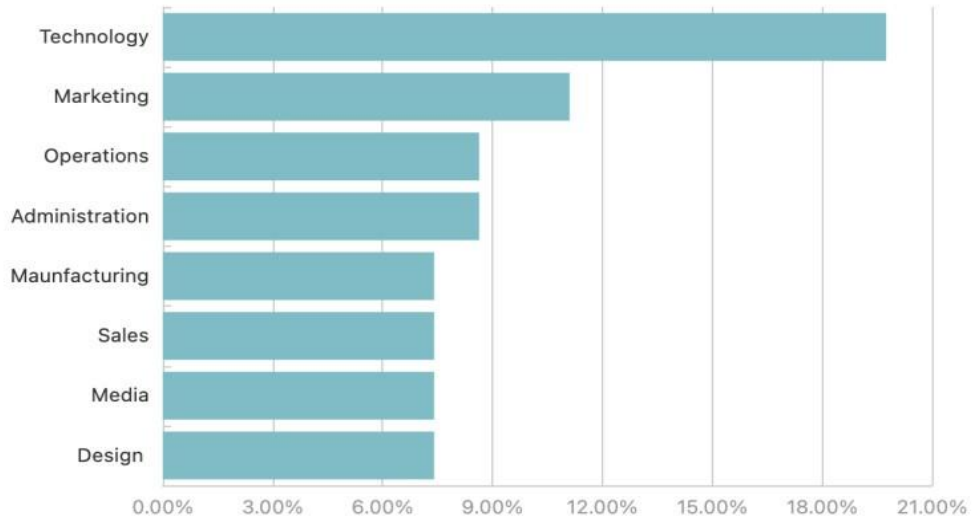
On the other hand, a study conducted by Fujimoto and Takemoto called " Revisiting the political biases of ChatGPT" used political orientation tests and the application of programming to evaluate the effects of how language, race, and gender are used in the system on the responses generated. The study concluded that ChatGPT consisted of notable bias when gender and race were set to "female", "black", or when the questions were in Japanese. This illuminated the biases in the system due to the training data, model, and algorithmic constraints (Fujimoto and Takemoto, 2023).

Overall, some studies show an improvement in productivity through the implementation of ChatGPT in the workplace by enhancing human labor and generating more output in less time. However, the question is in the quality of the output generated, as there is the risk of bias and inaccurate information.

5. Results of Changes in Resource Allocation

Resource allocation is the process of assigning available resources or factors of production (land, labor, capital, entrepreneurship) to specific uses chosen among several alternatives. When allocating resources, the main economic questions of what to produce and how much to produce are addressed (Tragakes, 2009).

Figure 5. *Occupations with high proficiency requirements regarding ChatGPT*



Source: *Chen, Lan, et al. Figure 6: Distribution of occupations with high proficiency requirements for ChatGPT related skills. 4 Nov. 2023. The Future of ChatGPT-Enabled Labor Market: A Preliminary Study in China, https://arxiv.org/pdf/2304.09823. Accessed 2024.*

Figure 5 shows and helps conclude that as the distribution and demand for certain occupations change, so will the allocation of resources (such as capital and labor)

among sectors. This could result in a misallocation of resources initially as companies and economies adjust to the changed landscape due to the use of ChatGPT.

Moreover, due to GPU scarcity, computing has emerged as a major obstacle to the development of large-scale AI models and the integration of those models into AI products. As Elon Musk stated in May 2023, "GPUs are at this point considerably harder to get than drugs" to an assembled group of CEOs (Vipra & West, 8). Hence, Microsoft is restricting access to its hardware and has explored a partnership with Oracle to share AI servers in an effort to address the GPU scarcity.

The negative consequences of the inelastic demand in this industry are further demonstrated by the difficulties faced by customers of the other major cloud infrastructure providers due to delays and shortages of GPUs. The $10 billion investment made by Microsoft in OpenAI was motivated by the company's need for massive amounts of computing, according to OpenAI CEO Sam Altman. "We're so short on GPUs, the fewer people that use the tool, the better," Altman told Congress (Vipra and West, 10).

Similarly, an article by Goldman Sachs showed AI to cause an increase in power demand, due to data centers, to increase by over 160%. The article demonstrated that since 2020, total energy demand has increased drastically by data centers. As AI innovations improve and increase their computing speeds, electricity use also increases tremendously. The expansion of AI will continue to lead to an increase in powder consumption where the demand greatly exceeds the supply.

For reference, one ChatGPT query uses 2.9 watt-hours of electricity while a Google search uses 0.3 watt-hours, according to the International Energy Agency (Goldman Sachs, 2024). However, although the use of ChatGPT and other AI causes a misallocation of resources in a set industry, overall, an issue by the PM World Journal confidently states that “ ChatGPT can help project managers allocate resources more efficiently by analyzing project data, identifying potential bottlenecks, and suggesting optimal allocation strategies.

It can also help project managers forecast project timelines, budgets, and resource requirements more accurately” (Reid, 5). This demonstrates that although the intense demand in the computing industry results in short-term misallocation of resources and supply shocks, in the long term, the wider global economy is to benefit as the information and analysis provided by ChatGPT can better guide project managers and officers.

Additionally, research conducted by Kaur called “Exploring the Use of Chatbots and AI in Human Resource Management: A Focus on ChatGPT and its Impact of ChatGPT on Human Resource Management Practices” proves that analyzing several papers and studies, it has evidently shown that ChatGPT has the greatest impact in

the HR sector, "It can also be used for recruiting, employee engagement, training, etc., and can automate the process of applicant evaluation, saving HR personnel time and effort" (Kaur, 2442).

The use of ChatGPT in this field automates repetitive tasks and allows HR to focus their time on strategic activities, effectively allocating their time and energy. Also, the research shows that by reducing manual labor in HR sectors, firms are able to allocate financial resources more efficiently and lower operational costs or invest in more R&D (Kaur, 2444).

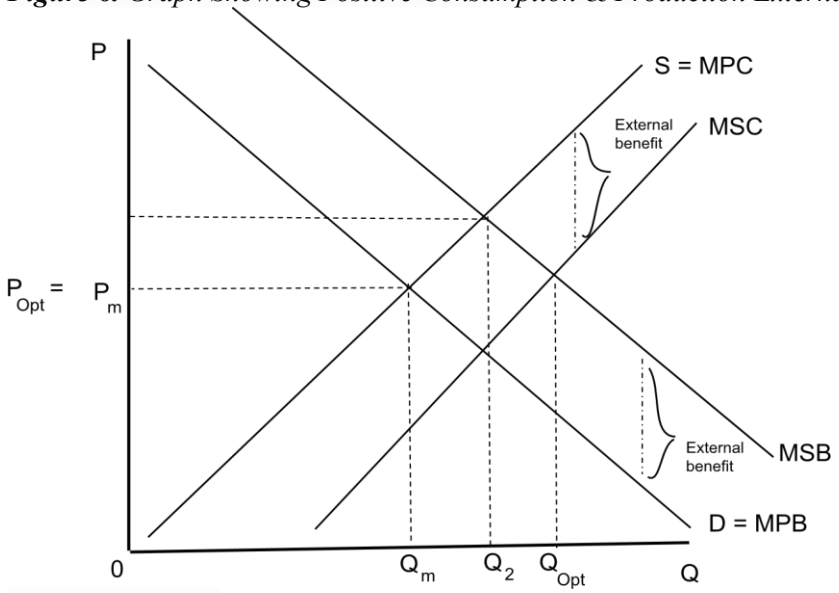
Overall, although the expansion of AI and ChatGPT creates complications in the short-term microeconomic supply side of the economy, the long-term impacts at a macroeconomic level show benefits.

6. Positive Externalities of ChatGPT

6.1 Graph and Explanation

In positive externalities, the equilibrium quantity determined by the market (Q m) is greater than the optimal quantity caused by the production or consumption of the good, Q Opt. . If the production or consumption of the good causes a positive externality, then the Q Opt > Q m as the production of the good is favorable and causes positive spillover on the society; the good is underproduced (Tragakes, 2009).

Figure 6. *Graph Showing Positive Consumption & Production Externality*



Source: *Own study.*

There is an increase in labor market efficiency caused by an increase in productivity and this causes a positive consumption externality. When firms and employees utilize ChatGPT, they are better able to perform tasks by increasing speed and quality. In this case, ChatGPT is considered a merit good which is desirable for consumers to consume and producers to produce but is underprovided by the market due to an underallocation of resources since the goods have a positive consumption and production externality (Tragakes, 2009).

In a positive consumption externality, the marginal social benefits are greater than the marginal private benefits; hence, Q Opt > Q m as the consumption of the good is favorable and causes a positive impact on the society but not enough of it is consumed as to how much should, so there is an underallocation of resources. During a positive consumption externality, the consumption of the good causes a positive spillover effect on society, so the Q Opt> Q m as the consumption of the good is favorable and causes a positive impact on the society but not enough of it is produced as to how much should, resulting in an underallocation of resources.

Although there is a positive externality, it results in an undesirable effect in an economy as there is a misallocation of resources (Tragakes, 2009). During a positive production externality, the production of the good causes a positive spillover effect on society, so the Q Opt > Q m as the production of the good is favorable and causes a positive impact on the society, but not enough of it is produced as to how much should, there is an underallocation of resources.

The difference between Q Opt - Q m with the optimum quantity being greater than the quantity produced at the market level, shows that the good is underproduced and there is an underallocation of resources. In the case of ChatGPT, the externality is both positive consumption and production.

Hence, both the MSC and MSB curves are shown shifting to the right. As this occurs, the Q Opt is greater than Q m and Q 2 (Q 2 represents the quantity when there is only production OR consumption externality). As ChatGPT has the ability to produce a positive externality in both facets, the optimal quantity procured is far greater. Additionally, as the optimum quantity produced and demanded both increases, the P m and P Opt remain equal.

6.2 Labor Market

In terms of the labor market, the positive production externality is caused by the automation of repetitive tasks and the enhancement of decision-making processes, leading to greater efficiency.

ChatGPT has the ability to enhance tasks such as planning, market analysis, video editing, copywriting, etc. It aids professionals in generating various marketing

solutions, written work, communication, and analysis of large volumes of data to identify patterns and trends to make decisions (Chen *et. al.,* 2023).

Additionally, there is a positive consumption externality because employees have greater and easier access to large amounts of targeted information by utilizing ChatGPT. It also improves skills and by performing repetitive tasks, it reduces the stress and energy of employees while improving their skill sets.

6.3 Productivity

In terms of productivity, the positive production externality is caused by a rapid generation of ideas and solutions, and more efficient streamlined communication. Analyzing large amounts of data quickly and automating repetitive routine tasks allows workers to focus on strategic and creative tasks, increasing their productivity.

Moreover, in terms of consumption, by incorporating ChatGPT in the workplace, employees have the option of having enhanced time management and access to greater information, which can aid in their adaptivity and productivity and make them produce greater output and knowledge in a lesser time frame.

6.4 Resource Allocation

In terms of resource allocation, the positive production externality is due to the reduction of waste and inefficiency because, by targeting specific information being accessible, electricity and energy are saved in researching and analyzing information.

There is a reduction of waste and inefficiencies. Furthermore, there is a positive consumption externality because ChatGPT helps individuals with repetitive daily tasks, reducing time spent on mundane activities and allowing them to focus and allocate their time to more important tasks, causing better use of human resources.

7. Negative Externalities of ChatGPT

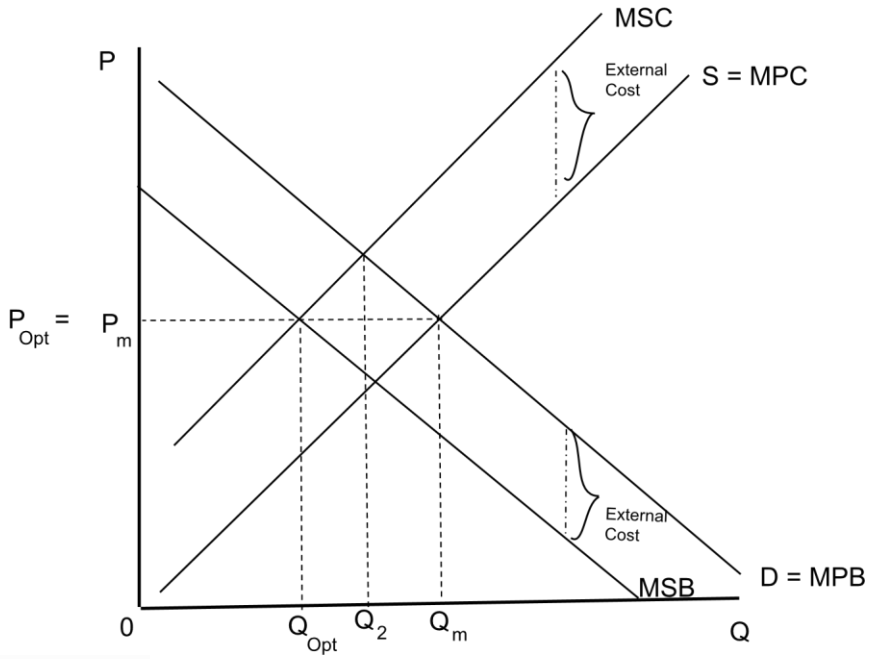
7.1 Graph and Explanation

A negative externality arises when the production or consumption of the good is not favorable and causes a negative spillover on the society; Q Opt < Q m and the good is overproduced.

ChatGPT can also be considered a demerit good that is undesirable for consumers to consume and producers to produce, but is over-provided by the market due to an overallocation of resources since the good has a negative consumption and production externality (Tragakes, 2009).

When there is a negative consumption externality, the market over-allocates resources to the production of the good rather than what is socially desirable. As Q m > Q Opt , too much of the good is demanded and produced, causing great negative spillovers on society. Also, MSC>MSB at Q m shows the costs being greater than the benefits in the society (Tragakes, 2009).

Figure 7. *Graph Showing Negative Consumption & Production Externality*



Source: *Own study.*

Negative production externalities arise from the difference between MPC and MSC. The difference shows the external costs caused by the production of the goods suffered by society. An example is a cement factory's overuse of clean air and production of E-waste and carbon dioxide, which produce a cost to society by causing global warming (destroying the stability of the global climate, which is a common pool resource), and this produces a cost to society by degrading the environment (Tragakes, 2009).

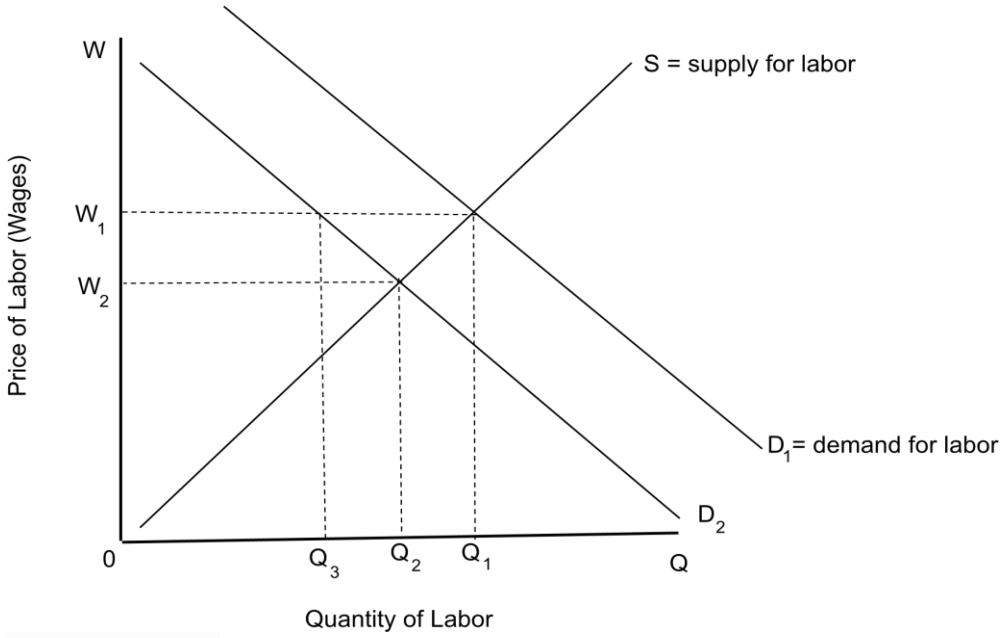
The free market allocates resources inefficiently because it does not consider the full social cost of production. In the free market with the presence of negative externalities, there is no consideration of the costs incurred by third parties or the society as this is not included in the prices paid by consumers and received by producers.

Hence, the market price does not show the external costs, and producers are motivated to sell at their lower private costs and continue producing than what is the

social optimum, resulting in an overallocation of resources (Tragakes, 2009). In the case of ChatGPT, the externality is both negative consumption and production.

Hence, both the MSC and MSB curves are shown shifting to the left. As this occurs, the Q Opt is smaller than Q m and Q 2 (Q 2 represents the quantity when there is only production OR consumption externality). As ChatGPT has the ability to produce a negative externality in both facets, the optimal quantity procured is far less. Additionally, as the optimum quantity produced and demanded both decrease, the P m and P Opt remain equal.

Figure 8. *Structural Unemployment - Mismatch between labor demand and labor supply, falling labor demand*



Source: *Own study.*

Figure 8 shows the presence of structural unemployment, which occurs as a result of technological changes and changing patterns of demand (causing changes in demand for labor skills), as well as changes in the government's location of jobs and labor market rigidities. In the case of ChatGPT, structural employment is caused by the introduction of new technology, which changes the demand for labor/skills in the economy.

For example, from Figure 1, there is expected to be an increase in the labor demand in the manufacturing, services, and education fields, while a decrease in design and sales. Hence, Figure 7 shows a decrease in labor demand from D 1 to D 2 , if the market forces worked perfectly, the wage would decrease from W 1 to W 2 where

only Q 2 workers would want to work, however, due to the idea of sticky wages and wages not falling easily in the short-run and remain at W 1 where greater people want to work causing a surplus in labor supplied.

This causes unemployment, represented by Q 1 - Q 3 (labor supplied - labor demanded) (Tragakes, 2009). This is a major negative externality as it leads to greater unemployment, which is undesirable for any economy. Hence, "This shows how In the future, having proficiency in ChatGPT and other AI technologies will become increasingly essential for workers across various industries, as these technologies continue to reshape the nature of work" (Chen *et. al.,* 2023).

7.2 Labor Market

In terms of the labor market, the negative externality is caused by job displacement due to automation skills mismatch and retraining challenges. Since ChatGPT has the ability to automate processes and reduce the labor required in tasks, there is a decrease in the demand for labor. Although there is expected to be some increase in labor demand in areas such as AI development, the net result is an increase in unemployment due to a decline in demand for the supply of labor provided (Zarifhonarvar, 2023).

7.3 Productivity

In terms of productivity, the negative production externality is caused by quality concerns and misinformation, such as the risk of bias or inaccurate outputs. Since ChatGPT collects vast amounts of information from the web, this causes it to reflect societal prejudices, which can lead to biased responses.

This bias can increase misinformation and lead to inaccurate decision-making processes, which can lead to inaccuracy and a decline in productivity. Also, negative consumption externality arises due to ChatGPT often generating faulty information, which leads to errors in decision-making, project delays, and increased costs (Ferrara, 2023).

7.4 Resource Allocation

In terms of resource allocation, the negative externality is caused by environmental impacts, causing the degradation of resources. Increased energy consumption in data centers creates a negative spillover effect on society through the production of information provided by ChatGPT. Also, the E-waste from hardware production and disposal contaminates water bodies and the environment, whose consequence is faced by society as a whole regardless of whether they use the technology or not.

Also, the high demand for computing chips and electricity, with the low supply, creates a shortage and causes inefficiency in the market. When there is a shortage of

computing chips and electricity, resources (such as labor, capital, and raw materials) may be misallocated. For example, businesses that rely heavily on computing chips may invest more resources in trying to secure them rather than in other productive activities that could generate more overall benefit to the economy.

8. Solutions to Correcting the Externalities

Although in theory, if there are both negative and positive externalities, they would cancel out, and no measures would need to be taken. However, it is prominent to note that the presence and extent of each externality are dependent on the country and sector of the economy. This study aims to identify externalities and explore possible effects and solutions, recognizing that these effects and solutions vary across different economies, countries, and circumstances.

8.1 Graphs

When positive consumption externalities are corrected, D 1 shifts right to D 2= MSB (increase in demand). This causes quantity to increase to optimal, and price to increase to optimal. Although ChatGPT is free, the latest model 5.0 requires a fee. When positive production externalities are corrected, S 1 shifts to S 2 = MSC (increase in supply). This causes quantity to increase to optimal and price to decrease to optimal (Tragakes, 2009).

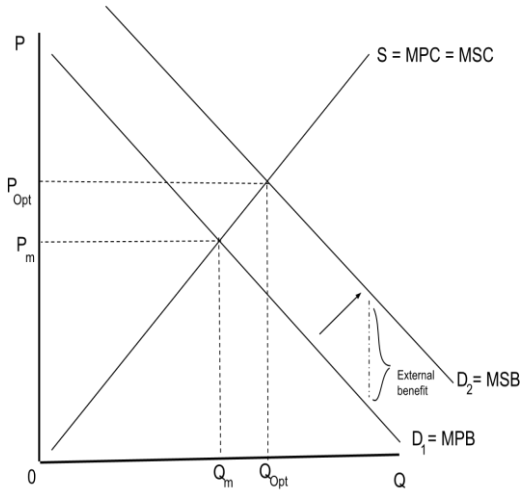


Figure 9: Correcting a Positive Consumption Externality

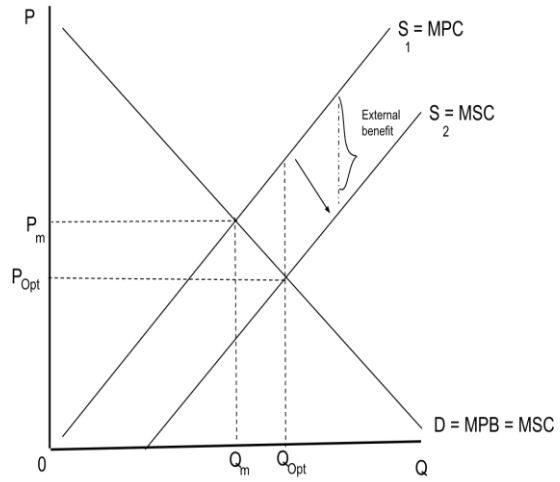


Figure 10: Correcting a Positive Production Externality

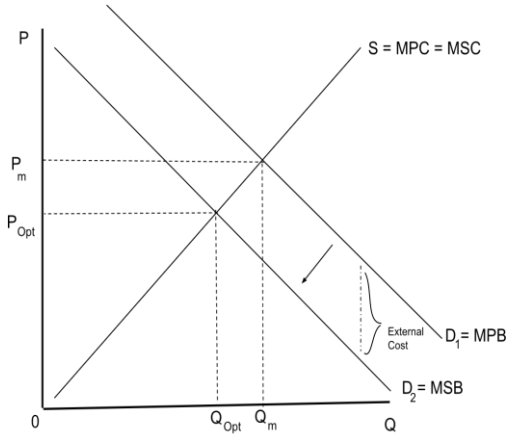


Figure 11: Correcting a Negative Consumption Externality

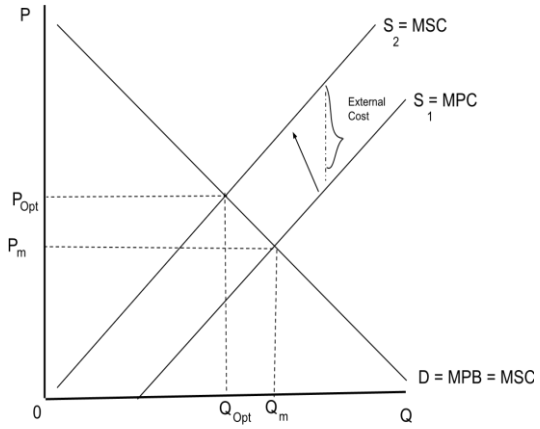


Figure 12: Correcting a Negative Production Externality

When negative consumption externalities are corrected, D 1 shifts left to D 2 = MSB (decrease in demand). This causes quantity to decrease to optimal, and price to decrease to optimal. When positive production externalities are corrected, S 1 shifts left to S 2 = MSC (decrease in supply). This causes quantity to decrease to optimal and price to increase to optimal (Tragakes, 2009).

8.2 Correcting the Externalities in Labor Market

Correcting the Positive Consumption Externality: By the government subsidizing ChatGPT and allowing it to expand, there will be an increase in skills demanded in certain sectors.

Correcting the Positive Production Externality: One method to cause an increase in S is by subsidies, which reduce the producer's cost of production and incentivize them to produce more of the good or service.

Correcting the Negative Production Externality: To resolve the mismatch between the skills possessed by workers and the skills demanded by employers, which exacerbate income inequality, the provision of education and retraining programs by the government or firms can help people gain new skills and stabilize the labor market.

Correcting the Negative Consumption Externality: Firms consuming and utilizing ChatGPT may begin to replace workers with AI. To avoid this, a tax can be imposed on ChatGPT's use by firms to prevent them from completely relying on the technology and incentivize them to employ human labor.

8.3 Correcting the Externalities in Productivity

Correcting the Positive Consumption Externality: One method to cause an increase in D to solve the externality is education and awareness, which causes people to demand more of the good or service.

Correcting the Positive Production Externality: By the government subsidizing the R&D in ChatGPT, the technology can be made available to consumers on a greater scale and be free of errors. Subsidy can fuel its development and make it more capable of performing tasks.

Correcting the Negative Production Externality: By regulations to maintain bias-free responses and accurate information, ChatGPT will have to strongly enforce development and maintain integrity in the responses generated.

Correcting the Negative Consumption Externality: By advertising and spreading greater awareness of the faults in ChatGPT, consumers can be more aware when utilizing the technology and relying on it for prominent decision-making.

8.4 Correcting the Externalities in Resource Allocation

Correcting the Positive Consumption Externality: By promoting and advertising the use of ChatGPT, more firms can take advantage of the benefits and direct information, reducing waste.

Correcting the Positive Production Externality: By subsidizing the development of ChatGPT, the technology can be further developed and greatly aid in providing specified and targeted advice to firms in managing their resources.

Correcting the Negative Production Externality: The implementation of tradeable permits will aid in limiting and controlling the amount of unsustainable electric energy used by data centers and incentivize data centers to innovate clean and renewable energy methods for generating power.

Correcting the Negative Consumption Externality: The implementation of an indirect tax, which is in part paid by consumers, will reduce the demand and use of ChatGPT due to increased costs.

9. Conclusion

Chat GPT is a multifaceted technology that has varying adverse externalities on the economy in terms of labor market, productivity, and resource allocation. The positive externalities: in the labor market, job creation, and enhanced efficiency through better decision making; in productivity, the enhanced communication and faster generation of ideas and analysis; in resource allocation, a decrease in waste and inefficiency by the targeting of specific information and data.

However, the negative externalities: in the labor market, job displacement, and skill gap (structural unemployment), in productivity, bias, and misinformation; in resource allocation, environmental impacts through resource degradation. The long-term impacts of ChatGPT on labor markets, productivity, and resource allocation greatly depend on how societies manage their integration and address the externalities.

Whether or not societies embrace or fear the changes ChatGPT brings, it is agreed by many economists that by choosing ChatGPT and following the idea of interdependence, society in the long term can gain tremendous benefits through improved sustainability, economic well-being, equity, and efficiency as the technology aids in addressing the problem of scarcity.

However, it is important for appropriate policy measures and government intervention to occur to help guide the integration of ChatGPT in the wider society and manage the externalities. Although the research has led to a conclusion supported by evidence, it is important to acknowledge that the secondary research is subject to bias and has limitations; it can not represent all the global economies with certainty, but it can aid in the development of understanding the economic implications of ChatGPT.

In conclusion, this extended essay shows that balancing the negative and positive externalities with the most adequate solutions can help ensure that the benefits of ChatGPT are the most utilized while the drawbacks are effectively mitigated.

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