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# A case study of the new expansion of the subway in Stockholm

Adopting Build-Operate-Transfer mode in public infrastructure project-subway system in Sweden

*Master of Science Thesis in the Master's Programme Design and Construction Project Management*

PENNY PENG CHENG ANDERSSON

Department of Civil and Environmental Engineering  
*Division of Construction Management*

CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden 2014



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Department of Civil and Environmental Engineering  
Division of Construction Management  
Chalmers University of Technology  
SE-412 96 Gothenburg  
Sweden  
Telephone: + 46 (0)31-772 1000

Cover:

Fig. 8 Framtidens spårkarta – The future's track map,  
Source: Stockholmsförhandlingen (2013)

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### **Abstract**

In nearest decade, Build-Operate-Transfer (BOT) contracts have been increasingly adopted for large infrastructure projects in many countries. However, there are very few BOT projects in Sweden. Can Swedish government have a favor on BOT contract? The agreement of the new expansion of the subway in Stockholm has been signed among relevant parties in early of 2014. The project will be carried out as a traditional public project, which implies the Swedish government will become a solo funder. To make the project viable, the Swedish government decides to increase traffic charges on imports at The City of Stockholm, in order to collect enough funding for the construction of the project. Can problems such like lack of funds always be solved by raising traffic charges? In this paper, I will make a test about if the Swedish government adopts BOT arrangement for the new expansion subway project. Then I compare this test with the current financial strategy which the Swedish government adopts for the new expansion project. In order to create a suitable BOT arrangement for the new expansion project, except early literatures review, I study and analyze two sub-case studies, Arlanda Express and Hong Kong Airport Express. Finally, BOT arrangement in an optimal model shows more efficient and benefits more for the Swedish government, private firms and the public.

Keywords: BOT contract, infrastructure project, subway project, BOT contract for subway project, financing of BOT project, efficiency of BOT project



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## **Preface**

BOT has been widely adopted by many countries in recent decades. It seems that there has been a trend toward introducing private finance to infrastructure projects. Due to my old work experience, I always have a great interest in subway projects. Moreover, as one type of infrastructure, many subway projects have been built with BOT (Build-Operate-Transfer) arrangement, but not the new expansion of the subway in Stockholm, Sweden. Actually, there has been so few BOT or PPP (Public-private Partnership) in Sweden. Although Sweden is recognized as a country with extraordinarily strong public finances, it still can bring huge financial burden for the Country of Stockholm which is responsible for public traffic. For this reason, I investigated the current financial strategy adopted by AB Storstockholms Lokaltrafik (SL). Then I found out something unusual. That is that around 1/3 finances of the project are collected through raising up traffic charges on imports at The City of Stockholm. As traffic charges cannot be raised everytime when the existing subway needs to be expanded or a total new subway needs to be built, so I am curious that if a BOT arrangement can be implemented in subway projects in Stockholm, for example, this new expansion subway project in Stockholm.

Hence, I made a big test that to adopt BOT mode in the new expansion of the subway in Stockholm. To form this test, except literature reviews, I made four interviews related to this issue and investigated two sub-case studies, Arlanda Express and Hong Kong Airport Express. Due to these three case studies are three big infrastructure projects, to investigate them I need a large number of the projects related materials. Some of those materials are publications which can be found on internet, and some are internal. Therefore I would like to thank SL, MTR Stockholm AB for their precious and useful materials, thank three interviewees, Christian LÖf, Lena Berglund and Peter Viinapuu (name order after alphabetical order), who provided important information. Furthermore, I appreciated technical guidance provided by my supervisor, Peter Viinapuu, and my examiner, Göran Lindahl.

## Notations

### Acronyms

ACP	Airport Core Programme
AEL	Hong Kong Airport Express
ALC	Arlanda Link Consortium
BOT	Build-Operate-Transfer
CBD	Central Business District
CEOs	Chief executive officers
ECO	Ecological
HKSAR	Hong Kong Special Administrative Region Government
HKD	Hong Kong dollar
IC	Incentive-compatibility
ICC	International Commerce Centre
IFC	International Finance Centre
IR	Individual-rationality
MTR	MTR Corporation Limited
MTRC	MTR Corporation Limited
MTR STHLM	MTR Stockholm AB
NRA	National Rail Administration
PPP	Public-private Partnership
SEK	Swedish Kronor
SJ	Svenska Järnväg or Swedish state railway
SL	AB Storstockholms Lokaltrafik
SLL	Stockholms läns landsting or the County of Stockholm
SOEs	State-owned enterprises
TBT	Tunnelbanan Teknik Stockholm AB
TCL	Tung Chung Line
TFP	Total factor productivity





## **1 Introduction**

The County of Stockholm is counted as one of the fastest growing region in Europe. Its population grows up with the speed of 35000 per year. This brings more stress to traffic and housing resources. Some documents show that traffic congestion and housing crisis have become main problems which hinder development of the region.

To solve these two problems, the Swedish government has decided to extend the existing subway and build around 78000 units' homes in the relevant municipalities which are involved in this new expansion of the subway in Stockholm. This project is also main case study in the paper. Thus the paper is composed as case study.

The current financial strategy of the new expansion project which is adopted by AB Storstockholms Lokaltrafik (SL) for the new expansion subway relies largely on support from increased traffic charges on imports at The City of Stockholm, i.e., SEK 9000 million. Although this approach has been investigated and proved as viable method for the current project, but it doesn't solve the initial problem which is SLL (Stockholms läns landsting or the County of Stockholm) bears overloaded financial burden for future subway projects. As traffic charges on the imports cannot be rose forever. Instead of traffic charges, where can SLL find extra financial sources?

The paper includes a big test, adopting BOT (Build-Operate-Transfer) model for the new expansion of the subway in Stockholm. This means that extra financial sources can be private funding. To support this test, I pick two sub-case studies, Arlanda Express and Hong Kong Airport Express, to analyze and find out useful parts for structuring BOT arrangement for this project, and to see what extent BOT is applicable in Sweden. However, without reviewing literatures, I cannot investigate an optimal model of BOT.

Note that the paper will focus on financial issues. Since the main problem which is needed to solve is overloaded financial burden on SLL. Apart from this, major benefits from adopting BOT model will be analyzed and generated.

Based on literature reviews and four interviews, and through analyzing two sub-case studies, I investigate the optimal model of BOT to compose a BOT arrangement for the new expansion project. By the end of the paper, I compare the BOT arrangement composed by myself with the current financial strategy adopted by SL, to find out a better choice for the new expansion project.

## **2 Theory**

The main purpose of the paper is to investigate a proper model of BOT which is applicable in the Swedish context. To achieve this purpose, two initial theories must be reviewed. First, what is a subway project? Or in another words, what attributes does the subway project have with respect to the economy? We cannot analyze one entity without knowing what it is. As the section of the introduction states, the paper will focus on financial issues. Thus, it is good to start with analyzing the economic attributes of a subway project. Thereafter, we cannot forget another theme of the paper is “BOT” (Build-Operate-Transfer) mode. Since BOT is one type of PPP (Public-private Partnership), it is better to begin with the definition of PPP. Afterward BOT will be fully analyzed in this section, from definition to a new developed model of BOT, i.e., an optimal model. At the end of this section, I will go to argument about why adopt BOT mode. The case study of the new expansion of the subway in Stockholm will be mentioned and discussed, initially, here while more analysis of it will be in the section entitled Result and Discussion.

### **2.1 The economic attributes of a subway project, semi-public-goods**

Shanshan Xu and her colleagues (2010) believe that subways have two attributes, pure public and private properties; therefore the subways should be defined as a semi-public property. To illustrate this definition, Shanshan Xu and her colleagues argued subway’s first nature is one of non-rivalry. They claim that, under certain precondition which is “when the quantity of passengers is less than the maximum carrying capacity of subways and the marginal cost of increasing an additional passenger to enjoy the service equals zero” (Li, et al., 2010, p. 1), then the transit service, which is in the public interest, is in a state of non-rivalry. The non-rivalry indicates that the nature of subway systems is one of pure public property. On the other hand, from an economic angle, each passenger purchases his or her own ticket to enjoy transit service; hence the nature of subways can be regarded as one of purely private property. To integrate these two characteristics, subway projects should be treated as semi-public-goods (Li, et al., 2010).

As the previous paragraph indicates, there is a precondition under laying the economic attributes of subways. If this precondition is unmet, what will happen? Once the flow of passengers goes beyond the maximum transport capacity, congestion will occur and the total welfare of all passengers will decrease. Thus, to avoid congestion and to fully meet the precondition, an expansion of subways should be implemented along with the growth of city urban, local economy and population.

In traditional terms, purely public enterprises should be carried out by the government while the purely private services should be offered by private parties. The question is: who should produce semi-public goods? This question will be discussed in the followed paragraphs.

### **2.2 Definition of PPP**

Public-private partnership (PPP) arrangements have been adopted widely in many countries in recent decades. However, there is no unique and clear definition of PPP. One definition given by The Education and Research Institute of United Nations is

that “PPP covers various institutionalized cooperative patterns between exponentials of different social systems aim to solve certain complex problems in local areas” (Li, et al., 2010, p. 1). This definition uses more academic words to describe PPP generally. There is another version of the definition which is comprised of simple words and is based on infrastructure projects. Carlos et al., (2013) summarized the situation where PPP is regarded as procurement and its two sectors, public and private sectors, participate in a contractual, or institutional relationship, relation to make certain that an infrastructure and/or service is available to residents and travelers.

In a second version, the public and private sectors are equal and cooperative. However, the detail of the relation between these two sectors is unclear or is described too simply. What are the important details of the relationship between them? As is mentioned in the definition, the relation can be regarded easily as the contractual. In this sense, the public sector is the employer while the private sector is composed of the employees. Generally, according to the public interest, the public sector which usually is the center government or local government lists some missions to achieve, such as roads, railways, ports, airports, water and wastewater, waste, energy, health, security and prisons and so on. Normally, they will hold a public tender so that the private sector can have a chance to become involved in public projects. As the guardian for the public project, the government (the public sector) empowers the private sector with the responsibility of designing, financing, building and operating infrastructure and/or service. There are several models, in accordance with contracts which are agreed to by both the public and private sectors, where not all responsibilities are assigned to the private sector. For instance, the design and financing might be maintained by the public sector (Cruz & Marques, 2013).

From the economy’s point of view, the public sector (the government) can be full/part financial provider for the private sector to implement the public projects, or the public sector backs off totally from financing the public projects. This means that the private sector has 100% responsibility of financing the public projects. Although the critical reason for developing PPP contracts is the greater efficiency of using public money, the fact is that most PPP projects are regarded as a bypass to constraints on the public budget (Cruz & Marques, 2013).

Differing in terms of the involvement of the government, the term of the contract which is assigned between the public and private sectors, can be “ranging from relatively short-term Management Contract (with little or no capital expenditure), through Concession Contracts (which may encompass the design and building of substantial capital assets along with the provision of a range of services and financing the entire construction and operation)” (Li, et al., 2010, p. 1). Traditionally, public projects are built by the government, which means that the government has full responsibilities for the entire public project from planning to financing, from design to construction, and, in the end, operation. Compared with the traditional public projects, PPP mode has opposing form, where it appears that parts or all of the responsibilities of different stages of the public projects have been transferred from the government to the private sector. Instead, the government becomes the guardian of the public projects.

As I mentioned, the responsibilities of public projects devolved to the private sector, can vary from parts of them to all of them. This indicates that PPP has different sub-

models in accordance with the scope of responsibilities of the public and private sectors respectively, as showed in Table 1. But in this paper, I am only going to focus on one type of model which is BOT. More discussion about it will be included in the followed sub-section.

Table 1 Models of PPP projects

Acronym	Designation
BOM	Build-own-maintain
BOO	Build-own-operate
BDO	Build-develop-operate
DCMF	Design-construct-manage-finance
DBO	Design-build-operate
DBFO	Design-build-finance-operate
BBO	Buy-build-operate
LDO	Lease-develop-operate
BOT	Build-operate-transfer
BOOT	Build-own-operate-transfer
BROT	Build-rent-own-transfer
BTO	Build-transfer-operate

Source: Cruz & Marques (2013, p. 5)

### 2.3 BOT: one type of PPP

As mentioned above, PPP actually has several sub-models. BOT is one of them. BOT actually is abbreviation of build, operate and transfer. In fact, BOT is a form of arrangement between the public sector (government/s) and the private sector (a private firm). Note that the private firm can be a single company or a group/consortium which consists of several companies. Then, the definition of BOT can be conceived as a typical arrangement “between a government and a private firm specifying that the government licenses the firm to build (B) a project and then to operate (O) the project for a certain period, normally 5 to 30 years, and finally, at the end of the concession period, to transfer (T) the project at no cost to the government” (Qiu & Wang, 2011, p. 127). Given the achievement made by the practice which has the similar procurement as current BOT in some countries, it is hard to imagine that the term “BOT” actually is fairly new. Such projects used to be called as “concessions” in Europe. It is very interesting that Cruz and Marques used a historic metaphor to interpret concession. As the idea of concession originated in the fifteenth century, the public sector is the grantor (the King) who history empowers the private firm which consisted of navigators, historically, to discover the new or unknown territory meanwhile benefits with rent were handed in by the latter (Cruz & Marques, 2013).

In theory, a private firm is partly/fully responsible for financing of building a project and “then owns it for a certain period of time before finally transferring it to the government at no cost” (Qiu & Wang, 2011, p. 2). When a transport infrastructure project is built, during concession period i.e., operation phase, the private firm bears

the costs of operation while it also gets fare revenue and/or project related revenue. Those revenues will pay off the payment which the private firm has invested on the project construction that might include plan and design of the project. After concession period, the government has superiority which is assuming ownership or extending the license to the private firm to operate the project continuously and earning profit from the project (Qiu & Wang, 2011). Instead of participating in planning, construction, or financing of a BOT project, nowadays a government acts more or less as a guardian who provides side service, such as providing loans, guarantees, tax credits, subsidies, price controls, and license renewal and so on (Qiu & Wang, 2011).

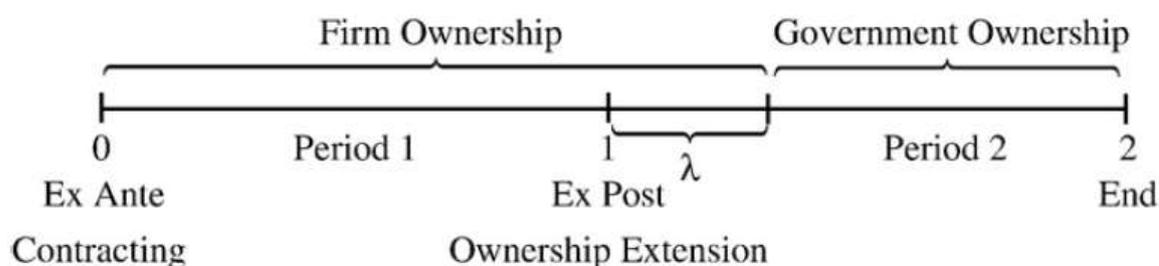
In reality, take look at those huge projects which have great importance for a country's economic development, for examples, the first BOT project in Hong Kong, the Kong Kong Cross Harbour Tunnel, The Channel Tunnel which connects the United Kingdom and France and Terminal 3 of Pearson International Airport in Toronto, these projects have adopted BOT and been deemed as successful projects. Moreover, to implement those projects, a great amount of human, physical and financial resources have been invested.

With respect to the economy, this was huge movement which stimulated an economic boom in those countries and supported their normal economic operation. Despite the fact that BOT has operated successfully in many huge projects, there still are many problems that have appeared under BOT practices. As the definition of BOT described above shows, BOT is but one kind of cooperative arrangement. It should be separated with complete privatization, complete nationalization, or joint ventures. In contrast with privatization, BOT has opposite processes of ownership transfer. The final owner of a BOT project is government while in privatization the final owner is a private firm. Furthermore, in BOT, a private firm might withstand all the costs of a project including building and operating under a concession period before the final ownership is handed over to a government at no cost. This is a most attractive feature of BOT. However this is also fundamental reason for troubles which BOT could cause after a concession period. In another word, the problems which BOT could bring about can be described as two issues which the government might face in a BOT project: "the private firm's monopoly under conditions of private ownership, and the private firm's incentive to invest in quality" (Qiu & Wang, 2011, p. 129). Differing from the first issue, the second issue is not easy to understand properly. To explain the second issue more understandably, we can say that, in BOT, the private firm may not dedicate itself to creating a sufficient investment for a longlasting quality project due to the fact that it might lose the ownership of the project after concession and the effects of the principle of profit maximum (Qiu & Wang, 2011). In addition, BOT usually is adopted in large public projects which have huge importance for a country's economic development as mentioned in the previous paragraph. Hence, a longlasting quality is required for BOT projects. On this issue, Qiu and Wang (2011, p. 128) have raised two questions: "How can a BOT contract be designed to induce the private firm to invest in the best quality? And if such a BOT contract exists, does it resemble a typical BOT contract found in reality?" Moreover, Björn Hasselgren (Hasselgren, 2013, p. 1), senior adviser and research fellow at the KTH Royal Institute of Technology, argued that "Efficiencies in PPPs are generally seen in the construction phase, where there is generally stronger incentive for cost reduction and lean processes. If contracts are well-designed, the cost of construction and maintenance over

the whole life of a project can be kept down”. He affirmed benefits of using PPP. According to his words, the matter should be design of PPP contracts. Due to BOT is one type of PPP, therefore, in the followed paragraphs this paper will focus on design of BOT contracts.

### 2.3.1 BOT contract: a license extension model

To answer the two questions which mentioned at previous pharagraph, Qiu and Wang (2011) have developed a typical BOT model based on stylized facts, a model of license extension policy. Simply, to induce right incentives for a private firm to build a quality project, one option is to add an additional period after the concession period for license extension with the intention of observing the quality of the project. In order to investigate an optimal model of BOT, the research on the license extension model which is made by Qiu and Wang will be displayed and analyzed briefly below. Note that the complex equations from their research will not be repeated and listed here.



*Fig. 1* The license extension scheme  
Source: Qiu and Wang (2011, p. 129)

As stated by Fig. 1, the extended period after the concession period is ex post i. e. Period 2. Period 1 consists of construction and concession periods. The unique function of the license extension policy is that it introduces a sub-period  $\lambda$  within Period 2 and it shows in Fig. 1. Under Period  $\lambda$  the government can observe the quality of the project under the precondition of private ownership in order to determine whether the private firm still runs the project under the rest of Period 2. However, after Period  $\lambda$ , whether the quality of the project meets required quality or not, the physical project will be handed over to the government, while the operational right under the rest of Period 2 could belong to the government or the private firm. In this sense, comparing with the original BOT model, the license extension model makes the private firm to continue own the project during quality observing period, i.e., Period  $\lambda$ . Note that Qiu and Wang think that quality is not verifiable but observable. Then, to investigate this, there must be a pre-specified threshold quality level in advance. If the observed quality equals to the quality threshold under Period  $\lambda$ , the private firm will run the project continuously. If the observed quality is below the threshold then there is no license extension in the rest of Period 2. Note that in Qiu and Wang’s model, the private firm has decided to operate and own the project under Period  $\lambda$  in ex-ante contract.

However the private firm still will not voluntarily invest for longlasting quality despite the fact that it has been authorized to operate the project over the entire Period 2. In Qiu and Wang's research, this kind of longlasting quality is called as socially optimal quality or first-best quality<sup>1</sup> (these will be discussed more later) which has the meaning of the quality required by the government with a standard of a social level. Hence, Qiu and Wang (2011) recommended setting a "punishment" if the private firm fails to invest at the socially optimal quality level which the government required, and, on the contrary, to give the private firm a reward if it meets the socially optimal quality level. Nonetheless, the problem is that, in reality, the government cannot really charstise the private firm according to the contract, except to stop extending the license to the private firm in the rest of Period 2. In this sense, to stimulate the private firm to invest required quality which equals the threshold (or even higher figure), Period  $\lambda$  can be comprised in the ex-ante contract along with an alternative assuming that the private firm contiunously runs the project if the quality is observed equal to (or higher than) the threshold, or if the quality is observed to be below the threshold during Period  $\lambda$ , then the government has the right to stop the license extension immediately. This ensures that the private firm must consider providing longlasting quality which can, at least, last over Period 2. This doesn't mean that the government has decided in the ex-ante contract, that the private firm is surely going to operate the project during the rest of Period 2. Due to the fact that public and private ownership are assumed to be equivalent in profitability and welfare during Period 2, so there is another alternative possible, namely, that the government can take over the operational right and run the project by itself after the concessionary period.

Moreover, as described above, a reward should be offered by the government if the private firm meets the socially optimal quality level. The particular reward must be enough to cover the investment offered by the private firm for the construction of the project. However, it doesn't need to be offered completely during the concessionary period, if one alternative is that private operational right will continue during the rest of Period 2. In this case, the private firm must ensure that it will invest the socially optimal quality to get access during the rest of Period 2, in order to get the rest of the reward to cover the investment for the construction of the project. Furthermore, as Qiu and Wang (2011, p. 132) point out since "the socially optimal quality level also maximizes the private firm's operating profit in each period" therefore there is no need for the government to adjust the license extension length slightly to influence the private firm's quality investment. This implies that the required quality will be followed by the private firm as long as the reward is amply large. In a sense, this proves that the ex-post optimal license extension included in the ex-ante contract would balance the benefit and cost under public ownership and induce investment at the required level of quality.

In Qiu and Wang's research, they believe that the flexibility of the license extension policy could solve the problem of time consistency (Qiu & Wang, 2011). However, there would still be other possible influences that lead to time consistency problems. These several possible influences must be considered when adopting a BOT arrangement. For instances, contractible quality, non-contractible quality, the

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<sup>1</sup> To achieve the first-best outcome, requires the first-best quality.

government's commitment, and the government cannot make a similar commitment if the private firm is a foreign firm. Discussion about them will be showed below respectively.

### 2.3.2 Cost control

Qiu and Wang (2011, p. 2) argued that “although letting the firm own the project in both periods for certain may help solve the underinvestment problem (the incentive problem), private ownership generally leads to a reduction in social welfare (the monopoly problem)”. Thus excluding quality-dependant license extension in the rest of Period 2, cost control is insisted by them.

According to Qiu and Wang's research, I constructed Table 2 which indicates that, despite the precondition of ignoring the incentive and monopoly problems, under the license extension policy, BOT contracts should be redesigned to specify both prices and quality. In this sub-section, I will go to focus on specified quality in BOT contract, which refers to cost control.

Obviously, to achieve the first-best outcome there needs to be a first-best quality. A first-best quality depends on a first-best contract. Note that a first-best outcome means efficiency in Qiu and Wang's research, while a first-best contract means a contract that can lead to a first-best outcome. Meanwhile the first-best outcome comes from the first-best quality. In this sense, quality can be contractible. Qiu and Wang (2011) argued that quality cannot be verifiable but can be observed. Then how to observe quality? Since quality can be contractible, then there must be a quality requirement included in BOT contract. Moreover, without measurable parameter, I don't think that quality can be observed. Hence a quality requirement contained in BOT contract should consists of measurable parameters which refer to different activities and facilities.

Table 2<sup>2</sup> The relation between the first-best outcome and price regulation

	Contractible quality	Non-contractible quality
Prices specified	Achieve the first-best outcome	
Prices not specified		Not achieve the first-best outcome

Source: Qiu and Wang (2011)

In reality, with incentive and monopoly problems, the first-best quality should be referred to as “the socially optimal quality”. Moreover, there is the possibility of over-investing in quality by the private firm, regardless of the fact that it is hard to believe the private firm would over-invest a project given the maximum profit principle. If over investing in quality happens, then not only the cost of investment increases but

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<sup>2</sup> ‘Prices specified’ means the prices have been specified in BOT contract; the first-best outcome means that the efficiency of BOT project under the precondition of the absence of the incentive and monopoly problems.

the marginal cost of increasing service<sup>3</sup> rises as well due to higher quality raising demand (Qiu & Wang, 2011). In this case, the private firm turns out not choose over-investing in quality.

Under ex-post conditions, the government has two options, operating the project by itself or licensing it to the private firm again. Qiu and Wang (2011) pointed out that these two options can lead to positive and negative results. The positive result, as discussed above, is that to stimulate the private firm to make longlasting quality projects in order to gain one more operation period after Period  $\lambda$  or past the period of observation of quality, i.e., Period  $\lambda$ . The negative result, despite who owns the second operational period i.e., Period 2, in general, private ownership will reduce the amount of social welfare, which is identified as the “monopoly problem” (Qiu & Wang, 2011). The monopoly problem will be discussed more in next sub-section.

### **2.3.3 Price regulation : a strict price control or a price ceiling under operation phase**

As mentioned previous sub-section, specified prices should be included in ex-ante BOT contract. Note that price here refers to ticket fare during operational phase. In addition, in reality, monopoly problems occur, in this sense, price regulation which can prevent monopoly effectively is necessary. Furthermore, in accordance with the incentive-compatibility (IC) condition, the private firm will be induced to choose the required quality from the government (Qiu & Wang, 2011). Finally, price regulation should be applied in both Period 1 and Period 2.

In terms of the price regulation, due to its extent, it can vary from strict price control to a price ceiling. Note that the term of strict price control refers to price determined by a government. If a price ceiling is assumed to be applied, then the price ceiling should be higher than the welfare-maximizing price (i.e., marginal-cost pricing) (Qiu & Wang, 2011). If the welfare-maximizing price is too low, that it will lead the private firm to make insufficient profit to cover the investment cost. Then the individual-rationality (IR) is hard to reach without gaining side benefits, as will be discussed in greater detail in the section on Result and Discussion. “In reality, firms often receive large side benefits from accepting BOT offers, which also helps cover portions of the investment costs” (Qiu & Wang, 2011, p. 131). In this case, approving the private firm to charge a price higher than the marginal cost is essential. Because of this, the private firm is also endorsed to execute a certain degree of monopoly power. In contrast, if the strict price control is adopted in both the concession period and the extended period namely Period 2, then the government has the ability to fully impose remote monopoly power. In addition, Qiu and Wang argued that full efficiency in the context of license extension policy model means a full solution of both monopoly power and incentive problem. This evidences furtherly that a strict price control can remove monopoly problem completely, while the license extension policy can fix incentive problem.

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<sup>3</sup> Many public projects have a natural limit of capacity. “Once the capacity is reached, the marginal cost of increasing production or services will be higher (at least not lower)” (Qiu & Wang, 2011, p. 130).

### 2.3.4 An optimal model of BOT contract

In this paper, I am not going to discuss all infrastructure projects other than subway projects. Back to our focus, BOT is absolutely applicable in the theoretical phase, but how this theory can be implemented in practice, or in other words, how were those successful BOT subway projects carried out? According to the economic report in The Annual Report 2012 from SL (AB Storstockholms Lokaltrafik, 2013), all the revenue of a year which includes ticket fare revenue and railway related revenue are insufficient to cover the total expenses of operating the whole public transport system yearly in Stockholm, as Table 3 illustrated. Note that the whole public transport system includes subway, buses, commuter trains, local trains and common transport. Accordingly, there is no money left to pay construction of new subway or expansion of the existing subway. Thus, as mentioned previously, in order to reach IR, side benefits have to be offered to the private firm. Since the subway project is very special, as it is public transport service which connects directly to social welfare. Regarding to principle of maximum social welfare, then ticket fare shouldn't be too high. Nonetheless, it doesn't mean that there is no profit from barely operating the subway in Stockholm. On the contrary, the subway in Stockholm could be easy for running profitable. The reason why operating profit doesn't exist in SL, is that SL ties all kinds of public transports together in one system to balance finance. All kinds of fares are tied in one system. This is also the reason why I recommend to adopt a special operational service contract during operation phase. This issue will be discussed deeply later in Section 4.

Table 3 Financial result

(MSEK)	2012	2011	2010	2009	2008
Fare Revenues	6,505	5,870	5,370	5,217	5,099
Operating Subsidies from SLL	6,402	6,296	6,099	5,945	5,685
Work Performed by the Company for its Own Use and Capitalised	93	94	119	89	54
Other Operating Income	2,937	2,689	2,536	2,597	2,267
<b>Total</b>	<b>15,937</b>	<b>14,949</b>	<b>14,124</b>	<b>13,848</b>	<b>13,105</b>
Purchased Services	-10,518	-10,092	-9,637	-8,561	-8,049
Other Costs	-4,633	-4,421	-4,496	-4,525	-4,119
Net financial items	-731	-592	-411	-348	-655
<b>Profit/Loss for the Year</b>	<b>55</b>	<b>-156</b>	<b>-420</b>	<b>414</b>	<b>282</b>
Total Assets	41,045	39,093	35,782	32,769	30,477
Tax funding level	45.8%	49.1%	51.2%	48.6%	49.9%

Source: AB Storstockholms Lokaltrafik (2013, p. 11)

Hence, according to public transport situation in Stockholm, operating over an extension period sounds unattractive to a private firm. To ensure that the private firm invests in project with required quality and to induce a private firm to seek an

extension period, the ex-ante contract should include side-benefits which consist of the coverage of the investment for the construction of the project and profits, but not all side-benefits should be promised to get during the concession period. In this case, part of side-benefit will be issued during the concession period, part of side-benefits will be given under the extension period. In the ex-ante contract, there will be included the proviso that if the actual quality of the project is observed to be equal to the required quality, i.e., the specified quality, at the end of Period  $\lambda$ , then the private firm will continue operating the project during Period  $(P_1+\lambda, P_2)$ <sup>4</sup>, plus obtain the remaining portion of side-benefits during Period  $(P_1+\lambda, P_2)$ . In this case, the private firm will continue owning the project under Period  $\lambda$  and thereafter the project will be handed over to the government. Note that the first part of side benefits should not cover the investment for the construction of the project. On contrary, the actual quality of the project is observed to be not equal to the required quality at the end of Period  $\lambda$ , then the government will take over the operational right and run the project by itself. This also indicates that the private firm will lose the remaining portion of side-benefits during Period  $(P_1+\lambda, P_2)$ . The full explanation shows on the followed figure, i.e., Fig. 2.

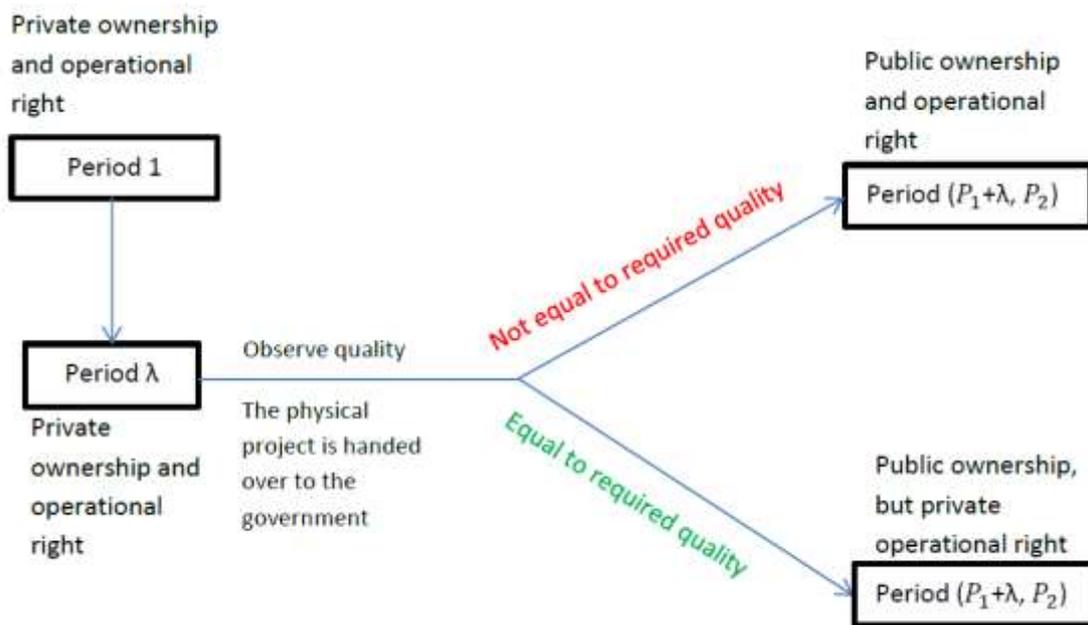


Fig. 2 The first developmental model of the license extension scheme for BOT

Under this model, I would question that if quality of the project can be observed properly under the condition of private ownership. To avoid this problem, I would suggest the subway project should be operated under the condition of public ownership during sub-period  $\lambda$  which is within the extension period (as Fig. 1 shows). After the concession period, the government takes back the ownership of the project and runs it by itself under Period  $\lambda$ . But it doesn't mean that the government will

<sup>4</sup>  $P_1$ =Period 1=Construction Period + Concession Period;  $P_2$ = Period 2

continue to run it over the rest of Period 2. There will be two possible results after Period  $\lambda$ , No.1 is that if the quality of the project reaches the requirement from the ex-ante contract under the condition of public ownership, then the government will give back the right of operation of the project after Period  $\lambda$  plus obtain the remaining portion of side-benefits during the rest of Period 2; another result is that if the quality of the project is observed to be worse than the required quality under the condition of public ownership then the private firm will not get back the right to operate the project and not access the remaining portion of side-benefits during the rest of Period 2. Note that after the concession period, the physical project will be handed over to the government. Before this hand-over, there is need to observe the quality of the project. Or in other words, at the end of the concession period, quality of the project should be observed. Furthermore, in accordance with the depreciation of the property which includes subway projects, the required quality at the end of the concession period shouldn't be equal to the required quality at the end of Period  $\lambda$ . Thus I would assume the required quality at the end of the concession period and Period  $\lambda$  to be Quality 1 and Quality 2, respectively. The Period  $\lambda$  equals to Period  $(P_1, P_1 + \lambda)$  and the rest of Period 2 is assumed as Period  $(P_1 + \lambda, P_2)$ . More simply, under the condition of public ownership the quality of the project will be checked again under Period  $\lambda$ , in order to decide the operational right over the rest of the Period 2. Totally, quality of the project will be double-check. The better explanation of this is displayed in Fig. 3 below. Note that both required Quality 1 and Quality 2 should include required technical quality ( $Q_t$ ) and required service quality ( $Q_s$ ). Since they are two different kinds of quality. For instance, technical quality refers to quality of rolling stock, quality of stations and quality of signal system etc.. On the other hand, service quality refers to required punctuality rate and required customer satisfaction etc..

Furthermore, to consider the negative result for the private firm, if the quality of the project doesn't meet the required Quality 2 under the condition of public ownership, the private firm will have no opportunity to access remainder of the side-benefits, which means that the investment for the construction of the project will not be covered totally. It also means that the private firm will lose money by having invested in a poor quality project. Moreover, since operation under private ownership is normally 5 to 30 years, so Period  $\lambda$  shouldn't be too long, I assume that 5 years would be appropriate. Furthermore, considering the depreciation of the property, a project upgrading within Period  $(P_1 + \lambda, P_2)$  is recommended to include in the ex-ante contract. Such as upgrading signal system, upgrading function of rolling stock, purchasing new rolling stock, and refurbishing stations and so on, can be included in project upgrading.

The second developed model for BOT as Fig. 3 shows, which is what I am going to use to analyze the case study of the new expansion of the subway in Stockholm in section entitled "Result and Discussion".

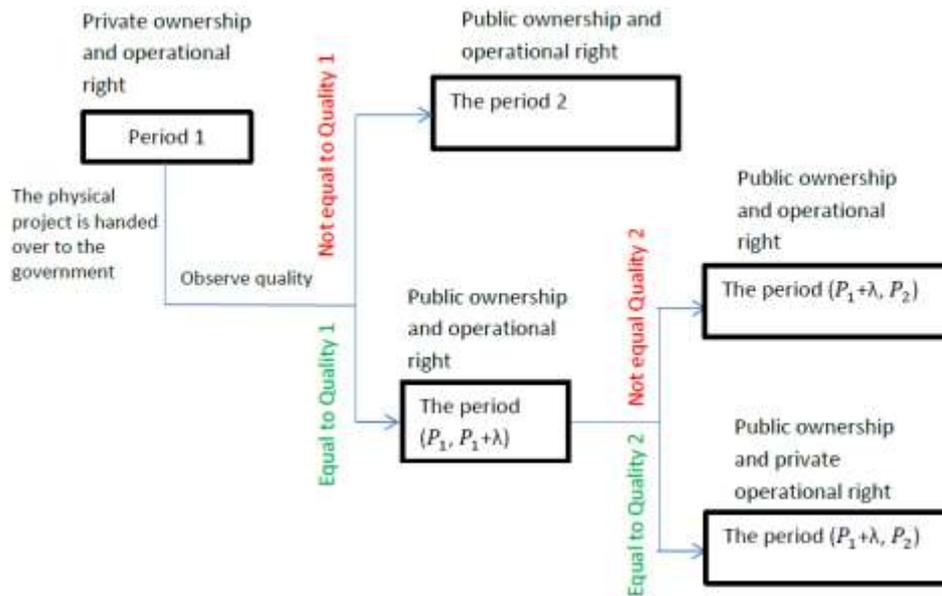


Fig.3 The second developmental model of the license extension scheme for BOT

### 2.3.5 If the government cannot commit the promise in the ex ante contract

To guarantee quality of project, by adopting the license extension policy a licensed extension can still be achieved. However this policy is positive for governments so far, it is negative for private firms when it comes to considering the interests of businesses, particularly, the principle of profit maximization. This means that there is a space for optimizing the license extension scheme. This is the principal topic for this sub-section.

As the preceding section discussed, the first-best outcome, i.e., efficiency, is available if adopting a BOT contract with an extendable license, cost control and price regulation. With consideration of economic implications of ownership, if social welfare is the same regardless of ownership of project under Period  $(P_1 + \lambda, P_2)$ , then government has no inducement to depart from its license extension policy included in the ex-ante contract. However, as I mentioned previously, there are few possible influence that can occur when the license extension policy is applied. One of those sources of influence is set if governments cannot commit their promise in the ex ante contract. Generally government would not betray their promises, but for some big enticements, such as a potentially big profit or cost savings, it could happen that governments refuse to extend licenses to private firm under Period  $(P_1 + \lambda, P_2)$ . So Qiu and Wang argued two potential factors which could affect the time consistency<sup>5</sup> of the license policy, namely affecting government's choose not to commit its promise contained in the ex-ante contract. One factor is general cost due to increasing taxes. This means that if government restates its ownership under the Period  $(P_1 + \lambda, P_2)$ , when government gains profit from project, at the same time it saves cost of increasing taxes elsewhere. In this case government has inducement to change its commitment to the ex-ante contract. Back to my major study, subway, as my previous sub-section illustrated, revenue made by operating the whole public transport systems in Stockholm cannot pay off its operating expenses according to The Annual Report

<sup>5</sup> Here the time consistency means the extension policy will be same all the times.

2012 from SL (AB Storstockholms Lokaltrafik, 2013). In this sense, I would say that the Swedish government would not betray its promise in the ex-ante contract by increasing taxes. This constitutes, then, no source of concern then, in my case study.

The second factor is that, the government would like to save the cost of transferring money from the private firm to the government, as the cost cannot be absorbed. To discuss this issue, there is a need to take look at other factors. Firstly, as much earlier research has pointed out, private ownership improves production, and is by and large more efficient than public ownership. The reason for this is that “management by the government suffers from bureaucratic inefficiency due to its huge organization and various incentive and information problems” (Qiu & Wang, 2011, p. 131). Because of this, social welfare will be differ under different forms of ownership, which will also affect the decision from the government of whether to license the ownership to the private firm continuously or take back ownership. Note that this also means that welfare under public ownership and private ownership is no longer equal. Furthermore, as we all know that efficiency plays a huge role at economic development. And it is also ture that bureaucratic inefficiency is a week point in governmental management. Therefore, although there is a loss when transferring money from the private firm to the government, there will be an efficiency loss as well due to the fact that the government is less efficient than the private firm when it comes to management efficiency. Then in this case, the government would commit the promise in the ex-ante contract.

### **2.3.6 If the private firm is a foreign firm**

It is not hard to subject this influence to discussion. As nowadays’ economic order is a one world economy or international economy. Under international circumstances, private firms could become international in scope. An international private firm has the ability to access any country’s public project. Furthermore, BOT usually is huge and international in scope. In other words, a strategy is adopted in huge public projects which requires that private firms have a certain size and strong financial and technical resources. Therefore governments are used to managing international open biddings for BOT projects and welcome bids from all over the world. In this sense, foreign firms are possible winners, typically in developing countries. Although the major case study of the thesis focuses on Sweden, a developed country, it is still essential to discuss foreign firms in BOT contracts.

The first big problem governments could face is that the welfare function of public projects would be affected if the private firm is foreign firm. The reason for this is that it contects indirectly with economy-wide profit tax. Qiu and Wang also have done some research on this issue. They suggested levying a lump-sum tax by governments on foreign firms in BOT projects. Moreover, if non-negative profit for the private firm in period 1 is assumed, it will benefit the government by avoiding subsidys for the private firm which is a foreign firm engaged in a BOT project. This is positive both for the foreign firm and the government. The negative impact on foreign firms is the lump-sum tax, which domestic firms don’t need to pay. Because of this, the foreign firm may try to reduce the investment in quality in Period 1. To avoid this, or to induce incentives of investing a required quality from the foreign firm in the BOT project, it must be ensure that there will be ample profits in the extension period, i.e., Period 2. Then in certain sense, this indicates that it is a guarantee for the foreign firm

to own and operate the project continuously. This condition will not fit or occur to the second developmental model of the license extension scheme for BOT. The solution for this is to return to a lump-sum tax during Period ( $P_1 + \lambda$ ,  $P_2$ ), if the foreign firm has passed two quality assessments and gets the right to win and operate the project in Period ( $P_1 + \lambda$ ,  $P_2$ ). From this point of view, actually this is one more incentive for the private firm to invest required quality in the BOT project in Period 1. Then negative factors have turned to positive in this case.

One more positive for the government occurs if the private firm is a foreign firm, i.e., the foreign firm might bring overseas financial resources to the domestic public project. According to the previous discussion, the private firm will take responsibility for full or partial financing of the project. Then the foreign firm has a bigger possibility of bringing the overseas financing resources than the domestic firms in general. To consider the economic implication for a country's development, introducing overseas financial resources for developing the country will benefit the country a lot.

#### **2.4 Benefit from BOT contract: private firms are more efficient than public firms**

In this sub-section, referring to subtitle, the major theme will be argument about why adopt BOT mode. Except bringing in private funding, there must be something else from BOT contract is better than traditional public contract. Those are flexibility, technical know-how risk allocation, market and marketing expertise, transparent and fast decision-making, which are regarded as the key contribution from private firms in conjunction with infrastructure development (De Jong, et al., 2008). Those issues have been widely discussed in many literatures. Apart from this, I think there are other three issues, efficiency, cost control and quality control, are most important and have big implication on comparison between private owned firms and state owned firms. Since cost control and quality control have been debated in sub-section 2.3.2 and 2.2.4, therefore I will focus on issue of efficiency later.

Efficiency can have different manifestation, such as performance improvement, productivity growth, cost decline and time saving and so on. Hasselgren (2013) argued that some studies from the UK National Audit Office, the European Investment Bank and the US Congressional Budget Office prove that in comparison with public firms, private firms can provide faster construction and decrease costs.

Besides, in sub-section 2.3.5, I claimed that one of the main reasons why private firms are more efficient than public firms is that bureaucratic inefficiency within public firms or governments. In some cases, efficiency of private firms can be called as managerial efficiency. Improving managerial efficiency can enhance firms performance. Without political interference, transferring management control from complete state-owned enterprises (SOEs) to privatized state-owned firms has a great impact on labor productivity and reduces employment (Gupta, 2005). Moreover, Gupta (2005) emphasized that chief executive officers (CEOs) from partial privatization firms play big role in managerial improvement. As managers can use

success at a private firm to further their careers, which is regarded as incentives for existing managers improve.

Apart from this, Ehrlich et al. (1994) investigated on 23 international airlines over the period 1973-83, and proved, despite of the degree of market competition or regulation, that a switch from complete state ownership to full private ownership absolutely raises the long-run annual rate of total factor productivity (TFP) growth by 1.6-2 percent and the rate of unit cost decline by 1.7- 1.9 percent. However the short-run effect on productivity level differences based on an ownership change is ambiguous.

Furthermore, when labor productivity and manage control are improved, time for producing one unit goods is cutted or shorter than before. In addition, time for decision-making is saved by improved manage control and clear decision-making structure. Consequently, efficiency is obtainable by a BOT contract with an extendable license, a cost and a strict price control.

## **3 Method**

### **3.1 Qualitative research**

The methodology applied in this thesis involves qualitative research. Because of this, the thesis is based on literatures reviews and case studies. Furthermore, because the thesis focuses on a major case study, the new expansion of the subway in Stockholm, this thesis should be re regarded as a research of case study.

### **3.2 Interview**

As the most common method in qualitative research, interviews are important to this thesis. There are four interviews which took place at interviewees' work places. The interviews are semi-structured interviews. The first interview was voice recorded for the whole interview. I prepared questions and sent them to the interviewees in advance.

The first interview was undertaken on 27 Jan. 2014, at headquarter of SL. The interviewee was Christian L f who works as business strategist at SL. The main focus of the interview was how the old subway projects have been funded in Stockholm and the relevant laws under which funding took place. The questions asked at the interview and answers from the interviewee, but written down by the interviewer, are included in the Appendix.

The second interview was undertaken on 22 Apr. 2014; at headquarter of MTR Stockholm AB (MTR STHLM). The interviewee was Lena Berglund who is the contract quality manager at MTR STHLM. The main focus of the interview was the key content of the operational service contract assigned between MTR STHLM and SL. As in the first interview, I sent the questions to the interviewee beforehand. The questions to the interviewee and answers, written down by the interviewer, are included in the Appendix.

The last two interviews were related to the same question. However, the interviewees are different. One was Peter Viinapuu who is CEO at MTR STHLM. The other was Christian L f who was interviewed for the first interview. The major reason why these two interviewees were asked to answer the same interview question is that they work for two different kinds of railway-related companies: the private firm and the public firm. However there still is a necessary to mention that all answers from the interviewees can only represent their own views. The interviews were undertaken on 21<sup>st</sup> and 22<sup>nd</sup> May 2014. The question to the interviewees and answers, written down by the interviewer, are included in the Appendix.

### **3.3 Sub-case study and publications**

To finally answer my research questions, I need to investigate my own BOT model. In order to construct my own BOT model, I studied two sub-cases, The Arlanda Express and The Hong Kong Airport Express. To analyze these two sub-case studies, a large number of publications from related companies have been studied. Some publications and documents, used as reference for the thesis, have been obtained from my com-

pany supervisor, Peter Viinapuu, CEO of MTR STHLM, and the interviewees, Christian Lof and Lena Berglund. I found the rest of the publications and documents on the internet. Indeed, all publications and documents used in this thesis can be found on the internet.

## **4 Result and Discussion**

As previously mentioned, this paper focuses on aspects of the financing of subway projects. To achieve the purpose of the paper, how to adopt BOT in public infrastructure projects in Swedish context, there is a need to analyze the current strategy and plan for the new expansion of the subway in Stockholm. Once again, the analysis will emphasize the financial aspect.

Furthermore, in order to investigate whether BOT is an appropriate candidate for a provisional scheme to produce subway infrastructures in Sweden and how to adopt BOT, a test of adopting BOT in the Swedish context will be created in this section to compare with the current strategy adopted in the new expansion of the subway in Stockholm. As mentioned above, the paper will include a couple sub-case studies. One is the first and largest BOT project in Sweden, Arlanda Express. Despite Arlanda Express and subway both are transport infrastructures; they still vary, in many aspects, due to various laws in Sweden. However it is still worth taking Arlanda Express as a sub-case study, since the project has been successful and the most important is that from business view, railway projects and subway projects are still same in Swedish context. Detailed analysis will be included later.

The second sub-case study is chosen from projects implemented by MTR Corporation Limited (MTR). The reason for that is not only that MTR carries around 5.1 million passengers daily in Hong Kong but also MTR is one of the world's leading railway companies in different respects, such as safety, customer service, cost efficiency (MTR Corporation Limited, 2011). In addition, in order to implement BOT successfully, it necessitates selecting a credible, knowledgeable, experienced and reliable contractor (De Jong, et al., 2008). MTR is one of the most optimal contractors to fulfill those requirements. Thus the second sub-case study a two lines project: Hong Kong Airport Express & Tung Chung Line, which is one of the most representative and successful projects to serve as a special model i.e., a property and railway-related business model. More detailed information and discussion will be displayed later.

Before constructing a BOT arrangement for the new expansion project, I would like to investigate why there have been so few BOT or PPP projects in Sweden? Unfortunately I haven't found any literatures related to this question, and then I choose an approach of interview. Two interviewees are from a private firm and a public firm, respectively. More detailed analysis of the interviews will be showed later.

At the end of this section, I will form a BOT arrangement for the new expansion of the subway in Stockholm. Subsequently, I will use this BOT arrangement to compare with the current financial strategy adopted by SL and finally find out which one is advantage and where shows ascendancy.

### **4.1 The facts about the new expansion of subways in Stockholm**

The County of Stockholm is counted as one of the fastest growing regions in Europe. According to a population report of the County of Stockholm 2013, until the end of 2013 the population of the county was 2163042 and it increased to 36036 people within a year which is equal to 40% of the increased population of Sweden (Statistiska centralbyrån Statistics Sweden, 2013). In this sense, therefore the popula-

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tion of the County of Stockholm has increased by around 35000 people every year, as Fig. 4 shows. Furthermore, it is predicted that there will be around a half million more people in 20 years in the County of Stockholm (Statens Offentliga Utredning , 2013). In addition, as stated by The Swedish statistic center in a statistical report of the population of the County of Stockholm, although the net number of citizens born in Sweden, moving in and moving out of the County of Stockholm in 2013 is negative, both the net number of people not born in Sweden, moving in and moving out, and the net number of citizens moving in and moving out, of the County of Stockholm in 2013 are positive, as shown in Fig. 5, 6 & 7. Hence, the increase of population in the future is a certainty.

## Folkmängd i Stockholms län kvartalsvis 2000–2013

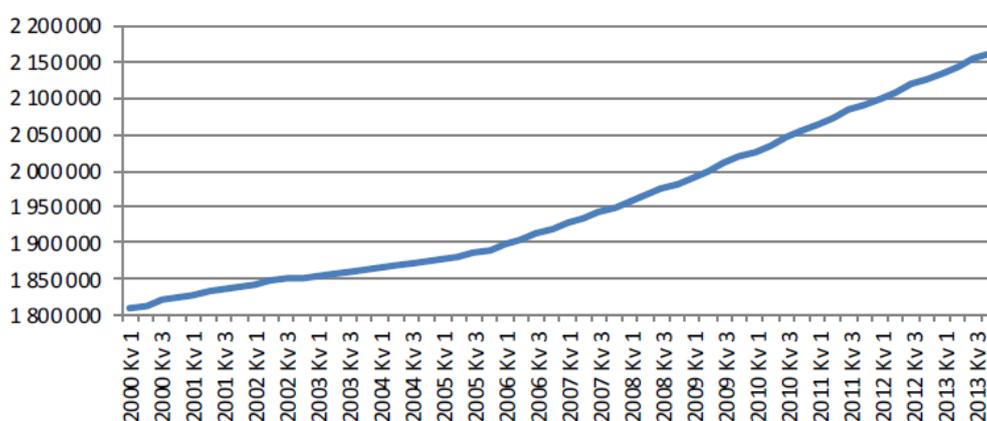


Fig.4 Folkmängd I Stockholms län kvartalsvis 2000-2013<sup>6</sup>  
Source: Statistiska centralbyrån Statistics Sweden (2013, p. 3)

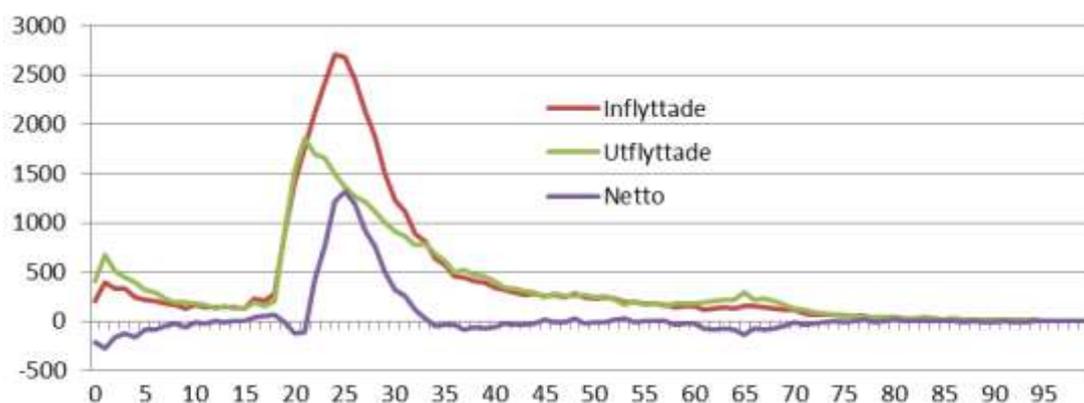


Fig. 5 Antal inrikes in- och utflyttade samt flyttningsnetto för Stockholms län under 2013, efter ålder<sup>7</sup>

<sup>6</sup> Translate from Swedish to English: The population in the County of Stockholm quarterly from 2000 to 2013

Source: Statistiska centralbyrån Statistics Sweden (2013, p. 6)

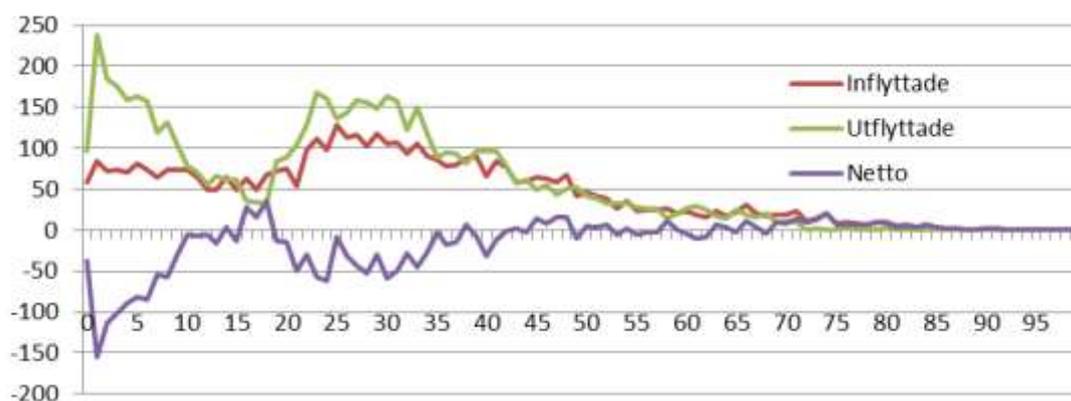


Fig. 6 Antal inrikes födda in- och utvandrade samt netto för Stockholms län under 2013, efter ålder<sup>8</sup>

Source: Statistiska centralbyrån Statistics Sweden (2013, p. 6)

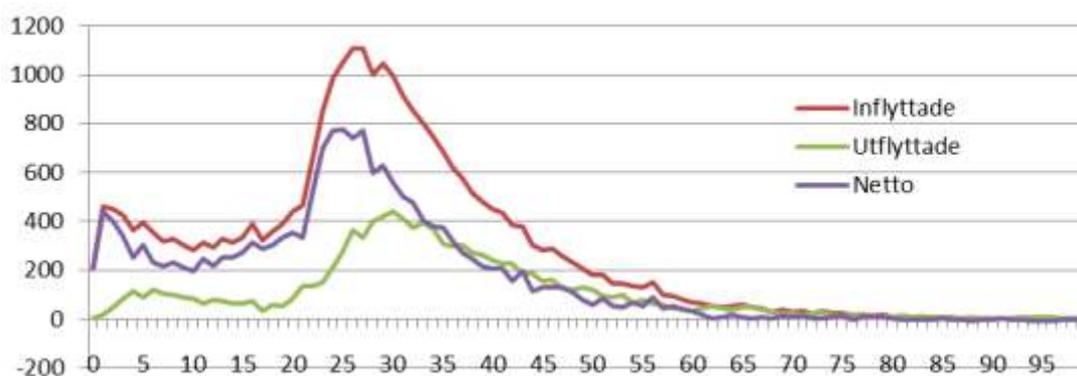


Fig. 7 Antal utrikes födda in- och utvandrade samt netto för Stockholms län under 2013, efter ålder<sup>9</sup>

Source: Statistiska centralbyrån Statistics Sweden (2013, p. 6)

On the other hand, many reports have pointed out that it is hard to find houses or apartments to live for those new people moving in. One reason is that the population

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<sup>7</sup> Translate from Swedish to English: Antal inrikes in- och utflyttade samt flyttningsnetto för Stockholms län under 2013, efter ålder=Number of citizens moving in and moving out plus net number of them for the County of Stockholm in 2013, by age; inflyttade=moving in; utflyttade= moving out; netto=net.

<sup>8</sup> Translate from Swedish to English: Antal inrikes födda in- och utvandrade samt netto för Stockholms län under 2013, efter ålder= Number of citizens born in Sweden, moving in and moving out plus net number of them for the County of Stockholm in 2013, by age.

<sup>9</sup> Translate from Swedish to English: Antal utrikes födda in- och utvandrade samt netto för Stockholms län under 2013, efter ålder = Number of people not born in Sweden, moving in and moving out plus net number of them for the County of Stockholm in 2013, by age.

has grown too fast; another reason is that there is a housing crisis in Stockholm. Besides new works and new companies have increased continuously in Stockholm, for instance, there were 25000 new jobs and 24000 new companies created in 2011 in Stockholm (Statens Offentliga Utredning , 2013). This means that there is or might be a shortage of office space as well.

Consequently, to ensure that the County of Stockholm grows normally, especially in terms of economic, social and environmental factors, housing crises, traffic jam problems, the impact of these issues must be reduced as much as possible. For this purpose, sustainable development, expansion of public transport is needed both for housing expansion and for the resolution of environmental issues.

However, public transport has a wide range of bus, train, plane, boat, subway transport. All requires big and high cost infrastructures. Then why does Stockholm need to expand the subway systems? Why not invest in roads? According to one report from The Authority of Traffic Analysis – “Stockholmsregionen är hårdast drabbad och kommer trots stora investeringar att vara hårt belastad med fler flaskhalsar år 2030 än i dag, både på vägar och spår. Trängseln i vägnätet beräknas att vara fem gånger större i kölängd räknat, eftersom vägtrafiken ökar betydligt snabbare (80 procent) än befolkningstillväxten (25 procent). Eftersom trängsel inte i längden kan byggas bort med väginvesteringar krävs betydande insatser för en utökad kollektivtrafik<sup>10</sup>”, the road traffic increases significantly faster (80 percent) than the growth of the population (25 percent). Therefore congestion cannot be reduced by investment in roads (Stockholmsförhandlingen, 2013, p. 22). Moreover, apart from road transportation, there is another kind of transportation which is very common in big cities and is more efficient, i.e., the subway. As is mentioned above, these kinds of infrastructures including subway projects cost extremely huge amounts, which might lead to that governments avoiding building infrastructures. Then problems caused by congestion will cost governments a lot of money too, for example, congestion creates a cost of over six billion Swedish kronor every year in Stockholm (Statens Offentliga Utredning , 2013). Six billion Swedish kronor amount to a huge cost and nearly 23% of the budget of the new expansion of the subway from 2014-2025 in Stockholm. So the possibility of avoiding expanded infrastructure by the governments is slight.

Accordingly, the County of Stockholm together with the state and the relevant municipalities, i.e., The City of Stockholm, Nacka Municipality, Solna Municipality and Järfälla Municipality, have decided to expand the current subway lines with 9 new stations, 19 km tracks and 78000 new homes (Statens Offentliga Utredning , 2013).

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<sup>10</sup> Translate from Swedish to English: Stockholm is the most affected and will be overloaded with more bottlenecks both on the roads and tracks in 2030 than today, regardless of its huge investments. Congestion on the road network is estimated to be five times greater in calculated queue length, because the road traffic increases significantly faster (80 percent) than the growth of the population (25 percent). Due to congestion, this cannot be remedied by road investments; rather, it requires significant efforts for an expanded public transportation system.



is built, the old Green line from Gullmarsplan and Hagsätra will be turned into the Blue line. The total investment of the new expansion project is SEK 25.7 billion at the price level of January 2013 (Statens Offentliga Utredning , 2013).

Table 4 Finansiering av infrastruktur (ej fordon och depå)<sup>12</sup>

Intäkter (mdkr i januari 2013 års prisnivå)	Summa	Gullmarsplan/ Söderort	Nacka	Haga- staden	Arena- staden	Järfälla/ Barkarby
Trängselskatter <sup>5</sup>	9,000	2,700	3,350	0,400	1,300	1,250
Statlig medfinansiering	3,825	1,250	1,750	0,125		0,700
Länsstyrelsen (länsplan)	0,825			0,825		
Kommunal medfinansiering, varav	5,200	1,750	1,450	0,700	0,500	0,800
Stockholms stad	2,950	1,750	0,600	0,600		
Nacka kommun	0,850		0,850			
Solna stad	0,600			0,100	0,500	
Järfälla kommun	0,800					0,800
Stockholms läns landsting	0,650	0,100	0,150	0,050	0,200	0,150
<b>Summa intäkter</b>	<b>19,500</b>					
<b>Summa finansiering</b>		<b>5,800</b>	<b>6,700</b>	<b>2,100</b>	<b>2,000</b>	<b>2,900</b>

Source: Stockholmsförhandlingen (2013, p. 10)

Table 4 is quoted from part report from Stockholmsförhandling 2013, namely Utbyggd tunnelbana för fler bostäder-delrapport från 2013 års Stockholmsförhandling<sup>13</sup>, which shows the detail of financing and co-financing of the new expansion project. The total investment excluding trains and depot is SEK 19500 million, almost half, i.e., SEK 9000 million, are from the traffic charges on imports at The City of

<sup>12</sup> Translate from Swedish to English: Financing and cofinancing of infrastructure (excluding trains and depots); Intäkter (mdkr i januari 2013 års prisnivå)= income (million Swedish kronor at the price lever of January 2013; Trängselskatter = traffic charges on imports at The City of Stockholm; Statlig medfinansiering = co-financing from the state; Länsstyrelsen = the county board, but this is under the control of the state and gains financial support from the state; kommunal medfinansiering = co-financing from municipalities; Stockholms läns landsting = the County of Stockholm; summa = total/sum.

<sup>13</sup> Translate from Swedish to English: Expanded the subway for more housing- partial report from Stockholmsförhandling 2013

Stockholm<sup>14</sup>. For instance, it has been decided to raise the traffic charge at import Essingeleden from 2016 with maximum charge SEK 30 and the tax on the current zone from 2016 with maximum tax SEK 35. The maximum charge per day has been increased to SEK 105. In this sense, a SEK 9000 million investment from the traffic charge isn't impossible. But since the traffic charge cannot be raised forever, therefore the traffic charge cannot be counted as a form of co-financing for the future new or expansion subway projects. ¼ of the total investment comes from the state of Sweden, i.e., SEK 3825 million. SEK 5200 million of the investment is from involved municipalities, namely The City of Stockholm, Nacka Municipality, Solna Municipality and Järfälla Municipality. It should be noted that there is not only SEK 650 million investments from SLL but SEK 6200 million investments for trains and depot from SLL too. Note that all numbers in Table 4 and Table 5 are given at the price level of January 2013 (Statens Offentliga Utredning , 2013).

*Table 5* Allocation of investment and the number of new homes among the relevant municipalities

The relevant municipalities	Investment for the new expansion project (SEK million)	Number of new homes
The City of Stockholm	2950	45900
Solna	600	4500
Nacka	850	13500
Järfälla	800	14000

Source: Statens Offentliga Utredning (2013)

As the agreement stated, there will be approximately 78000 new homes built in different the relevant municipalities, as Table 5 lists. According to the agreement on the new expansion of the subway in Stockholm, there will be around 40000 new homes along the influence areas of the subway from Gullmarsplan till Hagsätra, Farsta and Skarpnäck, around 3000 new homes in Hagastaden, around 2000 new homes in Hammarby sjöstad and around 900 new homes in Södermalm (Statens Offentliga Utredning , 2013). Moreover, since 2005 the average price of single-family homes has doubled. As stated by Svensk Mäklarstatistik AB, the average price for a villa and an apartment in the County of Stockholm are SEK 30000 /m<sup>3</sup> and SEK 38000 /m<sup>3</sup>, respectively. Typically for an apartment, price can vary from SEK 15000 /m<sup>2</sup>, in Nynäshamn to SEK 47000 /m<sup>2</sup>, in The City of Stockholm. In addition, prices for single-family homes are not going to fall (Länsstyrelsen Stockholm, 2013). As all known, profits from property development are quite big. According to the latest quarterly report from JM AB which is one of leading companies in property development in Nordic, profit from property development for residential housing in Stockholm is close to 19% (Nylander, 2013). Furthermore, according to Swedish law of landownership, land in Sweden can be separated into private and public. In private ownership,

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<sup>14</sup> There are several import regulations set in different parts of Stockholm, for example Essingeleden. There is a charge for each vehicle to go into The City of Stockholm through on imports.

owners can be private persons or private companies/organization. In public ownership, owners can be the state or municipalities. Every piece of land which will be used to build the subway must be acquired by negotiation. SL is responsible for land acquisition. According to the design of the subway line, SL knows which lands they need to build subway. Before negotiation, they have to get know who owns those lands through the author of landownership. Then they can begin negotiation with different landowners. Note that whether landownership is private or public, SL needs to gain lands by negotiation with landowners. This means SL might need to buy public lands. However, they might get land for free or at a very low price from the state or municipalities. Usually they don't get free land from private owners. In order to get lands with the prices as low as possible, normally SL needs to give landowners special offers, for example, make sure that one exit of a new subway station is not at the main entrance to a landowner's house. This situation is based on Swedish law, which means it doesn't matter if SL adopts BOT or not, this situation will not change. Back to topic of property development, as stated by Swedish land law, which has been mentioned above, municipalities own many lands within their own municipalities. Then they can build houses on lands owned by municipalities along with the new expansion project. In this sense, they can save lots of money from purchasing lands. Then the profits made by properties they control will be bigger.

In addition, through prices for single-family homes, as mentioned above, we can see that those the relevant municipalities are going to earn a lot from nearly 78000 new homes. But the total investment from the relevant municipalities is SEK 5200 million. This indicates that SLL suffers much more stress than the relevant municipalities. This result is typically caused by political decision-making.

Furthermore, old subway lines which were built in the 50's, 60's, 70's and early of 80's are owned and mainly financed by The City of Stockholm. Now the new expansion subway lines are owned by SLL and financed and co-financed by SLL and the relevant municipalities. This is the biggest difference between the past and the present. However there is one thing that hasn't changed. That is that both The City of Stockholm and SLL know that profit made by property development can pay off or partly pay off the costs of the construction of subway lines. In the past, The City of Stockholm owned lots of land in the city and some in other nearby municipalities. Residential areas along the old subway lines, especially shopping centers, high skyscrapers for apartments and so on, were built in conjunction with the subway. Most of them are developed and owned by The City of Stockholm (Löf, 2014). Although the old subway lines were financed mostly by The City of Stockholm, but most properties were developed and owned by The City of Stockholm too. Again this indicates that the money earned from property development can pay off or partly pay off the cost of the construction of the subway. In this sense, the stress of financing subway projects for The City of Stockholm was much less than it might otherwise have been.

Today the relevant Swedish laws have changed. SLL is responsible for public traffic in the County of Stockholm. According to Swedish tax law, 18% of personal income goes to municipal tax and 12% goes to county tax. Roughly 4/5 of the tax of the County of Stockholm will pay health care and rest will pay for public traffic, as Fig. 9 shows below. Moreover, according to Table 6 and 7, operating expenses of the public

traffic contributed by the tax of the County of Stockholm is SEK 7554 million (bought traffic + contributions to SL and WÅAB), among the total income of the tax of the County of Stockholm 2012 SEK 54800 million. Therefore, the total money invested yearly in public traffic is not very much. In addition, in accordance with the economic report in The Annual Report 2012 from SL, SEK 6402 million contributed by the county tax paid off nearly half the cost of public traffic operation in the County of Stockholm (AB Storstockholms Lokaltrafik, 2013). The rest of the contributions, excluding WÅAB, were little. From this analysis, we can see that there is very little money left, which is from the county tax for public traffic after paying off the yearly operating expenses of public traffic, for investing new infrastructure including subways. Furthermore, in the economic report of The Annual Report 2012 from SL, the yearly fare revenue of SEK 6505 million all went to pay off operating expenses (AB Storstockholms Lokaltrafik, 2013). There was no money from fare revenue that could be invested to build new infrastructure.

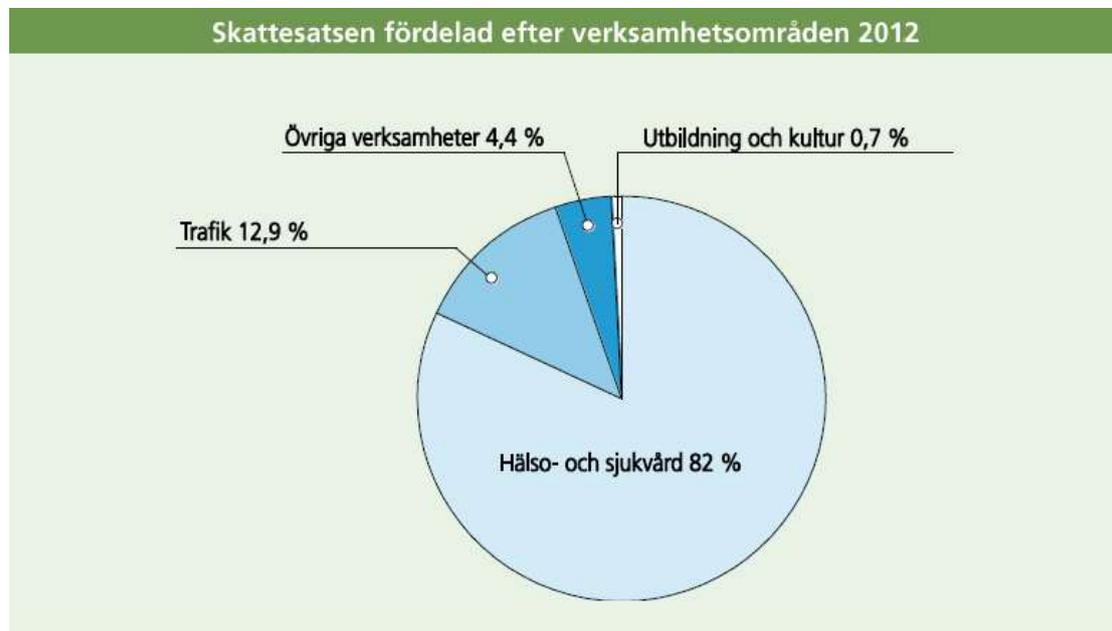


Fig. 9 Skattesatsen fördelad efter verksamhetsområden 2012, Stockholms län<sup>15</sup>  
 Source: Stockholms läns landsting (2013, p. 2)

15 Translate from Swedish to English: Skattesatsen fördelad efter verksamhetsområden 2012, Stockholms län=Tax rate distributed by activity 2012, the County of Stockholm; Trafik=traffic; Hälsa- och sjukvård=health and care; utbildning och kultur=education and culture; övriga verksamheter=other activities.

Table 6 Intäkter efter intäktsslag 2002-2012, miljoner kronor, Stockholms län<sup>16</sup>

Landstinget	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Patientavgifter, sjukvård	283	311	412	417	406	406	438	406	406	398	434
Patientavgifter, tandvård	0	0	3	0	0	0	0	0	0	0	0
Trafikantavgifter	104	108	128	121	115	142	147	163	160	171	179
Såld hälso- och sjukvård	487	508	742	783	897	924	975	1 035	1 101	1 113	1 189
Såld tandvård	0	0	4	5	4	4	2	1	0	0	0
Försäljning av övriga primärtjänster	100	83	81	79	92	91	97	81	64	69	61
Hysesintäkter, försäljning övriga tjänster, material och varor	1 769	1 760	1 632	1 653	1 782	1 801	1 844	2 020	2 048	2 113	2 211
Statsbidrag och övriga bidrag	1 874	1 949	1 744	1 796	1 862	1 708	1 685	2 138	1 867	2 052	2 192
Övriga intäkter	177	43	84	147	350	289	475	500	486	775	1 111
<b>Summa verksamhetens intäkter</b>	<b>4 794</b>	<b>4 762</b>	<b>4 830</b>	<b>5 001</b>	<b>5 508</b>	<b>5 366</b>	<b>5 663</b>	<b>6 345</b>	<b>6 133</b>	<b>6 691</b>	<b>7 378</b>
Skatteintäkter	31 939	38 305	40 784	41 221	43 243	45 459	47 819	49 433	50 077	52 190	54 800
Generella statsbidrag <sup>1)</sup>	3 867	4 113	4 309	4 443	4 668	4 649	4 575	5 016	5 392	5 430	4 773
Bidrag och avgifter för utjämning <sup>1)</sup>	-2 666	-3 716	-3 810	-2 048	-1 976	-1 396	-1 186	-1 257	-385	345	-80
<b>Summa skatteintäkter, generellt statsbidrag och utjämning</b>	<b>33 140</b>	<b>38 702</b>	<b>41 283</b>	<b>43 616</b>	<b>45 935</b>	<b>48 712</b>	<b>51 209</b>	<b>53 191</b>	<b>55 085</b>	<b>57 965</b>	<b>59 493</b>
Finansiella intäkter	183	180	173	292	219	183	143	355	341	447	535
<b>Summa intäkter</b>	<b>38 117</b>	<b>43 644</b>	<b>46 286</b>	<b>48 909</b>	<b>51 662</b>	<b>54 261</b>	<b>57 015</b>	<b>59 891</b>	<b>61 558</b>	<b>65 103</b>	<b>67 407</b>

Source: Stockholms läns landsting (2013, p. 3)

Table 7 Kostnader efter kostnadsslag 2002 – 2012, miljoner kronor, Stockholms län<sup>17</sup>

Landstinget	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Personalkostnader	10 595	11 162	14 107	14 629	15 255	15 847	16 513	15 508	15 625	16 648	17 336
Köpt hälso- och sjukvård	13 885	15 280	12 583	13 356	13 125	13 702	15 141	17 252	18 406	19 120	20 197
Köpt tandvård	548	600	610	622	629	659	682	705	736	764	801
Köpt trafik	757	808	760	743	751	770	791	857	894	951	917
Köpta övriga primärtjänster	40	41	37	20	21	20	22	23	19	20	16
Verksamhetsanknutna tjänster (lab., röntgen m.m.)	1 114	1 299	1 210	1 313	1 514	1 644	1 501	1 709	1 447	1 515	1 574
Läkemedel inom läkemedelsför- månen	3 778	3 968	3 924	4 641	4 069	4 172	4 333	4 514	4 598	4 810	4 717
Övriga material och varor	1 404	1 232	1 923	1 389	2 171	2 442	2 678	3 045	2 577	2 828	2 940
Lämnade bidrag	1 289	1 371	870	915	1 973	2 073	1 871	1 885	2 071	2 096	2 201
Lämnade bidrag till SL och WÅAB <sup>1)</sup>	..	3 861	3 820	4 125	4 588	5 346	5 883	6 157	6 261	6 511	6 637
Lokal- och fastighetskostnader, hyra av anläggningstillgångar	1 709	1 687	1 734	1 840	1 961	2 028	2 167	2 227	2 241	2 227	2 259
Övriga kostnader	2 374	2 526	2 362	2 741	2 726	2 880	3 153	3 242	3 343	3 525	3 472
Jämförelsestörande poster	..	..	..	..	2 374	117	282	105	93	440	0
<b>Summa verksamhetens kostnader</b>	<b>37 493</b>	<b>43 835</b>	<b>43 940</b>	<b>46 334</b>	<b>51 157</b>	<b>51 701</b>	<b>55 016</b>	<b>57 228</b>	<b>58 311</b>	<b>61 455</b>	<b>63 066</b>
Avskrivningar	568	628	815	874	940	1 004	1 033	1 057	1 112	1 131	1 220
Finansiella kostnader	1 024	968	769	750	773	861	750	930	673	1 937	950
Lämnade aktieägartillskott <sup>1)</sup>	3 596	..	..	..	..	..	..	..	..	..	..
<b>Summa kostnader</b>	<b>42 681</b>	<b>45 431</b>	<b>45 524</b>	<b>47 958</b>	<b>52 870</b>	<b>53 566</b>	<b>56 799</b>	<b>59 214</b>	<b>60 096</b>	<b>64 523</b>	<b>65 236</b>

1 Fr.o.m. 2003 redovisas landstingets bidrag till SL i posten "Lämnade bidrag till SL". Bidraget redovisades t.o.m. 2002 som aktieägartillskott.

Source: Stockholms läns landsting (2013, p. 5)

<sup>16</sup> Translate from Swedish to English: Intäkter efter intäktsslag 2002-2012, miljoner kronor, Stockholms län=Revenues by revenue activity from 2002 to 2012, million Swedish kronor, the County of Stockholm; skatteintäkter=tax income.

<sup>17</sup> Translate from Swedish to English: Kostnader efter kostnadsslag 2002 – 2012, miljoner kronor, Stockholms län=Costs by cost activity from 2002 to 2012, million Swedish kronor, the County of Stockholm; köpt trafik=bought traffic; Lämnade bidrag till SL och WÅAB=contributions to SL and WÅAB.

Let me take year 2012 as an example year. The increase rate of the population in the County of Stockholm is around 1.7% (population increase 35533 in 2012, the population of 2012 was 2127006) (Statistiska centralbyrån Statistics Sweden, 2013). Then the yearly county tax increased SEK 931.6 million, SEK 121.1 million among SEK 931.6 million was contributed to public traffic. The increased operating expenses of public traffic based on the increased population were SEK 128.4 million which was more than the increased contributions for the public traffic based on the increased population (SEK 121.1 million). Moreover, as mentioned in section 4.1, there will be around 35000 increases per year in population in the County of Stockholm. Due to yearly increased population has no big change year to year, but population has around 35000 increases every year. Thus, actually, yearly increase rate of the population will be decrease year by year. In this sense, net tax based on increased population (increased contributions for public traffic minus increased operating expenses of public traffic) is negative. Accordingly, we can ignore contributions from increased population to the new expansion project.

#### **4.2.2 Summary**

The conclusion of the current financial strategy adopted by SLL for the new expansion of the subway in Stockholm:

1. Almost half of the budget of the new expansion project (except trains and depot) is planned to come from traffic charges at imports of The City of Stockholm. To achieve this plan, the traffic charge at imports of The City of Stockholm will be increased. For the current project, the traffic charge increase can fix the problem of the shortage of financial resources. However, due to the fact that the traffic charges cannot be increased forever then the problem of the shortage of financial resources for future projects must rely on other solutions.
2. The increase of population demands the expansion of public traffic, but the increased county tax based on population increase cannot help the huge budget of the new expansion project.
3. Whether past or present, the idea of using profits earned by property development to pay off or partly pay off the cost of the construction of the subway has not changed. Since the substantial profits made by property development are visible.
4. The allocation of the investment for the new expansion project is not balanced. It shows as the substantial profit of property development is much more than the investment for the project contributed by the relevant municipalities. This means that SLL assumes a much bigger burden than that assumed by the relevant municipalities.

### **4.3 Some case studies of BOT projects**

#### **4.3.1 Sub-case study 1: Arlanda Express**

##### **4.3.1.1 Project description**

The Arlanda Express which is also called as the Arlanda rail link, is a two-track railway including “works to Stockholm central station, connections to the existing rail

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network between Stockholm and Uppsala, and three new stations at the Airport (one for existing regional rail services and two for the Arlanda Express)” (UCL Omega Centre, u.d., p. 1). The whole link is a total of 20km which includes a 7km tunnel. The actual cost is USD 1.07 billion (at the price level of 2010, US. dollar) which is 3% under budget. Moreover, this rail project is the first BOT project in Sweden. The public sector is represented by the Swedish government while the private sector is the Arlanda Link Consortium (ALC) which has changed the name to A-Train during the operation period and was comprised of GEC Alstom Group, NCC AB, SIAB AB, Svenska Kraftbyggarna Entreprenad AB and John Mowlem Group<sup>18</sup> before 2004. In 2004 ALC sold its shares to Macquarie Group Limited (which is an Australian investment company) but the name of operator is still A-Train (the Swedish OMEGA Partner, Lund University, u.d.). The construction of Arlanda Express was started in Nov. 1995 and completed 13 months ahead of schedule. The operation of Arlanda Express was started in Nov. 1999. According to the BOT contract, after construction, the physical infrastructure belongs to A-Banan Project AB which is a state-owned client company but leased to A-Train AB for monopoly use of the railway for 45 years. Under 45-year concession, excluding operating transport services and in charge of the maintenance and repair of the construction, A-Train is required to allow access to other rail companies for a ‘non-discriminatory’ fee (UCL Omega Centre, u.d.).



Fig. 10 Arlanda Express map  
Source: UCL Omega Centre (u.d., p. 1)

#### 4.3.1.2 Project funding

According to the BOT contract between the Swedish government and ALC, the Arlanda Express project is co-financed by both the government and ALC, namely 55% public, 45% private. Specifically, the government funded two of three sections, i.e., “Section A: upgrading the line haul from Stockholm to Rosersberg from dual-track to four-track; and Section C, the North Bend: providing a connection from Arlanda back to the main line at Odensala”; ALC as the private sector was invited to

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<sup>18</sup> GEC Alstom Group is an English supplier of rolling stock and electro-mechanical equipment; NCC AB is a Swedish construction company; SIAB AB is a Swedish construction company; Svenska Kraftbyggarna Entreprenad AB is a Swedish construction company; John Mowlem Group is an English construction group.

Section B: “building a branch line from Rosersberg to the Airport and three underground stations, and operating an express service between Stockholm and the Airport” (UCL Omega Centre, u.d., p. 1).

However, without state subsidies, the project would not be feasible (UCL Omega Centre, u.d.). As Table 8 stated, the total private sector funding was SEK 1.7 billion which was 45% of the total funding. Besides this, A-Train got a subsidy for SEK 850 million from the Swedish state in 1995 and the government agreed to the leasing of the rolling stock.

Table 8 Funding of Section B

ALC funded the SEK 2.7 billion cost of Section B	Bank loans	SEK 1.1 billion
	Stipulated loan from the government	SEK 1 billion
	Equity	SEK 0.4 billion
	Loans from its partners	SEK 0.2 billion

Source: UCL Omega Centre (u.d.)

In order to get the stipulated loan from the government, A-Train promised to give a share of its revenue at a fixed rate during the operation phase. However, there is another reason why A-Train got the conditioned loan. That is, due to the fact that the only profit is made by ticket sales after the construction and A-Train estimated that the repayment for the investment for the project construction was not expected until towards the end of the 45-year period, to encourage investors the government was willing to offer a stipulated loan to A-Train. In this case, the government was at risk itself on good sales of tickets. Unfortunately passenger numbers were overestimated as Table 9 indicates. They believed too much on the positive growth in flight passengers. The possible reason for this could be that when the government planned for Arlanda Express, Arlanda airport was the dominant airport in the Stockholm region, but today there are two more large airports in the region, Bromma Airport and Skavsta Airport. Moreover due to high train fares, they lost the ability to compete with other competitors, such as Airport buses, taxi, etc., as Table 10 shows below

Table 9 Prognosis of number of travelers on the Arlanda rail link

Year	Prognosis on number of passengers (BV 1990)	Prognosis on number of passengers (prop. 1993:94:213)	Actual outcome, number of passengers	Relative increase from previous year	Relative increase since 2000	Expected increase related to 2000 (BV 1990)
2000	6,800,000		2,100,000			
2001			2,900,000	38%	38%	
2002	7,200,000		2,750,000	- 5%	30%	5%
2003			2,550,000	- 7%	21%	
2005	7,600,000	5,100,000				12%
2020	10,200,000	7,400,000				50%

Source: The Swedish OMEGA Partner, Lund University (u.d., p. 40)

Table 10 Market shares for different modes of transportations to Arlanda airport

	1999	2001	2003
Arlanda Express	-	19	19
Other trains	-	4	5
Airport buses Stockholm	24	14	13
Airport buses Uppsala	-	2	2
Other buses	-	4	4
Taxi	23	22	21
Car	35	35	35
Other	10	3	4
No response	8	-	0.2

Source: The Swedish OMEGA Partner, Lund University (u.d., p. 41).

Excluding the risks taken by the government which are mentioned in the previous paragraph, another risk is that A-Train has the right to delay to pay the rents for Stockholm central station and Arlanda airport without any interest during the first 7 years of operation. The value of this could reach to SEK 90 million after 7 years (the Swedish OMEGA Partner, Lund University, u.d.).

Furthermore, when the Macquaire Group bought A-Train AB in 2004, apart from all shares in A-Train it also bought the debt of SEK 400 million. This implied that ALC had produced a loss of SEK 200 million at that time.

#### 4.3.1.3 Summary and comparison

When the proposal of the Arlanda Express project came out, the benefits were stated as timesaving, ticket revenues, lower emissions and reduced congestion. The Arlanda Express project was completed 13 months earlier which achieved the goal of timesaving. As previously discussed, for various reasons, ticket revenues were not much as forecast. As Table 9 shows, the number of passengers increased, which means that more and more passengers chose the train instead of cars and taxis. This implies that a certain emission is reduced. Since more and more passengers took the train, therefore traffic volume on roads decreased, which leads to reduced congestion.

Furthermore, there are few more highlights about the Arlanda Express:

- a) The project was intended to be funded by the private sector as much as possible, which released the public economy from a great investment. This was the main purpose of the BOT arrangement;
- b) The actual cost of the project was 3% under the budget;
- c) The project was completed 13 months ahead of schedule, which implies that private companies can run business more efficiently than the government can;
- d) The project was the first BOT project in Sweden. This could lead to the idea that the government had expected much of the project. To induce private investors, the government decided to give monopoly control of ticket fares to the private sector. This also reduced public welfare;

- e) After the construction, the physical infrastructure was handed over to the government but leased to A-Train AB for operation.

Unlike the subway system in Stockholm, Arlanda Express is counted as a railway project, which follows different laws than the law for subway projects. In the 1980s, the national structural holding of the railway network was re-structured in Sweden. The main change is that the Swedish state railways (SJ) operated trains continuously while the National Rail Administration (NRA) which was founded in 1988 is in charge of rail infrastructure. Afterward, the railways, i.e., tracks, were owned by NRA while trains could have different owners. This means different railway transport service companies such as SJ can operate their own trains by hiring tracks. This is the biggest difference between railway and subway in Sweden.

Under operation phase, A-Train also controls the station fees including other train companies running the distance. This means A-Train has the full right to decide the ticket price, which might reduce the social welfare. The reasons why the government gave A-Train the right of implementing a monopoly are argued above. However, people don't need to go to Arlanda Airport every day. The journey to Arlanda Airport is not included in people's daily life. Therefore a certain monopoly of ticket fare is allowed.

### **4.3.2 Sub-case study 2: Hong Kong Airport Express**

As mentioned previously, one of the reasons that why MTR became one of the world's leading railway companies is its special model: a property and railway-related business model. Thus a representative project which refers to this special business model should be chosen; even that project isn't BOT project. Hong Kong Airport Express (AEL) is the best choice. In this sub-section, I will analyze the Hong Kong Airport Express project in order to study the special business model from MTR.

#### **4.3.2.1 A short introduction to MTR Corporation Limited**

As mentioned before, it is important to select a credible, knowledgeable, experienced and reliable contractor, in order to implement a BOT contract successfully (De Jong, et al., 2008). Does MTR fulfill this requirement? Let's take a closer look at MTR.

MTR Corporation Limited as one of the world's leading railway companies did not just develop a subway system in Hong Kong; it also is one of the few railway companies which really make a profits. Or in another word, "while overseas governments have been subsidising their inefficient rail operators for years, MTR has not cost Hong Kong taxpayers a single cent, and remains one of the few unsubsidized rail companies" (Li, 2005, p. 3). This makes people wonder if MTR has a business secret. Yes, it has a secret. "The secret of its success is its rail and property business model. It works this way: a government gives MTR negotiated rights to develop property complexes alongside its rail stations and depots. The administration is then able to obtain full market value for the land, while MTR develops the sites with other developers, shares the profits, and then invests back into its rail system. Clearly it is a win-win situation and it has been at work for more than two decades" (Li, 2005, p. 3).

The previous paragraph might make you curious about MTR. Then it would be interesting to discover more about MTR. MTR was established in 1975 and 100% owned by the HK Government<sup>19</sup>. The name when it was created was Mass Transit Railway Corporation. This is the first marked milestone of its history. Totally there are 3 marked milestones since its creation. In June 2000, HKSAR<sup>20</sup> sold 23% of its issued shares to private investors and changed the corporation's name to MTR Corporation Limited. In October of the same year, shares of MTR Corporation Limited joined the Stock Exchange of Hong Kong. Since then MTR made its second marked milestone, namely becoming a shares-listed company in Hong Kong (MTR Corporation Limited, 2011). The third marked milestone was on 2 Dec. 2007 when the other railway operator, the Kowloon-Canton Railway Corporation, which was also owned by HKSAR, was merged into MTR. Since then MTR operates 9 commuter railway lines, a Light Rail network and Hong Kong Airport Express, as Fig. 11 shows below (MTR Corporation Limited, 2011).

The initial mission, at its establishing was to create an urban metro system under judicious commercial principles. With MTR's development and growth, this initial mission also evolved into a new business model, i.e., property and railway-related business model. Property business activities include residential and commercial project development, and property leasing and management. "Today, the Corporation has completed developments at 33 MTR stations, generating some 94,000 housing units and more than 2 million square meters of commercial space" (MTR Corporation Limited, 2011, p. 6). Of these, there are many famous buildings in Hong Kong or in the world, such as the 188-storey International Commerce Centre (ICC) in West Kowloon and the 88-storey Two International Finance Centre (IFC) in the Central Business District (CBD) on Hong Kong Island. They both are most marked projects of property development along AEL and are two of top 20 of the tallest buildings in the world. Furthermore, as Fig. 12 shows, these constitute sources of profits contributed by property development and Hong Kong property rental and management business are close to or more than half of the total sources of profits. Hence, in followed paragraphs, I am going to open an in-depth discussion regarding of this new business model.

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<sup>19</sup> 'HK Government' refers to the Hong Kong Government before the handover on 1 July 1997.

<sup>20</sup> 'HKSAR' refers to the Hong Kong Special Administrative Region Government after the handover on 1 July 1997.



#### 4.3.2.2 Project description

AEL which was 34.8 km long before its expansion was built for the purpose of express service directly between city center and airport. Today, AEL has a total length of 35.5 km and operates between CBD and The Asia World Expo (University of Hong Kong, 2008). Moreover, it has been regarded as the world's first railway built, particularly, to serve an airport. The Tung Chung Line (TCL) which is 31.1 km was constructed as a slower stopping service on the same alignment and also serves the new town of Tung Chung in Lantau, Hong Kong (UCL Omega Centre, u.d.). To support the new developments on the West Kowloon Reclamation and provide a third cross-harbor rail link are the other two main purposes of creating AEL and TCL. Since AEL and TCL share tracks, tunnels and stations partly and was constructed at the same time, they usually are regarded as one project, as Fig. 13 and Fig. 14 show. So in the paper, when I discuss about AEL, it actually includes TCL as well.

AEL was one part of the Airport Core Programme (ACP). AEL doesn't just serve the airport; together with TCL, AEL also helps to relieve congestion in the Nathan Road section of the Tsuen Wan Line (University of Hong Kong, 2008). A feasibility study showed that road bridge tolls and air passengers grew continuously, which contributed to the viability of AEL project.

“Government objectives (for both AEL and TCL):

- to serve as an express service from the airport to the urban areas;
- purposely designed and built to offer the maximum comfort and convenience to airport users;
- to serve the new developments on the West Kowloon Reclamation;
- to provide a third cross harbor rail link;
- to relieve the crowded Nathan Road section of Tsuen Wan Line.

MTRC objectives:

- to serve the new airport;
- to alleviate congestion in the existing network which was saturated, especially in the Kowloon area;
- there should be an acceptable commercial return on the investment.”

(University of Hong Kong, 2008, p. 12)



Fig. 13 Map of AEL  
Source: University of Hong Kong (2008, p. 10)

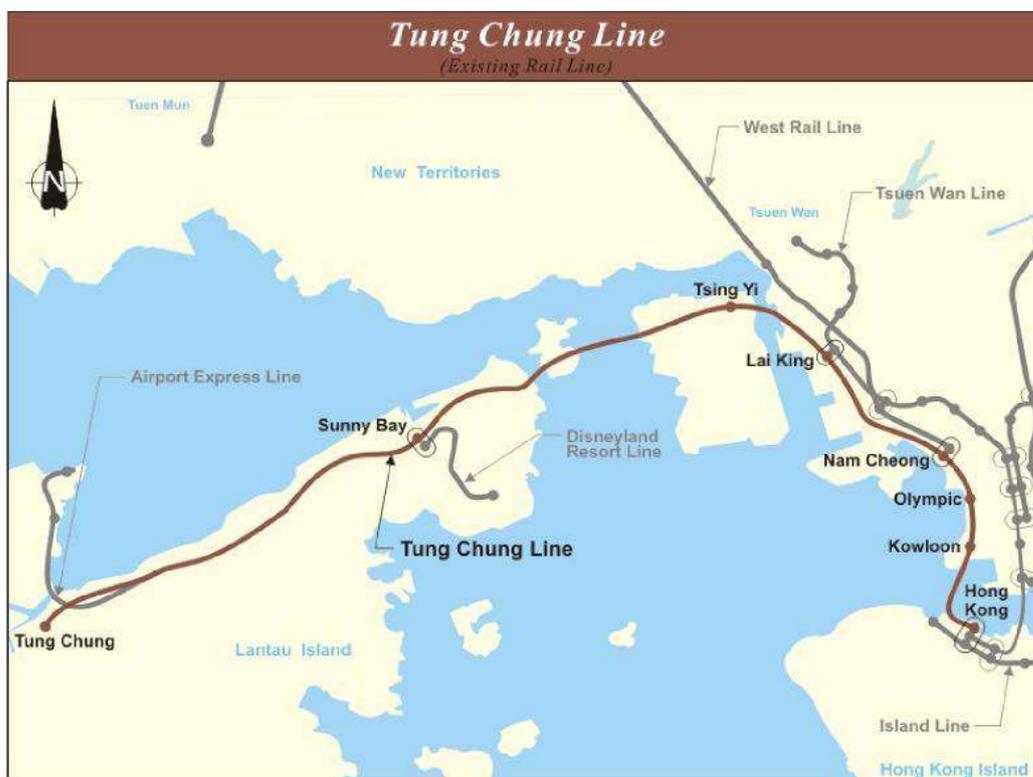


Fig. 14 Map of TCL  
Source: University of Hong Kong (2008, p. 10)

The planning of AEL project started in 1989. The project was developed by MTR, and construction started to construct in 1994 on newly reclaimed land and it opened in 1998. It contained 6 stations, Hong Kong Station, Kowloon Station, Olympic Station, Tsing Yi Station, Tung Chung Station and Airport Station, and one depot, Siu Ho Wan Depot, with an opening event. Later Nam Chung Station and Sunny Bay Station, with an extension to Asia World Expo opened in 2003 and 2005 respectively (University of Hong Kong, 2008). The railway tracks and railway-related property development of AEL project are mostly constructed on newly reclaimed land. The budget of the project was USD 4.29 billion but the actual cost was USD 4.37 billion (both at the price level of 2010). In general, the project was completed 12 months behind schedule and cost 2% more than was budgeted (UCL Omega Centre, u.d.).

#### 4.3.2.3 Project funding

AEL project was designed, constructed, managed and operated after the opening by MTR. As mentioned above, the cost of the project was USD 4.37 billion and was co-financed by both public and private sources, i.e., 68% and 32%, respectively (UCL Omega Centre, u.d.).

With regarding to the BOT projects' attribution, decisions by the public sector (government) always refer to political decision or political situation, which were particularly evident on AEL project. One of the most important milestones in Hong Kong's history was that the British Government handed over Hong Kong to the Chinese Government on 1 July 1997. However to guarantee that the economy of Hong Kong grow as normally as before, the Chinese Government has granted Hong Kong the status of a Special Administrative Region which has a more open and free trade market, and established The Hong Kong Special Administrative Region Government, HKSAR for short.

Since the project period of AEL crossed over two governments' reigns. Thus the topic of how much debt the HK Government should be left with on 1 July 1997 was once a matter of concern. China was worried that "Hong Kong would be left servicing massive debts created by airport expenditure" (University of Hong Kong, 2008, p. 75). Hence, there was a memorandum assigned by the Governments of the United Kingdom and China in Sept. 1991. The main content of the Memorandum of Understanding (MOU) was a listed below:

- "The HK Government would complete the ACP projects before 30 June 1997;
- The Chinese Government would support the construction of the airport and related projects. In particular the HK Government would be free to borrow as necessary provided the total debt to be repaid after 30 June 1997 was not more than HKD 5bn. The Chinese Government would adopt a positive attitude to necessary and reasonable borrowing by the HK Government to be repaid after 30 June 1997;
- Hong Kong's fiscal reserves would not be less than HKD 25bn on 30 June 1997."

(University of Hong Kong, 2008, p. 75)

Before the construction, there were four financial packages on AEL project composed by the British/HK Government and submitted to the Chinese Government from 1992

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to 1994 (University of Hong Kong, 2008). China rejected all of them due to the fact that they believed that the plans, which refer to the four financial packages, especially the amount of loans borrowed by MTR for operational phase of AEL would leave a huge debt to HKSAR after 1 Jul. 1997. The difficult process of negotiations proves that a complex political context influences decision about financial strategy. Besides, AEL is one part of ACP, which means that any delay of other projects of ACP could affect the construction period of AEL. In reality, the long-lasting negotiations between the two governments did really postpone the completion of the project (University of Hong Kong, 2008). Eventually, on 4 Nov. 1994, the Chinese Government and the British Government signed the ‘Agreed Minute on Airport Financing’ (University of Hong Kong, 2008).

Moreover, due to the fact that AEL was regarded as a project with limited passenger volumes as forecast, high construction costs and unpredictable patronage were involved. The forecast of limited passenger volumes was proved later in the form of ticket fare revenue, as Table 11 shows. The project developer, MTR, wasn’t interested in the non-commercial attractive project, i.e., AEL. However, AEL project is one part of ACP, plus “In reality, firms often receive large side benefits from accepting BOT offers, which also helps cover part of the investment costs” (Qiu & Wang, 2011, p. 131), thus the HK Government still supported the project with commercial offers (University of Hong Kong, 2008). Simply, excluding the equity injection by the HK Government, MTR also got 62 hectares of adjacent land granted by the HK Government for property development (UCL Omega Centre, u.d.). Here the equity injection refers to the loans borrowed by MTR from the Government. In short, the major financial sources for AEL project were from the Government, which is listed below:

- Equity injection
- Bank loans
- Revenues from property development along AEL.

(University of Hong Kong, 2008)

*Table 11* Airport Express fare revenue and its percentage share of total yearly fare revenue (HKD million)

	Year	Fare revenue per year	Percentage share of total yearly fare revenue
Airport Express	2000	252	10%
	2001	279	11%
	2002	275	11%
	2003	176	7.4%
	2004	246	9.4%

Source: MTR Corporation Limited (2005) (2004) (2003) (2002)

Note that the main contributor for financing AEL was the HK Government. Moreover, apart from gaining funding from the HK Government, MTR also got financing from more than 170 institutions including different banks.

In general, for MTR, “there were ‘four pillars’ underpinning the financing of the Airport Railway:

- Injection of initial equity by the shareholder;
- Deferral of dividend payments on previous investments to the shareholder;
- Profits from railway-related property development; and
- Borrowing from the financial markets.”

(University of Hong Kong, 2008, p. 84)

Equity injection and bank loans are very common financial sources for financing public projects. Moreover, as mentioned above, MTR as one of the few railway companies which made profits in reality has its own special business model i.e., a property and railway-related business model. Therefore, in the followed paragraphs, through AEL project, I will investigate explore how MTR implements this special business model.

#### 4.3.2.4 Revenue from AEL

“Revenue from the Railway consists of fare revenue from passengers, income generated from commercial activities at railway stations, and the useful recurrent estate management income contributed from completed property development along the lines” (University of Hong Kong, 2008, p. 88).

First of all, it is important to review profit contributed by property development. Since profit made by property development was a major source of finance for AEL. When it comes to property development, first, MTR got negotiated right empowered by the Government<sup>21</sup> to purchase development sites for property development at commercial valuation prices. Development sites were situated above AEL stations and also along AEL. Note that only the Government has the right to grant land premiums for sale. Therefore, the Government also gained the full market value of the land. After land had been purchased, MTR formed a joint venture with other property developers to plan and construct wholly integrated commercial and residential communities above the stations and along AEL line (MTR Corporation Limited, 2011). The reason for that some developments sites were located above AEL, is that design and construction both for the stations and the residential & commercial integrated communities can be combined together to make works more efficient and save time. After construction, MTR shared profits with developers and then invested them back into its rail system. For example, one project of AEL property development is Two IFC located at Hong Kong Station. Although developer of office at Two IFC is Sun Hung Kai Properties Ltd., but MTR still owns marketing of the 18 floors of Two IFC, which brings several billion Hong Kong dollar profit from sharing in kind (MTR Corporation Limited, 2004). Furthermore, profits made by property rental are really high, as Fig. 15 shows. Hence, apart from development of residential and commercial projects, property leasing and management also can bring significant profits to MTR. Moreover, in general,

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<sup>21</sup> ‘The Government’ refers to the HK Government before 1 Jul. 1997 and HKSAR after 1 Jul. 1997.

property development is located around stations, making it convenient for residents to access public transport. Besides, it also motivates patronage and enhances land values.

With reference to AEL project, although HKD 35.1 billion finance was funded by equity and debt, about 10 % internal rate of return over a 40-year period makes the project viable (University of Hong Kong, 2008). Furthermore, according to the financing agreement assigned by the HK Government and MTR, there are five sites along AEL including TCL have been identified for property development, namely Hong Kong Central, Kowloon, Olympic (Tai Kok Tsui), Tsing Yi and Tung Chung (University of Hong Kong, 2008). Payments received from developers are earned from property development. Apart from payments used to offset costs encountered in respect to the same development, the excess part of payments is regarded as ‘deferred income’ i.e., Note A in Table 12. “Deferred income is to be recognized as MTRC profits at the appropriate time after charging any remaining costs related to foundation and site enabling works, and after taking into account the outstanding risks and obligations retained by MTRC relating to each development” (University of Hong Kong, 2008, p. 90). In this sense, we can see that the profit made by MTR through property development of AEL project is optimistic, as Table 11 shows below.

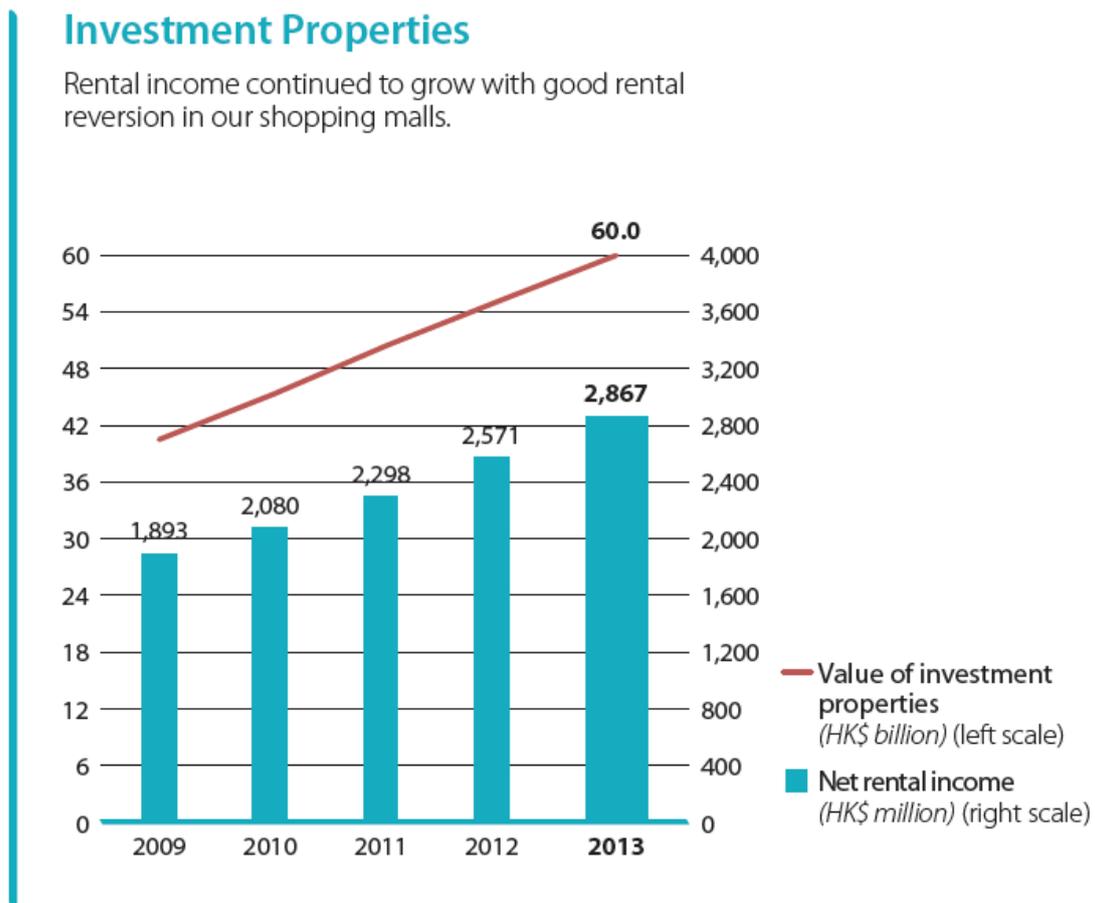


Fig. 15 Investment properties  
Source: MTR Corporation Limited (2014, p. 7)

In Hong Kong, the population statistics from The Census and Statistics Department of HKSAR Government shows that there were around 7.2 million people by the end of 2013 (Census and Statistics Department of the Government of the Hong Kong Special Administrative Region, 2013). Different from Stockholm, Hong Kong has 5 times more people than the County of Stockholm. This implies that the market for development of residential housing is huge. Fig. 16 shows that income from development of residential housing is a main contributor to Hong Kong's property management.

### Distribution of Hong Kong Property Management Income

At the end of the year, the Company had 90,523 residential units and 763,018 sq.m. of commercial and office space under management in Hong Kong.

(Percentage)

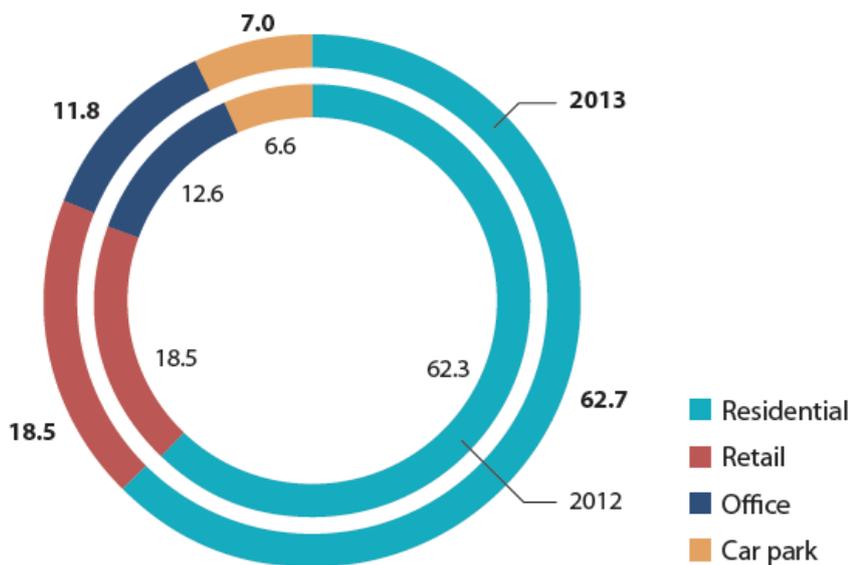


Fig. 16 Distribution of Hong Kong property management income  
Source: MTR Corporation Limited (2014, p. 7)

A big population is the base for big fare revenue. MTR has always been offered higher fare concessions from the Government (MTR Corporation Limited, 2014). Fare revenue from AEL in the future is positive. According to The Annual Report 2013 from MTR, fare revenue from AEL was HKD 843 million which was 6% higher than 2012 (MTR Corporation Limited, 2014). Moreover, passengers who take AEL are much more than other traffic types, as Table 13 illustrates. Regarding to Fig. 12, the profit contributed by Hong Kong transport operations is really high. In 2013, it was closed to half of the total profit contributions. Thus revenue from ticket fares should not be ignored. Note that differing with MTR, fare revenue barely offsets closed to half of the operating expenses of the subway in Stockholm, as Table 3 shows above.

Table 12 Airport Railway property development in progress and deferred income on airport railway property development (in HKD m<sup>22</sup>)

	Expenditure	Offset against payments received from developers	Payments received from developers	Offset against development in progress * (note A)
1996	780	(2,072)	10,119	(2,072)
1997	979	(1,490)	9,445	(1,490)
1998	1,810	(698)	-	698
1999	424	(547)	613	547
2000	159	(1,322)	1,320	(1,322)
2001	51	(102)	225	(102)
2002	76	(62)	425	(62)
2003	122	(63)	50	(63)
2004	116	(39)	132	(39)
2005	210	(152)	956	(152)
2006	106	(106)	20	(106)
2007	139	(139)	120	(139)
2008	31	(31)	-	(31)

Source: University of Hong Kong (2008, p. 90)

Table 13 Traffic by type and mode to the airport with and without railway

Traffic by type and mode (during airport peak hour (SBR))*	Number of passengers	
	With Railway	Without Railway
<i>Air Passengers</i>		
• Terminating Air Passengers (Arriving + Departing)	9,986	9,986
• Car Vehicle Trips	1,524	1,824
• Taxi Vehicle Trips	2,701	4,672
• Bus Passenger Trips	240	2,394
• Rail Passenger Trips	6,591	-
• Hotel Car/ Bus Vehicle Trips	301	974
• Tour Coach Vehicle Trips	141	328
<i>Airport Employees/ Services</i>		
• Car Vehicle Trips	102	135
• Taxi Vehicle Trips	111	126
• Bus Passenger Trips	490	2,687
• Rail Passenger Trips	2,316	-
• Special Purpose Bus Vehicle Trips	30	35

\* Airport Peak Hour (SBR) is Standard Busy Rate, and refers to the hour with the peak air passenger movements, which is forecast to be between 2pm to 3pm.

Source: University of Hong Kong (2008, p. 91)

#### 4.3.2.5 Summary

Through reviewing AEL project and discussion I have presented above, I conclude several points which might be useful when composing BOT arrangement for the new expansion of the subway in Stockholm.

<sup>22</sup> 'HKD m' refers to million HKD

- MTR is 77% owned by the Government, but SL is 100% owned by the Swedish government
- MTR is listed stock company, which is different from SL
- The project was financed both by public and private sources.
- Financial sources of the project were from injections and debts
- Apart from the injections from the Government, MTR also gained 62 hectares of adjacent land granted by the Government for property development
- There are four ways to offset the project's cost: injection of initial equity by the shareholder, deferral of dividend payments on previous investments to the shareholder, profits from railway-related property development and borrowing from the financial markets
- When comes to property development, the Government gets the full market value of green land.
- On the other hand, MTR usually gets negotiated rights granted by the Government and forms joint ventures with property developers to plan and construct properties, and after construction shares profits with developers
- The reason for completion delay of the project was the complex and long negotiation between the governments of United Kingdom and China
- Due to completion delay of the project, the actual cost of the project was 2% over budget
- Profits contributed by property development and property-related business are close to half of total profits. In the new expansion of the subway project in Stockholm, the relevant municipalities own land and get profits from property development.
- Besides, the biggest profit contributor is operating profit in Hong Kong. In Stockholm, all public transportations in one ticket system. There is no operating profit although it could be easy to operate the subway profitable. Because, for example, the operating profits earned by the subway offset part of operating loss from the buses.
- 'Four pillars', as mentioned previously, shows that deferral of dividend payments on previous investments to the shareholder and profits from railway-related property development support serve to circulate MTR's business.

Some points listed above are summaries derived from an analysis of AEL project. We can take a look at an overview of the financing of MTR in order to confirm its status as a successful business model. Through consolidated profit and loss accounting yearly reports of MTR from 2001 to 2013, we can see the corporation's revenue, expenses and profit through a whole year. But it is unnecessary to analyze that report year by year; therefore I take the latest report to illustrate MTR's financial situation, as Table 14 shows.

Revenue from Hong Kong transport operations was HKD 7258 million and was the biggest contributor to the total revenue of MTR in the first half year of 2013. Although so far there is no information about transport operation revenue in Hong Kong in the second half year of 2013, but according to the first half year's report and Fig. 12, it still can be proved that profits made from Hong Kong transport operations were biggest contributor to the total profit. Moreover, the most important is that MTR has already made a profit over the first half year of 2013. The profit for the period was

HKD 6256 million. Of this, the profit on Hong Kong property development was HKD 531 million (MTR Corporation Limited, 2014). Compared with the total profit over the first half year, profit on Hong Kong property development was just a small part. So what are other main contributors to total profit excluding profit from Hong Kong transport operations? The other two main contributors to total profit are Hong Kong property rental & management businesses and Hong Kong station commercial business, such as shopping malls, as Fig. 12 illustrates. As we know, without residential and commercial property development, there is no revenue from rental and management as well as no commercial business. Hence, property development is crucial business policy.

Table 14 Consolidated profit and loss account

In HK\$ million	Note	Half year ended 30 June 2013 (Unaudited)	Half year ended 30 June 2012 (Unaudited and restated)
Revenue from Hong Kong transport operations		7,258	6,914
Revenue from Hong Kong station commercial business		2,194	1,699
Revenue from Hong Kong property rental and management businesses		1,842	1,663
Revenue from Mainland of China and international subsidiaries	2	7,025	6,402
Revenue from other businesses		895	476
		<b>19,214</b>	<b>17,154</b>
Expenses relating to Hong Kong transport operations			
– Staff costs and related expenses		(1,916)	(1,854)
– Energy and utilities		(604)	(561)
– Operational rent and rates		(127)	(113)
– Stores and spares consumed		(232)	(226)
– Maintenance and related works		(518)	(484)
– Railway support services		(119)	(103)
– General and administration expenses		(187)	(179)
– Other expenses		(119)	(105)
		<b>(3,822)</b>	<b>(3,625)</b>
Expenses relating to Hong Kong station commercial business		(206)	(188)
Expenses relating to Hong Kong property rental and management businesses		(304)	(278)
Expenses relating to Mainland of China and international subsidiaries	2	(6,565)	(6,059)
Expenses relating to other businesses		(830)	(476)
Project study and business development expenses		(155)	(100)
<b>Operating expenses before depreciation, amortisation and variable annual payment</b>		<b>(11,882)</b>	<b>(10,726)</b>
<b>Operating profit before Hong Kong property developments, depreciation, amortisation and variable annual payment</b>		<b>7,332</b>	<b>6,428</b>
Profit on Hong Kong property developments	3	531	627
<b>Operating profit before depreciation, amortisation and variable annual payment</b>		<b>7,863</b>	<b>7,055</b>
Depreciation and amortisation		(1,641)	(1,613)
Variable annual payment		(589)	(402)
<b>Operating profit before interest and finance charges</b>		<b>5,633</b>	<b>5,040</b>
Interest and finance charges	4	(435)	(432)
Investment property revaluation		1,907	1,740
Share of profit or loss of associates	5	51	299
<b>Profit before taxation</b>		<b>7,156</b>	<b>6,647</b>
Income tax	6	(900)	(781)
<b>Profit for the period</b>		<b>6,256</b>	<b>5,866</b>
<b>Attributable to:</b>			
– Equity shareholders of the Company		6,158	5,785
– Non-controlling interests		98	81
<b>Profit for the period</b>		<b>6,256</b>	<b>5,866</b>
<b>Profit for the period attributable to equity shareholders of the Company:</b>			
– Arising from underlying businesses before property developments		3,804	3,521
– Arising from property developments		447	524
– Arising from underlying businesses		4,251	4,045
– Arising from investment property revaluation		1,907	1,740
		<b>6,158</b>	<b>5,785</b>
<b>Earnings per share:</b>	8		
– Basic		HK\$1.06	HK\$1.00
– Diluted		HK\$1.06	HK\$1.00

Source: MTR Corporation Limited (2014, p. 1)

#### 4.4 The current operational service contract for the subway in Stockholm

In this sub-section, I will analyze the current operational service contract for the subway in Stockholm. The aim of this is to help structure a BOT arrangement for the new expansion of the subway in Stockholm.

It is not by chance that MTR Stockholm has taken over operation of the subway in Stockholm 2 Nov. 2009 and continues operating the subway at least until 2017. The tender was preceded by a comprehensive study of the subway in Stockholm. Between year 2005 and 2008, a careful investigation has been made by MTR to determine whether it was interested to bid in Stockholm or not, and to gain a deeper understanding of areas for improvement. SL's target with the tender was to get more and more satisfied customers. This investigation along with a very detailed and professionally designed tender helped MTR to win the bidding finally. As discussed previously, MTR is one of world's leading railway companies. Thus relying on experiences and technology of MTR, the investigation was made in a realistic, rational and judicious manner. The reason why SL chose MTR is that the latter could provide four improved services:

1. Better customer service
2. Better punctuality
3. Fewer canceled trains
4. Better cleaning

(Berglund, 2014)

Since MTR got the contract, it established a company, which is MTR Stockholm AB (MTR STHLM) and is a daughter company to MTR London. It is important for MTR STHLM to be a trustworthy and reliable company that can carry out all the obligations regarding the contract awarded by SL. The contract was awarded to MTR STHLM 20 Jan. 2009 and the operational right was handed to MTR STHLM overnight 2 Nov. 2009. The transition was completed effectively. The contract will last until 2017 at least and it is possible to continue the contract until 2023. This means that if MTR STHLM can fulfill the requirement included in the contract within 8 years contract period, especially the requirement about more and more satisfied customers, then MTR STHLM will continue operating the subway until 2023 (Berglund, 2014). The total time of the contract whether 8 years or 14 years, is dependent on customer satisfaction.

The total amount of the contract is SEK 35 billion which includes maintenance of rolling stock and is delivered from SL to MTR STHLM every year, i.e., SEK 2.5 billion per year. However, SEK 2.5 billion is divided into 12 months and transferred to MTR STHLM. In other words, MTR STHLM gets the monthly payment of SEK  $\frac{2.5}{12}$  billion every month, namely SEK 0.2 billion. The trains, the hard infrastructure (including tracks, train lane change device and escalators and elevators within stations) and the soft infrastructure (premises, computing power, signal system, electricity, water and heating) are owned by SL, while MTR STHLM rents the premises and the rolling stock from SL and uses its tracks to operate the subway in Stockholm. MTR STHLM even pays for electricity for driving the trains and heating on board. The contract includes maintenance of rolling stock, and then MTR STHLM chose a solution with a joint venture which includes itself and an outside maintenance company. In the contract, the joint venture is called as Tunnelbanan Teknik Stockholm AB (TBT) which is responsible for vehicle maintenance and depot operation. TBT is a joint venture of 50% owned by MTR STHLM and 50% owned by Mantena AS (Berglund, 2014). Mantena AS is a Norwegian train maintenance company.

It is necessary to mention that the contract includes a portion that is a fixed amount and a variable part which is called “the incentive structure payment model”. The purpose of adopting this model is to steer MTR STHLM toward an even higher quality of service during the contract period, as Fig. 17 shows. In the contract with SL, is contained the stipulation that MTR STHLM must regularly report its work and performance to SL every week and every month respectively. Every month, Team Tub, which consists of staff both from MTR STHLM and SL, hold a meeting to go through monthly performance of MTR STHLM. By the end of month, remuneration is governed as follows: 80% of the fixed remuneration is paid the current month from SL to MTR STHLM. And any actual penalties shall be taken away from the 20% remaining and any actual bonus shall also be added to 20% remaining. The 20% remaining +/- bonus/penalties will be paid the next month after the current month (Berglund, 2014).

During the contract period, SL becomes the monitor who observes that the quality of service is in accordance with measurable parameters included in the contract. SL carries out a large number of pre-entry measurements in the contract and even conducts mystery shopping-surveys, namely unannounced anonymous measurements of quality. The most important parameter is time keeping which includes ordered kilometers, number of stops and punctuality from SL. The other important parameters are customer satisfaction and cleanliness of both carriages and stations. Within these areas, there are incentives which can lead to big bonuses or substantial penalties for MTR STHLM. Apart from this, there are some other measurable parameters, such as numbers of passengers. Every measurable parameter has its own curve to follow. The curve will look something like the curve shown in Fig. 17. This also means that the requirement for each parameter becomes more and more strict year by year. If one parameter achieves and/or surpass its requirement, MTR STHLM will get the corresponding bonus the next month. On the contrary, if a performance level falls below a specified base level, then MTR STHLM must pay penalties to SL by the next month.

Note that each parameter has its own maximum bonus and penalty, such as the maximum bonus of passenger increase is SEK 5 million per year (Berglund, 2014). Moreover, as mentioned above, and according to Fig. 17, we can see that it requires higher quality of service to get same amount of bonus the next year. Quite the reverse, it is easier to get a penalty the next year. Or in other words, we can say that when MTR STHLM keeps the same levels of services, it increases the risk for penalties. SL keeps this model to guarantee not getting a transport operational contractor who cannot improve its quality of services. Instead, it is critical for SL to get a contractor who is always willing to find better and more innovative ways to reach higher quality of services. Accordingly, this model pushes MTR STHLM to improve quality of service all the time, which assures a certain level of social welfare. However, the maximum total bonus is SEK 56 million and there is no limit on penalty (Berglund, 2014).

## Incitamentsmodellen styr mot en allt högre kvalitet under avtalsperioden

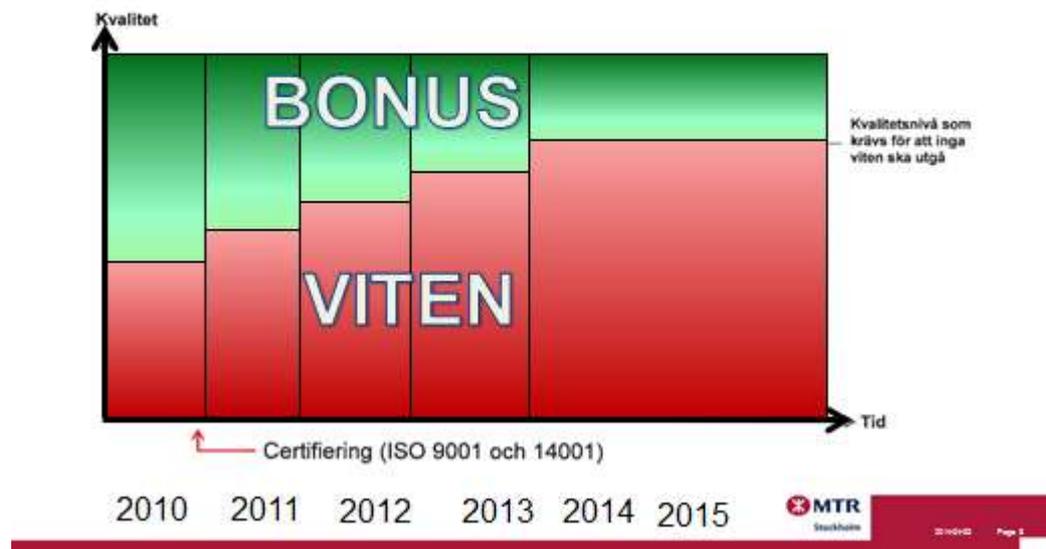


Fig. 17 Incitamentsmodellen styr mot en allt högre kvalitet under avtalsperioden<sup>23</sup>  
Source: Lena Berglund (2014)

According to the contract, MTR STHLM not just pays for the maintenance of rolling stock, cleaning of the stations, its own cars and personnel salary and managerial related expenses; it also pays all operational expenses at the depots, such as electricity, water and heating, and rent for premises which are disposed from SL (excluding head office of MTR STHLM). This rent contains expenses for water, electricity and heating. Further, MTR STHLM also pays for electricity used for driving rolling stock and heating in rolling stock in winter. SL stands for technical maintenance of stations and all maintenance of hard and soft infrastructures excluding rolling stock. When it comes to refurbishing stations or updating hard or soft infrastructures, SL will be responsible for time planning, project design and all expenses. The contract gives MTR STHLM possibility in some cases to obtain additional compensation for personnel from MTR STHLM who are involved in these projects.

In addition, MTR STHLM sells tickets to customers and receives a commission on sold tickets. SL gets all fare revenue, revenue from selling advertising space and other railway related commercial business revenue.

Note that apart from the requirement of customer satisfaction, there is another important requirement from SL to MTR STHLM, for instance, efficiency. The complete content of efficiency should be:

<sup>23</sup> Translate from Swedish to English: Incitamentsmodellen styr mot en allt högre kvalitet under avtalsperioden=Incentive model steers toward an even higher quality during the contract period; bonus=bonus; viten=penalty; Kvalitetsnivå som krävs för att inga viten ska utgå= required quality level for no penalty shall be paid.

- Follow time schedule
- Ecological (ECO) driving
- Answer customer questions
- More regular cleaning
- Reducing frequency of transports at non-peak time
- Well personnel training for helping disabled persons
- Personnel of MTR STHLM should be experts who can give customer good and safe service.
- Efficiency in rolling stock maintenance

(Berglund, 2014)

Since 2 Nov. 2009 to now, MTR STHLM has achieved higher efficiency in reality, for example, punctuality. Diagrams of punctuality are showed in Fig. 18. Before June 1999, SL operated the subway by itself. Between June 1999 and 1 Nov. 2009 Connex/Veolia Transport operated the subway. Since 2 Nov. 2009, MTR STHLM started operating the subway. The dotted lines in Fig. 18, 19 and 20, represent required punctuality for MTR STHLM. The solid lines represent realistic punctuality.

To show what efficiency MTR STHLM has achieved and in general private firms are more efficient than public firms, I choose a figure which displays the rates of punctuality of the Green lines from 1998 to the present. The reason why I only chose the Green lines, and not the Blue lines and the Red lines are:

1. The Blue lines are newest subway lines which were built in 70's and 80's. The whole lines are underground except for one station, which is situated above ground, namely Kista Station. This means that it is easy to hold punctuality in winter. As Sweden usually has cold winters with lots of snow and ice, which make difficult to hold punctuality for over ground subway lines in winter. Because of this, it is no big challenge to hold to punctuality in winter both for the private operators and the public operator.
2. The Green lines are oldest subway lines which were built in 50's. All rolling stock running on the lines are new mode C20. The lines lay both underground and above ground. It is a big challenge to hold punctuality in winter both for the private operators and the public operator.
3. The Red lines were built in 60's and 70's. The rolling stock operated on the lines includes C6, C14 and C20. Among these, C6 and C14 are old mode and shall be replaced by C30 by SL. But SL hasn't done it. Because the new C30 rolling stock delivery was delayed. The new predicted delivery time will be three years later. Hence, it is not suitable to use the rates of punctuality of the red lines to compare efficiency of the private operators with efficiency of the public operators.

According to Fig. 18, we can see that the rates of punctuality of the Green lines increase apparently. Especially the rates of punctuality under operation by the private firms, namely Connex/Veolia Transport and MTR STHLM, are much higher than under operation by SOE, namely SL. In this sense, this also proves that private firms are more efficient than public firms in general.

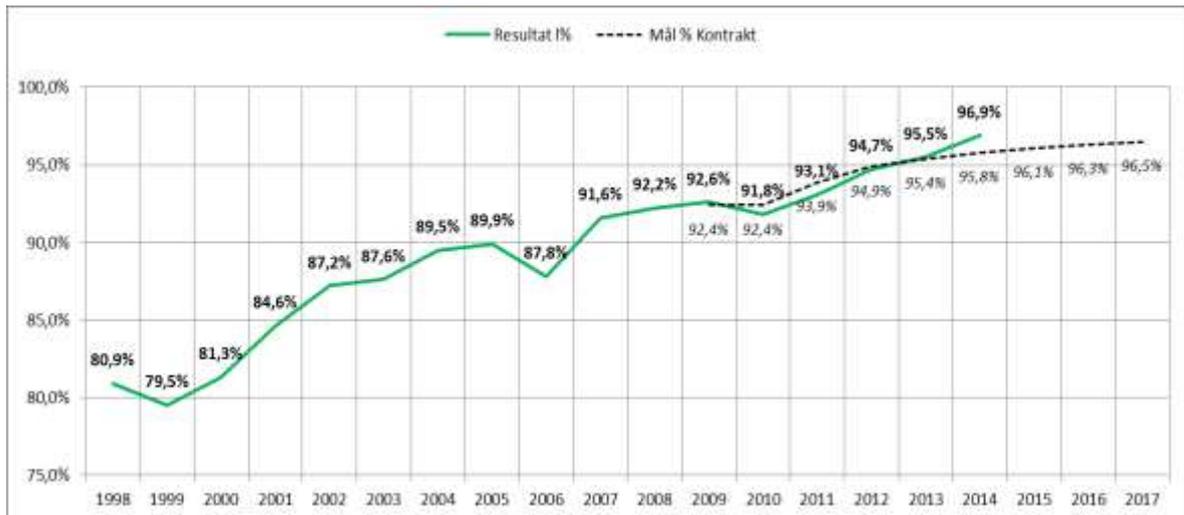


Fig. 18 Punctuality of the Green lines<sup>24</sup>

Source: Lena Berglund (2014)

#### 4.5 Why have there been so few BOT or PPP projects in Sweden

Before I come to address a test of adopting BOT arrangement for the new expansion project, I would like to analyze why there have been so few BOT or PPP projects to Sweden. Since the case study of this paper is located in Sweden, and the purpose of the paper is to develop a proper BOT arrangement which is applicable in the Swedish context. Thus there is need to discover and discuss the current situation for BOT or PPP projects.

Unfortunately, I couldn't find any literatures regarding to this issue. However, there still are some reports and debates referring to the issue on some reliable websites. Besides, as mentioned in the section entitled Method, there were two interviews regarding to this issue been held. The two interviewees have been asked for the same question: why have there been so few BOT or PPP projects in Sweden? However there still is a necessary to mention that all answers from the interviewees can only represent their own views. To some extent, their answers might reflect indirectly how a private firm or a public firm perceives this issue.

##### 4.5.1 Interview with Peter Viinapuu, CEO of MTR STHLM

The first interview regarding to this issue was took place at headquarter of MTR STHLM; the interviewee was Peter Viinapuu who is CEO of MTR STHLM. He thinks that the main reason of why there have been so few BOT or PPP projects in Sweden is political reason or political culture. Politicians think that, in history, public sector usually provides public traffic including providing finances. The Swedish politic structure can be generated to two sides, left and right. The left side wants more "Nationalization" while the right side wants more "Privatization". However, Peter doesn't think that the Swedish politic structure has affect adoption of BOT or PPP in infrastructure. As he has talked with many politicians from both sides, and those politicians all see positive at BOT or PPP. Moreover, he also mentioned that if China

<sup>24</sup> Outcome of the Green lines for 2014 is from January to March. Translate from Swedish to English: Resultat=result, Mål % Kontrakt =required goal in contract.

can accept BOT or PPP why not Sweden? Due to China has the socialist system, which means that Chinese government would prefer to “Nationalization” than “Privatization”.

Moreover, he also said that the Swedish government thinks that the government can always borrow money cheaper from banks. However he didn't think that the government has advantage on this issue. In order to explain what he exactly meant, he showed me a diagram which was investigated by MTR STHLM recently, as Fig. 19 shows. In this case, it assumes that there is a 5-year project. The investment of the project is SEK 10 billion. The Swedish government can get loans with 2% capital cost. If PPP is chosen in the project and MTR is the private sector. It assumes that MTR can get loans with 3% capital cost, then if MTR doesn't work efficiently, then the estimated total cost will be SEK 267 million more than the Swedish government pays. On contrary, it assumes that the capital cost doesn't change, if MTR works efficiently, for example, efficiency gaining rate is 2%, and then the estimated total cost will be SEK 327million less than the government pays. If MTR reaches 5% of efficiency gaining rate, it will be estimated to pay SEK 821million less in total cost than the government pays. Moreover, it will save construction period too. Accordingly, higher capital cost pushes private firms to work efficiently in order to gain maximum profit.

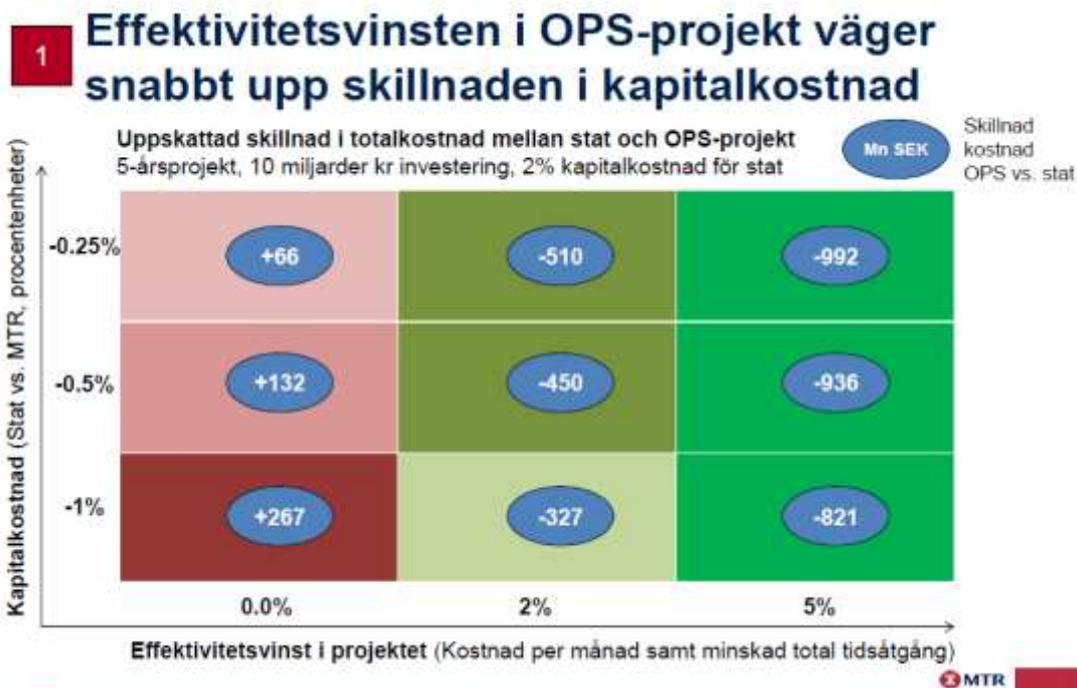


Fig 19 Effektivitetsvinsten i OPS-projekt väger snabbt upp skillnaden i kapitalkostnad<sup>25</sup>

Source: Viinapuu (2014)

He also pointed out that SLL and SL don't want to separate ticket revenue system. The reason for this is to balance win and loss among different transportations. For example, operating profits earned from the subway can offset some operating loss from buses.

During the interview, Peter had talked further about the current situation of infrastructure in Sweden. He pointed out that the county tax rate, in the County of Stockholm, is already high, i.e., 12.1%. But the increase rate of county tax is lower than the increase rate of population in the County of Stockholm. Or in other words, the increase of the county tax income is less than the growth of the population of the county. On the other hand, the increase rate of social welfare demand is higher than the increase rate of the county tax and increase rate of the population of the county. See Fig. 19 shows. Because of this, the financial structure of the County of Stockholm actually cannot support new big infrastructure project. That is why the Swedish government

<sup>25</sup> Translate from Swedish to English: Effektivitetsvinsten i OPS-projekt väger snabbt upp skillnaden i kapitalkostnad = Efficiency gaining in BOT project weights up quickly the difference in cost of capital; Uppskattad skillnad i totalkostnad mellan stat och OPS-projekt = Estimated difference in total cost between the state and the PPP project; 5-årsprojekt, 10 miljarder kr investering, 2% kapitalkostnad för stat = 5-year project. Investment is SEK 10 billion. 2% capital cost for the Swedish government; Effektivitetsvinst i projektet (kostnad per månad samt minskad total tidsåtgång) = Efficiency gaining in project (cost per month and total project period are decreased); Kapitalkostnad (Stat vs. MTR, procentenheter) = capital cost (the state of Sweden vs. MTR, percentage).

will raise traffic charges at imports of the City of Stockholm. But this solution can only manage this project. As traffic charges cannot be raised forever. Thus SLL and SL need to seek new financial resources in the future.

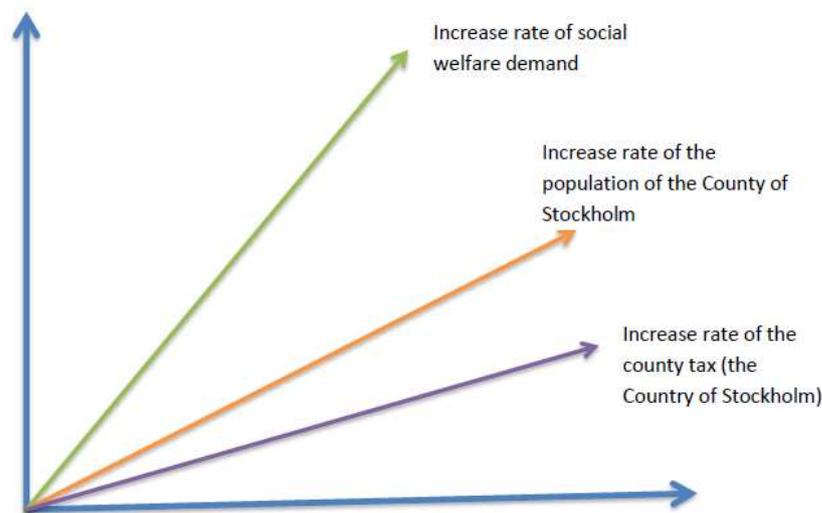


Fig. 19 Increase rate of social welfare demand, the population of the County of Stockholm and the county tax (the County of Stockholm)  
Source: Peter Viinapuu (2014)

#### 4.5.2 Interview with Christian Löf, business strategist of SL

The second interview regarding to this issue was took place at headquarter of SLL. This was the second time that I interviewed Christian Löf, business strategist of SL. He thinks that there have various reason regarding to this issue. From financial view, the County of Stockholm can borrow money from banks with low interest. From politic view, as the Swedish finance minister, Anders Borg, said he doesn't want PPP. The Swedish government agrees with that private firms can become co-financiers in infrastructure projects. Moreover, both SLL and SL don't want to change the current ticket revenue system. They want that buses, subway, community trains and local transports are all in one revenue system. The reason for this is precise same as Peter explained in previous sub-section. All in all, he thinks that the main reason for this issue is politic reason. It depends much on politic decision (Löf, 2014).

#### 4.5.3 Other findings

According to these two interviews, we can see that both interviewees think that the main reason leading to so few BOT or PPP in Sweden is politic reason. Besides, I found more information proved this reason as well.

Although the Swedish finance minister, Anders Borg, said "No" to PPP for infrastructure projects in Sweden, the infrastructure minister, Catharina Elmsäter-Svärd, wants to open a little door to let flesh sunlight, PPP, into infrastructure (Dagens Opinion, 2011). However, at the Swedish parliament, infrastructure has never become popular theme for debate (Nohrstedt, 2014). It is hard to believe this, as infrastructure is directly related to people's daily life as well as the country's economic development. According to the Friday debate on 31<sup>st</sup> January 2014 at the Swedish parliament, there were only two parties which said "Yes" to PPP for infrastructure (Nohrstedt, 2014).

Why did the Swedish government show so little interest on PPP? “The government also argues that there are uncertainties as to what extent PPPs in general can bring efficiency gains compared to other forms for construction and design” (Hasselgren , 2013, p. 1). They think that uncertainties include quality issue, for example, private firms will build worse quality infrastructure than the government will do, as private firms aim to produce profit for themselves (Nohrstedt, 2014). Apart from this, the reason which the Swedish government uses most to reject PPP is that the government can borrow money more cheaply from banks than private firms. Hasselgren (2013) argued that this pretense which the government always use, against to basic economic reasoning in the long run.

Furthermore, there is a number of research has proved two issues, one is BOT or PPP can bring in efficiency, innovation and expediency; one is private firms are generally more efficient than public firms. Accordingly, the matter still is how to design proper BOT or PPP contracts for infrastructure projects. Then, actually, the whole thesis talks this matter. And in the next two sub-sections, I will confirm that as long as BOT or PPP contracts are well-designed, BOT or PPP could bring more benefits to Sweden.

#### **4.6 A test of adopting BOT arrangement for the new expansion of the subway in Stockholm**

In this sub-section, based on the previous analysis, I will form a BOT arrangement for the new expansion of the subway in Stockholm. Then in the next sub-section, I will go ahead to compare this BOT arrangement with the current financial strategy adopted by SL. Soon we will see the outcome.

According to the agreement of the new expansion of the subway in Stockholm, the construction will start not later than 2016 and is forecasted to be completed in 2025. The budget for the new expansion project is SEK 25.7 billion. As illustrated in sub-section 4.2, without contributions from the traffic charge of imports, SLL cannot afford SEK 15850 million<sup>26</sup> for the new expansion project. Detailed evidences can be found in sub-section 4.2. Now I assume that private finances replace the traffic charge of imports to contribute SEK 9000 million to the budget. Then a BOT arrangement must be applied. Furthermore, as argued previously, there is no operating profit in public traffic in the County of Stockholm. Therefore, without side benefits, private firms have no willingness to invest the new expansion project. Moreover, it has been proved that both SLL and MTR know huge profits from property development and property related businesses. Hence, in this BOT arrangement, the side benefits are that the public sector offers some lands to the private sector for property development. Then it is necessary to offer negotiated right which is granted by the Swedish government to the private sector for property development. Note that in this BOT arrangement, the public sector should be the state, SLL and the relevant municipalities. The leader of the public sector should be SLL. The Swedish government can empower SLL to negotiate with the relevant municipalities and the private sector to decide which lands are offered to the private sector for property development. Then the private sector has right to decide whether to develop sites by itself or to form a joint ven-

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<sup>26</sup> 9000 (traffic charges) + 6200 (rolling stocks and depot) + 650 = SEK 15850 million;

ture with other developers to plan and construct properties. Of course, the private sector also gets right to design properties. Due to the land which is planned for property development is owned by the relevant municipalities. Hence, the relevant municipalities will get full market value of lands which are offered to the private sector for property development. As previously illustrated, it is more efficient that the sites above the new stations are offered to the private sector for property development. Then the sites above the new stations should be first consideration to be offered to the private sector for property development. In addition, property related businesses such as rental & management businesses and commercial businesses can make even bigger profits than property development allow. There are around a total of 78000 units of homes that will be built as planned. Then the Swedish government can require the private sector to build a residential and commercial integrated community at each site. The remaining parcels of land are offered to the relevant municipalities for property development. The private sector and the relevant municipalities share the total of 78000 units' home but distribution of the amount should be decided through negotiation between both sectors. With regard to the current agreement assigned in early of 2014, the relevant municipalities together should fund SEK 5200 million (at the price level of Jan. 2013) to the budget. In assumed BOT arrangement, SEK 5200 million still should be invested by the relevant municipalities due to the high profit rate of property development in the County of Stockholm as illustrated previously. Moreover, since the relevant municipalities also have parts of land for property development and share to build a total of 78000 homes with the private sector, so there is no problem for the relevant municipalities to pay SEK 5200 million. Plus the relevant municipalities still can earn big profits on property development. Sharing property development for both the relevant municipalities and the private sector can balance profit distribution and induce both the relevant municipalities and the private sector to fund the project. As the relevant municipalities have no obligation to invest in public traffic in accordance with the Swedish law.

Although subway lines reach almost all over urban of The City of Stockholm and some nearby municipalities, but there still are some places which are beyond subway service. This situation happens in Hong Kong too. To solve this kind of problem, MTR provides free ride buses to take passengers to nearest subway stations or bus stations in Hong Kong. In Stockholm, there are many places which are beyond subway transport. To give convenience inhabitants who live in those areas to access subway transport, and to consider environmental issues and traffic congestion problems, I suggest building a big parking facility by the private sector to allow inhabitants to drive personal cars to the parking facility and park their cars there at a reasonable charge. Then people can take free buses provided by the private sector to nearest subway station for catching the subway. The parking facility should be built by the private sector. In return, the private sector gets revenue of parking fees. The parking fee shouldn't be higher than market value then. This suggestion can help people to access subway transport, reduce traffic congestion and protect the environment. For the private sector, it can also bring positive profits.

All those mentioned above should be included in the BOT arrangement. According to section 2, I have investigated an optimal model of BOT, as Fig. 3 shows. This optimal model will be adopted in this BOT arrangement. In an ex-ante contract, some main clauses should be included as noted below:

- The project should be co-financed by both the public sector and the private sector, as Table 15 shows below.
- The public sector consists of the state of Sweden, SLL, The City of Stockholm, Nacka Municipality, Solna Municipality, and Järfälla Municipality. The leader of the group is SLL.
- The budget for rolling stock and construction of the depot is SEK 6200 million (at the price level of Jan. 2013) which should be funded by SLL. This means SLL is responsible for procurement of rolling stock and financing of the construction of the depot.
- The private sector should be responsible for planning, designing and constructing of the new expansion of the subway in Stockholm.
- Both the public sector and the private sector should negotiate to share the amount of 78000 units' homes for property development.
- Both two sectors should negotiate together to decide which parts of the land should be offered to the private sector to build a residential and commercial integrated community at each site. The sites above the new stations should be first consideration to be offered to the private sector.
- The relevant municipalities get full market value of the land which is offered to the private sector for property development.
- The private sector should build at least one big parking facility along the new expansion subway but away from the relevant local center. And when the opening starts, the private sector should provide regular buses for passengers with no fee between the parking facility/s and nearest subway station/s. The parking facility/s should be completed before the opening of the new expansion subway and the private sector will get revenue from charges for parking. The parking fee shouldn't higher than market value then. This clause aims to help residents who live area without subway service, to access public transport, and to give them the convenience of parking their personal cars in the parking facility/s and taking buses free of charge to catch the subway. This also protects the environment and decreases traffic congestion.
- The construction of the project should be started no later than 2016 and is forecasted to be completed in 2025.
- After the construction, the private firm still owns the project and has right to operate the Blue lines and the Grey line in 20 years (concession period).
- The public sector has an obligation to cooperate with and give convenience to the private sector under the construction.
- After the concession period, the physical infrastructure should be handed over to the Swedish government. Before the handover, the quality of the project will be observed to see if it meets the required quality, i.e., Quality 1. Quality 1 should be specified both on technical ( $Q_t$ ) and service ( $Q_s$ ) and included in the agreement, namely as an ex-ante contract.
- During the concession period, the private sector will not get fare revenue of the relevant subway lines. Instead, it gets an operational service contract for 20 years. The operational service contract will be included in the ex-ante BOT contract as a daughter contract.
- This BOT arrangement will adopt a license extension policy with the optimal model of BOT. Then there will be an extended period after concession,

namely Period 2. Period 2 will be 15 years. Within Period 2, there is a 5 year period, i.e., Period  $\lambda$ , where the quality of the project will be observed again under the precondition of public ownership.

- By the end of the concessionary period, if observed quality of the project at that time meets required Quality 1, then the private sector has opportunity to access the extended operational phase under Period  $(P_1+\lambda, P_2)$ .
- The content of the operational service contract should include mainly: better customer service, better punctuality, fewer canceled trains, better cleaning, operating more efficiently. And it will adopt an incentive model for bonus and penalty. The private firm will get a sum of payment from the public sector every year, but this yearly payment will be divided and delivered to the private sector monthly. Furthermore, the private sector will not get fare revenue of the relevant lines. Fare prices will be determined by SL. (Mostly like the current operational service contract between MTR STHLM and SL).
- Under concessionary period within Period 1, the private sector will get parts of the land which are offered for the private sector to develop properties. But those parts of land shouldn't provide profits which can offset the investment funded by the private sector.
- Within Period  $\lambda$ , the public sector will empower SL to operate the relevant subway lines. Or SL can hire staff from the future operating firm of other subway lines than the Blue lines and the Grey line, to operate them under Period  $\lambda$ . By the end of Period  $\lambda$ , if observed quality of the project at that time meets required Quality 2, then the private sector will get back the operational right and operate the relevant subway lines under Period  $(P_1+\lambda, P_2)$ . Required Quality 2 should be specified both on technical ( $Q_t$ ) and service ( $Q_s$ ) and included in the ex-ante contract. The private sector still will not get fare revenue of the relevant lines. Instead, it will get an operational service contract continuously. The content of the operational service contract for Period  $(P_1+\lambda, P_2)$  should be same as the first operational service contract.
- If the private sector will operate the relevant lines in Period  $(P_1+\lambda, P_2)$ , then it should upgrade some soft and hard infrastructure, such as upgrading signal systems, refurbishing stations and so on. The expenses of updating projects will be co-financed by both the public sector and private sector. But updating projects will be carried out by the private sector
- After the private sector gets the operational right for Period  $(P_1+\lambda, P_2)$ , it will get the rest of the land, which is offered for the private sector to develop properties.

Table 15 Financing of infrastructure (excluding trains and depot)

<b>Funding (SEK million at the price level of Jan. 2013</b>	<b>sum</b>	<b>Gullmarsp lan/Södero rt</b>	<b>Nac ka</b>	<b>Hagasta den</b>	<b>Arenasta den</b>	<b>Järfälla/Bark arby</b>
<b>Cofinancing</b>	9000	2700	3350	400	1300	1250

<b>from the private sector</b>						
<b>Cofinancing from the state</b>	3825	1250	1750	125		700
<b>County Board</b>	825			825		
<b>Cofinancing from the relevant municipalities</b>	5200	1750	1450	700	500	800
<b>The City of Stockholm</b>	2950	1750	600	600		
<b>Nacka</b>	850		850			
<b>Solna</b>	600			100	500	
<b>Järfälla</b>	800					800
<b>SLL</b>	650	100	150	50	200	150
<b>Sum of funding</b>	19500					
<b>Sum of financing</b>		5800	6700	2100	2000	2900

There is one main reason why I assumed that Period  $\lambda$  is 5 years. That is if Period  $\lambda$  is too long, then the rest of Period 2 will be short, which might make the extended period for operation unattractive for the private sector. Moreover, even though Period  $\lambda$  is certainly short, it still requires experiment and technology from the public sector to operate. However this doesn't bother SL. Since it has certain technology and long experience of running subway systems in Stockholm. Nevertheless, since the current operating firm which is operating all subway lines in Stockholm isn't SL, it is MTR STHLM. The operating contract will last to 2017 at least. There is no possibility to know which company will operate the subway in Stockholm after 2017. The future operating firm could be MTR Stockholm, or another private firm, or SL. But MTR STHLM has a big chance to operate continuously until 2023, as discussed previously. So if the subway (excluding the Blue lines and the Grey line) is operated by a firm other than SL and the private sector of this BOT arrangement, SL could rent some staff from the future operating firm to form a temporary department to operate the Blue lines and the Grey line under Period  $\lambda$ . This effort could help SL to avoid extra managerial expenses and to share knowledge with the future operating firm at the same time.

#### 4.6 Comparison and the outcome

Using the assumed BOT arrangement to compare with the current financial strategy adopted by SL, I conclude with the benefits of adopting the optimal BOT model for subway projects in Stockholm:

- Since BOT arrangement brings private funding to the project, SLL will be released from overloaded financial burdens. This also decreases the possibility of creating a financial deficit for SLL.
- As a BOT arrangement is a better choice, then without support from traffic charges on imports, it still is viable to finance an extension of the existing subway or building new subway for now and for the future.
- The BOT arrangement balances distribution of profits, which are made by property development and property related business, in the public sector and private sector.
- Private firms bring new knowledge and technology to public infrastructure projects.
- Private firms can build, manage and operate subways more efficiently than public firms can.
- Private firm has better and more commercial ideas for property development than public sector. This will create more business opportunities as well as will support Swedish economic development.
- The BOT arrangement reduces managerial expenses for in-house human resources of SLL.
- The optimal model of BOT assures that private firm will invest required quality in projects.
- Incentive model included in operational service contract pushes private firms to improve operating and services continuously as well as leaves the right of determining fare prices to SL in order to assure social welfare.
- The BOT arrangement is co-financed by private firm, then financial sources are more flexible. This could compress the construction period, subsequently operation can be started earlier. Once again, it proves that private firms are more efficient than public firms.

The last issue which was listed above might be confusing. Then I will make a better interpretation for this. In traditional public contracts, the government is the solo financier. Its financial sources are from taxes, and taxes are collected monthly. The government could collect a total investment before construction by borrowing money from banks. However, the government usually plan to invest on a project year to year according its own budget process. Simply, a total investment will be separated by year, and the government invests yearly to this project according to plan or budget process made by itself. Note that amount of yearly investment can vary. Therefore financial sources usually are injected into projects yearly, which makes projects complete around planned completion date. On the contrary, the private firm can collect all funds for a project before this project starts. It doesn't matter whether the private sector is solo financier or not, it can use and collect financial sources more flexibly than the public sector can. This effort could compress the construction period. In other words, the private sector can construct projects efficiently. Accordingly, private firms are more efficient than public firms.

All in all, it is better to adopt a BOT model for the new expansion of the subway in Stockholm. And the BOT model should be the new investigated model, i.e., the optimal model of BOT. Moreover, in the Swedish context, under the concessionary period, it should be adopted as an independent operational service contract which still is included in the ex-ante BOT contract. In order to leave the right of determining fare prices to SL, fare revenue should go to SL.

## 5 Conclusion

The thesis is based on a case study, the new expansion of the subway in Stockholm. To support my test of adopting BOT mode in this project, I chose two approaches, theoretical and practical. On the theoretical approach, amount of previous researches have been reviewed and analyzed. Based on the research of Qiu and Wang, I investigate further and form an optimal model of BOT which enhance incentives and prevent monopoly. Through illustration of the optimal model of BOT, it is proved that side-benefits must be included in the ex-ante BOT contract, in order to induce the private firm to invest in the new expansion project. By studying both the current financial strategy adopted by SL for the new expansion project and MTR's property and railway-related business model in Hong Kong Airport Express project, I find out that property development can be taken as side-benefits in the ex-ante BOT contract. To show advantage of BOT arrangement, I further study another sub-case study, i.e., Arlanda Express. This sub-case study evidences that private firms are generally more efficient than public firms in practice.

With support from theoretical study and case study, I finally can conclude that by adopting BOT mode in the new expansion subway project, both the public sector and the private sector will be benefited in finance and efficiency.

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## **7 Appendix**

### **7.1 First interview on 27 Jan. 2014**

Christian Löf

Tid: 2014-01-27

Intervjuare: Penny Andersson

Intervjuad: Christian Löf

why not save money from traffic

politic

market

the stat regulate,

the center of stat used to in-house procurement.

1, hur brukar ett tunnelbana projekt finanseras?

Old subway own by City Stockholm  
now Landsting

last early 80s

State 50% rail not train signal system  
parts stations

all own by city Stockholm

Old subway own by City Stockholm, now own by Stockholms landsting (County of Stockholm). This is biggest difference.

Old subway built in 50s, 60s, 70s and early of 80s. Old subway was paid by city Stockholm and the stat. The stat paid half of rail, construction of tunnel, lay of rail, parts of stations, not trains, signal system. Almost no co-operation with kommunerna surround the city of Stockholm. Old parts of subway, some of them lay in other kommuner, for example, Danderyd sjukhus and Mörby centrum are in Danderyd Kommune, then the involved kommuner paid parts of construction of subway. The main cost paid by City Stockholm. Because City Stockholm owns lots of land in other kommuner. All subway owned by City Stockholm. Many resident areas along the subway, old.

especially shopping centers, high skyscrapers for apartments and so on, all those were built with conjunction with subways. Most of them <sup>were</sup> owned by city Stockholm.

Today, the stat., landsting and kommunerna work together.

→ The finance for living buildings, shopping centers, the landsting have to take it on the tax.

Financing by having more apartments and shopping centers. to build

That's why kommuner ← Nacka and Järfala must promise to build such number of apartments to make sure they have enough people to travel and to volume expansion of the subway.

2, I Sverige, vem äger marken?

highway state

rent hus own kommuner

state

kommun

private per

Mix, land ownership is mix. Public areas are owned by city Stockholm, It's only public roads, owned by city Stockholm, high ways <sup>usually</sup> owned by the state, sometime co-ownership. Rental apartments, land of them owned by kommun, in Stockholm city, other kommuner, even rental apartments, land can be owned by developers, since 1980s' no force to move. Bostadsförening (每个小区自己选之组织) own the apartment land. (leases) can own the land, leases means, t.ex. land in Stockholm is too expensive, instead of sell land, Stockholm city prefer to leases out, people or organisation who is going to lease land, only pay some percentage of the worth of land, and have right to build something over the land.

In Sweden, land ownership is mix, the state, kommun, private: person/organisation, or land legal entertis

Question: what about villa, villa owner own the land?

3, När staten/kommun ska bygga ett samhälles infrastrukturs projekt, hur ska staten/kommunen få mark?

negotiation

find out each piece of land's ownership where the track will go, the price of the land what need to buy for infrastructure depend on how well SL can offer to the land's owners, t.ex. subway go through this land then the value of property will go up, then you have short term lost long term gain, even kommuners or the state's land. SL need to buy for subway project, the law says kommun must help public infrastructure build, so kommun could give land for free in theory or sell for low price, but prices are not always low. For private land, the price depends on the trade which SL offer to private. t.ex. cooperate with kommun see if another kommun land can exchange with the land they need from private, and <sup>plus</sup> pay a lower price. Or t.ex if you move 50 meters west. then we will make sure you get exit/entrance direct face your exit/entrance. No law of price legal

4, Befintlig tunnelbana, vem äger dem? SL? Staten? Lokal kommuner? Eller Stockholm län?

whole system landsting = SL  
pendel tåg train own SL

SL AB = SLL

---

The whole subway system owned by landsting = SL  
commute trains (pendel tåg) owned by the state  
railway

SL own the trains, depots.

Landsting own the whole of SL, 100%, MTR 70%

5, Vem får biljettintäkterna? SL? Staten? Lokal kommuner? Stockholm län? Eller någon/några utav dem?

50% tax

subway + pendlar tåg  
+ buss

---

All inkomst of tickets go to SL  
but 50% of tickets are tax

6, Varje år, kan netto inkomsten utav tunnelbana biljetterna och omkring inkomster betala kostnaderna av befintlig tunnelbana och lån av banker? Om inte, var kommer pengar ifrån för att stödja tunnelbanan? Skatt?

invest  
2014 4 bilj kor  
all tax

transport contract, investmen for  
12.5 bilj 运营 exclude infrastructure  
half av 12.5 ticket

jämfallet 1 bilj  
around  
Nacka less  
andra half tax

fact of SL online 30% inkom tax  
kommun 18%  
landsting 12%

? health care  $\frac{2}{3}$  more than  
 $\frac{1}{3}$  trafik

Every year, cost of operating subways, ~~bank rent~~  $\rightarrow$  ~~finansnetto~~  
tickets income and 50% from tax (landstingets skatten)  
(bus + subway + pendle tåg, all in same system) + lokalbana  
yearly investment of infrastructure, transport contract <sup>operating + bank + other</sup>  
cost 12.5 billion kr, half of 12.5 get from tickets, the  
another half from landstings tax.  
Tax system inkomst tax = 18% kommun tax + 12% landsting 12%  
30%

7, Den nya utbyggnaden kostar 26 miljarder kronor. Drygt hälften av de pengarna ska betalas av staten, och finansieringen sker också delvis med höjda trängselskatter. Det blir byggstart om 2 år och allt ska vara klart 2025. Tycker du att trängselskatter kan betala hälften av 26 miljarder kronor? Om inte, hur ska staten betala? Skatt?

KTH research dagblad

a few hundred million

Contractors:

usually few subcontractors, railway contractor, train contractor, signal contractor, tunnel contractor  
around 5-10 contractors

contracts, some do in-house, some contract out  
to consultant (外包业务)

do as Trafikverket

project management run by SL,  
policy wise and decision making done by SL (a lot legal form)  
Main document of contract written by SL. technic  
specification written by consultant,  
SL has specification-technic guideline, SL contract  
details

## Jernhus center trainstation

8, Landstinget och kommunerna delar på den andra hälften. Kan landstinget och dessa kommuner betala detta?

Har landstinget och kommunerna andra viktigare ämne än utbyggnaden av tunnelbanan att betala?

shops at station money go to SL

7½ till 200-300 million

Jernhus

project and program department of SL  
deal alot of timeplan questions

proper excel pm — project management method

9, Vad är syfte av utbyggnaden? Ordna kapaciteten i infrastrukturen eller bygga fler bostäder? (SVT, professor KTH Jan-Erik Nilsson)

plan Blue Line since 2012 sept, Oct

plan 1.5-4 years

build 6 years Nacka

contractor  $\hat{=}$  trafikverket = SL

2017

political decision MTR operate subway  
SL make sure there is public traffic, but should  
not be the one who carry out the public traffic.  
politac  
Reel party want more in-house source

10. You said investment of 2013 is 4 billion, all from tax, but p.12 "Finansieringen av SL:s investeringar" shows that investment is not all from tax, some of them from statsbidrag, which means from statsskatt? Does Landstinget bidrar investment (Landstinget betalar investment?)  
What is "Län SLL"?

10. spårfordon means all subway trains (includes spåragn) ✓  
11. "leasingfinansiering ~~means that av fordon~~" means that SL rent trains from other company?



- o better customer service
- o better punctlighet
- o färre inställda tåg
- o bättre städning

the contract make MTR improving all the time SL measure customer satisfaction

according to European quality standard

SL want from MTR more passengers, very focus on customer bonus depend on customer pleasure

efficiency 1) No delay, time schedule

2) drive trains good way

3) answer customer questions

4) more regular cleaning

5) peak time observe, 车次控制合理

6) ECO driving

7) MTR personell should be expertise - service, safety.

8) personell training 残疾人

bonus travel 5 million 按容量

every week report to SL

MTR get paid from SL  $\frac{2.5 \text{ billion}}{12} \times 80\%$

20% see - vite or + bonus

Total could get Max 56 million bonus

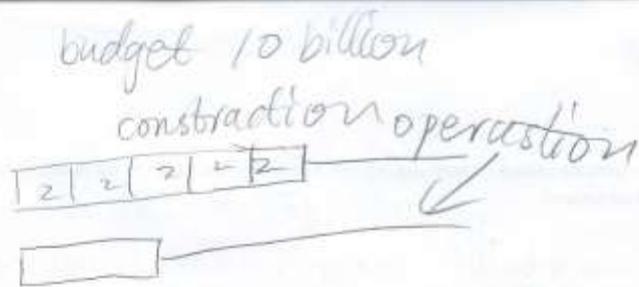
2. How long is the contract period? Does it have an extended period?

3. How does the MTR STHLM get the paid from the SL?

4. Within the contract period, is there any request, included in the contract, for updating hard or soft infrastructure?

no underground infrast updating  
rebuild control run get little extra  
rent more trains paid  
MTR buy practice driving mo-  
MTR offer to SL 模型  
personell  
SL paid  
MTR rent  
out-house

No bonus no punishment in the  
contract with TBT



metro in Stockholm could  
 be easy running profitable

Hongkong fare price raise rate control  
 under the HK Eire

? 80% report from MTR 表精确  
 MTR's report is 2/3

80%	
1 year	2 year

15 Aug. 2008 投标, Total 6 bidders

20 Jan. 2009 the MTR got the bid

2005-2008 three years investigated Subway in Stockholm

MTR started operating subway in London in 2007

Veolia Transport operated subway since 1999 in Stockholm

↓  
Hundölgåren är Veolia Environment, headquarter in Paris.

- 6 bidders: Veolia Transport, S-Bahn Berlin GmbH, T-Banabolaget AB, Stockholm Tub AB, Svenska Tågkompaniet/Nedrailways, MTR

MTR took over the subway 2 Nov. 2009

Four points won the bidding

- ① better customer service
- ② better punctuality
- ③ fewer canceled trains
- ④ better cleaning

Contract last from 2009 to 2017, in 2017.

depends on service which MTR deliver to public, to see if MTR will continue operating subway to 2023.

SL has one contract with MTR.

MTR has one contract with TBT

TBT is a Joint Venture company, MTR owns 50% of it, Mantena owns 50% of it

built 70's 80's  
blue line is newest, all underground except one station  
Kista, winter situations is easy to hold punctuality

Green line is oldest, built 50's, new mode trains C20

Red line built 60's 70's. trains C6, C14, C20

old ~~skulle byskaffa~~  
skulle replace by  
C30.  
but SL hasn't  
done. trains will  
be ~~delay~~ delivery  
delay.

### 7.3 Third interview on 21 May 2014

Interviewer: Penny Andersson ①

Interviewee: Peter Viinapu

Time: 2014-05-21

Q: Why has there been so few BOT or PPP projects in Sweden? (due to financial structures and culture?)

- Arlanda Express NKS Öresundsförbindelsen Öresundsbron
- main reason politic reason history public sector provide public traffic  
tax ~~rate~~ rate is already high, but increase rate is lower/less than population increase rate  
tax income increase is less than growth population
- system public transportation
- county tax 12.1%
- politic

# strömbråk

depåt samarbete med trafik  
TBT  $\rightleftharpoons$  MTR

större ~~avdelning~~ fler mer personal  
tidsplan avdelning.  
analysis

från beställning SL till planering  
av trafik

föret ~~ta~~ chef och medarbetare känna inte  
varandra ~~nu~~ me delaktiv, känna ~~ta~~ varandras  
namn.

Peter thinks that the main reason to this issue is politic reason, i.e. politic culture.

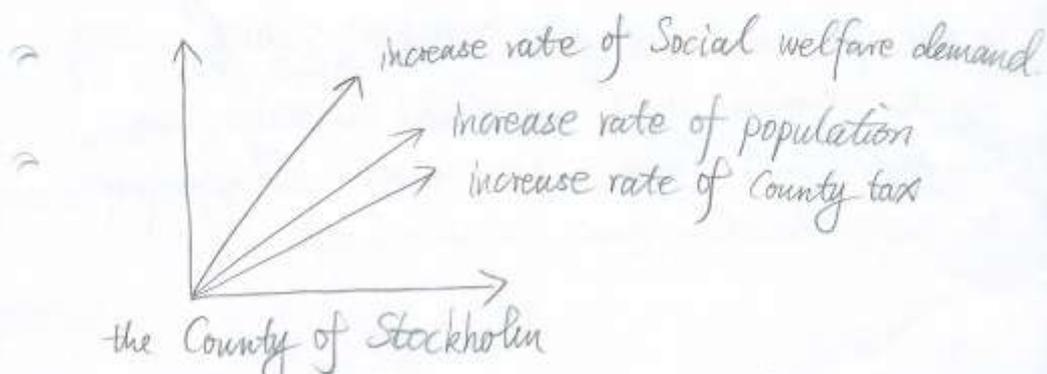
Politicians think that, in history, public sector usually provides public traffic (including providing finances)

County tax rate, in the County of Stockholm, is

already high, <sup>i.e. 12.1%</sup>, but increase rate of County tax is

lower than increase rate of population. Or in other words, increase of County tax income is less than growth of population rate

On the other hand, increase of social welfare demand is higher than increase rate of County tax.



SL and the SL don't want to separate ticket revenue system. The reason is to balance win and loss among different transportations.

the financial structure of the County of Stockholm actually cannot support big infrastructure project, that's

why the government will raise traffic charges at tolls of the City of Stockholm. But this solution can only manage this project, as toll charges cannot be raised forever, therefore SL and the SL need to seek new financial resources.

The Swedish politic structure can be generated to two sides, left and right, left side wants more "Nationalization" while right side wants more "Privatization". Peter thinks that the Swedish politic structure hasn't affect adoption of BOT or PPP in infrastructure. As he has talked to many politicians from both sides, they all see positive at BOT or PPP.

He also mentioned that if China can accept BOT or PPP why not Sweden? Due to China has the socialist system. This means that Chinese government would prefer to nationalization than privatization.

#### 7.4 Fourth interview on 22 May 2014

Interviewer: Penny Andersson ①  
Interviewee: Christian Löf  
Time: 2014-05-22

Q. Why has there been so few BOT or PPP projects in Sweden? (due to financial structures and culture?)

- Lägga ränta. borrow money easy from Banks
- Anders financial minister said "Don't want PPP" plan for 2013.  
agree with partly financed by private sector  
↓ means it's ok to have co-financer  
politic decision
- Internal ~~in~~ company  $\frac{20\%}{8}$

FUT

SLL, se ~~text~~

SLL ~~and~~ don't want to separate ticket revenue system. they want Buses, subway, local transports in one system. Because ~~revenue~~ <sup>profits</sup> from subway can support loss from Buses.

From financial view, the County of Stockholm can borrow money from banks with low interest (2)

From politic view, the Swedish financial minister Anders Borg

- The Swedish government agrees with partly financed (namely co-financed) by private sector
- So it's much about politic decision

SL and the SL don't want to separate ticket revenue system. Namely, they want buses, subway, local transports and etc. in one system. Because profits from subway can support loss from buses.