

# KOREA'S MASAN FREE EXPORT ZONE: BENEFITS AND COSTS

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## I. INTRODUCTION

A component of the Republic of Korea's shift away from an import substitution trade policy in the late 1960s was an interest in the establishment of export processing zones. It was hoped that these zones would attract foreign investment in export-oriented manufacturing activities and would thus contribute to the export-led growth path to which Korea had become committed. This hope was influenced by the apparent success of the free trade conditions existing in Hong Kong and Singapore in attracting this type of investment, and, more particularly, by the view that Korea was competing with Taiwan for Japanese investment and that Taiwan's establishment of a large export processing zone in Kaohsiung in 1966 left Korea at a disadvantage.

Two export processing zones were established. One is at Masan on the southeastern coast of the Korean peninsula and a second is at Iri on the mid-western coast. These zones began operations in 1971 and 1973, respectively. In common with export processing zones in other countries these zones consist of a fenced area of land which is essentially outside the normal customs jurisdiction. Imported raw materials and intermediate goods may be brought into the zones duty free for processing into final consumer goods or more developed intermediate goods provided all output is sold abroad.<sup>1</sup> In Korea these zones are known as free export zones (FEZs). Since the Masan FEZ is much larger than the Iri FEZ this paper concentrates attention on it.

The decision to establish the Masan FEZ was announced by the Economic Planning Board in January 1969. At this time Korea was still experiencing significant balance of payments and employment problems. The government's announced objectives in establishing the zone were thus to attract foreign investment in labor-intensive, high value-added manufacturing activities and through this to promote foreign exchange earning through increased exports, expanded employment in the Masan area, and improved technological knowledge among local firms through technology transfer.

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<sup>1</sup> For general discussions of the economics of export processing zone, see Grubel [3], Kawahara [4], and Wall [11].

The Masan site was chosen because of: proximity to the southern industrial center of Pusan, to which it is connected by a good highway; the harbor facilities existing in Masan; proximity to Japanese ports; and the labor surplus conditions existing in the Masan area at the time. In 1970 an administrative office was established to operate the zone and applications were accepted from firms wishing to enter. Production began in 1971. Since 1977 the Masan zone has been administered through the Industrial Estates Administration under the Ministry of Commerce and Industry.

Although the zone was promoted aggressively during the early 1970s, by the mid-1970s the Masan zone had essentially filled and by the late 1970s the government was no longer actively interested in attracting new firms into the FEZs. This contrasts markedly with the present policies of other (lower wage) countries possessing export processing zones, such as the Philippines and Sri Lanka. The Korean attitude is that expansion of export processing zones is no longer necessary for export growth in Korea and that rising real wages in Korea have meant that its comparative advantage no longer lies in the labor-intensive light manufacturing activities that the zones usually attract.

The interest of the Masan FEZ lies mainly in the lessons that may be drawn from it by other countries at earlier stages of economic development which are currently establishing, or intending to establish, export processing zones of their own. Of course, the fact that Korea's overall policy of export-led growth has, by most assessments, succeeded dramatically does not necessarily mean that each component of that policy has been similarly successful. The Masan FEZ has undoubtedly achieved, in qualitative terms, many of the purposes for which it was founded. But this has been achieved at considerable cost. To a certain extent, the nature of these costs distinguishes the FEZs from most other aspects of Korea's export promotion policy. Large investments in publicly supplied infrastructure and major tax concessions have been provided and this raises the question of whether this investment has been worthwhile. The present paper attempts to provide an answer to this question in the case of the Masan FEZ.

## II. DESCRIPTION OF THE ZONE

### A. *Incentive Package*

The official list of incentives available to firms operating in the zone has remained largely unchanged since 1970. The fiscal incentives include a complete exemption from all customs duties applying to imported and exported commodities. This exemption applies to imported capital goods, provided their importation is approved. Permanent exemptions also apply with respect to business activity tax and value-added tax. Foreign employees of firms operating in the FEZ are exempt from earned income taxation, and profits and dividends remitted abroad are also untaxed. In addition, there is a temporary exemption from corporate income tax, individual business income tax, property tax, and property acquisition tax. This exemption applies during the first five years of

TABLE I  
MASAN FEZ: AGGREGATE ECONOMIC PERFORMANCE

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
No. of firms	4	22	70	115	110	105	99	99	97	94	88	89	83
Employment	(0)	(6)	(24)	(71)	(98)	(101)	(96)	(97)	(95)	(86)	(85)	(81)	(80)
	0	1,248	7,072	21,240	20,822	22,248	29,615	28,401	30,960	31,153	28,532	28,016	26,012
Average wage per employee (U.S.\$ per month)	n.a.	66.0	69.3	70.2	75.5	86.8	101.9	121.5	127.8	137.7	144.3	175.6	191.0
Exports (U.S.\$ million)	0	2.4	23.9	145.5	298.0	257.1	441.0	496.5	579.2	621.7	577.3	664.4	601.3
Local sales (U.S.\$ million)	0	0	0	0	6.2	7.9	25.2	28.1	81.7	90.7	82.5	99.0	92.1
Imports (U.S.\$ million)	0	1.9	16.5	91.7	176.7	137.8	216.7	239.3	270.7	293.0	266.2	295.9	281.7
Local raw material (U.S.\$ million)	0	0	1.0	23.1	48.6	44.6	92.7	120.0	130.0	149.4	131.3	144.0	142.7
New investment (U.S.\$ million)	4.8	9.1	77.8	94.8	10.0	0.1	13.1	8.0	9.6	3.2	-1.9	4.2	-1.0
Value added (U.S.\$ million)	n.a.	0.5	6.4	30.7	78.9	82.6	156.8	165.3	260.2	270.0	262.3	323.5	269.0
Value added per worker (U.S.\$ 1,000 per annum)	n.a.	0.40	0.90	1.45	3.79	3.71	5.29	5.82	8.40	8.67	9.19	11.55	10.34

Source: Calculated from data obtained from Administration Office, Masan Free Export Zone and International Monetary Fund, *International Financial Statistics*, various issues.

Notes: 1. At constant 1982 prices.

2. Figures in parentheses indicate the number of operating firms.

a firm's operation in the zone, and a 50 per cent exemption applies for the next three years.<sup>2</sup>

Nonfiscal incentives include simplified customs clearance procedures for imported capital goods and raw materials and for exported products. FEZ firms are also exempted from most statutes restricting commodities which may be imported, provided these commodities are not resold domestically. Although FEZ firms are expected to export most of their output, sale within Korea is sometimes permitted. Electronics may not be sold domestically but for other goods local sales are limited to a maximum of 30 per cent of the previous year's exports. Intermediate goods, rather than final consumer goods, receive the most favorable treatment in this regard. A feature of the FEZ of great importance to firms in the zone is the existence of a centralized administrative office with authority to intercede between firms in the zone and the various government departments. This reduces firms' administrative costs. Firms are permitted to build factories on rented FEZ land or to rent space in the standard factory buildings which are provided. In late 1981 this rental space had been full for several years. Electricity is available at a 30 per cent discount relative to commercial users outside the FEZ.

Strict labor laws constrain the activities of Korean employees of FEZ firms. Zone firms are treated identically with essential public utilities in that unions are prohibited and collective action of all kinds is illegal. Firms entering the zone receive an official guarantee that their work force will not be allowed to unionize. Remittance of profit and dividends in full is permitted at any time, subject to approval, and remittance from the local sale of capital equipment is permitted up to a maximum of 20 per cent of the value of total capital investment each year after the third year of operation. Finally, firms which incorporate in Korea, as all firms have done to date, are eligible in some cases for export subsidy payments and for concessional rates on local borrowing.<sup>3</sup> Obviously the incentive package offered to FEZ firms is a favorable one.<sup>4</sup>

#### B. *Economic Characteristics*

Since detailed descriptions of the Masan FEZ are available elsewhere,<sup>5</sup> the discussion here will be limited to features of most direct interest for this study.

The aggregate economic record of the zone is summarized in Table I. All monetary amounts presented in the table have been converted to U.S. dollars at constant 1982 prices.<sup>6</sup> The choice of U.S. dollars as the unit of measurement

<sup>2</sup> In practice, the exemption has frequently applied much longer than this, provided firms can argue "special need." In late 1981 some firms which had been operating since 1972 were still enjoying a complete tax exemption.

<sup>3</sup> This applies to some producers of light metal products and chemicals.

<sup>4</sup> For example, the tax incentives and labor regulations outlined are each for more favorable to investing firms than those offered in the Philippine or Indonesian export processing zones. On the other hand, Korean wages are much higher.

<sup>5</sup> See, for example, Asiatic Research Centre [6], Choe [1], and Van [9] [10].

<sup>6</sup> This uses the official exchange rate to convert Korean won into U.S. dollars, where applicable, and U.S. dollar amounts are converted to 1982 prices using the export unit value

is purely a matter of convenience. Korean currency could equally have been used. Employment reached a maximum in 1979, after which there was a 17 per cent decline to 1982. The importance of the Masan FEZ in terms of gross exports can be placed in perspective by comparing it with Korea's other large industrial estates. In 1980 the value of total exports from the five largest of these was U.S.\$3,498 million. This subtotal comprised 21 per cent of Korea's total exports in that year. The composition of this subtotal was: Masan FEZ, 18 per cent; Iri FEZ, 3 per cent; Chang Won Industrial Complex, 7 per cent; Gumi Industrial Complex, 23 per cent; and Korea Export Industrial Complex, Seoul and Inchon, 49 per cent. Exports from the Masan FEZ comprised 3.6 per cent of Korea's total exports in 1980.

The official composition of firms in the Masan FEZ in December 1982 is indicated in Table II.<sup>7</sup> This table is based on the official statistics on the value of total investment of firms classified by industry and country of origin of equity in the firms. The final row of the table shows the distribution of 1982 exports across industry categories. This indicates that 65 per cent of total investment in the zone was fully owned by Japanese firms, 23 per cent was jointly Japanese-Korean, 2 per cent was fully American owned, 5 per cent joint American-Korean, and 5 per cent was fully owned by Koreans. These figures are understood to overstate somewhat the actual degree of Korean ownership. Some firms which are officially listed as joint Japanese-Korean investments, for example, are known to be fully Japanese owned but have thought it expedient to disguise this fact. However, owing to the secrecy involved, it is not possible to estimate the true extent of Korean ownership.

Of the eighty-three firms present in the zone in December 1982, sixty-three occupied their own privately constructed factory buildings, and twenty rented space in the standard factory building provided by the FEZ. Firms renting floor space are considerably more mobile into and out of the zone than those owning their own buildings. In part, this reflects restrictions on the transfer of ownership of self-constructed factory buildings within the FEZ. For example, between December 1981 and December 1982 the number of firms present in the zone fell by six. This decline occurred solely among firms occupying standard factory buildings. However, nine firms actually left the zone during this year and three entered. The firms which left consisted of five fully Japanese owned firms (mainly producing metal products and machinery) and four jointly owned Japanese-Korean firms (more broadly distributed). From the last column of Table II it is clear that electronics and electrical firms represent by far the most important component of total exports from the FEZ. This proportion, 62 per cent of the total, had grown from 52 per cent in 1977.

The FEZ work force has consistently been 75 to 80 per cent female. Average wages for female employees are well below those for males. In Novem-

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index for industrialized countries, expressed in U.S. dollars, published International Monetary Fund, *International Financial Statistics*, various issues.

<sup>7</sup> The accumulated nominal value of total private investment in the zone as of December 1982 was U.S.\$117 million.

TABLE II  
 MASAN FEZ: DISTRIBUTION OF TOTAL INVESTMENT BY INDUSTRY AND COUNTRY OF ORIGIN (December 1982)  
 (% of total private investment)

	Fully Foreign			Joint Foreign/Korean			Fully Korean	Total	Industry Export/Total FEZ Exports
	Japan	U.S.A.		Japan/Korea	U.S.A./Korea Others/Korea				
		U.S.A.	Japan/Korea		U.S.A./Korea	Others/Korea			
Electronics and electrical goods	45.6 (18)	1.3 (1)	0	0.4 (1)	0	0	0	47.2 (20)	61.5
Metal products	7.7 (6)	0	12.0 (6)	1.1 (3)	0	0	3.4 (3)	24.2 (18)	8.2
Non-metal products	0.2 (1)	0.2 (1)	0.6 (2)	0	0	0	0.6 (2)	1.5 (6)	0.4
Machinery	1.6 (3)	0	0	1.2 (1)	0	0	1.3 (1)	4.1 (5)	1.8
Precision machinery	5.7 (4)	0	2.5 (3)	0.2 (1)	0	0	0	8.4 (8)	12.7
Textiles	0.3 (2)	0	1.9 (6)	0	0.3 (1)	0	0.2 (1)	2.7 (10)	5.0
Shoes	0.6 (2)	0	2.2 (2)	2.1 (1)	0	0	0	5.0 (5)	6.1
Other	3.1 (6)	0	3.9 (5)	0	0	0	0	7.0 (11)	4.3
Total	64.7 (42)	1.5 (2)	23.2 (24)	5.0 (7)	0.3 (1)	0	5.4 (7)	100 (83)	100

Source: Calculated from data provided by Administration Office, Masan Free Export Zone.  
 Note: Figures in parentheses indicate the number of firms.

ber 1981 the average wage for females was approximately 100,000 won per month (U.S.\$146) while male wages averaged around 210,000 won per month (U.S.\$308). This is mainly accounted for by the fact that males predominate in higher paid supervisory and managerial positions and tend to be considerably older, on the average, than female workers, who predominate in direct production activities and are concentrated in the age group seventeen to twenty-five years. Female workers tend to be employed in the zone for around six years and then leave after marriage. Zone employees work an average of twenty-four days per month and an eight-hour day is normal although workers can be required to accept overtime during periods of peak labor demand.

The zone administration has attempted to encourage FEZ firms to substitute domestically produced raw materials for imported inputs. The proportion of domestically produced raw materials in total input use rose from 21 per cent in 1975 to 33 per cent in 1980, since when it has remained constant. In 1980 the use of domestic raw material was most noticeable in the chemical industry in the FEZ (70 per cent), followed by metals (40 per cent), electronics, and textiles and clothing (each 33 per cent). Precision machinery used only 9 per cent.

Finally, although all exports from the Masan FEZ are required to be labelled "Made in Korea," occupant firms are not entitled to be allocated portions of quotas set by importing countries against Korean exports. FEZ firms consequently do not compete with Korean firms outside the zone for these quotas and are required to make their own arrangements to ensure that their products can be sold abroad.

### III. EVALUATION OF THE ZONE

#### A. *Framework*

Since both the benefits aimed for in the establishment of an export processing zone and the costs incurred in doing so are essentially economic in nature, economic analysis should be capable of indicating whether the investment has proved to be worthwhile. As usual, availability of data constrains this exercise somewhat, but in the case of the Masan FEZ the available data on the economic inputs and outputs from the zone and the costs of construction are of relatively high quality. Even so, some strong assumptions must be made for an economic evaluation of the zone to be possible.

In this exercise the FEZ will be treated as an enclave.<sup>8</sup> We shall focus on the transfer of funds and resources between it and the rest of the Korean economy. Our aim is thus to study the net benefits and costs, as experienced by the rest of the Korean economy, resulting from the existence of the FEZ. We are therefore comparing the welfare outcome for Korea where the FEZ is present with the hypothetical situation in which it is absent. The analysis will disregard income

<sup>8</sup> For a discussion of the "enclave model" in evaluation of foreign investment, see Corden [2]. For an application of this model to a study of the benefits and costs of Indonesia's Jakarta Export Processing Zone, see Warr [14].

distributional considerations within Korea. That is, changes in incomes of all Korean nationals are weighted equally, but changes in the incomes of foreigners receive zero weighting.

### 1. *Firms' profits and losses*

An important and difficult issue is the treatment of the ownership of firms in the zone. If firms were fully foreign-owned, their profits and losses as such would be irrelevant for an economic evaluation of the zone which takes the national economic interests of Korea as its frame of reference. Only the transactions and other economic transfers, broadly conceived, between these firms and the local economy would be considered. The profits and losses of such firms are changes in the incomes of foreigners and thus would not be counted. In the case of domestic firms, these profits and losses would count, since they contribute to domestic incomes.

The domestically-owned proportion of profits and losses from firms in the zone properly belongs in a national economic evaluation of the zone. But these profits cannot be estimated satisfactorily from the available data. This arises because the true domestic content is known to be smaller than nominal ownership records indicate. Some firms have considered it expedient to disguise the true extent of foreign ownership. Second, partly because of the efforts of firms to minimize their tax burdens, profits are seldom officially declared. Many firms report losses year after year. The high rate of turnover of firms suggests that very large profits are not the norm but the fact that some firms consistently report losses over several years and yet continue to operate, and even expand, indicates that reported profits and losses are unreliable.

In this study, the firms in the zone will be treated as if they were fully foreign-owned. This assumption, though not strictly correct, simplifies the analysis greatly and is thought likely to lead to less error than the feasible alternatives. The profits and losses of these firms as such are consequently disregarded.

### 2. *Employment*

The government's concern for the employment generated by the zone obviously reflects the view that the social benefits derived from generating an additional job outweigh the costs. In economic terms, this may be interpreted as meaning that the wage received by the worker exceeds the opportunity cost of his or her employment in the zone. The well-known difficulty of measuring the opportunity cost of workers then arises. In the case of Korea, the absence of minimum wage restrictions or other impediments to the functioning of the labor market is generally taken to mean that market wages provide a good indication of the opportunity cost of labor. But workers in the Masan FEZ are known to be paid consistently higher wages than similar workers employed outside the zone, so the difference represents a source of net gain. This wage differential is mainly explained by the desire of the foreign firms in the FEZ to retain the goodwill and loyalty of their work force, and also by their desire to avoid public criticism.



### 3. *Foreign exchange earnings*

To a first order of approximation, the foreign exchange earnings of foreign-owned firms in the zone merely constitute transactions between firms in the FEZ and firms abroad. Transactions of this sort have no direct effects on Korean nationals and are therefore essentially irrelevant for the calculation of Korea's net gain from the zone. But FEZ firms must convert sufficient of their foreign exchange earnings into Korean currency to meet their domestic wage bills plus purchases of locally produced raw materials minus the value of their local sales of final product. The conversion of foreign exchange into Korean won is made at the official exchange rate and the question therefore arises of whether the social value of the foreign exchange received by the Korean central bank exceeds the value of the domestic currency the firms are given in exchange.

"The value of the foreign exchange received" must be understood to mean the domestic value of the additional traded goods and services Korea may absorb as a result of the addition to its foreign exchange holdings. "The value of the domestic currency" given in exchange to FEZ firms means the domestic value of the Korean factors of production and intermediate goods purchased by FEZ firms with these funds. It is helpful to think of this calculation in two separate steps. The first step is the calculation of the value in domestic currency of the additional traded goods Korea is able to absorb as a result of the foreign currency received from FEZ firms relative to the amount of domestic currency given up. This ratio is equivalent to the shadow price of foreign exchange divided by the official exchange rate. The second step is the calculation of the social opportunity cost of the domestic factors and intermediate goods purchased by the firm relative to the market prices of these items, also in domestic currency. This part of the calculation, involving the shadow prices of domestic factors and raw materials, is best handled separately.

Of course, the firms' true foreign exchange earnings will presumably exceed their conversion of foreign exchange into domestic currency. It is widely understood that transfer pricing is one of the mechanisms by which this profit is realized. But for an *ex post* measurement of Korea's actual gains, the firms' actual foreign exchange conversions are the relevant quantity to look at, since this is what affects Korea.

### 4. *Technology transfer*

During the planning of the FEZ it was hoped that Korean firms would benefit from the technological knowledge of foreign firms entering the zone. It is generally agreed among administrators and firm managers in the zone that this has not occurred to a significant extent. First, most of the firms operating in the FEZ are involved in labor-intensive production and have very little technological knowledge to impart which is not already widely available in Korea. Second, the few firms which do have unique technological advantages protect their knowledge carefully. These firms, of which electronics firms are the best example, are mainly concerned that their competitors, also present in the FEZ, do not gain

access to their technological secrets. These are, after all, valuable company assets, and they are guarded as closely as any other corporate property.

On the other hand, managerial techniques and methods of product quality control are inevitably transferred to the local middle-level managers the firms employ. When these workers transfer to employment elsewhere the managerial training they have received confers a benefit to the domestic economy which is not captured in the wages these workers have received in the zone. One way of treating this is to say that the social opportunity cost of the employment of these workers in the FEZ is lowered by such training. These externality effects can thus be captured in principle by adjusting the opportunity cost of labor parameter. The fact that these managers can obtain significantly higher salaries after a period of employment by foreign firms in the zone than they could have obtained after a similar period of employment elsewhere suggests that these benefits do exist.

##### 5. *Taxes and public expenditure*

The taxes raised from firms in the FEZ are small, but they nevertheless represent a clear source of economic benefit for the domestic economy. They would not be received if the firms were not present, generally speaking, but firms which transfer to the zone from elsewhere in Korea, or foreign firms which would have entered Korea in any case, if the zone was not present, represent an exception. Taxes actually raised in the FEZ would therefore tend to overstate the net tax revenue effects of the zone, which could even be negative.

Public expenditures required to set up the zone represent a clear economic cost. Some of these expenditures made in the zone area may have been required in the absence of the zone. Local roads are an example, but since the Masan FEZ was constructed largely on reclaimed land, this seems unlikely to be important. Similarly, some public expenditures which would otherwise have been required elsewhere in the country are reduced by the movement of population to the Masan area. These include school facilities, public health facilities, etc. Consequently, looking at actual expenditures in the zone area will tend to overstate the net expenditure effects of the zone's existence. But the largest expenditures involved are in fact specific to the FEZ and expenditure diversion seems likely to be a small proportion of the total.

##### 6. *Domestic sales and domestic raw material inputs*

Except for electronics producers, firms in the FEZ are officially permitted to sell part of their output on the domestic market and the 30 per cent upper limit has frequently been relaxed. Many of the goods produced in the FEZ are subject to protection within Korea and domestic sales enable FEZ firms to sell at the higher domestic price. This means, in effect, that in the case of tariff-protected goods the firm is able to collect the tariff revenue which would otherwise have been paid on the equivalent quantity of imports. The net value to Korea of the goods purchased in this way is the net opportunity cost of imports, as given by their border (c.i.f.) prices, but since the firms receive a tariff-inclusive price for them, the difference between domestic and border prices is a net loss to Korea.

On the other hand, when protection takes the form of quantitative restrictions, domestic sales from the FEZ are equivalent to relaxation of quotas by the amount of the sales. Local sales do not displace imports in this case, but are additional to them. The price paid by Korean consumers for these goods is then equal to their marginal value and these sales have no net welfare effect.<sup>9</sup>

The government wishes to encourage the use of domestically produced raw materials and intermediate inputs in the zone. This can be interpreted as meaning that the price paid by firms for these materials is thought to exceed the social cost of producing them. In a domestic environment in which trade interventions and minimum wage laws operate extensively, this view is supported by simple economic theory; the social opportunity cost of both the labor and traded inputs used in domestic production will be below their market prices, implying that the market value of final output exceeds its social opportunity cost. In the Korean case, this source of gain seems unlikely to be important since minimum wage laws are not present and trade distortions are small outside the agricultural sector.

#### B. *Details of Benefit-Cost Analysis*

The estimated annual net benefits and costs from the zone, expressed in U.S.\$ millions at constant 1982 prices, are reported in Table III. Net cost items are identified with negative signs.

##### 1. *Employment*

The net gain from employment is estimated from the total wage bill minus the estimated social opportunity cost of employing these workers. Following Koo [5] the opportunity cost of labor is taken to be the prevailing market wage outside the zone. It is very unlikely that zone workers would be unemployed if the FEZ did not exist. Average wages for semiskilled and unskilled female workers inside the zone were estimated in a 1979 survey conducted by the FEZ administration to exceed wages outside the zone by an average of 17 per cent. This difference in average wages somewhat overstates the true differential because at these wages FEZ firms are able to select among a substantial pool of available employees and the average quality of employees of FEZ firms is somewhat higher than that found in similar firms outside. Firm managers estimate that a differential of between 8 and 12 per cent would be more accurate. Taking the midpoint of this range—10 per cent—means that  $w^f = w^*(1.1)$ , where  $w^f$  and  $w^*$  denote FEZ and market wage rates, respectively. The net gain from employment is thus estimated as the actual wage bill multiplied by  $(0.1)/(1.1) = 0.091$ . The wage data in Table I relate to average wages of direct factory employees and Korean middle-level managers and supervisors, and our analysis applies the same adjustment factor to all wages in each year.

##### 2. *Foreign exchange earnings*

The gains from this source are estimated by taking the value of total wages plus local raw material purchases minus local sales of final product from the FEZ and multiplying by the estimated proportional difference between the estimated

<sup>9</sup> The author has discussed these issues in detail in Warr [12] [13].

TABLE III  
MASAN FEZ: ANNUAL COMPONENTS OF BENEFIT-COST ANALYSIS  
(U.S.\$ million)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Employment	0	0.09	0.54	1.63	1.72	2.11	3.30	3.77	4.32	4.68	4.50	5.35	5.43
Foreign exchange earnings	0	0.11	0.82	4.34	5.39	4.01	7.78	12.00	9.19	9.70	5.89	6.23	6.58
Domestic sales	0	0	0	0	-0.17	-0.22	-0.74	-0.81	-2.02	-2.29	-2.11	-2.26	-2.43
Domestic raw material use	0	0	0.02	0.33	0.73	0.70	1.39	1.80	1.85	2.24	1.97	2.16	2.14
Construction cost	-16.56	-13.96	-11.42	-9.49	-2.08	-1.05	-1.46	-0.97	-0.94	-0.68	-0.44	-0.32	-0.27
Lease charges	0	0	0	1.44	1.79	1.55	1.71	1.50	1.85	1.78	1.74	2.31	2.17
Administrative cost:													
Personnel	0	-0.21	-0.60	-0.71	-0.75	-0.77	-0.81	-1.21	-1.29	-1.37	-1.51	-1.63	-1.67
Buildings	0	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.3
Electricity subsidy	0	-0.01	-0.06	-0.43	-0.77	-0.66	-1.13	-1.28	-1.49	-1.60	-1.49	-1.71	
Net benefit	-16.56	-14.41	-11.13	-3.32	5.43	5.24	9.61	14.37	11.04	12.03	8.12	9.70	9.97

Note: At constant 1982 prices.

shadow price of foreign exchange and the official exchange rate. Estimates of the ratio of the shadow price of foreign exchange relative to the official exchange rate for Korea over the period of interest in this study have been made by Koo [5]. The ratio varies from 1.117 in 1970 to 1.06 in 1980. This provides the basis for the estimates of net gains from this source in Table III, except that Koo's estimates of the proportional difference between shadow and official exchange rates for 1980 were assumed to apply to 1981 and 1982 also.

### 3. *Domestic raw material and local sales*

Estimates of nominal rates of protection by commodity category were used to estimate the domestic net gain from purchase of raw material and the revenue loss from sale of final product.<sup>10</sup> Rates of protection applying to intermediate goods are quite low in Korea, averaging around 2 per cent in nominal terms (effective rates are generally negative, Nam [7]) but protection of finished consumer goods is heavier, averaging around 11 per cent. Local sales from the FEZ have tended to be concentrated on lightly protected items.

### 4. *Taxes*

Data on tax collections from FEZ firms are not available. Tax collections are said to have been very small to date but these collections are likely to become more significant in the future. Nevertheless, the calculations reported in this paper make no provisions for this.

### 5. *Construction cost*

Data were obtained on annual construction costs incurred in connection with the FEZ. These were available on an annual basis except for the years 1970 to 1973, for which only an accumulated total was available. To obtain the data in Table III this subtotal was divided evenly in nominal amounts across these four years and then converted to constant prices. The accumulated nominal total of construction costs up to 1982 was distributed among the various categories as follows. Costs incurred by the Ministry of Commerce and Industry: standard factory building construction, 21 per cent; public utilities, 5 per cent; welfare facilities, 4 per cent. Costs incurred by the Ministry of Construction: land acquisition and preparation, 32 per cent; water supply, 2 per cent; port facilities, 22 per cent; dredging, 10 per cent. These costs do not include construction of the FEZ administration building, which is handled separately under "administrative cost," below.

### 6. *Lease and other charges*

Total receipts from charges levied on FEZ firms, other than utility charges, are reflected in Table III. The distribution of these components within the total was, in 1982: land leases, 25 per cent; standard factory building leases, 37 per

<sup>10</sup> See Nam [7] [8]. Professor Nam kindly provided the author with updated and more detailed information, and the calculations reported in Table III are based largely on this.

cent; management and maintenance charges, 35 per cent; and other charges, 3 per cent.

#### 7. *Administrative cost*

The administrative cost of the FEZ has two components: the opportunity cost of administrative personnel and the opportunity cost of administrative buildings. The number of administrative and other personnel employed by the government to operate the FEZ has remained relatively constant since 1973. It consists of a total of 163 persons, divided as follows: Ministry of Commerce and Industry, 120; Ministry of Construction, 15; Ministry of Labor, 3; and Customs personnel, 25. The average salary of these employees is estimated from data on average wages and salaries of all central government employees published in the national accounts. The administration of the FEZ utilizes building space of approximately 12,000 square meters. This building space would have had a commercial rental value of approximately U.S.\$3 per square meter per month in 1982 and we take this to be the opportunity cost of the administrative buildings of the FEZ, namely a total of U.S.\$432,000 per annum in 1982 prices.

#### 8. *Electricity*

Since electricity is provided to FEZ firms at a 30 per cent discount relative to commercial users elsewhere it seems likely that this entails a social loss. In any year this loss will be equal to the electricity consumption of the FEZ multiplied by the difference between the social marginal cost of generating electricity and the rate paid by FEZ firms. The marginal social cost of generating electricity is presumably below the commercial rate since increasing returns to scale in electricity generation is normal and this implies that marginal costs are below average costs. Taking 30 per cent of the actual electricity bill of FEZ firms will thus be likely to give an upper bound to the loss involved. This is the procedure used in Table III.

#### 9. *Discount rate*

Discount rates are estimated for Korea in Koo [5] from estimates of the real rate of return to capital in various industries. On an economy-side basis these estimates rose over the period of interest in this study from 8.5 per cent in 1970 to 16.3 per cent in 1978. This rise reflects the manufacturing boom which occurred in Korea during this time. It has been argued elsewhere (Warr and Wright [15]) that in a country with an open capital market, and which is a net borrower internationally, the appropriate discount rate is the real rate of interest at the margin on international borrowings. This would imply discount rates well below Koo's estimates and in the range of 2 to 5 per cent. From inspection of the final row of Table III it seems likely that the discount rate will be an important issue in the evaluation of FEZ, since net benefits follow the familiar pattern of large negative values in earlier years, followed by positive values. We will therefore conduct the benefit-cost analysis over a wide range of discount rates.

TABLE IV  
MASAN FEZ: RESULTS OF BENEFIT-COST ANALYSIS

Wage Differential (%)	Net Present Value (U.S.\$ Million)					Internal Rate of Return (%)		
	Discount Rate (%)					Life of Zone (Years)		
	2.5	5	7.5	10	12.5	20	25	30
10	101.5	63.4	37.7	20.0	7.6	13.7	14.6	15.0
7.5	84.3	50.9	28.4	12.9	2.0	12.1	13.1	13.5
5	67.3	38.7	19.4	6.1	-3.2	10.5	11.5	12.1
2.5	48.9	25.4	9.6	-1.3	-9.0	8.4	9.6	10.2
0	29.4	11.5	-0.7	-9.2	-15.1	5.9	7.3	8.0

### C. Results of Benefit-Cost Analysis

The results of the benefit-cost analysis are summarized in Table IV. The net present value of the FEZ is calculated for real discount rates ranging from 2.5 to 12.5 per cent. These net present value calculations all assume the life of the zone to be twenty-five years. This means that the stream of annual net benefits is assumed to be as indicated in Table III until 1982 and then to remain the same as the 1982 value until 1995, after which the zone itself has zero residual value and the land is converted to its best alternative use. Internal rates of return are also computed and are shown on the right side of the table. To study the importance of the assumed terminal date of the zone, as described above, these internal rates of return are calculated under three alternative assumptions about the life of the zone: a twenty-year life (terminating in 1990); a twenty-five-year life (terminating in 1995, as in the net present value calculations); and a thirty-year life (terminating in 2000).

The first row of Table IV shows that, under the assumptions we have described, the FEZ generates an internal rate of return of around 14 per cent. This is a high rate of return by the standards of public projects. This result is not particularly sensitive to assumptions about the life of the zone. By inspection of Table III it is clear that the high net benefits derived from employment and foreign exchange earnings are responsible for this outcome. The gains from foreign exchange earnings are based on estimates of the shadow price of foreign exchange derived by Koo and these estimates seem to be reliable. The gains from employment are based on the estimated wage differential of 10 per cent between FEZ firms and firms outside the zone. This estimate is approximately correct, to the best of the author's knowledge, but since this part of the analysis is open to dispute it is of interest to see how much the results would change if the assumed wage differential was reduced.

In Table IV this issue is handled by recomputing the net present value and internal rate of return results when FEZ wages are assumed to be 7.5 per cent, 5 per cent, and 2.5 per cent above wages outside the zone and finally when there is no wage differential. In the worst case, where the differential is assumed to be zero, the FEZ would generate negative net present value only for rates of discount above 6 to 8 per cent, depending on the assumed life of the zone.

Even this would not be an unfavorable outcome because real international borrowing rates were below 5 per cent throughout the 1970s.

On balance, it would seem that the simplifying assumptions we have made in the course of the analysis will bias the estimated returns from the zone downward, rather than upward. This includes the omission of profits received by Korean firms and Korean joint-venture partners, omission of some tax receipts from foreign firms, possible omission of some gains from technology transfer, possible overestimation of the social cost of electricity subsidies, and the assumed zero residual value of the zone after twenty, twenty-five, or thirty years. We therefore conclude that the Masan FEZ has proven to be a beneficial public investment from the standpoint of economic welfare in Korea.

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