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A R A Ş T I R M A   M A K A L E S İ / R E S E A R C H   A R T I C L E

EXTERNALITY AND THE PROBLEM OF OPTIMUM PRODUCTION OF THE COVID 19 VACCINE

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ABSTRACT

Although the vaccines developed against the COVID-19 virus led to significant results in the fight against the pandemic, it has been shown that the supply of vaccines could not be increased to the desired extent. As predicted in neoclassical economic theory, the optimum production level for goods with positive externalities under free market conditions remains below the socially desirable amount. The externality requires consideration of social benefits and costs instead of private benefits and costs, which cause the state to take a role in the market as a regulator. Although the subsidy and consumption expenditures for the COVID-19 vaccine are covered by the government, it is seen that the rate of vaccination is not at the desired level.

Keywords: Public Goods, externality, covid 19, optimum production, neoclassical theory

Jel Codes: E13, E17, P34

DIŞSALLIK VE COVİD 19 AŞISININ OPTİMUM ÜRETİM SORUNU

ÖZ

COVİD 19 virüsüne karşı geliştirilen aşıların pandemi ile mücadelede önemli kazanımlara yol açmasına karşılık aşı arzının arzu edilen düzeyde artırılamadığı görülmektedir. Aşı arzının küresel boyutta talep edilen miktarın oldukça altında kalması genelde sağlık mallarının özelde aşı piyasasının kendine özgü özelliklerinden kaynaklanmaktadır. İktisat teorisine göre serbest piyasa koşullarında pozitif dışsallık yayan malların optimum üretim düzeyi toplumsal açıdan arzu edilen miktarın altında kalmaktadır. Dışsallık, özel fayda ve özel maliyet yerine toplumsal fayda ve maliyetin dikkate alınmasını gerektirdiği için devlet piyasada düzenleyici olarak yer almalıdır. COVİD 19 aşısı büyük oranda sübvanse edilmekte ve tüketim harcamaları kamu yetersiz kalmış ve tarafından karşılanmaktadır. Buna rağmen küresel düzeyde aşılanma oranı aşılanma hızının artarak toplumsal bağışıklığın bir an önce sağlanması için fikri mülkiyet hakkından feragat önerisi ortaya atılmış; ancak bu konuda belli bir uzlaşma sağlanamamıştır.

Anahtar Kelimeler: Kamu malları, dışsallık, covid 19, optimum üretim, neoklasik teori

Jel Kodları: E13, E17, P34

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INTRODUCTION

A new type of coronavirus, the COVID-19 pandemic, started about a year and a half ago. The rapidly developing COVID-19 pandemic has not only put many countries in the world into a health crisis but has also increasingly brought along economic and social crises. As of July 2021, a total of 200 million cases and 4.2 million deaths were recorded. Social distancing and the use of masks have a limited effect, although they reduce contagion. It has been seen that the main solution for ensuring social immunity and preventing the pandemic is vaccination.

With the vaccination that started to be implemented in December 2020, the number of deaths and intensive care patients due to this new virus has decreased significantly. According to the studies, the rate of vaccination that should be applied on a global scale to prevent the spread of the pandemic and to provide social immunity is about 80-85%. However, the problems in the vaccine supply show that it will take a long time to reach this rate. This problem is due to the unique characteristics of the healthcare market, among other factors. Healthcare services have both private and public property characteristics. The criteria of non-competition in consumption and exclusion from benefits used in the classification of public goods do not generally apply to health services. In other words, the fact that a person receives health care, for example, vaccination against infectious diseases, affects the consumption of another person of this vaccine, and therefore there is competition in consumption. Similarly, a person who does not participate in vaccine financing may be excluded from consumption.

Therefore, within the framework of these criteria, health care is assessed in the category of special goods. But the fact that a person receives medical care benefits not only himself, but also third parties, and no one can be deprived of this benefit. Health, the production costs of which are covered, radiates external benefits, and no one can be deprived of this benefit. In addition, this external benefit is not subject to competition; that is, the benefit of one person does not affect the benefit of another person. In this context, health, which is considered a private good that emits mainly externality, is defined as a global public good by some authors. The externality of health care and/or its acceptance as a global public good means that effective products in the market will not occur spontaneously. Orthodox economics, or Neoclassical economics, asserts that in a free market economy, the interests of society coincide with the interests of rational individuals acting on the principle of maximization of benefits under competitive conditions. In other words, it is assumed that social well-being is also maximized when the maximization of individual benefits is achieved. In this regard, the situation when the benefit of another person cannot be increased without reducing the benefit of one person is called the Pareto optimum, and it is assumed that in such a situation the optimal level of production that ensures the effective distribution of resources will occur. According to neoclassical economic theory, if there are only market failures the government can intervene indirectly or directly. The lack of competition, the presence of public goods, externalities, and asymmetric information are important factors that lead to market failures and determine the role of the state in the economy. These factors leading to market failure can be seen as a common feature of health care. Therefore, when the production and supply of vaccines are left to market conditions, the amount of production does not occur at the socially desirable level, that is, the behavior of producers and consumers aimed at maximizing their individual benefits has socially irrational consequences. The solution to this conflict is possible with the intervention of the state in the market and its necessary regulation.

In this study, the lack of COVID-19 vaccine supply and how to eliminate the restrictions on this issue are discussed. In the first chapter, the concept of public goods is explained in detail and the

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issue of how the optimal production of public goods is determined is discussed. The topic of the second part is the intervention of the state in the production of goods that create externality and externality. In the third and final chapter, the lack of COVID-19 vaccine supply and the necessary measures to increase supply are discussed.

1. Public Goods: Conceptual Framework

The effective distribution of resources is explained by the presence of competitive markets in the Orthodox approach. The fact that the markets are not competitive provides the necessary and sufficient conditions for the effective distribution of resources. A large number of buyers and sellers, the similarity of products (homogeneity), the absence of any obstacles to manufacturers entering the market, and the fact that it is costless to access the necessary information ensure the optimal distribution of resources and, consequently, the optimal amount of reproduction. In the absence of any of these conditions, the maximization of social well-being or, to put it the same way, Pareto optimization does not occur. The necessity of state intervention arises in such a situation, which is called a market failure.

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Public goods are considered and studied in the literature together with the issues of state intervention in the economy and privatization. Since the 1950s, when the theory of public goods was developed, was the period when state interventions were most intense, the theory of public goods had a statist point of view. Recently, there has been a shift away from a statist presentation, towards a private and voluntary presentation and the use of multi-actor authority.

With the realization of industrialization in the 20th century, there was also a serious explosion in the supply of public goods. The share of public goods in GDP increased from 10% in the 1870s to 30-50% during this period. In 1945-75, known as the Keynesian golden age, the share of the public sector peaked. The public's expectations of the state have increased. Public goods already offered, such as infrastructure and education, were presented more widely and more generously. New ones such as health, housing, and higher education were added to them, and social welfare payments such as pensions, social security, and poverty benefits were raised. However, because rising inflation since the early 1960s and the 1973 oil crisis caused serious crises in the economy and the public budget, social transfer spending was cut first when the public budget started to run a deficit, and then public goods began to be questioned. Privatization practices have narrowed the scope of goods and services offered in the public sphere. The financing of these goods and the quality of service have been reduced. On the political front, opinions advocating for a reduction in public property presentation have won elections or remained in power. In other words, since the 1980s, the issue of public goods has started to have difficult times both theoretically and practically (Durmuş, 2006: 69).

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The theory of public goods provides a scientific basis for the allocation function of budget resources and is extremely important not only for the public economy; but also for the theory of consumer and producer behavior. The properties of public property, first raised by U. Mazolla and K. Wicksell, were later thoroughly examined and formalized by P. A. Samuelson and R. A. Musgrave. Samuelson and Musgrave explained the conditions for Pareto's optimal status of public goods (Blankart, 1998: 27). In this sense, the mathematical model developed by Samuelson in his 1954 article "Pure Theory of Public Expenditure" is the beginning of modern public goods theory. In the model developed here, the goods are classified as private consumption goods and collective consumption goods. Collective consumer goods are defined as goods that everyone benefits from in common in terms of "each individual's consumption of such a good lead to no other individual's consumption of that good" (Samuelson, 1954: 387). In another article a year later, Samuelson used the concept of "public consumer goods" instead of the concept of "collective consumer goods". Here, he demonstrated the necessary condition for the optimum production quantity of public goods in the model he developed using indifference curves and transformation curves. Accordingly, the sum of marginal substitute rates between public property and any private property should be equal to the marginal conversion rate between these goods. In other words, the slope of the transformation curve should be equal to the indifference curve in the graph with public goods on the horizontal axis and private goods on the vertical axis; that is, the number of private goods that individuals are prepared to give up in order to consume one more unit of public goods should be equal to the production of abandoned private goods for the production of one unit more publicly (Samuelson, 1955: 352-354). In the marginalized approach, which is the main feature of neoclassical economic theory, the market economy guarantees the effective distribution of resources in the production of goods, under assumptions that ensure the fulfillment of certain conditions. The demands of consumers acting on the principle of benefit maximization are met by producers acting on the principle of profit maximization. For the products that consumers wish to buy, manufacturers produce at the lowest cost in a way that maximizes their profits. Competition is a combination of manufactured goods and consumer preferences (Musgrave et al., 1994: 68).

The lack of competition in consumption means that a person's use will not affect the benefit of others who use this product (Brümmerhoff, 2001: 94). In this context, a dwelling is used only by households who are willing to pay the rent and pay it, that is, other persons are excluded from the use of this dwelling. In addition, if this housing was to be used by other persons, the benefit would be reduced. In contrast, a person cannot be prevented from benefiting from walls built to protect against flooding in an area. Although this person pays no price for the construction of the wall, it provides a certain benefit and this does not affect the benefits of others (Blankart, 1998: 55).

What kind of problems public goods will cause in the market can be explained by distinguishing the consumption and production processes after these goods are ready for use. In this sense, if public goods are finished and ready for use, the market price for their use must be zero. Thanks to the lack of competition in consumption, these goods also benefit new consumers without reducing the benefit of any consumer. The marginal cost of benefiting an extra consumer is zero. In the Orthodox approach, the effective distribution of resources requires that the price be equal to the marginal cost. Therefore, the price of the goods must also be zero, since the cost of allowing the use of a new consumer is zero. In such a case, the exclusion will not be desirable, even if possible (Blankart, 1998: 56-57). For example, because the marginal cost is zero if the capacity is sufficient in the use of a bridge, exclusion from the use of the bridge is an unnecessary practice in terms of the effective distribution of resources. In other words, the exclusion is

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possible, but unnecessary because there is no competition in consumption. Consumers using the bridge should not be charged a toll as increasing one unit will not bring an additional cost (Musgrave et al., 1994: 69-70). According to these descriptions, public goods do not cause any problems in the market when they are ready for use and consumed; the cost of obtaining an additional benefit is zero. However, the supply price is greater than zero, as making these goods ready for use requires a certain cost to be endured. In a market system where the free exchange takes place, the supply price is greater than zero and the demand price cannot equal zero. Therefore, the free market mechanism for public goods does not work, that is, the effective allocation of resources does not occur spontaneously (Blankart, 1998: 56-57).

Table 1. Classification of Public Goods

	Excluded	Not Excluded
Rivaled in consumption	1	2
Non-Rivalness in consumption	3	4

Source: Musgrave et al., 1994: 71

Goods with competitiveness and exclusion in consumption are special goods. Table 1 shows this with the number 1. The exchange of these goods in the free market ensures the effective use of resources and the optimum level of production. In the other 3 cases, market disruption occurs. Musgrave points out that the concept of "public property" can be used in all three cases but emphasizes that the conditions shown in 3 and 4 take precedence (Musgrave et al., 1994: 71-72).

According to Stiglitz, there are many goods that have only one of the criteria in the definition of public property in real life and therefore do not have the pure public domain or private property quality. The service of vaccination against infectious diseases protects individuals, and vaccinating an extra individual has a significant (marginal) cost; however, vaccination benefits the whole society, and no individual the society can be excluded from this benefit. However, as explained above, the attributes of the goods, i.e., their classification, may change over time, as the marginal cost will be radically reduced thanks to technological development (Stiglitz, 2000: 132-135). As these explanations show, the biggest difficulty in distinguishing public property from private property is that the defining characteristics of public goods are both present to varying degrees. It is not easy to draw a clear line of distinction between pure public goods, pure private goods, and goods with varying degrees of publicity. There are very few pure public goods, such as sunset, where consumption is completely unrivaled and exclusion is almost impossible (Ulbrich, 2003: 97). Some economists consider the criteria of non-competitor and non-exclusion as very strict interpretations and argue that the social situation should be considered in addition to the criteria that the goods have in determining the status of the goods. Social preferences also play an important role in the definition of the extended concept of public goods developed in this way. According to this definition, private goods such as health and basic education are made a non-exclusion table from consumption by political preferences (virtuous goods) and are included in the classification of public goods (Göker, 2008: 114-115).

Global public goods are goods that have the characteristics of public goods, but whose effects are global, affecting all mankind. Therefore, the benefit of global public goods affects not only a group of countries and, moreover, not only current generations; but also future generations (Oral, 2014: 80). Global public goods were first raised by the United Nations Development Programme (UNDP) in 1999 in the book "Global Public Goods-International Cooperation in the 21st Century". Accordingly, the two criteria for global public goods, publicity, and the degree of

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spread of benefits; come to the fore. First, the characteristics of non-exclusion and lack of competition in consumption are handled from a global perspective. In this context, there is no competition between countries for public goods, and no one can be deprived of the use of these goods. The second criterion states that global public goods are outputs on a universal scale due to the spread to all countries, populations, and generations. Apart from UNDP, the World Bank (WB) has also identified and classified global public goods. According to this definition, global public goods are goods, resources, services, or policy systems with cross-border externalities that are necessary for the purpose of poverty reduction and development and only require the joint action of developed and developing countries. (Yilmaz and Yarar, 2011). The concept of global public goods has been developed to understand specific global problems and the need for coordinated international intervention. The concept of global public goods, which has recently been widely covered in the literature, has become a definitive consensus; but covers everything from the global environment, international financial stability, and market efficiency to health, information, peace and security, and human rights (Long and Woolley, 2009).

2. Externalities and Optimum Production

The provision of the Pareto condition, which means the maximization of social welfare, assumes that the decisions of economic units in the free-market economy are independent of each other and not affected by each other. Externality Pareto, which means that other economic units (positive or negative) are affected by the decision of one economic unit (production or consumption), prevents optimal distribution. The point to be emphasized in this definition is that the interaction between economic units occurs not through the price mechanism, but directly through benefit and harm (Brümmerhof, 2001: 73-76). In other words, as long as externalities are reflected in prices spontaneously by the market mechanism, there is no market failure.

Externalities are typically caused by basically special activities, which have side effects (costs or benefits) that we cannot easily prevent from spreading to others. When there are positive externalities resulting from consumption or production, it is costly to prevent those who do not pay from benefiting. The education of a child benefits not only that child and his family; but also other people in society. If a neighbor regularly collects their garbage, the risk of people living with them having health problems decreases, and real estate value in the area may increase. If there is a streetlight half a block from your house and the fee is paid for by the person who lives there, you can walk more safely at night. When a person organizes his house attractively or makes his landscape attractive, the benefits accrue not only for neighbors; but also for everyone living in the neighborhood (Ulbrich, 2003: 111-112). In such activities, when producing a special commodity, public goods (das öffentliche Nebenprodukt) are produced in the form of external benefit. The social marginal benefit is greater than the individual marginal benefit. Therefore, if the externalities are not internalized, the amount offered will not be at the optimal level. There is a partial market failure. Externalities must be internalized to ensure optimal production levels (Blankart, 1998: 484).

Stiglitz states that goods that create externality can be seen as a special type of public goods. Characteristic of pure public goods: If one unit is purchased more, the benefit of all consumers using this product increases by the same amount. Feature of pure private goods: If one person buys more, others (at least directly) are not affected. In contrast, the peculiarity of goods that emit externality in consumption: others are affected by one person buying more, but this effect does not have to be in the same amount. Externalities can be interpreted as a special type of public property, Stiglitz said, perhaps it is more accurate to say that public goods reflect a special

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state of externality (Stiglitz, 2000: 135-136). The advantage of the theory of exclusivity is that it can apply to any non-excluded commodity that is not a competitor or competitor. As a result, the theory of externality is more general than the theory of public goods. Therefore, a pure public domain can be seen as a special type of externality (Long and Woolley, 2009: 116). In contrast, those who argue that externalities are a private type of public goods suggest that the service provided to the global community from a stockpile of medicines and vaccines should be considered a global public commodity. These externalities should be considered pure public goods and supplied by the government (Moon et al., 2017). Another approach that explains the relationship between externality and public property is the acceptance of externality as a feature of public goods. According to some authors, in addition to the non-competitor and inability to exclude from consumption of public goods, a third feature is the spread of externality (Altvater, 2003: 178). In this approach, the presence of externalities leads to government intervention, either to promote the potential for positive spread effects or to deter negatives.

Within the scope of these explanations, is health itself a global public domain? the question can be formulated. Most economists think it is not, according to a report by the World Health Organization. Although there are some positive externalities for health (negative externalities in case of deterioration of health), personal health is often considered a special commodity by economists. However, "Public" health is a different issue. Governments will intervene occasionally to change the behavior of private individuals to maximize the public health impact. For example, by supporting health research to advance knowledge; the state intervenes in the market to support vaccination campaigns to prevent or slow the spread of infectious diseases in a population. The global public goods approach focuses on such public health programs and policies with full global reach. In summary, global public goods are public goods that exhibit cross-border externalities, and therefore are likely to be under-supplied by both markets and governments at the global level (Feachem and Sachs, 2002).

Figure 1 describes the optimum production of the product, which provides a positive externality in consumption. The DP curve was achieved by horizontally collecting the demand curves of individuals who provide special marginal benefits (e.g., vaccinating against infectious diseases). Dx is the "so-called demand" curve (die "Pseudo-Nachfrage"), which shows the external benefit obtained by third parties as a result of the vaccination activity of some individuals. The Dx curve, which reflects the benefit of individuals who do not get vaccinated, is obtained by vertically collecting the demand curves of these individuals. The Ds curve, which shows the vertical sum of the DP and Dx curves, represents the sum of the external benefits of this activity with the special benefit of the vaccinated individuals. Balance is achieved at the 0Qp production level in free-market conditions where special marginal benefit (Dp) and special marginal cost (S) are considered. However, this equilibrium point Pareto is not optimal because external benefit or social benefit is not considered. The effective production amount reached because of the internalization of external benefit is Qs. To increase the balance production quantity from 0Qp unit to 0Qs unit, the state must spend as much as Dx (Zuschuß) for each unit, reflecting the vertical difference between Ds and Dp. For the balance point, this amount of expenditure is as much as FC. At the point of balance that ensures the effective distribution of resources, 0R shows the unit price paid by consumers, rt state-funded. The RTCF area reflects the total transfer expenditure on consumers covered by the public budget and funded by taxes. Alternatively, with the subsidization of producers, the supply curve shifts down to the Sn level, resulting in the same result. Internalizing externality with public intervention is not as simple in real life as in theory. Since the Dx curve is unknown in real life, it is not technically possible to estimate the

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external (marginal) benefit and determine the required amount of public expenditure. Therefore, the solution depends on certain political processes and decisions.

According to these explanations, the classification of public goods can be expanded by the criterion of increasingly completing internal benefits (interne Nutzen) for the individual consumer with external benefits. In other words, pure private goods (das rein private Gut) are goods that provide only internal (special) benefits and do not emit external benefits; pure public goods can also be defined as goods where the total benefit is equal to the external benefit. In this sense, the FC length is zero because the Ds and Dp curves will be identical in pure special goods. In pure public goods, the Ds curve represents only the Dx curve, which reflects external benefit. Since the total benefit is external, the entire unit price must be covered by public resources. In other words, public goods defined only as goods of external benefit should be fully funded by the state (Musgrave, 77-79).
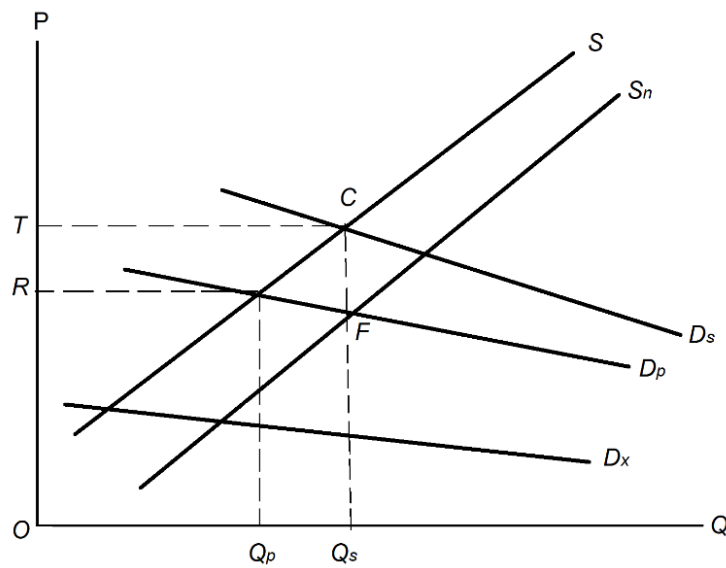

Figure 1. Positive Externality and Optimum Production

According to the above explanations, determining the optimum level of production of foreign goods and distributing the cost appropriately among users is a very difficult process for the public finances. Measuring externalities, responding to production as necessary, and sharing the cost among users is an extremely complex process. In the 1950s and 1960s, the standard practice against such market failures was the production of public goods or goods with significantly positive externality by the public authority (Ulbrich, 2003: 118). The main elements of neoliberalism, which began to take effect in the 1970s, were the emphasis on the free market and, in relation to it, the withdrawal of the state from production. Neoliberalism can be seen as a central driving force of globalization and a central factor in deep social and political-institutional change. Neoliberal thinking has led to the privatization of increasingly public goods and services under the principle of efficiency, while at the same time bringing with it a high degree of global mobility of people and consumer goods. Deregulation of capital and labor eroded the flexibility and impact of social security systems in times of crisis. Efficiency optimization of the health and education sectors has resulted in significant cost savings due to inadequate staffing and insufficient resource use in both sectors. This situation is particularly notable during the COVID-19 pandemic (Saksena, 2021).

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3. The Health Services and Vaccine Market: Case of Covid 19

Broadly taken, there are many public aspects of health care. All countries benefit from the information produced about health at the same time, and no one can be deprived of this benefit. In the field of health, both the activities of countries alone and the efforts of international organizations to protect human health are considered global public goods. Medical studies for the prevention and treatment of diseases such as cancer, malaria, tuberculosis, and AIDS carried out by states in the country or in partnership with international organizations and other countries benefit all mankind as a result. Especially the measures taken for environmental health are of the nature of non-competitor and non-exclusion (Peace and Barlas, 2017: 143-144).

Vaccination against infectious diseases is not a public commodity, as it has the characteristics of competition and exclusion in consumption. For example, if an individual consumes a vaccine, there is competitiveness in consumption, as there will be fewer vaccines for other consumers. In addition, those who do not pay a price can be excluded from the consumption of health services; that is, manufacturers can easily prevent the consumption of those who do not pay fees (Help, 2020: 95). In contrast, the characteristic feature of health care is that it creates externality. In this context, for example, vaccination against infectious diseases is an activity that spreads positive externalities in consumption. If a person is vaccinated against infectious disease, that person ceases to be a source or cause of infection for other individuals. The vaccinated person provides social benefits as well as individual benefits. Once the positive external effects of vaccination are noticed, an important requirement for public intervention arises, if they are not properly internalized, because individuals acting in their personal interests will tend to be less vaccinated than the socially optimal level. Under the assumption that the vaccine against infectious disease, for example, the polio vaccine is sold at a certain price, the individual's decision to get vaccinated depends on several factors. The individual will consider the possibility of avoiding the risk of the occurrence of the disease if he does not receive the vaccine and the special costs (such as price and time) that he will bear if he does. If he thinks that these costs will be higher than the benefits he will get, he will not be vaccinated according to the principle of rational behavior. However, as a result, not only this individual; but also other segments of society will be at risk of contracting the disease. Therefore, if the benefit to be obtained was considered not only on an individual but also social level, the total benefit would be valued above the costs. In other words, due to positive externality, costs should be compared with social benefit, not individual benefit. The gap between individual benefit and social benefit can only be solved by public intervention. These characteristics of health services mean intervention in market functioning or the release of preventive health services to the free market (Oral, 2014: 84).

The coronavirus refers to a large family of viruses. Covid 19 is the name of the new coronavirus disease. It was first detected in China in late 2019. The outbreak caused by the virus Covid-19, which fulfills the conditions necessary for an epidemic to be considered a "pandemic", is in fact similar in many respects to the global pandemics that existed before it. The most important of the measures taken against the Covid 19 pandemic is undoubtedly the vaccination activity. Vaccination against the Covid 19 virus will weaken the likelihood of people who have been vaccinated, as well as people who are not vaccinated, thereby preventing the spread of the epidemic. Approximately a year and a half after the outbreak of the pandemic, with significant success in vaccine studies, most countries are trying to ensure that an effective vaccine can be applied to a large part of their population. For vaccination to prevent the spread of the disease, it is estimated that the rate required to achieve "social immunity" or "herd immunity", in other

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words, is 80%. Globally, this means that in the short term (to vaccinate enough people) 5.5 to 6.2 billion people (doses of the COVID-19 vaccine) will be required to be vaccinated (Saksena, 2021: 1).

As of July 2021, according to the website of the world health organization in data 27.1% of the world's population received at least one dose of covid-19 vaccine and 13.7% were fully vaccinated. Canada is one of the countries where at least one dose of vaccine is administered. At least one dose of the vaccine has been administered to 70% of the population in Canada. The rate of vaccination of at least one dose was approximately 27% (about 1 billion people) worldwide. When we look at both full vaccination and partial vaccination rates, it is seen that the amounts to provide social immunity are well below. Considering that the daily vaccinated population is 0.44% (about 34 million people), it will take a very long time for enough people to be vaccinated for social immunity to occur. In addition to the low total vaccination application, another important problem is that the difference between vaccination rates between countries is quite high. In some countries selected in Figure 2, it is seen that the United Arab Emirates ranks first when the share of all doses specified in the vaccination protocol is examined in the total population. The vaccination rate in this country is 68.4% about 5 times the world average. Israel, Canada, the United States, France and Germany are among the other countries with the highest full vaccination rate among the total population. When countries are classified according to income groups, only 0.2% of the population in low-income countries receives all the necessary doses, while in countries in the high-income group, 40% of the total population is vaccinated. This data shows that, first, access to the vaccine is largely associated with income level, and secondly, the supply of vaccines, in general is inadequate. As figure 2 shows, the global vaccination rate is only 13.7% (ourworldindata.org/covid-vaccinations) in approximately 7 months from 27 December 2020, when vaccination applications began.
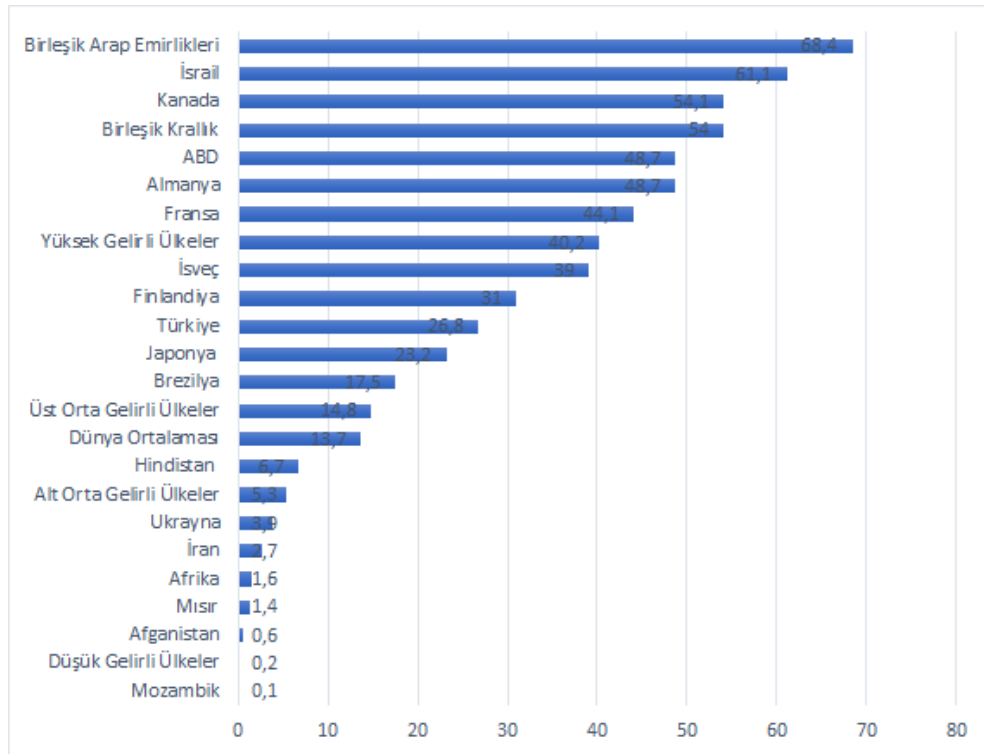

Figure 2. Full Vaccination Rate Against COVID-19 (%)

Source: ourworldindata.org

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These statements demonstrate the importance of increasing the supply of Covid-19 vaccines, as well as sharing vaccines fairly between rich and poor countries. The COVAX project, which is prepared on the idea that no one will be safe unless everyone is safe due to a fast-moving pandemic, aims to share the vaccines produced to fight the coronavirus fairly among all countries. Regardless of the income level of the countries, it is aimed to ensure the fair distribution of vaccines. However, it is seen that this goal is not achieved. The global supply of COVID- 19 vaccines has been left to compete between countries based on their ability to pay rather than public health needs. As a result, the rate of vaccine applications among low-income and high-income countries has increased, while the total supply of vaccines has not been sufficiently increased (Kim, 2021). Minimizing the deadly impact of COVID-19 and making it possible to eliminate this global pandemic with effective vaccine implementation has created a great demand in this regard. Vaccines produced by companies like Pfizer and Moderna have proven to be 90 percent effective, and hospitals are trying to rapidly increase vaccine practices. However, there are certain difficulties in supply. For example, the delivery of products to the points requested from the factories is one of these problems. In other words, various challenges are present in managing the production and supply chain of COVID-19 vaccines (Essay on COVID-19 vaccine supply chains, https://www.informs.org/Publications/OR-MS-Tomorrow/Essay-on-COVID-19-vaccine-supply-chains).

Tedros A. Ghebreyesus, director-general of the World Health Organization, noted inequality in vaccine supply at a meeting in May attended by the health ministers of 194 member states and emphasized that 75% of all vaccines made so far have been administered in only ten countries. Stating that the international COVAX initiative has so far provided vaccines to only 1% of the population in 124 countries, the Director-General stated that the aim is to reach 30% of the population by the end of the year. This, in addition to the supply problem of existing vaccines, requires a significant increase in vaccine production. In order to increase the supply of vaccines developed for COVID-19, the proposal is first proposed to remove the patent right of the developed vaccines.

A patent is an intellectual property right that gives the company that makes the invention in the relevant subject the right of monopoly such as producing and exporting for a certain period. Patent protection in the field of health is an important element of intellectual property due to the cost of developing the drug and the institution that discovered it to finance subsequent R&D costs. This intellectual property leads to the sale of the drug at high prices and restricts people's access to it. Patent rights in the field of health care remain an important topic of discussion, especially since it is vital to prevent outbreaks and infectious diseases in terms of public health protection (Seç and Shar, 2019: 275).

Patent protection for all necessary products to prevent, limit, and treat COVID-19 should be temporarily suspended, according to a proposal introduced at the World Trade Organization in October 2020 and supported by U.S. President Joe Biden at the Initiative of South Africa and India. Proponents of the proposal argue that patent rights have slowed the expansion of vaccine production. Opponents of the suspension of patent protection emphasize that the development and expansion of production capacities require time and special knowledge. The protection of the patent right is described in standard textbooks as one of the reasons why the monopoly market has emerged. The company, which is in a legal monopoly position, has the opportunity to apply a high price compared to the competitive market. However, during the COVID-19 pandemic, high-profit expectations and government support provided in the R&D studies of companies led to the development of various vaccines. Given the expansion of production capacities in this way, there is already a certain competition among the vaccine manufacturers in

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question. The price is usually determined during the negotiation process with the relevant countries. Therefore, the power of pharmaceutical companies to determine the price for vaccines, i.e., monopoly power, is limited. There is an incomplete competitive market where the manufacturer acts on the principle of profit maximization, individual consumers do not pay, the consumption price is met with public resources, and the price is determined because of negotiations with the relevant countries. (Light and Wambach, 2021).

Waiving intellectual property rights will make significant gains in tackling inequality in the global distribution of covid-19 vaccines, where rich countries control many existing supplies. More than a year after the outbreak, the vaccination rate is well below the desired target globally. The average number of deaths has decreased, but the virus is still very low due to variation and the low vaccination rate is high. The average weekly death toll in April is over 36,000 in India and Brazil alone. In addition, with the emergence of new variants, experts note that a devastating new wave may occur in Asia and Africa. In this context, the waiver of intellectual property, increasing the supply of vaccines, as well as deaths pandemic will also reduce the social and economic costs induced. In the discussions regarding the proposal to waive the right to patent, it should also be considered that the R&D work of vaccine manufacturers is financed with a significant number of public resources. Together, companies with patent rights are estimated to benefit from about €93 billion in government funding. Modern covid vaccine is almost entirely funded by the U.S. government with public resources. To summarize, the lack of competition in the vaccine market has a long history. There are numerous examples of inadequate access to basic vaccines in a system that prioritizes monopolies.   This will happen again if intellectual property is not waived for Covid-19 vaccines. Waiving the patent right would prevent companies from claiming "inappropriate" prices, leading to a certain amount of acceleration. These explanations indicate that the global intellectual property system needs to be renegotiated and that the fight against the pandemic cannot be left to private companies in market conditions in several rich countries (Krishtel and Malpani, 2021).

CONCLUSION

After the emergence of the COVID-19 virus, intensive R&D studies were carried out for an effective vaccine. In the countries where these studies are carried out, funding is largely provided by the public. It is stated that almost all of the work done by private companies in the USA is carried out with public financing. After these long and intensive studies, successful results started to be achieved towards the end of 2020, and vaccine production was implemented. In the process, however, on a global scale, oligopolistic in the COVID-19 vaccine market, which has a market feature, the fact that the supply of vaccines remains extremely below the desired level is an important problem that needs to be solved. The amount of vaccination, both globally and on a country-by-country basis, is well below the potential demand. Only 14% of the population worldwide has been vaccinated at the required dose specified in the vaccination protocol. There are also huge inequalities between countries when it comes to vaccination. It can be said that the main source of this inequality is income level. In low-income countries, only %0,2 have been vaccinated. Therefore, one aspect of the problem is the lack of total vaccine supply, while the other dimension is the size of the difference between the countries. The issue of supply and financing, which is a problem in the health market in general, also manifests itself in the process of vaccination for COVID 19. In the health care market, especially those that are of public health concern or infectious diseases counter-goods and their R&D activities are partially or completely financed by public resources while the service supply is carried out by the private sector. Health goods, especially vaccines developed against infectious diseases, are often purchased by the public and consumed for free. Therefore, the market for health goods has quite complex

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qualities. This situation is closely related to the nature of health goods. For example, the vaccine against infectious diseases is classified in the special category of goods, as it has the characteristics of competition and exclusion in consumption. However, individual marginal cost as it emits positive externality and social cost, and benefit should be considered instead of the principle of individual marginal benefit. Once presented, it is classified by some authors as a global public commodity since it is not possible to deprive other members of society of the benefit and this benefit is not subject to competition. Therefore, if positive externalities are not internalized, the level of production remains below the desired amount. In other words, there is market failure.

COVİD 19 vaccine is produced by private companies and is offered in the market by pricing because of negotiations with governments. While individual consumption is free, it is acted on the principle of maximization in the production process. Market monopoly or oligopolistic features. The emergence of incomplete competition conditions is especially relevant to the protection of intellectual property rights. Granting the patent right to the company that successfully completed the vaccine work for a certain period means that this company will be rewarded and reach the necessary financing for the continuation of R&D studies. The Monopolist's appearance of behavior results in low demand for the price. It is observed that the monopoly power of the companies is the most important determinant in the process of determining vaccine prices in the COVID-19 vaccine market by negotiation between vaccine companies and states. The controversial proposal to increase supply and lower prices is to waive the right to intellectual property. Giving up the patent right will primarily significantly eliminate the problem of lack of production and distribution. This practice has had significant public health consequences in the past. Failure to apply patent rights for a vaccine developed against the most dangerous polio outbreak in history in the U.S. in 1952 restriction has played an important role in preventing polio cases from occurring, reducing polio cases by 80-90%. Waiving intellectual property rights will also make significant gains in tackling inequality in the global distribution of covid-19 vaccines, where rich countries control many existing supplies. The proposal to waive the patent right should be addressed together with the fact that the R&D work of vaccine manufacturers is funded with a significant number of public resources. In the U.S., for example, in Modern, almost all vaccine is funded by public resources. More than six months after vaccination, the vaccination rate remains significantly below the desired level and deaths are too large to ignore, indicating that urgent measures need to be taken. Social benefits and costs should be considered instead of individual benefits and costs.

As a result, there are numerous examples of inadequate access to basic vaccines in a system that prioritizes monopolies. In economic theory, incomplete competition, public goods, and externalities are cited as the main reasons for market failure. Covid 19 vaccine market has all three of these features. Therefore, the state should intervene in the market as a regulator and ensure that the optimum production level is reached with the principle of social benefit. In this sense, with the implementation of the patent waiver proposal, it should be foreseen that the amount requested will rise rapidly with the decrease in prices because of the increase in supply both nationally and globally. Dr. Jonas Salk, who developed the polio vaccine in the 1950s, asked if the vaccine's patent was for humans, and the fact that the developers of the COVID-19 vaccine were among the 500 richest people in the world shows the difference between the two periods in the health market.

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EXTENDED ABSTRACT
GENİŞLETİLMİŞ ÖZET

EXTERNALITY AND THE PROBLEM OF OPTIMUM PRODUCTION OF THE COVID 19 VACCINE

COVİD 19 virüsüne karşı geliştirilen aşıların pandemi ile mücadelede önemli kazanımlara yol açmasına karşılık aşı arzının arzu edilen düzeyde artırılamadığı görülmektedir. Aşı arzının küresel boyutta talep edilen miktarın oldukça altında kalması genelde sağlık mallarının özelde aşı piyasasının kendine özgü özelliklerinden kaynaklanmaktadır.

İktisat teorisine göre serbest piyasa koşullarında pozitif dışsallık yayan malların optimum üretim düzeyi toplumsal açıdan arzu edilen miktarın altında kalmaktadır. Dışsallık, özel fayda ve özel maliyet yerine toplumsal fayda ve maliyetin dikkate alınmasını gerektirdiği için devlet piyasada düzenleyici olarak yer almalıdır.

COVİD 19 aşısı büyük oranda sübvanse edilmekte ve tüketim harcamaları kamu yetersiz kalmış ve tarafından karşılanmaktadır. Buna rağmen küresel düzeyde aşılanma oranı aşılanma hızının artarak toplumsal bağışıklığın bir an önce sağlanması için fikri mülkiyet hakkından feragat önerisi ortaya atılmış; ancak bu konuda belli bir uzlaşma sağlanamamıştır.

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