The Impact of US Tax Depreciation Law on Asset Location and Ownership Decisions

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Abstract

The decision of whether to manufacture products within the US, manufacture internationally or to outsource production depends critically upon a thorough understanding of the costs and benefits of each option. In this paper, we contribute to such an understanding by considering the impact of US tax depreciation rules, which differ depending upon whether a US corporation locates its assets at domestic or foreign branches. Our analysis and illustrative examples demonstrate that US depreciation law can indeed have a non-trivial impact on location and sourcing decisions, with direct ownership of foreign assets appearing relatively less attractive once depreciation law is taken into account. More broadly, our results demonstrate that comprehensive asset location and ownership decisions require a detailed understanding of international tax law, rather than just a simple recognition of differences in tax rates among countries.

Keywords: Asset location, depreciation, facility location, income tax, offshoring, outsourcing

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1. Introduction

Determining where to manufacture products, whether in the US or internationally, or to outsource production depends critically upon a thorough understanding of the costs and benefits of each option. In this paper, we contribute to such an understanding by considering the impact of US tax depreciation rules, which differ depending upon whether a US corporation locates its assets at domestic or foreign branches. We thus supplement the recent body of research that explores analytical production models in a global environment, taking into account the cost factors that are unique to international enterprises.

Comprehensive consideration of international facility locations necessitates a detailed understanding of international tax law. Existing literature, however, often ignores tax issues or suggests that income taxes can be incorporated simply by applying the corporate tax rates of the relevant countries to expected profits from those countries. For example, the well known studies of Kogut and Kulatilaka [11], Huchzermeier and Cohen [9], and Lowe et al. [13] use stochastic analysis to evaluate world-wide facility location options under random fluctuations in exchange rates. These studies do not account for taxes, except in a perfunctory way by subtracting a percentage of the profit from the objective function. Similarly, the optimization models of Hodder and Dincer [8] and Gutiérrez and Kouvelis [7] assume that taxes can be incorporated into the (possibly stochastic) per-unit production cost at each facility, but they ignore depreciation calculations in setting these costs.[1]

In sum, prior research oversimplifies the role of taxation by ignoring important details regarding the calculation of US taxable income as well as important interactions between US and foreign tax systems. By considering the impact of US tax depreciation, therefore, we increase the

[1] See also the review paper by Verter and Dincer [21].

richness of existing asset location and ownership research.[2] In doing so, we explain the complicated manner in which US depreciation law, foreign tax rates, and the foreign tax credit interact to potentially impact after-tax cash flows. Our analysis and illustrative examples demonstrate that US depreciation law can indeed have a non-trivial impact on facility location and ownership decisions. Specifically, in most cases, direct ownership of foreign assets appears relatively less attractive once depreciation law is taken into account.

2. Taxation of domestic and foreign branches of US corporations

A foreign branch of a US corporation, like a domestic branch, is not a separate legal entity. While other forms of doing international business exist (most notably, foreign subsidiary corporations), the use of foreign branches remains a popular alternative. During the year 2000, for instance, US corporations reported over $94 billion in non-tax exempt income from profitable foreign branches [14]. Among other advantages, foreign branches are relatively easy to establish and operate, and are not subject to host country laws that require separate foreign subsidiaries to have local owners or board members [15]. Also, a US corporation can reduce taxable income on domestic profits by losses from foreign branches, unlike losses from foreign subsidiaries.[3]

The income from a foreign branch typically is subject to host country income taxation. In addition, US corporations must report income from all branches, domestic and foreign, on their US

[2] To our knowledge, only one previous paper considers depreciation explicitly in a facility location context [16]. As discussed further in the next section, we significantly extend the prior research by (1) applying "declining balance" depreciation to US assets, consistent with common practice, (2) recognizing differences in accepted depreciation methods and prescribed asset lives depending upon whether assets are located domestically or outside the US, and (3) incorporating other details such as the relevance of foreign tax rates and the US prescription against taking a full year's depreciation during the year in which an asset is placed into service.

[3] Though sufficient to demonstrate the importance of foreign branches, the $94 billion figure reported in this paragraph underestimates foreign branch activity [14]. Of particular relevance is the fact that unprofitable branches are not represented. As noted above, the branch form of international business is especially attractive to corporations that expect international activities to be unprofitable (as measured for tax purposes), due to the ability to deduct foreign branch losses on US returns.

tax returns. To reduce the burden of this double-taxation, Section 27 of the US Internal Revenue Code (IRC) provides for a "foreign tax credit," which allows a US multinational corporation to reduce its US taxes on foreign-source income by the amount of foreign income taxes paid. In the typical case where US income tax on foreign-source income (before the credit) exceeds host country income tax[4], therefore, the corporation must only pay the excess amount to the US. The United Kingdom (UK), for instance, has a maximum corporate income tax rate of 30%, whereas the maximum rate in the US equals 35%. On profits from UK branch operations, therefore, the typical US corporation pays 30% to the UK and 5% to the US (35% - 30% credit). Total income taxes paid to all countries in such cases equal the calculated US income tax prior to the credit.

2.1. Depreciation of domestic and foreign assets

IRC Section 162(a) permits US corporations to deduct from their taxable revenues all ordinary and necessary business expenses. Included among these deductions is depreciation, or the estimated portion of a productive asset's cost that is "used up" during the relevant period due to wear, obsolescence, etc. Regardless of the "true" or "economic" changes in the value of a productive asset, US tax law allows corporations to depreciate (deduct) the full acquisition cost over time, in accordance with provisions of the IRC Section 168.[5]

Of particular relevance to this research is the difference in US depreciation law depending upon whether an asset is located outside or within the US. For assets used predominantly outside the US, IRC Section 168 requires corporations to apply the "Alternative Depreciation System," under which depreciation deductions are allocated equally to each year of an asset's estimated

[4] A 2004 study of corporate tax rates, for instance, reports that only 8 of 68 foreign countries have income taxes rates that exceed the maximum US rate of 35%, whereas 56 of 68 countries have lower maximum rates [12]. As measured for this purpose, foreign income tax rates include national taxes as well as taxes imposed by political subdivisions (e.g., provinces).

[5] We note that depreciation for tax purposes can differ significantly from depreciation for financial reporting purposes. Unlike US tax law, for instance, US financial reporting standards require firms to reduce an asset's acquisition cost by the amount that can be recovered at the end of the asset's useful life (salvage value) prior to calculating depreciation.

useful life (straight-line depreciation). For personal property located within the US, however, the "Modified Accelerated Cost Recovery System" allows a corporation to elect accelerated "declining balance" depreciation. Relative to straight-line depreciation, declining balance depreciation allows for greater depreciation deductions during the early years of an asset's life, but smaller deductions in later years. Furthermore, IRC Section 168 allows US corporations to depreciate domestic assets over shorter time horizons than foreign assets.

Table 1 provides a comparison of depreciation schedules for various types of manufacturing assets, depending upon whether the assets are sourced outside or within the United States.[6] As can be seen in Table 1, foreign investments are depreciated at a much slower rate than domestic investments due to the combined effect of straight-line depreciation and longer prescribed useful lives. Whether or not this delay in tax deductions is costly to a US corporation depends, in part, upon the income tax rates in the relevant foreign country. As noted earlier, in the typical case where host country income taxes are lower than those of the US, total taxes paid to all countries equals the calculated US income tax prior to the credit. In such a case, due to the time value of money, the difference in depreciation deductions can be quite costly as demonstrated below.[7]

[INSERT TABLE 1 HERE]

[6] The depreciation schedules provided in Table 1 assume the "half-year convention", under which each asset is treated as if it were placed in service in the middle of the first year and thus warrants only one half-year's depreciation during that period. We do not provide tables or results based upon the alternative "mid-quarter convention" because the half-year convention applies much more frequently and the difference in conventions has no qualitative impact on our analysis. See IRC Sections 168(d)(4)(A) and 168(d)(3) for further information regarding the half-year convention and mid-quarter convention, respectively.

[7] When the relevant US income tax rate *is less than* the corresponding host country rate, the impact of US depreciation law depends upon whether the foreign branch is profitable. If the branch is profitable, the corporation pays no US income tax due to the foreign tax credit (and receives no refund for the excess foreign taxes paid.) Hence, the US corporation only pays host country income taxes and US depreciation of the branch assets becomes irrelevant. If the branch reports losses, however, the corporation generally can deduct the losses in full on its US tax returns. In such a case, the difference between domestic and foreign asset depreciation has the same effect as in the case where the host country has lower income tax rates than the US. This possibility is especially relevant since, as noted earlier, the branch form of international business is attractive to corporations that expect losses from international activities.

2.2. Valuation of depreciation differences

To illustrate the impact of the differences in depreciation schedules, consider the example of investing in a facility that produces furniture, as this has recently arisen in the news [6]. As shown in Table 1, US corporations can elect to depreciate investments in domestic furniture manufacturing assets over eight tax years using a declining-balance method. If the assets are to be located in a foreign country, however, the depreciation occurs over 11 tax years using straight-line depreciation.

In each period, net after-tax cash flow increases by the amount of the allowed depreciation deduction multiplied by the applicable tax rate. Thus, we can measure the differential impact of locating assets at a foreign branch by taking the net present value (NPV) of the differences in depreciation percentages and multiplying by the corporation's marginal US tax rate. This requires both a discount rate (to compute the NPV) and the tax rate. Figure 1 plots the NPV of the differences in depreciation relative to the investment cost for discount rates between 0% and 50%. We apply the current maximum US corporate tax rate of 35%, which is the applicable rate for most large US corporations.

As can be seen in Figure 1, the maximum ratio is 6.32% at a discount rate of 24%. This means that a corporation that locates its furniture production facility in the US would achieve a 6.32% savings, as a function of the investment cost, when compared to investing offshore if it applies a 24% discount rate to such investments. Such potential savings become more pronounced as the difference between depreciation schedules increases. When a firm invests in equipment for the manufacture of "primary steel products," for instance, the maximum savings is 9.32% of the investment cost at a discount rate of 19%.

[INSERT FIGURE 1 HERE]

3. Comprehensive Examples

The preceding analysis and examples show that US depreciation law increases the relative cost of operating a foreign branch. We next demonstrate that this difference in costs can be meaningful when incorporating other relevant factors into the analysis – namely, labor costs, location factors, labor productivity and distribution costs.

3.1. Brazil versus United States Comparison

We begin by considering an automobile manufacturer's decision of whether to produce a new automobile in the US or Brazil. Based upon a similar example reported in the media, we assume that production in Brazil would require a $240 million investment in fixed manufacturing assets and 1,500 new production workers. Production in Brazil would yield 90,000 automobiles per year (for export) [4].

To perform the analysis, we apply hourly wage rates for production workers as reported by the US Bureau of Labor Statistics [18]; and location factors and productivity factors reported by Humphreys [10]. Table 2 summarizes the hourly wage rates, location factors and productivity factors for the US, Brazil and several comparison countries. We assume that labor costs are paid on an hourly basis over a 40-hour work week and a 50-week year.

[INSERT TABLE 2 HERE]

Following [22], we divide global demand into nine regions. We aggregate the demand for each region into a single city located approximately near the region's geographic center. These regions and their representative cities are listed in Table 3, along with each region's share of world private consumption expenditures (adapted from [22]) and annual demand. We compute the annual demand for a given region by multiplying the region's consumption share from Table 3 by 90,000, the output of the proposed facility. To compute distribution costs, we assume that the cost to ship one automobile is given by \$400 + \$0.08d, where d is the great-circle distance between the two sites.

[INSERT TABLE 3 HERE]

As shown in Table 1, US corporations can elect to depreciate domestic automobile manufacturing assets over eight tax years using a declining-balance method. If the assets are located in Brazil (or any other foreign country), the depreciation occurs over 13 tax years using straight-line depreciation. We chose a 13-year study horizon, therefore, to achieve full depreciation of the investment regardless of the depreciation method. We also note that the US tax rate of 35% is relevant for the analysis of both branches, since Brazilian rates are less than US rates under even the most conservative assumptions.[8] We assume a discount rate of 20% for purposes of the analysis.

Table 4 summarizes the after-tax cash flows for investing in Brazil both before and after consideration of US depreciation law. After-tax cash flows (ignoring depreciation) are calculated simply as:

$$(1 - t)(\text{Revenues}) - (1 - t)(\text{Expenses}), \qquad (1)$$

where t is the relevant US tax rate (35%). In contrast, incorporating the value of tax deductions for depreciation yields the following formula:

$$(1 - t)(\text{Revenues}) + t(\text{Depreciation}) - (1 - t)(\text{Expenses}). \qquad (2)$$

[INSERT TABLE 4 HERE]

[8] The maximum corporate income tax rate in Brazil is 25%. Brazil also applies a “Social Contribution Tax” of 9% on corporate income, but commonly allows a partial credit against that tax.

Table 5 summarizes expected cash flows when locating in the US. The results are computed similarly to those when locating in Brazil, except that we adjusted for the location and productivity factors shown in Table 2. Specifically, we assumed that it cost $240 million to locate assets in Brazil, which translates to a $218 million cost in the United States given a location factor of 1.1. Further, given a productivity factor of 1.8, only 833 production workers would be needed in the United States, as opposed to 1500 in Brazil.

Examining the net present values of the two options shows that, prior to incorporating depreciation differences, the optimal decision is to locate in Brazil at the cost of $498 million versus $502 million in the US. However, after adjusting for tax savings from depreciation, in-house manufacturing through a Brazilian branch becomes $9.6 million more expensive. This is despite a US hourly wage that is 8.3 times higher.

[INSERT TABLE 5 HERE]

3.2. Single Facility Location

We now expand our analysis to include each country listed in Table 2 as a possible location. Table 6 reports the NPV of investment costs for each location, both before and after depreciation, at a 20% discount rate. While the US only moves up in the ranking from sixth to fifth after including depreciation, Table 6 reveals that the relative cost of locating in the US decreases dramatically once depreciation is considered. For instance, locating in the US costs $16 million less than the average before including depreciation and $28 million less than the average when deprecation is included, a difference of 72%. Furthermore, the difference in depreciation deductions significantly reduces the disparity between the US and lower-cost countries. For example, the difference between the cost of locating in China and that of locating in the U.S. decreases by 49% due to depreciation, and the difference for Poland decreases by 44%. Hence, once adjustments are made for additional factors relevant to the specific enterprise, such as international business risk [17] or potential negative US public reaction to offshore manufacturing, the US is more likely to emerge as the optimal solution.

[INSERT TABLE 6 HERE]

3.3. Locating Multiple Facilities

We now discuss the problem of locating multiple facilities to meet global demand. This section has two main goals. The first is to show that classical facility location models can be used to solve the problem of locating multiple facilities under an after-tax, after-depreciation objective function. The second is to demonstrate empirically that US branch operations that appear prohibitively expensive when depreciation is ignored can, in actuality, compare quite well against foreign branch operations. Hence, alternatives such as foreign in-house production and outsourcing may be relatively less attractive than previous analyses suggest.

3.3.1. Formulation

We model the after-tax (with depreciation) facility location problem using the classical uncapacitated fixed-charge location problem (UFLP) [1]. The UFLP can be formulated as follows:

$$\text{minimize} \quad \sum_{j \in J} f_j X_j + \sum_{i \in I} \sum_{j \in J} h_i d_{ij} Y_{ij}$$

$$\text{subject to} \quad \sum_{j \in J} Y_{ij} = 1 \qquad \forall i \in I$$

$$Y_{ij} \le X_j \qquad \forall i \in I; j \in J$$

$$X_j \in \{0,1\} \qquad \forall j \in J$$

$$Y_{ij} \in \{0,1\} \qquad \forall i \in I; j \in J$$

In the classical UFLP, I is the set of demand points and J is the set of potential facility sites. f_j is the (annual) fixed cost to operate facility $j \in J$, h_i is the (annual) demand of customer $i \in I$, and d_{ij} is the cost to ship one unit of demand from facility j to customer i. There are two sets of decision variables: X_j equals 1 if a facility is located at site j and 0 otherwise, and Y_{ij} is 1 if customer i is served by facility j and 0 otherwise.

In the after-tax facility location problem, we assume that the time horizon of the UFLP is the anticipated life-span H of the facilities. In our example, $H = 13$. We set the demand h_i to the total demand over H years; i.e., the demand for region i is given by 13 times the annual demand quantity listed in Table 3.

The transportation cost d_{ij} includes both the actual transportation cost (computed as described earlier) and the site-dependent production cost at the facility (computed from Table 2). To account for the fact that these costs are incurred throughout the H-year time horizon, we multiply the before-tax production and transportation costs by $(1 - t)\theta$ where t is the tax rate and

$$\theta = \left[\frac{1}{1+r} + \left(\frac{1}{1+r} \right)^2 + \cdots + \left(\frac{1}{1+r} \right)^H \right] \div H = \frac{(1+r)^H - 1}{rH(1+r)^H}.$$

Here r is the discount rate (in our example, 20%). The reasoning behind this transformation is that \$1 spent per year over H years is equivalent to \$$\theta$H spent in year 0; therefore, since the same production and transportation costs are incurred each year, we can compute the equivalent NPV after-tax cost by multiplying the per-unit cost by $(1 - t)\theta$. We compute the fixed cost f_j in UFLP as the investment cost plus the savings from depreciation (depreciation charges times the tax rate) discounted to time zero.

By formulating the data as just described, one can solve the after-tax facility location problem using a classical facility location model; that is, solving the after-tax location problem requires a change in data, not a change in problem structure. The UFLP can be solved using a number of heuristic or exact methods (see, for example, [2,5]), or using off-the-shelf software such as the freeware program SITATION [3].

3.3.2. Results

To demonstrate the misleading results that may come from ignoring depreciation deductions, we solved the UFLP both before and after depreciation using the data described previously. We then solved both instances again, this time forcing the US to be one of the facility locations chosen. The results are summarized in Table 7.

[INSERT TABLE 7 HERE]

When the unconstrained problem is solved without depreciation, the optimal solution is to locate in the United Arab Emirates (UAE). If the firm wishes to force the US into the solution, the new optimal solution is to locate in the US and the UAE, but that solution costs 42.3% more than the UAE-only solution, making the option to locate in the US seem very unattractive. After including depreciation, however, the picture is quite different. In this case, when the US is forced into the solution, the favorable depreciation schedule makes locating solely in the US only 8.7% more expensive than the unconstrained solution of locating in Mexico. As noted earlier, these results are prior to consideration of additional factors that may favor US production, such as international business risk [17]. In summary, similar to our findings from the single location analysis, incorporating depreciation significantly increases the likelihood that the US will emerge as part of the multiple location solution.

4. Conclusions

We extend previous asset location and governance research by considering the impact of US tax depreciation rules, which differ depending upon whether a US corporation locates its assets at domestic or foreign branches. Our analysis and illustrative examples demonstrate that US depreciation law can indeed have a non-trivial impact on production decisions. In our first example, a firm is choosing whether to locate manufacturing assets in the US or Brazil. Before considering depreciation, analysis indicates that it is less expensive to operate in Brazil than in the US. Results that incorporate tax deductions for depreciation, however, suggest that production through a Brazilian branch is $9.6 million more expensive. We then extend the analysis to include additional potential locations and find that foreign branch sites appear relatively less attractive when depreciation is taken into account. Finally, we employ a classical facility location model to consider the case in which a firm can choose more than one location. Our results show that, ignoring depreciation, the optimal solution that includes a US facility appears much worse than the optimal solution without a requirement to locate in the US. After depreciation is taken into account, however, the difference in costs is substantially smaller. Hence, complete reliance upon foreign in-house production is less likely to be optimal than previous analyses suggest.

More broadly, our results demonstrate that comprehensive consideration of international facility locations necessitates a detailed understanding of international tax law. Such an understanding must go beyond the simple recognition of differences in tax rates among countries, and must incorporate potentially complicated interactions between various tax laws and situational factors. As explained in this paper, for instance, the impact of US depreciation law on cash flows is influenced by several factors, including the location of assets, the relevant industry, foreign tax rates and the foreign tax credit. We thus encourage future researchers to further refine multinational location models by identifying and comprehensively analyzing the impact of additional relevant details of current tax law.

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TABLE 1: US Tax Depreciation Schedules for Domestic and Foreign Manufacturing Assets for Example Industries*

Chemicals			
Year	Domestic	Foreign	Difference
1	20.00%	5.26%	14.74%
2	32.00%	10.53%	21.47%
3	19.20%	10.53%	8.67%
4	11.52%	10.53%	0.99%
5	11.52%	10.52%	1.00%
6	5.76%	10.53%	-4.77%
7	0.00%	10.52%	-10.52%
8	0.00%	10.53%	-10.53%
9	0.00%	10.52%	-10.52%
10	0.00%	10.53%	-10.53%

Wood Products, Furniture, Aerospace			
Year	Domestic	Foreign	Difference
1	14.29%	4.76%	9.53%
2	24.49%	9.52%	14.97%
3	17.49%	9.52%	7.97%
4	12.49%	9.53%	2.96%
5	8.93%	9.52%	-0.59%
6	8.92%	9.53%	-0.61%
7	8.93%	9.52%	-0.59%
8	4.46%	9.53%	-5.07%
9	0.00%	9.52%	-9.52%
10	0.00%	9.53%	-9.53%
11	0.00%	9.52%	-9.52%

Finished Plastic Products			
Year	Domestic	Foreign	Difference
1	14.29%	4.55%	9.74%
2	24.49%	9.09%	15.40%
3	17.49%	9.09%	8.40%
4	12.49%	9.09%	3.40%
5	8.93%	9.09%	-0.16%
6	8.92%	9.09%	-0.17%
7	8.93%	9.09%	-0.16%
8	4.46%	9.09%	-4.63%
9	0.00%	9.09%	-9.09%
10	0.00%	9.09%	-9.09%
11	0.00%	9.09%	-9.09%
12	0.00%	4.55%	-4.55%

Motor Vehicles, Ships, Boats, Railcars			
Year	Domestic	Foreign	Difference
1	14.29%	4.17%	10.12%
2	24.49%	8.33%	16.16%
3	17.49%	8.33%	9.16%
4	12.49%	8.33%	4.16%
5	8.93%	8.33%	0.60%
6	8.92%	8.33%	0.59%
7	8.93%	8.34%	0.59%
8	4.46%	8.33%	-3.87%
9	0.00%	8.34%	-8.34%
10	0.00%	8.33%	-8.33%
11	0.00%	8.34%	-8.34%
12	0.00%	8.33%	-8.33%
13	0.00%	4.17%	-4.17%

Pulp and Paper Products			
Year	Domestic	Foreign	Difference
1	14.29%	3.85%	10.44%
2	24.49%	7.69%	16.80%
3	17.49%	7.69%	9.80%
4	12.49%	7.69%	4.80%
5	8.93%	7.69%	1.24%
6	8.92%	7.69%	1.23%
7	8.93%	7.69%	1.24%
8	4.46%	7.69%	-3.23%
9	0.00%	7.69%	-7.69%
10	0.00%	7.70%	-7.70%
11	0.00%	7.69%	-7.69%
12	0.00%	7.70%	-7.70%
13	0.00%	7.69%	-7.69%
14	0.00%	3.85%	-3.85%

Primary Steel Mill Products			
Year	Domestic	Foreign	Difference
1	14.29%	3.33%	10.96%
2	24.49%	6.67%	17.82%
3	17.49%	6.67%	10.82%
4	12.49%	6.67%	5.82%
5	8.93%	6.67%	2.26%
6	8.92%	6.67%	2.25%
7	8.93%	6.67%	2.26%
8	4.46%	6.66%	-2.20%
9	0.00%	6.67%	-6.67%
10	0.00%	6.66%	-6.66%
11	0.00%	6.67%	-6.67%
12	0.00%	6.66%	-6.66%
13	0.00%	6.67%	-6.67%
14	0.00%	6.66%	-6.66%
15	0.00%	6.67%	-6.67%
16	0.00%	3.33%	-3.33%

*SOURCE: US Department of the Treasury [19,20]. Schedules assume application of the “half-year convention” (See IRC Section 168(d)(4)(A) and Note 6).

TABLE 2: Hourly Wage Rates, Location Factors and Productivity Factors*

Country	Hourly Wage	Productivity Factor	Location Factor
Australia	$15.44	1.60	1.40
Brazil	$2.58	1.80	1.10
China	$3.00	3.00	1.00
France	$17.27	1.20	1.15
Mexico	$2.61	1.70	1.00
Poland	$10.33	1.70	0.95
United Arab Emirates	$4.03	1.60	0.95
United Kingdom	$18.03	1.20	1.40
United States	$21.37	1.00	1.00

*SOURCES: Hourly wage rates are from [18]. Location and productivity factors are from [10].

TABLE 3: Regional Share of Global Private Consumption Expenditures

Demand Region	Representative City	Demand %	Demand Qty.
United States and Canada	Washington, DC, USA	32.2%	29017
Western Europe	Paris, France	29.4%	26438
East Asia and Pacific	Beijing, China	21.9%	19713
Latin America and the Caribbean	Bogota, Colombia	6.9%	6172
Eastern Europe and Central Asia	Kiev, Ukraine	3.4%	3040
South Asia	New Delhi, India	2.0%	1842
Australia and New Zealand	Canberra, Australia	1.5%	1382
Middle East and North Africa	Cairo, Egypt	1.4%	1290
Sub-Saharan Africa	Kinshasa, Congo	1.2%	1105

TABLE 4: Cash Flows from Brazilian Automobile Manufacturing Investment

Year	Investment	Production	Depreciation	Distribution	ATCF w/ Dep	ATCF w/o Dep
0	$240,000,000				$240,000,000	$240,000,000
1		$7,740,000	$10,000,000	$79,835,715	$53,424,215	$56,924,215
2		$7,740,000	$20,000,000	$79,835,715	$49,924,215	$56,924,215
.		.	.	.	.	.
13		$7,740,000	$10,000,000	$79,835,715	$53,424,215	$56,924,215
				NPV(20%):	$469,534,311	$498,019,285

TABLE 5: Cash Flows from US Automobile Manufacturing Investment

Year	Investment	Production	Depreciation	Distribution	ATCF w/ Dep	ATCF w/o Dep
0	$218,181,818				$218,181,818	$218,181,818
1		$35,616,667	$31,178,182	$60,738,128	$51,718,253	$62,630,617
2		$35,616,667	$53,432,727	$60,738,128	$43,929,162	$62,630,617
.		.	.	.	.	.
13		$35,616,667	$0	$60,738,128	$62,630,617	$62,630,617
				NPV(20%):	$459,939,899	$502,066,400

TABLE 6: Discounted Investment Costs Before and After Depreciation (In Absolute Terms and Relative to the US)

	Ignoring Depreciation		Including Depreciation	
	NPV	Relative to US	NPV	Relative to US
United Arab Emirates	$ 448,852,194	89.40%	$ 424,251,534	92.24%
Mexico	$ 449,146,779	89.46%	$ 423,251,349	92.02%
China	$ 470,031,154	93.62%	$ 444,135,723	96.56%
Poland	$ 470,734,933	93.76%	$ 446,134,274	97.00%
Brazil	$ 498,019,285	99.19%	$ 469,534,311	102.09%
United States	$ 502,066,400	100.00%	$ 459,939,899	100.00%
France	$ 524,100,581	104.39%	$ 494,320,836	107.48%
United Kingdom	$ 583,187,851	116.16%	$ 546,934,248	118.91%
Australia	$ 719,337,784	143.28%	$ 683,084,181	148.52%
Average	$ 518,386,329	103.25%	$ 487,954,039	106.09%

TABLE 7: Solutions to the Multiple-location Problem Before and After Depreciation

	Unconstrained Problem			Including US		
Problem Type	**Location(s)**	**Cost ($M)**		**Location(s)**	**Cost ($M)**	**% Difference**
Before Depreciation	UAE	$ 448.9		US & UAE	$ 638.8	42.3%
After Depreciation	Mexico	$ 423.2		US	$ 460.0	8.7%

FIGURE 1: **Net Present Value of Depreciation Differences Relative to Investment Cost (Furniture Manufacturing Example)**