Investigating the Transportation Economics of the Eastern Economic Corridor in Thailand

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ABSTRACT

This paper investigates the transportation economics of Thailand's Eastern Economic Corridor (EEC), highlighting significant challenges and potential solutions. Rapid economic development and increased industrial activities in the EEC have led to problematic transportation issues, including traffic congestion and environmental degradation. This study examines the interplay of supply and demand, opportunity costs, and externalities in the context of EEC's transportation challenges. Three economic solutions are explored: congestion pricing, Pigouvian environmental taxes, and subsidies for non-substitutable modes. Congestion pricing, successfully implemented in cities like London and Singapore, aims to reduce traffic by charging fees during peak hours, thus internalizing the external costs of driving. Pigouvian taxes, such as those in Sweden and British Columbia, target vehicle emissions to align private costs with social costs, encouraging cleaner transportation alternatives. Subsidies are proposed to promote the use of less polluting transport modes, shifting demand from private cars to public transportation. The paper underscores the importance of local community participation in policy-making to ensure equitable and practical solutions. By adopting these economic tools, the EEC can achieve more sustainable urban mobility and improved environmental quality, balancing economic growth with environmental preservation.

Keywords: eastern economic corridor, Thailand, transportation economics

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Introduction

1. Background of the Eastern Economic Corridor

Established in 2018, the EEC aims to transform Thailand's eastern provinces Chonburi, Rayong, and Chachoengsao into a hub for high-tech industries and sustainable development. This special economic zone is a key component of Thailand's "Thailand 4.0" economic policy, which focuses on innovation-driven growth (National Economic and Social Development Board, 2016). The EEC was expected to be completed by 2021 to create a hub for technological manufacturing and services with robust land, sea, and air connectivity to neighboring ASEAN countries (ASEAN Business News, 2018). The Thai government projected US$43 billion in investments through diverse funding sources. The EEC's development focused on four key areas: 1) enhancing infrastructure, 2) fostering business and industrial clusters along with innovation hubs, 3) promoting tourism, and 4) creating new cities through intelligent urban planning (Kudun et. al., 2021). The EEC aims to attract substantial foreign investment, promoting sectors like next-generation automation, smart electronics, biotechnology, robotics, aviation, and digital technology. Key projects include the development of the U-Tapao International Airport and the Eastern Airport City, a high-speed rail system connecting the three major airports, and the expansion of major industrial ports like Laem Chabang and Map Ta Phut (Bangkok Post, 2023). Moreover, the government expected the EEC to generate 100,000 jobs annually in the manufacturing and service sectors by 2020 (ASEAN Business News, 2018). The EEC also plans to enhance infrastructure, upskill the workforce, and promote environmentally friendly and sustainable practices to ensure long-term growth and development.

2. EEC Economic Performance in 2024

In 2024, the EEC is projected to experience modest growth despite challenges like geopolitical tensions and global economic instability. GDP growth is estimated at 2.2-3.2 percent, driven by key sectors.

Key growth drivers include industrial investments aligned with the Bio-Circular-Green (BCG) economy model. (2) Growth in the real estate sector, driven by economic stimulus measures such as reduced registration fees for property transactions; (3) Preparations for the "Ignite Thailand" initiative, aiming to transform Thailand into a global industrial hub; (4) Recovery in the tourism sector, supported by government stimulus measures and visa-free policies for foreign tourists; (5) Expansion of public sector infrastructure investments; and (6) Rising prices of agricultural products. However, significant risks and limitations could temper this growth, including delays in budget disbursements, high levels of household and business debt, drought impacting agricultural yields, and uncertainties stemming from fluctuations in the global economic and financial system, including international tax measures (Deloitte, 2024).

According to the NESDC (2024) in the EEC Economic Quarterly Report, the Thai economy experienced growth in the first half of this year compared to the same period last year. This expansion is driven by several factors, including the growth of the tourism sector, which saw increases in both visitor numbers and revenue, positively impacting the trade and service sectors in the region. Tourist arrivals in the EEC reached 14.72 million in the first and second quarters of 2024, representing a 10.3 percent increase from the same period last year and accounting for 10.2 percent of the national total. Tourism revenue in the EEC amounted to approximately 122,566 million baht, marking a 43.9 percent increase compared to the previous year. The majority of this tourism activity is concentrated in Chonburi, which accounts for 68.9 percent of the total. The trend for the entire year is expected to continue growing, supported by government tourism stimulus measures, particularly the visa-free policy.

Additionally, there has been a modest recovery in industrial investments from key trading partners, coupled with improvements in markets for specific product groups such as electronics and automotive parts, which are major industries in the EEC. The total investment in factories licensed to operate in the EEC is on an upward trajectory, in line with the gradual recovery of the global economy, particularly in the export and trade sectors. Consequently, entrepreneurs are expected to increase investments in the production of industrial goods for export, especially in key industries such as automotive and parts, electrical and electronic appliances, and agricultural and food processing. This trend is evident in the rising Eastern Industries Sentiment Index, which has increased due to manufacturers' growing confidence in domestic demand recovery and higher orders from key trading partners, partly attributed to the depreciation of the Thai baht. Additionally, government support policies, such as the EV3.0 subsidy measure and the diesel price fixing policy, which help reduce production and transportation costs for operators, have further stimulated investment. Rayong and Chonburi are notably the areas attracting the most investment (BOI, 2024).

More importantly, the labor market in the EEC has shown continuous improvement. In 2023, 2.43 million people found new work, reflecting an expansion from 2020-2022, with an average annual growth rate of 5.9 percent. Over 74.3 percent of the workforce was concentrated in four main sectors: manufacturing (37 percent), wholesale and retail trade (17.7 percent), hotel and food services (9.9 percent), and agriculture, forestry, and fisheries (9.8 percent). The first three sectors saw the highest increase in employment, with more than 146,000 additional jobs compared to the previous year, aligning with the economic recovery in the industrial and service sectors. Conversely, employment in agriculture, forestry, and fisheries decreased by over 28,000 people, the largest decline among all sectors due to labor migration away from agriculture, challenges in adding value to agricultural products, and price fluctuations. Most of the increase in the workforce came from workers with vocational higher education, with an addition of 27,000 positions from the previous year. Additionally, the number of individuals with education levels below junior high school increased by 82,000 positions, while those with higher education levels decreased by 19,000 positions, indicating a mismatch between labor skills and market demands (NESDC, 2024).

In summary, the EEC serves as a critical driver of the Thai economy. The contribution of the EEC provinces to the Gross Domestic Product (GDP) is expected to increase from 14.6 percent in 2022 to 15.5 percent in 2023. This contribution is composed of 70 percent from the industrial sector, 27 percent from the service sector, and 3 percent from agriculture. Notably, the industrial sector in the EEC represents 33.5 percent of the nation's total, the highest of any region. This significant contribution is primarily driven by major industrial segments, including automobile and automotive parts manufacturing, as well as the production of electrical and electronic equipment (NESDC, 2024).

While the EEC benefits the Thai economy, it also brings some disadvantages, particularly in terms of transportation within the EEC areas. The increased number of employees and tourists has made transportation more difficult. Additionally, the higher volume of traffic and the traffic disruptions caused by construction projects have raised the risk of traffic accidents in these areas. Furthermore, the use of heavy trucks in the EEC corridor contributes to environmental issues such as air and noise pollution, further impacting the quality of life for residents.

3. Transportation in EEC's Provinces

The EEC has been a driving force behind Thailand's economic growth, but it has also introduced significant transportation challenges in the EEC provinces. The increased number of vehicles, including both commercial and tourist transport, has made navigating these areas increasingly difficult.

1) Increased Traffic and Complexity

With the influx of workers and tourists, the volume of traffic has surged, leading to frequent congestion and longer travel times. This higher traffic volume has also worsened ongoing transportation construction projects, creating confusion and inefficiencies on the roads. As a result, the incidence of traffic accidents has risen, posing safety risks to both residents and visitors. The Department of Land Transport (2024) provided the number of registered vehicles in Chachoengsao, Chonburi, and Rayong, which clearly showed an increasing trend. Chonburi consistently has the highest number of vehicles registered among the three provinces, followed by Rayong and Chachoengsao (Figure 1).

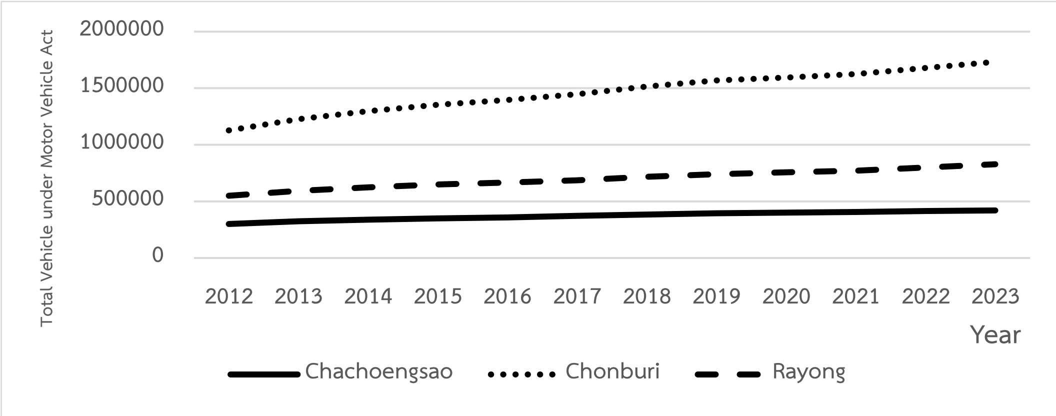

Figure 1 Number of Vehicles Registered

Source: Transport Statistics Sub-Division, Planning Division, Department of Land Transport (2024)

This growth in vehicle registrations aligns with the overall economic development in the EEC and highlights the increasing challenges in transportation due to the rising number of vehicles. This data can be used to support the discussion on transportation difficulties, traffic congestion, and related environmental issues in the EEC provinces.

Moreover, the number of trucks registered in all three provinces shows a consistent increase over the years, reflecting economic growth and urbanization in the EEC (Figure 2). Chonburi consistently has the highest number of truck registrations, indicating its significant industrial and commercial activity.

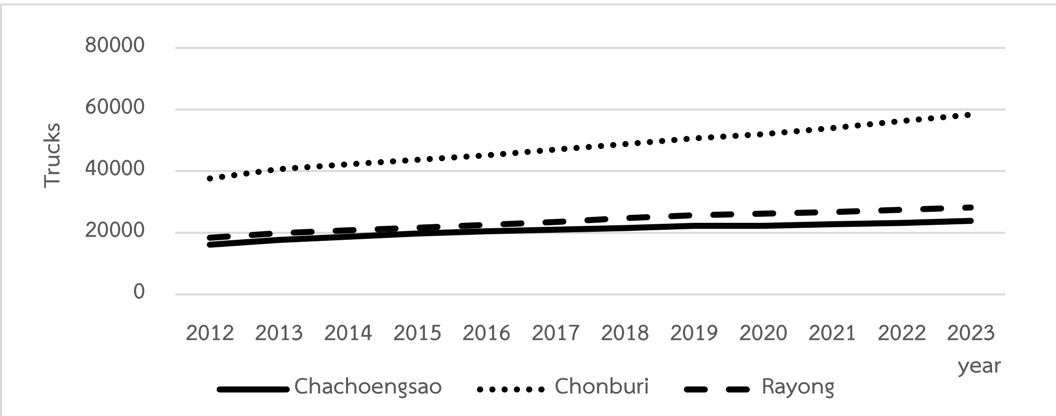

Figure 2 Number of Trucks Registered

Source: Transport Statistics Sub-Division, Planning Division, Department of Land Transport (2024)

The increasing transportation challenges in the EEC, with rising vehicle numbers contributing to congestion, environmental issues, and infrastructure strain. Addressing these challenges is crucial for sustainable development in the region.

2) Environmental Impact

Diesel-powered trucks, vital for EEC operations, significantly impact air quality, exacerbating air pollution, which poses health risks to residents and challenges for sustainable growth. Additionally, the noise and vibrations caused by the continuous movement of trucks have further degraded the quality of life in these regions. According to the United Nations Environment Program (2017), air pollution severely affects the environment, human health, and economic development. For example, NO2 and O3 are produced by transportation. When these gases are presented at ground level, they cause smog, especially in the presence of sunlight. Likewise, the study of Bazrbachi et. al. (2017) revealed that heavy-duty vehicles, including trucks, are major contributors to greenhouse gas emissions. For instance, heavy-duty vehicles account for about 25% of CO emissions from road transport in the European Union, which is a trend likely mirrored in the EEC due to similar industrial and logistical demands.

Moreover, trucks emit significant amounts of nitrogen oxides (NOx) and particulate matter (PM), which deteriorate air quality. These pollutants are linked to respiratory and cardiovascular diseases, impacting public health adversely (Liu et al., 2020). The report by the World Health Organization (2018) shows that the detrimental effect of air pollution on human health is a problem in developing countries. Air pollution is linked to respiratory and cardiovascular diseases (Kim et al., 2015). In severe cases, air pollution can cause premature death and a reduction in life expectancy (Lelieveld et al., 2015; Chen et al., 2017). The human health impacts of air pollution may eventually lower economic productivity, including working days, labor productivity, and labor output (World Bank, 2016). Furthermore, air pollution can reduce visibility, thus causing traffic accidents, and can make cities less attractive to talented workers (World Bank, 2016).

The heavy use of transport vehicles, particularly trucks, in Thailand's EEC has notable environmental impacts. The EEC is a significant industrial hub covering the provinces of Chonburi, Rayong, and Chachoengsao, and it plays a crucial role in Thailand's economic strategy. However, the extensive industrial activities in this region contribute to substantial environmental challenges. Clearly, the Thai government is faced with difficult choices that affect the support for economic growth while balancing the need for a reduction in the impact of air pollution (Zahedi et al., 2019). Based on the literature review, there is no single organization that can provide statistics or indicators of environmental issues such as air pollutants from 2018 to 2024, which is the EEC period. Thus, there is a need for more data related to environmental impact from the EEC. For example, the study of Pholgerddee, Ngakasam, and Mahaman (2021) analyzed the distribution of PM_{10}, identified regions susceptible to air allergies due to particulate matter 10 (PM_{10}), and examined the trends of such allergies, focusing on the EEC. Their findings indicated that PM_{10} was more widely dispersed in Chon Buri and Rayong provinces compared to Chachoengsao and also identified 31 sources of dust, including 28 industrial plants, 3 stone mills, and major transportation routes: 15 in Chachoengsao, 14 in Chon Buri, and 7 in Rayong. The study of Muenmee and Bootdee (2021) revealed the link between particulate matter 2.5 ($PM_{2.5}$) and people's health issues affecting the respiratory system and increasing mortality rates. Their study investigated $PM_{2.5}$ emissions from the industrial area in Pluak Daeng district, Rayong province, to evaluate the associated health risks. Their results showed that the particles were chemically complex, typically containing elements such as oxygen, iron, magnesium, aluminum, potassium, or sodium, which likely originate from the industrial area. In addition, children will inhale more $PM_{2.5}$ into their respiratory systems compared to adults. This increased exposure means that children have a higher health risk than adults. Likewise, Khamkaew et al. (2022) examined the impact of ambient air pollution on outpatient department (OPD) visits and mortality in the EEC areas between 2013 and 2019. The study highlighted the severe health impacts of air pollution in the EEC and suggested that reducing PM_{10} concentrations could significantly lower the number of OPD visits, emphasizing the need for stricter air quality standards and pollution control measures.

From the information provided, the EEC leads to both benefits and drawbacks for people living in the corridor. While the EEC continues to be a pivotal economic hub, these transportation challenges highlight the need for sustainable and efficient transportation solutions. Addressing these issues is crucial for ensuring the long-term success of the project while preserving the livability of the people of the EEC provinces.

Objectives

The objectives of this academic article are 1) to explain transportation challenges in the EEC provinces through an economic lens, specifically focusing on issues such as traffic congestion and environmental externalities, and 2) To propose solutions grounded in economic theory, including concepts like externalities, market failures, and incentives for sustainable transportation, with particular emphasis on tools such as Pigouvian taxes, public goods theory, and government intervention.

Theory and Academic Principal

1. Transportation Challenges

The challenges due to the increase in transportation are a pervasive problem in the EEC provinces. These challenges can be effectively analyzed using basic economic principles and investigating the factors of supply and demand, opportunity costs, and externalities.

Traffic congestion arises from a mismatch between supply and demand, compounded by socio-economic inequalities and governance challenges unique to the EEC region. The transport infrastructure represents the supply, while the number of vehicles represents the demand. When the demand for the infrastructure (i.e., the number of vehicles on the road) exceeds the supply (the available road capacity), congestion occurs. This situation is analogous to what occurs in any market where excess demand causes stress.

The supply of road space is relatively fixed in the short term. Roads and highways have a limited capacity, and expanding them requires significant time and investment. Over the long term, the supply of road space can be increased through infrastructure projects like building new roads, expanding existing ones, or improving public transportation systems. However, these solutions are bounded by practical and financial constraints.

The demand for road space is influenced by factors such as population growth, urbanization, economic activity, and the availability of alternative transportation modes. In the short term, the demand for road space is relatively inelastic because people have limited alternatives to driving. However, in the long term, demand can become more elastic as people adapt by using public transportation, carpooling, or relocating closer to work.

In an ideal market, the equilibrium point is where the quantity of road space demanded equals the quantity supplied. However, in many urban areas, the demand often exceeds the supply, leading to congestion. When more drivers want to use the road than there is space available, congestion occurs. This is akin to excess demand in any market, where shortages lead to delays and increased costs (in this case, time and fuel). Congestion leads to inefficiency in the transportation system. The extra time and fuel costs incurred by drivers represent a deadweight loss to society. This loss is a measure of the inefficiency created by congestion, as resources are not used in their most valuable way (Figure 3).

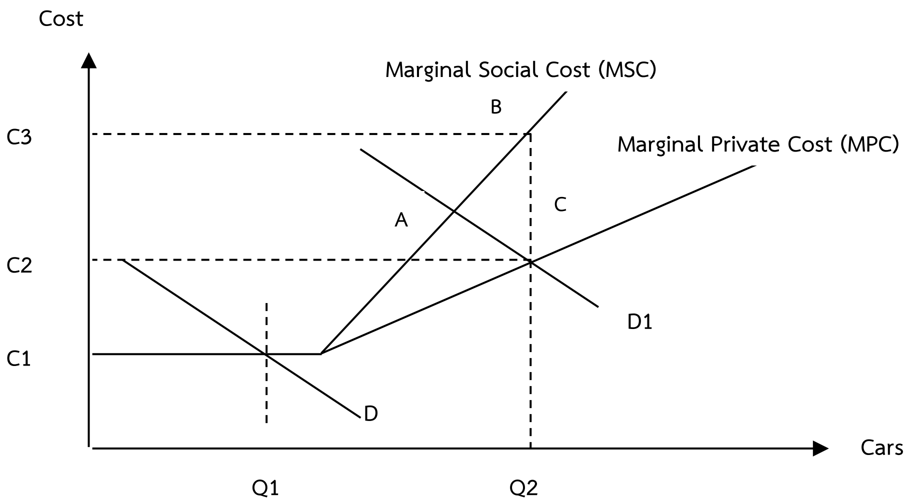

Figure 3 Traffic Congestion

Figure 3 illustrates the inefficiency and deadweight loss resulting from increased traffic and road space complexity. Initially, consider the demand for road space represented by the demand curve D. At the equilibrium point, where demand D intersects the marginal social cost (MSC) and marginal private cost (MPC) curves, the cost of using the road space (transportation cost) is C1, and the number of cars utilizing the road is Q1. At this point, there is no difference between MSC and MPC, indicating that there are no external costs associated with road usage.

As the demand for road space increases to D1, the equilibrium shifts. The new equilibrium shows that the cost of using the road space rises to C2, which represents the private cost of transportation, including fuel and car depreciation. However, at this increased demand level (Q2), road usage also incurs additional social costs, such as externalities and opportunity costs, which are not accounted for in the private cost.

The full social cost of road usage at Q2 is represented by C3, which includes both the private cost (C2) and the external costs. The difference between the MSC and MPC at this level of demand (area ABC) represents the deadweight loss due to traffic congestion. This deadweight loss highlights the inefficiency in the market, where the social cost of road usage exceeds the private cost, leading to overuse of the road space and resulting in congestion.

In summary, congestion leads to significant opportunity costs, as time spent in traffic could be used for more productive activities. The time lost by commuters represents a cost to the economy in terms of lost labor hours and decreased productivity. Moreover, traffic congestion is a classic example of a negative externality. An externality occurs when the actions of individuals or firms have unintended side effects on third parties. In this case, each additional vehicle on the road imposes a cost on others by increasing travel times and contributing to pollution. These external costs are not reflected in the private costs borne by the drivers themselves because roads are considered a common resource, where their use by one individual reduces their availability to other users. This scenario is often referred to as the "tragedy of the commons," where individual users of “freely available” common resources, acting in their own self-interest, overuse the resource, leading to its degradation or destruction. Road overuse and the resulting congestion, particularly in urban areas, are clearly encapsulated by these phenomena (Kolstad, 2000).

2. Solutions

From an economic perspective, investing in infrastructure to increase road capacity can alleviate congestion. However, this is often only a temporary solution due to the phenomenon of induced demand, where increasing road capacity encourages more people to drive, eventually leading to congestion levels equivalent to those before the expansion. Economists often propose *congestion pricing* as a solution to traffic congestion. By charging drivers a fee to use congested roads during peak times, demand can be reduced to more optimal levels. This pricing mechanism aligns the private costs of driving with the social costs, internalizing the negative externality (Figure 4). It is well known that traffic congestion generates negative externalities, which are costs imposed on third parties. These include air pollution, noise pollution, and increased accident rates, all of which affect public health and quality of life. Thus, economists suggest measures such as congestion pricing to internalize these externalities. By charging drivers a fee to use congested roads during peak times, the private cost of driving is aligned with the social cost, potentially reducing congestion (Bardi et. al., 2006).

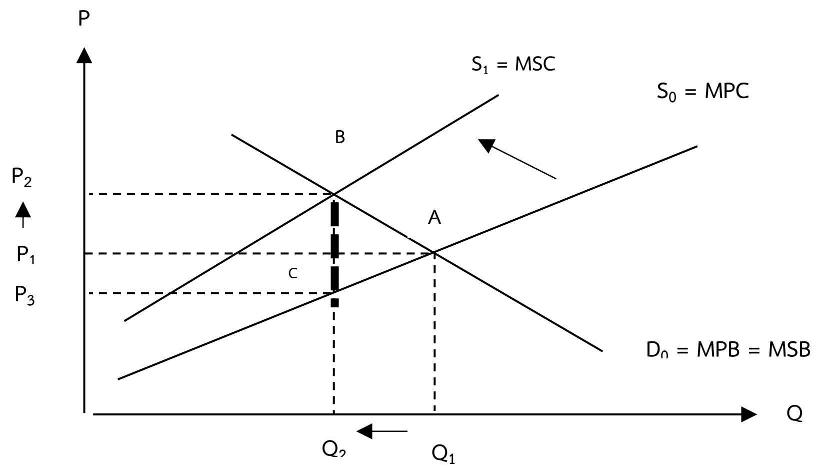

Figure 4 The Concept of Congestion Pricing

Figure 4 illustrates the fundamental concept of congestion pricing. In this context, P represents the price or cost of using a car, and Q represents the quantity of cars on the road. Initially, drivers operate at point A, where the Marginal Private Cost (MPC) equals the Marginal Private Benefit (MPB). At point A, the cost of driving is P_1, and the number of cars on the road is Q_1. To reduce the demand for road usage, the government can implement congestion pricing. This involves designating certain high-traffic areas, such as central business districts, as congestion zones where charges apply. Automated systems, including electronic toll collection, license plate recognition, and GPS tracking, are used to monitor and charge vehicles entering these zones. As a result, the cost of using cars increases to P_2. The imposition of a congestion charge effectively shifts the supply curve to the left (from S_0 to S_1), moving the equilibrium point to B. At this new equilibrium, the quantity of cars on the road decreases from Q_1 to Q_2, demonstrating that congestion pricing can effectively alleviate traffic congestion. In this method, Pricing Mechanisms are divided into 1) Dynamic Pricing: Charges vary based on real-time traffic conditions. Higher fees are applied during peak hours, and lower or no fees are applied during off-peak times 2) Flat-Rate Pricing: A fixed fee is charged during specific times of the day, regardless of real-time traffic conditions.

Furthermore, congestion pricing ensures that drivers pay the Marginal Social Cost (MSC) of driving, which includes the external costs of congestion. The difference between P_2 and P_3 represents this marginal social cost. At quantity Q_2, the private cost of driving is only P_3. Thus, the government not only addresses traffic congestion but also generates revenue from this policy. Typically, the revenue generated from congestion charges is reinvested into public transportation infrastructure, enhancing services and providing viable alternatives to driving. Additionally, these funds can be used for road maintenance, pedestrian pathways, and cycling lanes, promoting sustainable transportation modes and overall urban mobility.

Many countries in the world are adopting congestion charges. For instance, congestion charges have been applied to vehicles in London, United Kingdom, since 2003 for drivers entering the city center between 7 AM and 10 PM on weekdays. The charge reduced traffic volumes by around 15%, improved air quality, and increased public transport use. Revenue has been used to enhance the city's public transportation network (Transport for London, 2023). Likewise, Singapore launched Electronic Road Pricing (ERP) in 1998. Singapore's ERP system uses gantries to automatically charge vehicles based on real-time traffic conditions. This system successfully manages traffic flow, reducing congestion by about 25% during peak hours. The funds support public transit and road infrastructure projects (Development Asia, 2023).

Stockholm's congestion tax became permanent after a public referendum. This caused traffic volume in the city center to decrease by 20-25%, emissions to drop by 10-15%, and increased revenue to support public transportation and infrastructure improvements (Harvard University Graduate School of Design, 2016).

Another method that economists often propose to deal with environmental problems from transportation is *the Pigouvian environmental tax.* A Pigouvian tax is imposed on activities that generate negative externalities, which are costs not reflected in the market price of goods or services (Johnston et. al., 2017). Named after the British economist Arthur Pigou, this tax aims to correct market outcomes by aligning the private cost of an activity with its social cost. In the context of transportation, a Pigouvian environmental tax targets the external costs of vehicle emissions, such as air pollution, health impacts, and environmental degradation. Vehicle emissions contribute to air pollution, leading to health problems and environmental damage. These costs are borne by society but are not accounted for in the market price of driving. The government can internalize these external costs by imposing a tax on fuel or emissions. The tax incentivizes drivers to reduce their vehicle usage or switch to cleaner alternatives, thus aligning private costs with social costs. The tax rate should equal the MSC of the negative externality. This ensures that the price of driving reflects its true cost to society. However, determining the MSC involves assessing the economic impact of pollution, health care costs, and environmental degradation caused by vehicle emissions (Figure 5).

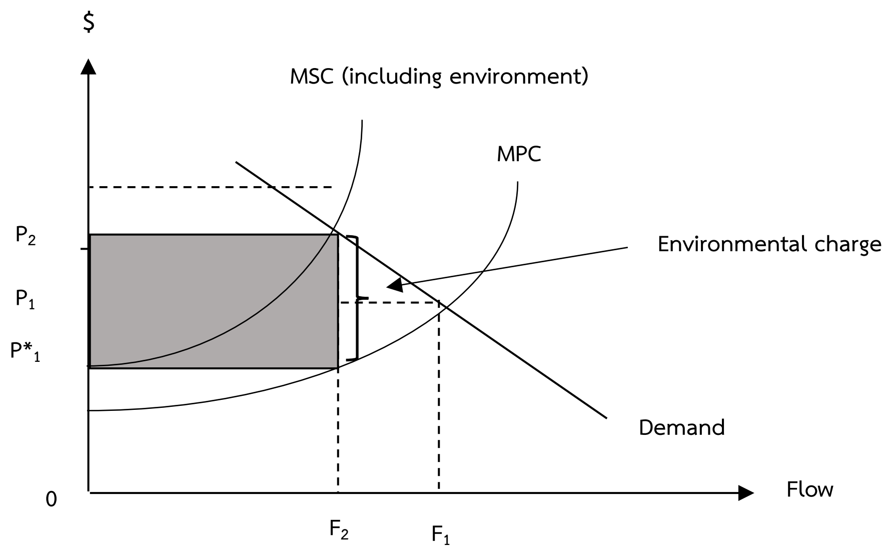

Figure 5 The Pigouvian Environmental Tax

Figure 5 illustrates the application of a Pigouvian environmental tax to road transport. The graph demonstrates how the marginal private cost (MPC) of using a road increases as traffic flow rises. Road users typically consider only the costs they incur themselves, such as fuel and time, leading them to continue making trips until the traffic flow reaches F_1. However, road traffic also generates external costs, such as chemical and noise pollution, which are not accounted for by individual road users. When these externalities are included, the full marginal cost at each level of flow increases is represented by the marginal social cost (MSC) curve. If road users bore these additional costs, they would reduce their trips, resulting in a decreased traffic flow of F_2. The optimal environmental charge, designed to internalize the external costs, is the difference between the MSC and the MPC at the reduced flow level, represented by the segment P_2P_1. By imposing this charge, the marginal cost of trips for road users increases from P_1 to P_2. This discourages trips that do not cover the full social cost, thus reducing the traffic flow to F_2. It is important to note that this diagram assumes that imposing a pollution charge will directly affect traffic flow. While this is often the case, there are other ways in which road users might respond to an environmental charge. For instance, a noise charge might lead road users to adopt noise-reducing measures without significantly reducing the number of trips. Similarly, a carbon tax might incentivize the use of smaller-engine, more fuel-efficient vehicles, which conserve fuel but do not drastically alter travel patterns. Therefore, part of the impact of an emissions charge could also reduce the MSC itself, as users adapt their behavior to mitigate the external costs.

In the past, many countries adopted a Pigouvian tax to attempt to solve environmental issues related to transportation. For example, a pollution tax is one of the most successful implementations of a Pigouvian tax in Sweden. This policy was introduced in 1991. It targets the emissions from fossil fuels, including those from transportation. The tax has significantly reduced transportation emissions while promoting renewable energy. Sweden has seen a decrease in transportation emissions by nearly 27% since the tax's implementation despite economic growth (Government of Sweden, 2023).

Similarly, the United Kingdom implemented the Fuel Duty Escalator in the 1990s. The Fuel Duty Escalator increased the tax on petrol and diesel annually above inflation rates. This policy led to a reduction in fuel consumption and vehicle emissions. The revenue generated was used to fund public transportation projects and improve environmental quality (Parliament of the United Kingdom, 2011). Likewise, Canada (British Columbia) also introduced a pollution tax in 2008. British Columbia's carbon tax covers all fossil fuels, including those used in transportation. The tax has successfully reduced fuel consumption and emissions. The revenue is used to lower other taxes, such as personal and corporate income taxes, making it revenue-neutral (Government of British Columbia, 2023). Mostly, the revenue generated from the tax is spent on public environmental projects such as renewable energy initiatives, public transportation improvements, and pollution control programs. Moreover, Revenue can also be allocated to healthcare systems to mitigate the health impacts of pollution.

Subsidies, when carefully designed, provide an alternative to pricing mechanisms by incentivizing fewer polluting modes of transportation while addressing equity concerns for lower-income populations. Subsidies are politically attractive because they distribute the financial burden across a broad base of contributors while providing focused benefits to specific recipients. This discussion excludes subsidies aimed primarily at social objectives, such as ensuring acceptable levels of mobility, meeting the needs of the physically disadvantaged, and providing access to remote regions. Instead, the focus is on subsidies designed to change travel patterns and encourage more environmentally friendly forms of transport (Kenneth, 2010)

It is important to note that these subsidies are not typically "Pigouvian subsidies" directly paid to individuals to reduce external costs. Rather, they are indirect subsidies intended to promote activities associated with lower levels of external or adverse economic impacts. For example, in surface personal travel, the conventional wisdom suggests that an efficient public transport system with adequate load factors is more energy-efficient than the use of automobiles.

There are general issues to consider with any subsidy, such as the justification for using taxes collected from the general public to subsidize public transport and car users. Additionally, the efficiency of the subsidy regime can be questioned, as it may become inefficient and be captured by transport-providing agencies and their employees. However, from an efficiency perspective, for subsidies aimed at promoting less environmentally intrusive modes of transport to be effective, there must be significant cross-elasticity of demand between these modes (Figure 6).

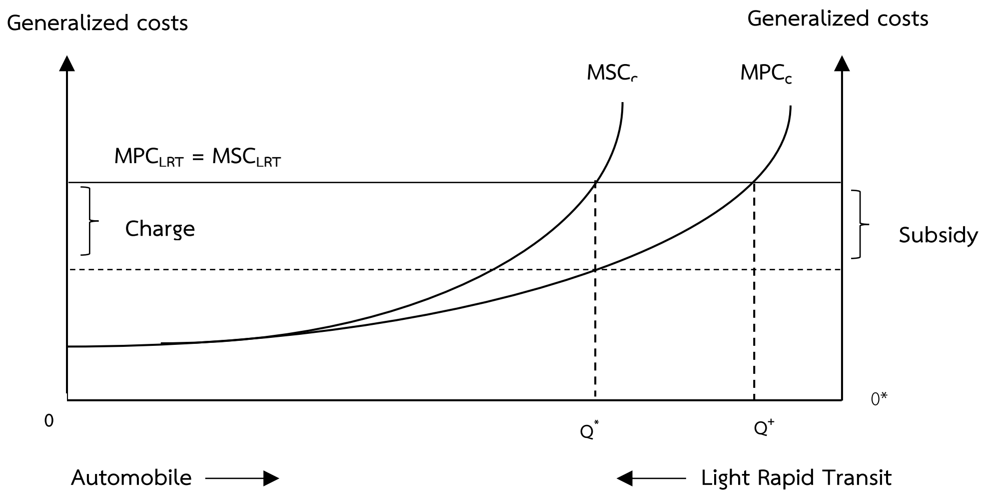

Figure 5 The Optimal Subsidy to a Non-Substitute Mode with Fixed Aggregate Demand
Source: Kenneth (2010)

In Figure 6, the overall demand for transport, supplied by a combination of private automobile (C) and a light rapid transit (LRT) system, is fixed. Private automobile usage is associated with external costs, represented by the difference between the Marginal Private Cost of automobiles (MPC_C) and the Marginal Social Cost of automobiles (MSC_C). In contrast, the LRT system has no externalities associated with its use, meaning the Marginal Social Cost of LRT (MSC_{LRT}) equals the Marginal Private Cost of LRT (MPC_{LRT}). For simplicity, we assume that the marginal costs of the LRT system are constant.

In a free-market scenario where externalities are ignored, the traffic distribution is represented at point $0Q^+$ in the diagram. The optimal solution, which accounts for external costs, is a traffic distribution at Q^*. This optimal distribution can be achieved either by implementing a Pigouvian pollution charge at the level indicated in the figure or by subsidizing the public transport mode (LRT) by an identical amount.

By charging a Pigouvian tax on private car usage, the external costs are internalized, effectively increasing the marginal cost of car travel to align with its true social cost. This encourages a shift in demand from private cars to the LRT system. Alternatively, subsidizing the LRT system by an amount equivalent to the Pigouvian tax can achieve the same effect. The subsidy lowers the effective cost of using the LRT, making it a more attractive option compared to private car usage.

Both approaches—implementing a Pigouvian tax or providing a subsidy—aim to correct the market distortion caused by the external costs of car travel. By doing so, they promote a more efficient allocation of resources, align private incentives with social welfare, and lead to an optimal mix of transportation modes that minimizes overall externalities.

In a perfectly competitive world, there would be no justification for such subsidies. However, in situations where marginal cost pricing is not universal and political considerations prevent the introduction of measures like emission fees, subsidies may offer a pragmatic second-best approach to addressing externalities. When the cross-elasticity of demand between transport and other goods is negligible, and the overall demand for transport is highly inelastic—an often-realistic scenario in the context of commuter travel in large urban areas—the optimal subsidy for a zero externality-generating transport mode can effectively reduce the use of externality-generating modes, similar in effect to the impact of pollution charges.

Discussion and Conclusion

The information presented in the previous sections has shown the transportation challenges in EEC's areas and some possible solutions to traffic congestion and environmental issues, including congestion pricing, a Pigouvian environmental tax, and subsidies. These methods exhibit both benefits and drawbacks. Congestion pricing is an effective economic tool designed to manage road traffic and reduce congestion by internalizing the external costs of driving. The fundamental principle behind congestion pricing is to charge drivers a fee for using certain roads during peak hours. This approach aims to discourage non-essential trips during busy times, thereby reducing overall traffic volume and improving traffic flow. Congestion pricing has been successfully implemented in several major cities, including London, Singapore, and Stockholm. While these cities have reported reductions in traffic congestion, improved air quality, and increased public transportation usage, the report should detail how such strategies could be adapted for Thailand's specific urban and regional contexts. The revenues generated from congestion charges are often reinvested in public transportation infrastructure, further enhancing the overall transportation system. Despite its benefits, congestion pricing faces several challenges. There are also concerns about the equity of congestion pricing, as it may disproportionately affect lower-income individuals. Addressing these concerns requires careful policy design, such as providing exemptions or discounts for certain groups and ensuring that revenues are used to improve public transportation options.

Moreover, by charging drivers a fee to use congested roads during peak times, demand can be reduced to optimal levels. However, in the context of the EEC, challenges such as the decentralized governance structure, limited integration of public transportation, and potential public resistance to additional charges must be considered. These factors may necessitate a phased implementation, coupled with public awareness campaigns and investments in alternative transportation modes, to ensure public acceptance.

A Pigouvian environmental tax is levied on activities that generate negative externalities, such as vehicle emissions. The tax aims to align the private cost of an activity with its social cost by internalizing the externalities. In the context of transportation, a Pigouvian tax on fuel or emissions encourages drivers to reduce their vehicle usage or switch to cleaner alternatives. The Pigouvian tax is a powerful tool for reducing emissions and promoting environmental sustainability. By making polluting activities more expensive, it incentivizes behavioral changes that lead to lower emissions. Successful implementations, such as Sweden's carbon tax and British Columbia's carbon tax, have shown significant reductions in greenhouse gas emissions and increased investment in renewable energy. Implementing a Pigouvian tax presents several challenges. Setting the appropriate tax rate requires accurately assessing the marginal social cost of the externalities.

Additionally, there may be resistance from the public and industry stakeholders who are affected by the tax. Effective communication of the environmental and health benefits, as well as the use of tax revenues for public goods, can help mitigate opposition. In addition, A Pigouvian tax is imposed on activities that generate negative externalities. Adapting this tool to the EEC requires addressing measurement challenges for marginal social costs and mitigating potential public backlash. For example, strategies could include targeted exemptions or discounts for lower-income groups, coupled with reinvestment of revenues into enhancing accessible public transport options. Policies should consider revenue recycling, such as using tax proceeds to subsidize public transportation or improve infrastructure in underserved areas.

Subsidies can be used as an economic solution to promote the use of less polluting transportation modes. In situations where the overall demand for transport is fixed, subsidies can shift the demand from private cars to more environmentally friendly options, such as public transportation. The optimal subsidy aims to reduce the external costs associated with private car usage by encouraging the adoption of cleaner alternatives. Subsidizing public transportation can reduce traffic congestion and vehicle emissions. However, ensuring equity by prioritizing underserved areas and creating accessible alternatives for lower-income populations is essential. By lowering the cost of using public transport, subsidies make it a more attractive option for commuters. This shift not only reduces congestion but also promotes energy efficiency and reduces the environmental impact of transportation. Designing and implementing effective subsidies involves several challenges. There is a need to ensure that subsidies are efficiently allocated and do not lead to inefficiencies or capture by transport-providing agencies or special interests.

Additionally, the cross-elasticity of demand between transportation modes must be significant for the subsidy to effectively shift demand. Policymakers must carefully evaluate the economic and social impacts of subsidies to ensure they are likely to achieve the desired environmental outcomes. Furthermore, Subsidies, when carefully designed, provide an alternative to pricing mechanisms by incentivizing less polluting modes of transportation while addressing equity concerns for lower-income populations. In the EEC, subsidies could be directed toward expanding public transportation networks, developing cycling infrastructure, and incentivizing the adoption of electric vehicles. The effectiveness of these subsidies would depend on ensuring that funds are allocated transparently and target the most pressing local needs, such as underserved rural areas.

Economic tools such as congestion pricing, Pigouvian environmental taxes, and subsidies for non-substitute modes offer powerful solutions to reduce the environmental impact of transportation. Each approach has its strengths and challenges, and their effectiveness depends on careful policy design and implementation. By internalizing external costs and promoting cleaner transportation options, these economic solutions can contribute to more sustainable urban mobility and improved environmental quality. Therefore, this article proposes possible solutions to the transportation challenges in EEC's areas by considering the source of demand. For example, implementing flexible work hours policies can help reduce peak-hour congestion by staggering work schedules. This could involve pilot programs with large companies and public awareness campaigns to encourage adoption. The policy implementation requires large companies to develop and implement staggered work schedules that reduce the number of employees commuting during peak hours. The government may offer grants or subsidies for businesses to invest in technology and infrastructure that support flexible working hours, such as remote work tools and flexible office spaces.

Moreover, there are many possible solutions to solve traffic congestion and environmental issues by changing the demand for transportation, such as telecommuting incentives (to reduce the number of commuters by encouraging remote work) and commuter benefits programs (to encourage alternative transportation methods through employer-sponsored benefits). These policies focus on shifting the responsibility from commuters to employers, encouraging businesses to adopt practices that reduce peak-hour traffic and promote sustainable transportation options. By addressing the root causes of transportation demand-such as rigid work schedules, inadequate infrastructure, and centralized office locations-these policies can lead to more effective, inclusive, and sustainable solutions to the EEC's transportation challenges.

However, it is also crucial to involve local communities in the policy-making process. Engaging local residents ensures that policies can be tailored to meet their needs and generally gain broader acceptance. Participation ensures community members can voice their concerns and preferences, fostering policies that are equitable and contextually appropriate. For instance, stakeholder workshops and local advisory panels could be institutionalized to refine policy proposals. Local input can help identify the most pressing issues and practical strategies, ensuring that policies are not only environmentally beneficial but also socially inclusive. By incorporating local participation in the creation of transportation policies, the government can enhance their effectiveness and ensure that the benefits are distributed fairly among all stakeholders. This collaborative approach can foster a sense of ownership and responsibility among residents, leading to more sustainable and lasting environmental improvements.

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