Valuing the Paso Del Norte

Resident and Business Perspectives on the Value of the Environment Relative to Reopening the ASARCO Copper Smelter

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In an earlier study, the economic impact of ASARCO reopening its smelter operations in El Paso was conducted. In impact analysis, the economic contribution of a business is only one side of the story since it tells what types of firms benefit from an impact, but it tells nothing about whether those benefits are equitable. These trade offs are policy analysis concerns that are best understood with all available information. In this regard, IPED has been contracted to examine other amenity and economic factors that may lend themselves in support and/or opposition to the reopening of ASARCO.

The analysis conducted for this report can be considered typical for any region considering projects that may have a large impact on quality of life. To capture some of these impacts, the Institute for Policy and Economic Development (IPED) at the University of Texas at El Paso conducted three separate analyses to measure how residents and businesses in the region value the environment and other amenities that are not fully captured by economic impact models. The analyses include:

1. A general opinion and *contingent valuation* study that measures how residents of the region value the environment. Surveys were conducted in El Paso, Texas; Sunland Park, New Mexico; and, Ciudad (Cd.) Juárez, Chihuahua.
2. A survey of businesses in El Paso and Sunland Park that gauges perceptions about potential impacts on business expansion or relocation from a re-opening of ASARCO.
3. The construction of a set of models that measure other amenity impacts through the analysis of property values.

In addition, an alternative economic impact is provided that considers the *possibility* that ASARCO does not reopen and the land is redeveloped for other purposes. Any alternative at this point is hypothetical and serves only as an example that potential economic activity (such as smelter manufacturing operations) is not an "all" or "nothing" proposition. That is, while ASARCO's economic impact is substantial, in the case that it does not reopen there exist substitute operations for job creation. Two scenarios were selected that incorporate industries associated with health and life sciences. They are:

1. Construction investment and operations for a mid-sized pharmaceutical manufacturing plant.
2. Cluster of plants in pharmaceutical and medical devices manufacturing.

The study concludes with recommended measures that best capture the "true economic impact" of industry on the region using as an example a sector that has created substantial employment and investment in the region – data processing. It also identifies the industry clusters that are the primary drivers and productive core of the El Paso economy. This analysis includes:

1. An economic impact from the data processing sector that serves as a services-based impact on the economy and complements current recruitment and workforce training efforts.
2. Cluster analysis to evaluate data processing and smelting industries.

Valuing the Environment

Quality of life is not easy to define and can be difficult to understand. For example, to some, quality of life with regard to the environment means clean air and water, and to others the presence of a heavy manufacturing facility near regional destinations (i.e., downtown and university) may be viewed as an eyesore. Placing a specific market value on quality of life is also problematic. Clean air is an example – it is simply worth more to some than it is to others. The

reason for this is that consumers are not accustomed to "paying" for environmental goods. With goods and services (i.e., clothes and a restaurant visit) consumers make specific decisions based on income constraints. But environmental amenities are fundamentally different in that they are public goods and belong to an entire affected region.

Using multiple perspectives from the public and business community we find distinct populations within our community that hold quite different views about ASARCO's potential reopening. Taken together, this study provides a wide view of the ASARCO debate, revealing the extent to which the public may be at a distinct disadvantage in understanding the issues involved and how it may be limited in its ability to respond due in part to economic considerations. The critical issues relate to balancing a broad set of quality of life issues (i.e., environment and health) against citizen concerns for economic growth, especially the desire for well-paying jobs.

Citizen Surveys: Opinions about ASARCO

Two citizen surveys were conducted that cover the regional areas directly impacted by the smelter – one examined residents from El Paso, TX and Sunland Park, NM, and the other residents from Cd. Juárez, MX. These surveys were all conducted using a method called contingent valuation (CVM) which *provided researchers with a conservative monetary value that residents place on the environment.*

El Paso and Sunland Park

Respondents were asked about their support for ASARCO reopening. Twenty-six percent indicated that they favored an ASARCO reopening, 44 percent stated that they did not favor the option and 30 percent were not sure of their position. Only considering the "yes" and "no" respondents, almost two out of three persons who had a definitive view about reopening ASARCO are against it.

Cross tabulations were used as one method of data analysis, and the chi-square test was used to determine "statistical significance" between those who are in favor/against ASARCO reopening and respondent characteristics. By significance we mean whether there is a statistically significant difference between a particular characteristic of the population and their answers to whether they support or do not support ASARCO reopening. For example, in order to determine whether men were more likely to support the reopening of ASARCO, a chi-square test of independence was performed which examined whether there were differences in support of reopening between men and women.

The following groups had a statistically significant majority of respondents against renewal of ASARCO's air permit: 1) females, 2) household incomes of $60,000 and below, 3) households with two or more children, 4) the age group 18 through 35, 5) persons with fewer years of El Paso/Sunland Park residency, and 6) Hispanics.

Of particular interest are females and the age group 18 through 35 since these two groups also had a majority more willing to pay to keep ASARCO from reopening (as determined by CVM analysis). This age group includes young professionals with a different view of how El Paso should develop. For example, over 50 percent of persons between the ages of 18 and 35 responded that they are against renewed operations, with only 15 percent in favor of reopening. For persons between 36 and 65 years old we see that a greater percentage are also against air permit renewal, but support for ASARCO reopening increases when compared to the 18 to 35 age cohort. The older generation of 66 years and older is the only age group with more in favor of than against ASARCO renewing operations.

The relationship between age and support for ASARCO reopening should not be underestimated. Young and college educated adults between the ages of 25 and 39 are the most mobile population in the United States. This cohort is a highly-coveted group of workers, a creative class that is the most entrepreneurial, a key contributor to economic opportunity, and an asset to the region's stock of human capital. In addition, women in this age group are now more likely than their male counterparts to be better educated. Consequently, the location decisions of these talented young adults are increasingly influential to metropolitan economic success; for example, high paying industry often follows a highly skilled labor force.

It is no secret that young educated persons are being disproportionately drawn to certain cities. Their choice for places to live is not only based on economic considerations, but also on social and environmental amenities. While economic growth is still an important determinant of migration, many young adults, particularly the well-educated, appear to be putting a higher value on quality of life factors. Regions that ignore these highly mobile young adults do so at their own economic peril. For El Paso, ignoring this group can only exacerbate its negative net migration rate (also known the "brain drain").

Cross tabulations also show that a majority of persons are against ASARCO reopening regardless of distance from ASARCO, area of town, or level of education. This is summarized as follows:

- As a percentage, more persons closest to the smelter are against its reopening with almost two-thirds living within a two mile radius against the idea. This is followed by residents living between two and

five miles from ASARCO with one-half against. The fact that there is no statistical difference between those in favor/against ASARCO reopening and distance from ASARCO means that no distance group supports its reopening (the percent in favor does not change as distance from ASARCO changes).

- Every area of town has a greater percent against renewed operations; hence, there is no statistical difference between persons in favor/against ASARCO reopening and area of town since lack of support remains constant as area of town changes.

- There is also no statistical difference between those in favor/against ASARCO reopening and education level; the results are almost the same with no education group favoring renewed operations.

Survey participants were questioned about who they thought had the best ability to decide if ASARCO should reopen. A majority of the public, 42.4 percent, responded that they can best decide if ASARCO should reopen. Over one-half also indicated that if ASARCO were to re-open they felt that there would be damage to the environment (30 percent reported they were not sure).

Participants were asked a series of questions to gauge their knowledge about ASARCO. Over 90 percent of all respondents indicated that they were aware of ASARCO's existence. Of those that were aware of the ASARCO facility, 96 percent indicated that they knew of the renewal process. However, when respondents were asked how well they understand and how closely they follow the process in which ASARCO is engaged to renew its air permit, *one-half the population failed to understand the process well or follow it closely.*

Lastly, when asked about balancing growth and protection, residents favor a middle ground of protection and economic growth. This is closely followed by more residents inclined to protect the environment versus seeking economic growth. Supporting development over the environment falls a distant third. Thus, quality of life concerns trend towards a middle ground and pro-environmentalist attitude than a developmentalist attitude.

Cd. Juárez

Support in Cd. Juárez for ASARCO reopening is almost non-existent, with 85.2 percent against renewed operations. Since most Cd. Juárez residents oppose renewed operations, cross tabulations using various sample characteristics show that in all but one relationship there is no statistical difference between groups. That is, the majority opposes regardless of 1) gender, 2) area of town, 3) distance from ASARCO, 4) education level, 5) household income, 6) the number of children or minors in their household, or 7) years of residency. The one demographic showing a significant difference with how they answered this question is age group: *the age group 26 through 55 is (statistically) more against renewed ASARCO operations, showing similarities with young El Paso respondents also strongly against*.

Public sentiment in Cd. Juárez about who should decide if ASARCO reopens mirrors El Paso with over two-fifths believing it is a decision for the general public. Moreover, 78.4 percent of Cd. Juárez residents associate ASARCO with more damage to the environment.

Cd. Juárez residents by almost two-thirds indicate they are aware of the facility. Of these citizens aware of ASARCO's existence, four out of five know about ASARCO filing to renew its permit. However, only 18 percent have an adequate understanding and only 12 percent closely follow the process. Participants also afforded more protection to the environment than the need for economic growth.

Willingness to Pay (WTP) and Contingent Valuation Summary

CVM provides a method for estimating the economic value for commodities with no known market value, a concern related primarily to air quality in the case of ASARCO. The most important consideration for conducting these surveys is the use of a referendum vote. In this regard, participants are asked to "vote on whether to tax themselves or not for a particular purpose." *The nature of a tax, however, is one that requires an individual's Willingness to Pay (WTP) based on some calculation of costs versus benefits and a clear understanding about the proposed program that is the reason for the tax.*

El Paso and Sunland Park

Respondents were provided with a scenario that included the possible re-opening of the ASARCO facility and were asked how much money they would be WTP per month as part of a government-sponsored program to keep ASARCO closed.

Adopting a conservative philosophy, *an estimate of the amount of money that El Pasoans are WTP per month into the program is $12.80 per month*. (Median WTP = $8.03 per month – 50th percentile.)

Cross tabs between WTP bid amount of $10 (close to the mean value of $12.80 per month) and various sample demographics show that the majority in the following groups would be WTP a $10 tax to push for a program that protects the environment: 1) females, 2) the age groups 18 through 35 and 46 through 55, and 3) those that are against ASARCO reopening. As noted earlier, of particular interest is the age group

that includes younger El Pasoans. The younger working age population shares a different view about valuing the environment than their older counterparts.

A note of interest is the reasons why persons voted against the program. It is important as a gauge of the number of persons who are not necessarily in support of ASARCO renewing its air permit, but simply cannot afford the proposed program bids. One-quarter of responses as to why they voted against the program (not WTP) said that they can't afford it, while another 16 percent provided other reasons such as cost considerations, too many taxes, lack of trust in government, and that taxpayers should not cover clean up costs.

Cd. Juárez

Respondents were given a script about WTP to fund a legal defense to keep ASARCO from reopening based on violation of the La Paz Agreement.

In Cd. Juárez the mean estimate participants are WTP into the program is the equivalent of $12.28 per month (assuming no wage disparity with El Paso; with the wage disparity the mean estimate is 20.82 pesos per month). The two estimates between El Paso and Cd. Juárez did not statistically differ from one another, after adjusting for wage/income differences and the exchange rate.

Similar to El Pasoans, the two key characteristics of those WTP to promote a program to protect the environment is age groups and those against renewed ASARCO operations.

Hypothetical Bond Program

Employing the scenario presented to respondents in the El Paso household survey, *hypothetically,* municipal bonds with a 10-year maturity would be issued to finance the purchase of the ASARCO facility and redevelop the land for public use. The WTP value, based on an average rate of $12.80 per month emerging from the survey, combined with additional assumptions, can provide insight concerning the amount of funds that, in reasonable probability, could be raised for such a project (Table ES1).

Table ES1. Municipal Bond Issues under WTP Assumptions

WTP	**$12.80 / month**
Number of El Paso Households	230,000
Tax/Payment Receipts Per Year	$35.328 million
Municipal Bond Rate	6.0%
Maturity of Bonds	10 years
Feasible Bond Issue	$260.0 million
Change in Feasible Bond Issue Per 50 Basis Point Change in Rate	$6.5 million

A similar scenario can be developed for Cd. Juárez. The WTP value generated from the Cd. Juárez household survey indicates a WTP amount of 249.84 pesos per year for the typical household. Employing a 10.93 exchange rate (2007 average), the dollar-equivalent WTP value is $22.86 per year per household over a 10-year period. Assuming there are 246,750 households in the "localidad" of Cd. Juárez, $5.64 million per year over 10 years could be contributed to a legal defense fund to "purchase" the perceived environmental-health benefits associated with the El Paso ASARCO facility remaining closed.

If the community participated in such a referendum, negotiations would no doubt be far more complicated than what has been presented here, evidenced in part by the range of opinions. However, it is a proposition that the city might consider if indeed not reopening ASARCO is the chosen course.

Regardless of the course of action undertaken by ASARCO and the City of El Paso, the above analyses indicate that regional residents do place a substantial monetary value on the environment, specifically cleaner air in this study. The program selected is not the critical issue since any number of potential programs could be created. Instead, the critical issue is the economic value that residents place on the environment (specifically, ASARCO reopening). The specific hypothetical program used in this study is simply a means of obtaining that economic value.

El Paso and Sunland Park Business Survey

Contingent valuation was not used for the business feedback. Similar to the citizen surveys, businesses were asked about their support for ASARCO reopening. Forty-seven percent indicated that they favored ASARCO renewing operations, 31 percent opposed renewal, and 23 percent were not sure of their position. Of those who only had a "yes" and "no" opinion, the ratio is 3:2; that is, three-fifths favor and two-fifths are against ASARCO's reopening.

Questions were asked about the types of impact ASARCO's reopening would have on business. Fort-six percent feel ASARCO will have no impact on their business, with another 11 percent believe it will have a negative impact and another 13 percent unsure about any impacts. Thirty-one percent indicate they see a positive effect.

Businesses are split between whether ASARCO's reopening will either have a positive impact or no impact at all on local suppliers (38 vs. 36 percent, respectively). Nineteen percent are not sure about any impact on local suppliers while 8 percent believe there will be a negative impact.

When asked about their thoughts about the potential impact of ASARCO's reopening on businesses

looking to relocate to El Paso, the responses for a negative impact rises to almost one-quarter, while one-third see a positive impact.

Comparing impacts on their own business with impacts to local suppliers and relocation decisions, businesses are associating a negative impact more towards business relocation. Regarding whether ASARCO would affect business relocation into El Paso, *the business community has both pro-and anti-ASARCO segments but also a very significant neutral and undecided segment that reaches 43 percent*.

When asked in what perspective they would mention ASARCO if a business contact was considering El Paso as a relocation or expansion opportunity, a majority, almost three-fifths, would fail to even mention the smelter operations.

Businesses show a high level of awareness about the ASARCO facility and of the renewal of its air permit. Of these, only three-fifths indicated that they understood the renewal process well while the remainder has little to no understanding.

Overall, it appears that a majority of businesses believe that renewed operations will have no impact or are indifferent or unsure about any impact at all.

Alternative Impact: Pharmaceuticals and Medical Device Manufacturing

Alternative impacts consider the possibility that ASARCO does not reopen and the land is redeveloped for other purposes. Any alternative is hypothetical and does not promote recruitment of specific industrial activity onto the land currently owned by ASARCO. Rather, it serves as an example that potential economic activity (such as smelter manufacturing operations) is not an "all" or "nothing" proposition. While ASARCO's economic impact is substantial, in the case that it does not reopen there exist substitute operations for job creation.

In selecting alternative impacts, the primary criterion was to introduce industry activity that was deemed a "good fit" with the structural changes taking shape in our region. Specifically, two key events are changing our regional economy: 1) BRAC expansion and 2) the proposed Medical Center of the Americas (MCA – includes the four year medical school) in combination with UTEP's health sciences complex. Two scenarios were selected that incorporate industries associated with the health and life sciences.

(Note: Demolition and clean up is omitted from this exercise even though their economic impact would be sizeable given the scale of the site preparation that would have to take place. Values in 2004 dollars.)

Scenario 1: Construction and Operations for a Mid-sized Pharmaceutical Manufacturing Plant

The first scenario involves a $70 million one-time construction investment and 291 employees to match the projected ASARCO direct employment.

Table ES2: Scenario 1 Construction Impact

El Paso	Direct	Indirect	Induced	Total
Employment	1,116	95	301	1,513
Output	70,000,000	11,096,694	27,870,999	108,967,694
Value Added	45,544,576	5,555,114	16,398,209	67,497,896
Labor Income	38,584,808	3,635,584	8,409,866	50,630,258

Table ES3: Scenario 1 Operations Impact

El Paso	Direct	Indirect	Induced	Total
Employment	291	473	248	1,012
Output	225,761,648	58,380,241	22,982,563	307,124,452
Value Added	35,191,260	31,367,452	13,522,091	80,080,804
Labor Income	15,893,889	18,310,173	6,934,644	41,138,705

Scenario 2: Cluster of Pharmaceutical and Medical Devices Manufacturing Plants

The second scenario involves a cluster of businesses in the following industries:

1) Pharmaceutical & medical mfg. – 100 jobs
2) Surgical & medical instruments mfg. – 70 jobs
3) Surgical appliance & supplies mg. – 50 jobs
4) Gasket, packing & sealing device mfg. – 50 jobs
5) Dental laboratories – 20 jobs

Employment and production differences between the above five industries means space requirements for each establishment will also differ. Hence, this analysis does not include construction impacts. The omission of construction also reduces the true economic impact.

Table ES4: Scenario 2 Operations Impact

El Paso	Direct	Indirect	Induced	Total
Employment	290	248	244	782
Output	126,951,013	31,254,437	22,574,949	180,780,400
Value Added	38,338,941	16,638,747	13,282,307	68,259,997
Labor Income	23,316,987	9,900,693	6,811,551	40,029,231

Both alternatives selected in this exercise would generate significant economic impacts for the El Paso region. Moreover, the space requirements would not be as demanding since these operations would only require a fraction of the current ASARCO site. This means that excess land would be available for further development and job and income creation beyond these alternatives. Redeveloped properly and given

its strategic location, a clustering of industries (through recruitment and economic gardening) at the ASARCO site has the *potential* to outweigh its current heavy manufacturing use.

More importantly, as an alternative that is closely linked to the MCA, the Texas Tech Medical School and UTEP's health sciences complex, these scenarios encompass benefits that extend beyond the quantified economic measures. Such intangible benefits include the economic stimulus created by spin-off businesses, contributions to community and individual quality-of-life, and greater research that is a magnet for greater funding and breakthroughs in the field. These intangibles are strongly correlated to higher paying jobs.

Economic Impacts in Perspective: Data Processing and Clusters

The data processing sector has created substantial employment and investment in the region and is expected to continue expanding. An economic impact is performed for Automatic Data Processing (ADP), Inc. as an example of a services-based impact on the economy that complements current recruitment and workforce training efforts, as well as serves as a comparison to smelting operations. Cluster analysis is also performed to evaluate data processing and smelting industries.

Impacts in Perspective and ADP Operations

The table below shows the IPED study regarding the operations impact if ASARCO is allowed to reopen.

Table ES5: ASARCO Operations Impact

El Paso	Direct	Indirect	Induced	Total
Employment	291	1,092	437	1,819
Output	917,448,512	202,110,982	40,390,284	1,159,949,788
Value Added	74,607,248	72,294,592	23,764,058	170,665,897
Labor Income	20,544,832	41,204,197	12,187,713	73,936,742

The study reported an increase in "*regional economic output by $1.159 billion.*" Output, however, should not be misinterpreted or thought of as a true measure of economic "impact" because output is only the total value of production, which is traditionally greater than the goods and services that go into production. The reason for this is that output multipliers account for sales by other industries who are feeding into the directly impacted industry. Thus, final output includes sales from other industries – i.e., it can double count (in the same way that t-accounts in accounting track two sides of a ledger). In the case of smelters, the production function indicates that a majority of sales are intra-industry (or intra-firm), meaning that there are stages of production within the same industry – i.e., transfers from one plant or unit to another.

Consequently, while output is a useful measure for sales or production volume and is primarily important when there is a diversity of industries contributing, solely promoting output of an impact study tends to overestimate the "true economic impact" to the region. Similar to other IPED impact studies, value added or labor income is recommended as a more important measure of the influence of an industry on the regional economy since they measure income going to people in the region rather than measure business or production inputs. The importance in interpretation is captured with the following example.

In one year of operations in El Paso beginning in 2006, ADP has invested $9.5 million in building improvements and has created about 1,028 jobs. The overall impact for ADP on the El Paso economy is:

Table ES6: ADP Construction Impact

El Paso	Direct	Indirect	Induced	Total
Employment	129	25	37	190
Output	9,500,000	2,332,424	3,409,475	15,241,899
Value Added	5,174,600	1,224,184	2,006,001	8,404,785
Labor Income	4,373,638	799,461	1,028,786	6,201,885

Table ES7: ADP Operations Impact

El Paso	Direct	Indirect	Induced	Total
Employment	1,028	706	435	2,168
Output	149,018,080	54,950,434	40,209,997	244,178,505
Value Added	55,078,056	31,372,656	23,658,125	110,108,834
Labor Income	42,664,360	20,722,494	12,134,154	75,521,007

Comparing Table ES5 (ASARCO operations impact) with Table ES7 (ADP operations impact), we see a large difference in estimated total output ($1.159 billion vs. $244.2 million). However, as noted above, the best measures for the "true economic impact" in a region is value added (equivalent to gross metropolitan product) or labor income. Taking this into account, we see a different picture – in terms of labor income, ADP has a slightly higher economic impact than ASARCO within the region.

The large discrepancy between the estimated ASARCO output and labor income lies in that the majority of the production value is captured within the industry itself – it is unclear what portion of the output impact stays in El Paso.

Cluster Analysis

Clusters are built based on strongly associated linkages among industries, via sales and purchasing patterns, and provide insight into areas that can be developed to promote regional economic expansion and competitiveness. Moreover, these clusters each have narrowly defined industries that employ specific

occupations that can be used by regional training providers to match industry development with occupational skills sets.

For El Paso, services-based clusters are the primary drivers and productive core of our regional economy, witnessing healthy growth rates since 1991. Due to the high degree of intra-industry stages of production, there is a relatively small employment size of business clusters related to ASARCO. By comparison, the Information Services cluster, whose strongest core industry is data processing, is not only a major employer in the region (over 20,000) but is well diversified (almost 1,900 firms).

Furthermore, the Information Technology cluster, which is also driven by data processing and related services, has the 2nd largest employment of any technology-based cluster in El Paso, employing over 4,000 among 159 firms. Job growth in these clusters has been bolstered by recent expansion and recruitment efforts. Benefits extend beyond the direct relationship between technology-based employment and wages found in information services; they extend to transferable skills that can be used across various industries, providing more economic stability as opposed to being dependent on any one industry.

The El Paso area has changed significantly over the past several decades, and has undergone structural changes since 1999 when the ASARCO smelter ceased operations. Whereas smelter operations were once a key employer, the region's economic viability has recently been driven by different and more diverse types of operations. For example, employers in the El Paso area now include information technology-based operations like ADP and medical facilities, and more in the life sciences such as suppliers of pharmaceutical and medical devices are considering the region for investment. The impact of BRAC will also have a profound impact on the region in terms of population and the businesses and services that will develop to serve this growing population. For policy makers, promoting the right employment opportunities as the structure of our economy changes is a prime opportunity to tackle the severe case of underemployment faced by our region's college educated and highly trained professionals.

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Section I

Introduction

The 1999 closure of the ASARCO Copper Smelting facility in El Paso, Texas was immediately met by concern among citizens and government representatives as 370 jobs were thought to be lost to global influences on copper prices. El Paso economic development officials claimed the closure "would be a very devastating blow to the El Paso economy."[1] After a merger with Grupo México in 1999, a bankruptcy protection filing in 2005 and allegations about exposure to excessive pollutants, ASARCO's position as an economic driver was called into question.

In addition, ASARCO's role and its relative contribution to the economy since its closure in 1999 has subsequently been affected by other economic development. The Base Realignment and Closure (BRAC) process is leading to a dramatic change in the military and federal presence in the community as over 21,000 new troops and their dependents make their way to El Paso by 2013, a total aggregate economic impact of $20.9 billion estimated by 2013 from construction and other spending including troop disposable income.[2] Further economic transformation is underway as the Texas Tech Regional Health Science Center becomes elevated to a four year medical school, bringing with it a new Medical Center for the Americas (MCA), a new Children's Hospital as part of the county-owned Thomason Hospital complex, and aggressive recruitment of firms to El Paso as a result of the Regional Economic Development Corporation (REDCO).

However, even with a positive economic track being followed, public opinion polls in 2005 suggested that the city remained split about ASARCO and its potential reopening. Of those surveyed, 42 percent were in favor, 48 percent were in opposition, and 10 percent reported they were unsure.[3] Clearly, there is much happening in the region and ASARCO, as a business entity, has filed a critical air permit application with the Texas Commission on Environmental Quality (TCEQ) in order to capitalize on current world copper prices that have made El Paso operations once again potentially profitable. ASARCO is following the regulatory process of the TCEQ and has examined the potential economic impacts of reopening its facilities, estimated to be $20.5 million in direct labor income (ASARCO payroll, benefits and related in 2004 dollars) from 291 new ASARCO jobs, primarily union jobs with the United Steel Workers (see Appendix A). In addition to ASARCO's direct purchases from local suppliers, it would create secondary

[1] Vic Kolenc, 1998. "Smelter officials say the pressure's on," *El Paso Times,* 11 November.
[2] Dennis Soden, et al., 2007, "2025: What Will We Need? An Infrastructure and Service Demand Study of El Paso County," Technical Report 2007-01, Institute for Policy and Economic Development, University of Texas at El Paso, August.
[3] Diana Washington Valdez, 2005. "El Paso voters split on Asarco reopening plant," *El Paso Times*, 18 May.

economic impacts through local supplier-to-supplier linkages and regional spending of its employees – $170 million in gross regional product or value added.[4] Based on this economic study conducted by the University of Texas at El Paso's Institute for Policy and Economic Development (IPED), the City of El Paso has taken a position that "ASARCO commissioned half of a study from UTEP solely to determine the positive economic impact of the smelter reopening, failing to address the costs, such as health impacts. The city is paying for the other half of the study that details the full-story of the positive and negative economic impacts if the smelter reopens."[5]

It is important to understand that impact models – like the one utilized in the earlier ASARCO study – answer questions that address the magnitude of the number of jobs created, which industries are affected by other businesses, or how much a business contributes to the economy.[6] Impact models are not, however, valuation, choice, efficiency or location models – that is, they cannot answer questions like what the benefits and costs are, whether a business should open or close, whether one business operation is more profitable than another operation, or whether a business should locate in a particular area. The economic contribution of a business is only one side of the story since it tells what types of firms benefit from an impact but tells nothing about whether those benefits are equitable or what the consequences are. These trade offs are policy analysis concerns that are best understood with all available information. In this regard, IPED has been contracted to examine other potential amenity factors that may lend themselves in support and/or opposition to the reopening of ASARCO.

The analysis conducted for this report can be considered typical for any region considering projects that may have a large impact on quality of life. To capture some of these impacts IPED conducted three separate analyses to measure how residents and businesses in the region value the environment and other amenities that are not fully captured by economic impact models.[7] The analyses include:

1. A general opinion and contingent valuation study that measures how residents of the region value the environment. Surveys were conducted in El Paso, Texas; Sunland Park, New Mexico; and, Ciudad (Cd.) Juárez, Chihuahua.
2. A survey of businesses in El Paso and Sunland Park that gauges their perceptions about potential impacts on business expansion or relocation from a reopening of ASARCO.
3. The construction of a set of models that measure other amenity impacts though the analysis of property values; a method specifically termed hedonic regression.

In addition, the City of El Paso requested an alternative economic impact that considers the *possibility* that ASARCO does not reopen and the land is redeveloped for other purposes. Two scenarios were selected that incorporate industries associated with health and life sciences for the alternative impact:

1. Construction investment and operations for a mid-sized pharmaceutical manufacturing plant.
2. Cluster of plants in pharmaceutical and medical devices manufacturing.

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[4] The total output impact is estimated at $1.159 billion. However, it is important to note that output measures the total value of production, which is traditionally greater than the goods and services that go into production. The reason for this is that multipliers account for sales by other industries who are feeding into the directly impacted industry. Hence, final output includes output or sales from other industries – in other words, it can double count. The IPED study on the impact of ASARCO on the economy indicated that labor income (employee compensation and proprietor's income), which is the biggest component of value added, is a more important measure as it relates to the true economic impact on the regional economy (see Appendix A-4).

[5] John Cook. 2007, "City stands fast in opposition to Asarco," El Paso Times, 29 July.

[6] The ASARCO economic impact study was conducted solely to capture economic effects and such studies are not intended to do anything other that examine the economic role of business and industry development. The role of salaries and wages from ASARCO renewing its operations are accurately captured by that analysis. IPED does not have a position on ASARCO reopening and views its role as an organization that serves as an "honest broker" who, when requested, will examine all sides of an issue in order to insure the public dialogue can be conducted with as much information as possible and takes no advocacy role.

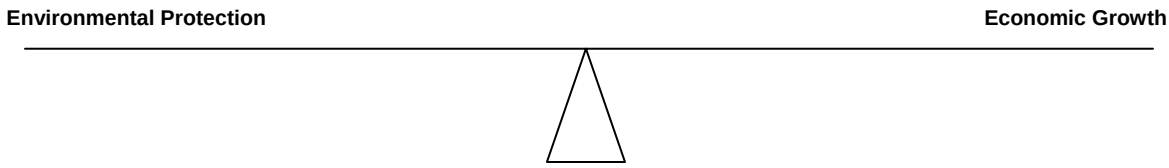
[7] IPED did not look at technical issues relating to smelter operations and air quality standards, inasmuch as these are under the regulatory purview of TCEQ and the on-going air permit renewal process.

The study concludes with recommended measures that best capture the "true economic impact" of industry on the region using as an example a sector that has created substantial employment and investment in the region – data processing. It also identifies the industry clusters that are the primary drivers and productive core of the El Paso economy. This analysis includes:

1. An economic impact from the data processing sector that serves as a services-based impact on the economy and complements current recruitment and workforce training efforts.
2. Cluster analysis is performed to evaluate data processing and smelting industries.

Putting the complexities of an issue like a smelter reopening into a framework that can be supportive of public deliberations is not easy. However, in the case of ASARCO, the critical issues relate to balancing a broad set of quality of life issues (i.e., environment and health) against citizen concerns for economic growth, especially the desire for well-paying jobs. As a community, El Paso consistently reports that well paying jobs are a priority.[8] For public officials, the general public and the business community balanced growth is no easy task and can be thought of in terms of extremes balancing on a very small fulcrum, such that there is a constant shift that goes from one side of the balance point to the other with the hopes that in time a sustainable blend is achieved (see Figure 1.1). Many communities succeed in creating a balance and for most it is a critical period in their community development as a transition or paradigm shift takes place among the public, elected officials, and especially public agencies as they adapt to new forms of planning, community and economic development. However, job creation in a community that has a several decades long record of below national average household incomes, especially must realize the difficulty of shifting to what is known as "smart growth," and faces critical decisions when looking at the future of industry and businesses with long standing positions in the community. Yet, other parts of the nation have faced similar eras of transition, and the transition was not always easy. Like the El Paso region's dependency on the garment industry up until the 1990s, in the Pacific Northwest, the same type of single industry dependence on wood products and the forestry industry had devastating effects on towns like Portland, most of Idaho, and a majority of communities in the Cascades of Washington when it fell into decline in the late 1970s and 1980s. Over two decades later, Portland, Oregon, along with Vancouver and Seattle in Washington, are now examples of community re-thinking and combining new theories of urban development to achieve high standards for both income and quality of life.

Figure 1.1
Balancing Economic Growth and Environmental Protection



Regional Impacts and Valuing the Environment

As previously noted, ASARCO was once a thriving copper smelter that chose its location well in advance of the urban development that now surrounds it. With that urbanization has been a parallel change in how Paso Del Norte residents view the smelter. Just over a decade ago, elected officials regularly visited Austin in support of ASARCO expansion and modernization plans. This shift in opinion is one that has developed nationwide as individuals have begun to value the environment in a fashion equal to the value

[8] See, for example, Dennis L. Soden and America Tirado. 2004, Technical Report 2004-07, **"***Vision 2004: El Paso Citizen Survey*," Institute for Policy and Economic Development, University of Texas at El Paso, June; America Tirado and Dennis L. Soden. 2006, Technical Report 2006-02,"*Vision 2006 El Paso Citizen Survey for the City of El Paso*," Institute for Policy and Economic Development, University of Texas at El Paso, February.

they give to economic development gains, such as new jobs or adding to the property tax base – the trade off discussed above. In the last four decades, the industries often subjected to this kind of analysis are heavy manufacturing operations. Unlike the manufacturing that historically comprised U.S. employment in the first half of the 20th century and the post World War II era, quality of life has become far more important in a post-modern or service based economy.

Quality of life concerns also are related to proximity to the source or point of origin of pollution. In this case ASARCO is unique because most smelter operations in the United States are located some distance from urban areas or operate in relatively small towns where the affected population is minimal, as well as dependent. The ASARCO operation in Hayden, Arizona, for example, resides in a town of 835 and is 69 miles from Tucson, the closest major MSA. Other copper smelters either still in operation or closed since 1985 reside up to 100 miles from the closest major population center (see Appendix B).

Quality of life is a difficult concept for a community balancing growth and protection to address. For some, quality of life with regard to the environment includes clean air and clean water, and to others the presence of a heavy manufacturing facility near regional destinations (i.e., downtown and universities) may be viewed as an eyesore. The problem in many cases is that when we measure quality of life there is no specific market value we can attach to items such as clean air, lack of noise pollution, or an undisturbed view. Moreover, some of these amenities are worth more to some than to others placing them on one side of the other of our scale.

A useful way of conceptualizing the issues brought about by ASARCO is by detailing the location of the goods and services that will be affected and how those goods and services are marketed. In the case of ASARCO, there are both market (copper) and non-market (air) goods that are affected. The location of the goods and services affected can also be classified as either on site (copper) and off site (indirect business impacts). The figure below provides a graphical representation of these impacts.

Table 1.1
Location of Goods and Services Impacted by ASARCO[9]

	On Site	Off Site
Marketed	1 ASARCO production and regional economic impact.	2 Direct, indirect and induced incremental increases in business activity due to ASARCO reopening.
Non-marketed	3 Impacts on health and environment as submitted to TCEQ by ASARCO, with the former finding that ASARCO will not contribute to a condition of air pollution.	4 Natural resource assets, aesthetic degradation (air quality, smell, clarity), property values, business recruitment and expansion impacts, etc.

Thus far, the research necessary to understand how ASARCO's renewed operations impact the region has been conducted for quadrants 1, 2 and 3 as noted above. For Quadrant 4, the off site-non-marketed impacts, are also, in many ways, the most difficult to understand. Especially among consumers who are not accustomed to "paying" for environmental goods. With other consumables – clothes, food, automobiles – consumers make specific decisions based on income and trade-off between different goods depending on that budget constraint. But environmental amenities are fundamentally different in that they are public goods and belong to an entire affected region and are not goods from which any resident can be excluded.

[9] Adapted from Dixon, John A., Louise F. Scura, Richard A. Carpenter, and Paul B. Sherman (1994). *Economic Analysis of Environmental Impacts*. Earthscan Publications. London.

Added to the need to balance community development is the critical role of the public in the policy process. TCEQ, as is the case with most regulatory bodies, has a period for public response as part of its air permit application process. Thus, when ASARCO applies for a permit the public, individually, collectively, or through government can respond about the consequences of an approved permit. This is made more difficult because of the scientific and technical nature of many issues at hand. ASARCO's air quality permit falls into the category that involves a high degree of technical and scientific knowledge to fully understand. In this regard, we are faced with a question of what to do about democratic norms and processes when the public appears to lack the requisite policy relevant information.[10] Social scientists refer to this issue as the "technical information quandary" and the degree to which the public does not comprehend the consequences of decisions, regardless of who makes them, often becomes problematic at later periods when negative externalities arise. These externalities can range from concerns about additional air emissions to cycles in labor markets as a result of a variety of global conditions that treats labor much like any other commodity. Moreover, ASARCO's 100 plus year role in El Paso creates considerable confusion, especially among residents who resided here or worked at ASARCO and always considered it an anchor in the community.

Overall, the ASARCO issue involves a series of knowledge domains that must also be understood. In considering the role of the public's views about ASARCO that are addressed in this report, being able to conceptualize the issue as one of great complexity is important. More important, when individual citizens do not feel they have adequate information or a large number are unsure of the outcome and can not declare a preference, policy and decision makers must take a closer look at the implications of any action and act in the public interest. They must also bear the burden of making difficult choices about the opportunities before them, recognizing that not all things can be done nor will all constituencies be supportive of all outcomes.

Figure 1.2
Knowledge Domains

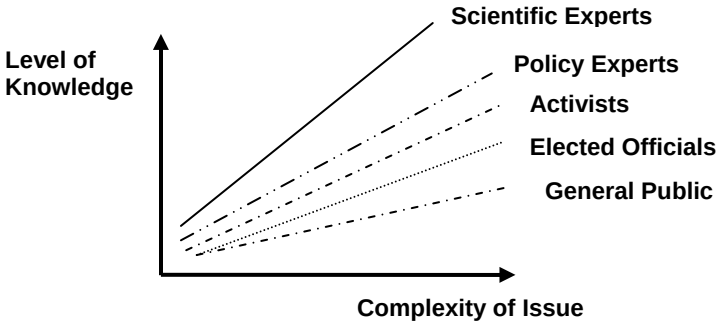


Figure 1.2 provides a diagram of this issue reflecting how the public becomes hindered in its ability to make clear choices as an issue becomes more scientifically complex. ASARCO's request for a new air permit falls into this arena, something a read of the TCEQ report will confirm. The TCEQ reports are not necessarily developed to answer public concerns, but instead address key technical issues and emission and by-product measurement criteria. However, closing the gap between the general public and the

[10] A significant literature exists in this regard including the important work of Lovrich, Pierce, Soden, and Steel, as early pieces that set the parameters of the discussion about policy processes and technical information: Dennis L. Soden and Brent S. Steel, (Eds). 1999. *Global Environmental Policy and Administration*. New York, NY: Marcel Dekker; Dennis L. Soden. 1995, "Trust in Sources of Technical Information: Issue Specific or Consistency Over Time?", *Journal of Environmental Education* Volume 26 (2), Refereed; Dennis L. Soden. 1990. *Managing Florida's Coastal Resources: Technical Complexity and Public Attitudes*. Gainesville, FL: Florida Sea Grant College; John C. Pierce and Nicholas P. Lovrich, 1985, *Water Resources, Democracy and the Technical Information Quandary,* New York, NY: Associated Faculty Press.

scientific community or policy experts is in fact unlikely to occur. This then becomes a burden that falls to citizens and elected officials to demand the answers to the many questions they have, doing the best they can to use the policy process to close the knowledge gap.

Perhaps, more importantly, the outcome of a complex issue may often fall to the group that does the best job to help citizens overcome "rational ignorance." Rational ignorance is quite simple in today's world where we are bombarded by information. Individuals have to make choices about what political or social issues they will pay attention to and at what level of interest. Interest in sports or one's children may take precedent over following a controversial event, ranging from war to commercial development. We all must make choices about what we learn and as a consequence these rational choices result in decisions to not follow all events, even when the outcomes may have a negative effect on us individually, our families, or our communities. In the end we are indeed ill-informed about many issues and only when we are convinced that our interests and those close to us are threatened do we take the time or make the effort to learn more and shed our rational ignorance.

This report makes the assumption that indeed the question of the reopening of ASARCO is very complex and that there are numerous issues and concerns. Using multiple perspectives from the public and business community we find distinct populations within our community that hold quite different views. Taken together, this study provides a wide view of the issue and the extent to which the public may be at a distinct disadvantage in understanding the issues, at one level and, embedded in limits to their ability to respond, on another level, due to economic and related considerations. Figure 1.3 provides an overview of ASARCO's role in El Paso since 1887.

Figure 1.3
ASARCO Timeline in El Paso

1887: Robert S. Town, a pioneer industrialist, founds El Paso lead smelter in order to handle lead ores from Mexico.

1894: ASARCO operates a small hospital for its employees and residents of Smeltertown, a community which grew up next to the plant on Doniphan Drive. The hospital was founded by Dr. Michael P. Schuster of Kansas City. He was assisted by Dr. Henry Towne Safford, nephew and namesake of the smelter's founder. The hospital operated for 66 years, closing in 1960.

1899: Smelter becomes part of American Smelting and Refining Co.

1900: Many of the original workers at ASARCO at the turn of the century were of German descent. It was not unusual to see a keg of cold German-brewed beer in the furnace rooms, according to newspaper accounts.

1911: ASARCO workers had a front-row seat to the Mexican Revolution. One revolutionary leader, Pascual Orozco set up camp across the Rio Grande from ASARCO, just a stone's throw from the smelter. El Pasoans came up from town and showed their support for the insurrectos by throwing dollars and cookies across the river to the Orozco army.

1911: ASARCO adds copper smelter at a cost of $300,000.

1920-1930: Refugees from the Mexican Revolution – poor, uneducated, unable to speak English – find employment at ASARCO, pulling themselves up by the bootstraps and eventually joining El Paso's middle class.

1933: The Rev. Lourdes Costa, a Spaniard and pastor of San Jose Catholic Church in Smeltertown, persuades members of the congregation to erect a monumental cross at the peak of nearby Cerro de Mulerso, Mule Drivers Mountain. The parishioners, whom he affectionately called Esmeltianos, agree. For the next five years, men, women, and children from Smeltertown carved a trail up the mountain.

1940: The 42-foot monument to Christ the King, sculpted by Spaniard Urbici Soler, is completed and dedicated – a monument to the dedication and commitment of the ASARCO workers who built it.

1948: ASARCO constructs slag fuming facilities to recover zinc from lead blast furnace slag.

1949: United Mine, Mill and Smelter Workers, CIO, goes on strike at ASARCO. Strike ends weeks later when contract is approved.

1951: ASARCO builds a 610-foot chimney as demands increase for more pollutant control.

1967: ASARCO's Mexican mines and plants reorganized as ASARCO Mexicana S.A., and 51% interest sold to Mexican investors.

1967: 828-foot smokestack completed; at the time, the largest in the world.

Late 1960s to early 1970s: Employment at El Paso smelter peaks at 1,500 employees.

1970: City of El Paso files $1 million lawsuit, later joined by the State, charging ASARCO with violations of the Texas Clean Air Act.

1970: ASARCO invests heavily in pollution control equipment. From 1970 to 1987 it spends $100 million to combat pollution.

1971: El Paso City-County Health Department reports ASARCO had emitted 1,012 metric tons of lead between 1969 and 1971 and later determined the smelter was the principal source of particulate lead within a radius of one mile. During that period, the smelter also emitted 520 tons of zinc, 1.2 toms of arsenic, and 12 tons of cadmium. ASARCO also reported the smelter was emitting about 230,500 tons of sulfur dioxide a year, or 640 tons a day, during 1969-71.

1971: Additional pollution control equipment is added which results in an 80 percent reduction of lead emissions. Completion of new sulfuric acid plant with its safe scrubbing equipment further reduces lead emissions.

1971: High levels of lead found in the soil at Smeltertown, adjacent to the smelter, prompting the company to remove the top 1 ½ feet of soil and replace it with fresh soil.

1972: High blood lead levels in children living near smelter discovered. ASARCO buys land in Smeltertown and removes residents.

1972: Sulfuric acid plant installed to convert sulfur dioxide gas into acid.

1974: United Steelworkers of America strikes both ASARCO and Phelps Dodge Refining Co., idling 1,350 workers at both plants. The strike ends with a union contract after 154 days.

1975: Corporate name changed to ASARCO Inc.

1975: Injunction requires ASARCO to spend $120 million on modernization and environmental improvements.

1977: Worldwide copper surplus, spurred by 3rd world countries producing more at a cheaper cost, causes markets to plummet.

1977: Follow-up study of blood lead levels in children living near the smelter showed levels had decreased significantly from 1972.

1978: Second sulfuric acid plant installed.

1979: Modernization of El Paso plant completed, reducing emissions of sulfur dioxide by nearly two-thirds from pre-1970 levels.

1980: The El Paso plant no longer processes lead, zinc, antimony, or cadmium.

1983: The zinc plant closes and is demolished.

1984: ASARCO loses $56.8 million.

1985: Lead smelting operations suspended, laying off 300.

1986: The domestic copper industry, which employed 44,000 in 1980, had only 15,000 workers in 1986. Around the country, mines, concentrators, smelters and refineries were being closed.

1986: The antimony and cadmium plant closes and is demolished.

1989: ASARCO board approves expansion of copper facilities at El Paso smelter.

1992: The Texas Commission on Environmental Quality (TCEQ) approves permit for ASARCO's $81 million plant expansion and installation of continuous top-feed oxygen process technology (CONTOP).

1993: ASARCO installs CONTOP as part of $81 million modernization project. This increases production and reduces emissions.

1996: Two acid plants upgraded to expand capacities in El Paso.

1999: ASARCO lays off 370 workers and announces the smelter will be closed Feb. 1, 1999, for a period of at least three years, due to depressed copper markets. Fifty employees are left to maintain the plant so it can be started up quickly. Company officials pledge to start up again when economic conditions improve.

1999: ASARCO agrees to spend $1.8 million to pave roads, alleys and parking lots in a dust-control project in El Paso, and to recycle at least 1,200 tons of scrap tires a year as part of a nationwide penalty to settle claims the company violated federal hazardous-waste and clean-water laws in Texas, Tennessee, and Montana.

1999: Grupo México purchases ASARCO for $2.2 billion (including debt) and retains it as wholly owned U.S. operating subsidiary.

2000: $10 million storm water collection and reuse system is built.

2001: All buildings no longer in use are demolished.

2001: ASARCO submits engineering and design plan to TCEQ. Plan contains results of soil testing.

2002: ASARCO applies for permit renewal.

2002: Faced with copper prices at historic lows and debts exceeding $450 million, ASARCO schedules public auctions at its El Paso plant and at least three others in July to sell surplus equipment, including $3 million to $6 million worth in El Paso.

2002: ASARCO reaches environmental agreement with Justice Dept. guaranteeing ASARCO has liability funds to handle violations.

2003: ASARCO and the Environmental Protection Agency install a fiduciary fund to help pay the costs of environmental cleaning.

2004: TCEQ decides to hold public hearings to examine air pollution and the history of the plant's final three years of operation, as well as the possible risks associated with the renewal of the emissions permit.

2005: ASARCO declares bankruptcy.

2003: TCEQ orders field studies to analyze plant conditions.

2003: Renewal of the emissions permit is currently in process and acceptance could be determined in September.

Source: El Paso Times and Diario de El Paso

Section II

El Paso and Sunland Park Citizen's Survey

Methodology

In this section we discuss the findings related to the citizen survey conducted with residents from El Paso, TX, and Sunland Park, NM. These surveys were all conducted using a method called contingent value methodology which, in its basic form, is designed to "create the missing market for public goods by determining what people would be willing to pay for specified changes" in environmental amenities.[1] Put in layman's terms, contingent value methodology provides policy and decision makers a perspective on how much the public would be willing to pay (WTP) to insure that some action or externality will not occur.

Among economists and policy analysts, contingent value methodology is widely accepted and fills the extant literature.[2] In its basic form contingent value methods are also known as passive use. The bases of this is a theory that individuals need not use the amenity in question but may still derive some value from its mere existence. For example, a person may have never visited a National Park, but is willing to pay a tax to insure it exists. Passive use/contingent value was employed in a well-known incident by the National Oceanic and Atmospheric Administration (NOAA) in determining environmental damage estimates after the Exxon Valdez ran aground in Prince William Sound in 1989. In 1993 NOAA specifically released the findings of its Blue Ribbon Panel headed by two Nobel Prize winners in Economics that concluded that contingent value methods could produce reliable estimates of economic value.[3] Prior to the release of the NOAA report, contingent value studies were conducted in a myriad of ways, with no commonly accepted state of the science method in place. In this regard, the NOAA report provides a set of recommendations for researchers to conduct contingent value studies, with all applicable recommendations as described in Figure 2.1.

Perhaps the most important recommendation for conducting these surveys is the use of a referendum vote. In this regard, participants are asked to "vote on whether to tax themselves or not for a particular purpose."[4] The nature of a tax, however, is one that requires an individual's willingness to pay based on some calculation of costs versus benefits and a clear understanding about the proposed program that is the reason for the tax.[5]

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[1] Richard T. Carson, Robert C. Mitchell, Michael Hanemann, Raymond Kopp, Stanley Presser, and Paul A Rudd. 2003. "Contingent Valuation and Lost Passive Use: Damages from the Exxon Valdez Oil Spill." *Environmental and Resource Economics* 25, pp. 257-286.

[2] Kenneth Arrow, Robert Solow, Paul R. Portney, Edward E Leamer, Roy Radner, and Howard Schuman. 1993. *Report of the NOAA Panel on Contingent Valuation*; Portney, P. R. 1994, "The Contingent Valuation Debate: Why Economists Should Care," *The Journal of Economic Perspectives* 8(4), pp. 3-17; Richard T. Carson,et al. *Environmental and Resource Economics*" 25, pp. 257-286; Michael W.Hannemann. 1994. 'Valuing the Environment Through Contingent Valuation." *The Journal of Economic Perspectives* 8(4) pp. 19-43.

[3] Kenneth Arrow, et al., op. cit.

[4] Kenneth Arrow, et al., op. cit.

[5] W. R. Dubourg, M. W. Jones-Lee, and Graham Loomes. 1994. "Imprecise preferences and the WTP-WTA disparity." *Journal of Risk and Uncertainty* 9(2); R. S. Hartman; M. J. Doane, & C. Woo, 1991. "Consumer Rationality and the Status Quo," *The Quarterly Journal of Economics* 106(1), 141-162. From another perspective, there is also Willingness to Accept (WTA). A property owner has property rights, thus, if some group of individuals owns something that can be transferred into the public domain, hence a public good, they should be compensated for

Figure 2.1
Recommendations for Conducting and Reporting Contingent Value Studies

- Probability sampling: *Probability sampling was used in both the Random Digit Dial survey of households in El Paso and Sunland Park. Probability sampling was also used in the selection of households for in-person interviews in Cd. Juárez.*
- The use of personal and telephone interviews as the two best methods: *Telephone interviews were conducted in El Paso and Sunland Park, while in-person interviews were conducted in Cd. Juárez.*
- Careful pre-testing of questionnaire: *The questionnaire was examined by several trained researchers in Economics, Public Administration and Psychology and was pre-tested extensively prior to fielding.*
- Reporting: *The reporting guidelines recommended by the NOAA are followed here and are presented in the findings.*
- Survey format: *The referendum format recommended by NOAA and additional studies published after NOAA was adopted here. Willingness to Pay (WTP) was also used to provide a conservative estimate despite the existing property rights involved in this particular issue.*
- Reminder of un-substituted commodity: *Respondents were reminded that by choosing a Willingness to Pay option that they would have less money to spend on other items immediately before the Willingness to Pay question.*
- No answer option: R*espondents were allowed to provide an unsure response, with all unsure respondents being included in the group voting against the Willingness to Pay amount. This results in a more conservative result.*
- Cross tabulations: Statistically significant c*ross tabulation recommended by NOAA is provided.*

Source: Kenneth Arrow, Robert Solow, Paul R. Portney, Edward E Leamer, Roy Radner, and Howard Schuman: *Report of the NOAA Panel on Contingent Valuation*, 1993.

El Paso and Sunland Park Contingent Value Survey

Several survey methods are amenable to contingent value analysis, with the two strongest being in-person and telephone surveys. The NOAA Panel that reviewed the use of contingent value for the federal government found that telephone surveys are, in fact, more cost effective and can provide more precise estimates than face-to-face interviews when random digit dialing (RDD), which approximates simple random sampling, is used.[6]

For the surveys conducted in El Paso and Sunland Park, a RDD sample was obtained from a leading national firm, with the sample pre-tested for fax machines and disconnects. All calls were made between July 11th and July 23rd, 2007, on weekdays and Saturdays, between the times of 10:00 am and 8:00 pm. The calling center was also staffed with bilingual (Spanish) personnel.

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giving it up. WTA, however, has no income constraint and leads to higher estimates or demands. Consequently, WTP estimates are found to be more conservative than WTA estimates.

[6] Kenneth Arrow, Robert Solow, Paul R. Portney, Edward E Leamer, Roy Radner, and Howard Schuman. 1993. *Report of the NOAA Panel on Contingent Valuation*.

Each caller received approximately four hours of paid training prior to beginning work. Three IPED staff members were used as supervisors, with at least one supervisor on hand at all times.

A final sample size of 1,175 surveys completed by telephone was achieved. At the 95 percent confidence level, a sample of 1,175 surveys gives region-wide (or total sample) findings at an accuracy level of plus or minus 3 percent. This can be interpreted by looking at a response rate, such as 90 percent in favor of policy X. With a margin of error of plus or minus 3 percent, if the survey was administered 100 times, the range of responses could be between 87 and 93 percent and would fall within this range 95 times out of 100. This sample size and consequent small margin of error affords a high level of survey precision to reflect the population characteristics of El Paso (see Appendix C).

The survey instrument (see Appendix D) was developed by IPED and was subjected to nine rounds of revision and a structured pre-test. Upon completion, the survey was converted to electronic format for use by interviewers in the IPED Survey Research Center. The electronic version of the survey was also pre-tested and verified with regard to data integrity and accuracy and captured data was monitored by IPED staff on a real-time basis. For some questions, the order in which the options to the question were asked was random – randomly generated by the electronic survey – in order to reduce respondent bias sometimes introduced by the order of questions (highlighted grey in the survey in Appendix D and E).

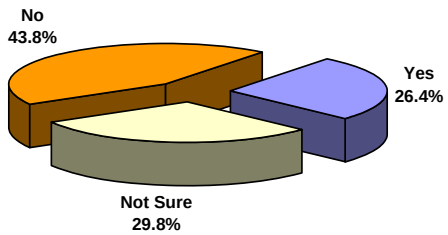
Findings[7]

In this subsection, data on general opinions and characteristics of our sample are reported for both the El Paso and Sunland Park residential surveys. Cd. Juárez results are presented in the following section. While the surveys are very similar, the findings are reported separately because of slight variations and jurisdictional issues. Willingness to pay is presented separately following the residential survey results.

Citizen Opinions about Reopening ASARCO

Respondents were asked about their support for ASARCO reopening in Figure 2.2. Over one-quarter of the participants indicated that they favored an ASARCO reopening while over 40 percent stated that they did not favor the option. Of considerable interest in Figure 2.2 is that almost 30 percent are unsure of their position. At this point in the permit process and given the significant level of media generated by advocates and proponents, it is remarkable in some ways that so many people are unsure of their position. Clearly there are some mixed messages in what people know and mixed feelings that straddle the concern for the environment and the need for jobs in a community with historically high levels of unemployment. Figure 2.3 only considers the "yes" and "no" respondents from Figure 2.2 and shows that almost two out of three persons who had a definitive view about reopening ASARCO are against it.

Figure 2.2
Are you in favor of ASARCO reopening?



[7] A full set of frequency distributions for both the El Paso/Sunland Park and the Cd. Juárez surveys are located in Appendix F and G, respectively.

Figure 2.3
Considering only "yes" or "no" answers from Figure 2.2, are you in favor of ASARCO reopening?

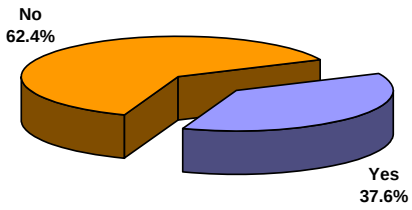


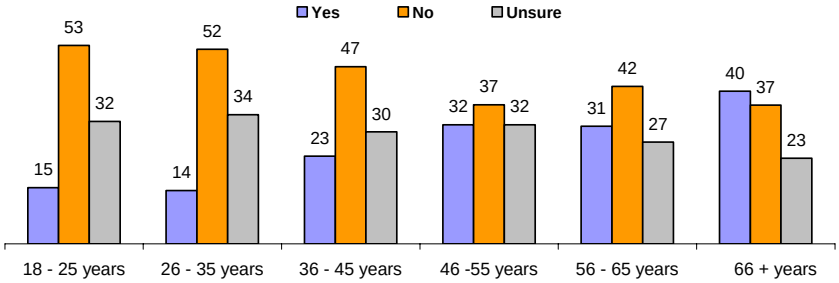
Table 2.1 shows the statistical significance between those who are in favor/against ASARCO reopening and population characteristics. By significance we mean whether there is a statistically significant difference between a particular characteristic of the population and their answers to whether they support or do not support ASARCO reopening. For example, in order to determine whether men were more likely to support the reopening of ASARCO, a chi-square test of independence was performed which examined whether there were differences in support of reopening between men and women. The following groups had a statistically significant majority of respondents against renewal of ASARCO's air permit: 1) females, 2) household incomes of $60,000 and below, 3) households with two or more children, 4) the age group 18 through 35, 5) persons with fewer years of residency, and 6) Hispanics.

Table 2.1
Cross tabs with question: Are you in favor of ASARCO reopening?

	Chi-Square Significance	Statistically Significant
Gender	0.000	Both genders are against reopening but statistically more females are against or unsure.
Household Income	0.002	Incomes $60,000 or less have statistically more persons against & incomes $60,001 or more vary in support.
Number of Children/Persons Under 18 in Household	0.000	Households w/ 2 or more children/minors have statistically more persons against & unsure.
Age Groups	0.000	Ages 18 thru 35 have statistically more persons against & 65 and older only group w/ statistically more in favor.
Years of Residency	0.000	As years of residency rise, statistically more persons are in favor w/ noticeable change above 40 years.
Ethnicity	0.000	Hispanics overwhelmingly against, Caucasians slightly in favor & more African Americans & Asians unsure.

Of particular interest are females and the age group 18 through 35 since these two groups also had a majority more willing to pay to keep ASARCO from reopening (see Section IV). This age group includes young professionals with a different view of how El Paso should develop. For example, Figure 2.4 shows that over 50 percent of persons between the ages of 18 and 35 responded that they are against renewed

Figure 2.4
Cross tab: 1) Are you in favor of ASARCO reopening, and 2) Age group



operations, with only 15 percent in favor of reopening (one-third were not sure). For persons between 36 and 65 years old we see that a greater percentage are also against air permit renewal, but support for ASARCO reopening increases when compared to the 18 to 35 age cohort. The older generation of 66 years and older is the only age group with more in favor of ASARCO renewing operations.

The relationship between age and gender and support for ASARCO reopening should not be underestimated. Young and college educated adults between the ages of 25 and 39 are the most mobile population in the United States.[8] This cohort is a highly-coveted group of workers, a creative class that is most entrepreneurial, a key contributor to economic opportunity, and an asset to the region's stock of human capital. In addition, women in this age group are now more likely than their male counterparts to be better educated. Consequently, the location decisions of these talented young adults are increasingly influential to metropolitan economic success;[9] for example, high paying industry often times follows a highly skilled labor force.

It is no secret that young educated persons are being disproportionately drawn to certain cities. Their choice for places to live is not only based on economic considerations, but also on social and environmental amenities. While economic growth is still an important determinant of migration, many young adults, particularly the well-educated, appear to be putting a higher value on quality of life factors.[10] Regions that ignore these highly mobile young adults do so at their own economic peril. For El Paso, ignoring this group can only exacerbate its negative net migration rate (also known as the "brain drain").

Table 2.2
Cross tabs with question: Are you in favor of ASARCO reopening?

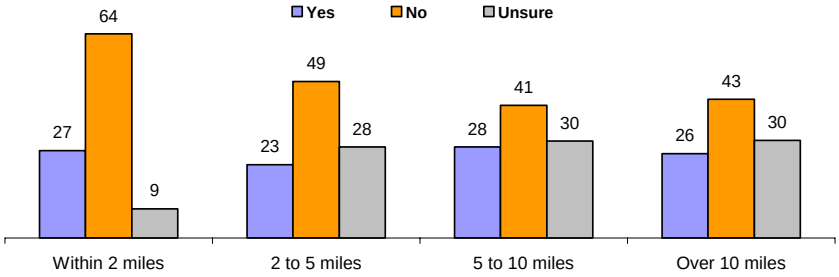
	Chi-Square Significance	Not Statistically Significant
Area of Town	0.383	All areas of town have more persons against ASARCO reopening.
Distance from ASARCO	0.277	All distances from ASARCO have more persons against although w/in 2 miles more are substantially against.
Education	0.338	All education levels have more persons against w/ less persons unsure as education increases.

Table 2.2 shows that a majority of persons are against ASARCO reopening regardless of distance from ASARCO, area of town, or level of education. This indicates no "statistical" association between distance, for example, and support for renewed operations; that is, favoring ASARCO's reopening does not increase as one lives farther away from the smelter. Respondents from all over town with various educational attainment levels share a similar view in their opposition towards renewed operations. This can visually be seen in Figures 2.5 through 2.7.

- Figure 2.5 shows that as a percentage, more *persons closest to the smelter are against its reopening with almost two-thirds living within a two mile radius against the idea. This is followed by residents living between two and five miles from ASARCO with one-half against.* The fact that there is no statistical difference between those in favor/against ASARCO reopening and distance from ASARCO means that no distance group supports its reopening (put another way, the percent in favor does not change as distance from ASARCO changes).

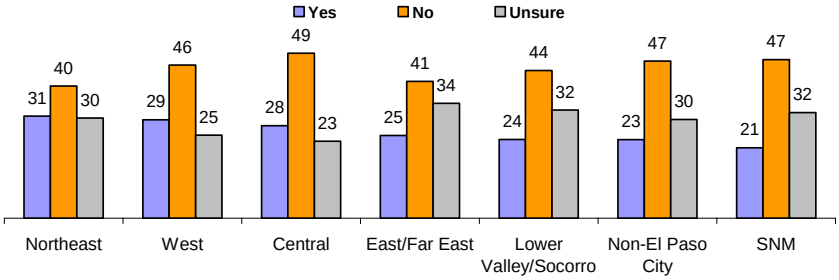
[8] U.S. Census Bureau, "Migration of the Young, Single, and College Educated: 1995 to 2000," CENSR-12.
[9] Cortright, Joseph, December 2005. "The Young and Restless in a Knowledge Economy," Joseph Cortright, Impresa Consulting, for CEOs for Cities.
[10] Ibid.

Figure 2.5
Cross tab: 1) Are you in favor of ASARCO reopening, and 2) How far do you live from ASARCO



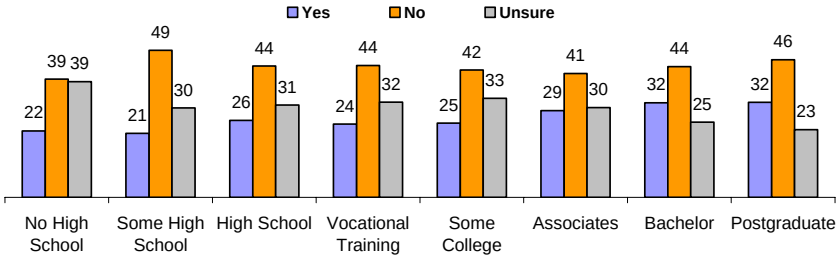
- Figure 2.6 shows that every area of town has a greater percent against renewed operations; hence, there is no statistical difference between persons in favor/against ASARCO reopening and area of town since lack of support remains constant as area of town changes.

Figure 2.6
Cross tab: 1) Are you in favor of ASARCO reopening, and 2) Area of town



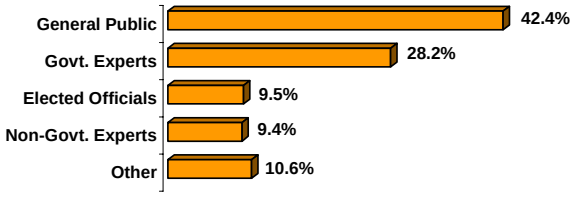
- Figure 2.7 similarly shows no statistical difference between those in favor/against ASARCO reopening and education level; the results are almost the same with no education group favoring renewed operations.

Figure 2.7
Cross tab: 1) Are you in favor of ASARCO reopening, and 2) Education



Getting to the core of the ASARCO air permit renewal process, survey participants were questioned about who they thought had the best ability to decide if ASARCO should reopen. Foremost in the public's mind in Figure 2.8 is themselves, self-defining a role as an interested party and significant stakeholder. Government officials, such as the TCEQ which directs the process, are also afforded less responsibility than the general public. Given today's political and social environment, it appears El Pasoans see themselves in the center of this issue and in a major way. Responding to that interest or demand becomes a critical stepping stone in paving the way for an effective and workable policy outcome.

Figure 2.8
Who do you think has the best ability to decide if ASARCO should reopen?



Questioned about the potential impacts in a non-specific way, respondents overwhelmingly felt there would be impacts that were positive and/or negative as described in Figure 2.9. However, moving beyond the fact that there will be impacts, responses to an open ended question that asked "what they (impacts) were" were recoded into 67 categories based on same or similar responses. Three categories accounted for 63.1 percent of the responses with no additional category beyond these three receiving more than 5 percent as shown in Figure 2.10. However, to add to a policy dialogue that is both complex and controversial, we see that the distribution of impacts, as participants were not asked about either positive or negative impacts, is spread across positive, negative, and both in almost equal distributions.

Figure 2.9
Do you think there are potential impacts, either positive or negative, if ASARCO reopens?

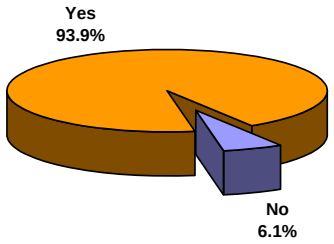


Figure 2.10
Top 3 comments from open-ended question "What are they (potential impacts)"?

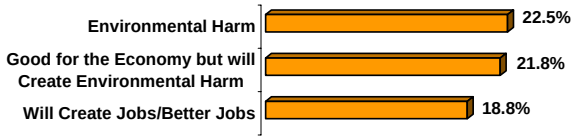
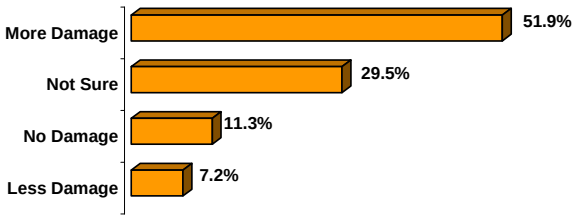


Figure 2.11
In the next ten years, if ASARCO reopens what will be the damage to the environment?



In consideration of a reopening of ASARCO based on TCEQ approval of their air permit, over half of participants indicated in Figure 2.11 that if ASARCO were to re-open they felt that there would be more

damage to the environment. However, 18.5 percent felt there would be no or less damage. Over one quarter also reported they were unsure, once again raising the concern about the ability of the public to make a decision. More importantly there appear to be people who are not fully informed and may need or want additional information. This need for need for information and how they obtain it is described below. How this information is "messaged" may be what sets the overall tone of the public dialogue in the not-too distant future.

General Policy Issues and Importance

In order to provide a general policy context for discussing the issue related to the possible opening of ASARCO's El Paso smelter, several questions examined other issues facing the region. In Table 2.3 citizens were asked about how spending on six issues was needed. Response categories ranged from a "Great Deal More," "Somewhat More," the "Same Amount," "Somewhat Less," to a "Great Deal Less."

Table 2.3
Ranking for Spending on Issues in the Region[11]

	% Great Deal & Somewhat More	% Great Deal & Somewhat Less	Index	Rank
How much should we spend on:				
Creating jobs?	88.1	1.8	**86.3**	**1**
Improving public education?	82.0	2.8	**79.2**	**2**
Public health?	81.2	3.3	**77.9**	**3**
Fighting crime?	74.9	1.8	**73.1**	**4**
Protecting the environment?	75.0	3.7	**71.3**	**5**
Border security?	58.6	10.2	**48.4**	**6**

A ranking for spending preferences indicates that creating jobs is the number one priority, a degree of issue salience that has held a primary position among the general public for over a decade in the region, especially following the decline of the garment industry.[12] Following creating jobs, spending to improve public education ranks second followed by a concern for public health. Fighting crime falls in the fourth position with protecting the environment in fifth. With the concern for spending on border security sixth, three points are worthy of consideration. First, spending to fight crime is important regardless of the fact that El Paso is one of the nation's safest medium size cities.[13] Second, the environment never dominates public surveys, nor has it achieved a priority position in the top rankings for nearly 40 years following the formal development of the environmental movement in the late 1960s. Yet, it still remains among the list of consistent top ten issues and does relate strongly to other concerns and regionally important issues and the "NIMBY" or "not in my backyard" position that is prevalent in many areas. Third, expenses for border security rank last, reflecting a relatively consistent low concern on this issue in several studies among border regional residents. Daily flows across the border are a way of life in the region and national concerns about border security are not always viewed the same among those who actually reside alongside the border.

In developing a study that has a strong public policy content, the amount that individuals are willing to spend on issues, should be mirrored in what they characterize as the most important issues impacting a region. The importance of better paying jobs verifies consistency about issues and spending as seen in

[11] Rank is based on taking the combined total of those who replied "Great Deal More" and "Somewhat More" and subtracting those who replied "Somewhat Less" and "A Great Deal Less."
[12] This statement is based on the series of public opinion surveys conducted by the authors in the region.
[13] Dennis Soden, et al. 2007, "2025: What Will We Need? An Infrastructure and Service Demand Study of El Paso County," Technical Report 2007-01, Institute for Policy and Economic Development, University of Texas at El Paso, August.

Table 2.4, where respondents were asked to rank the importance of issues from "Extremely Important" to "Not Important at All" on a five-point scale. The degree to which the public holds its concerns and willingness to support addressing those concerns in close association insures validity of the data collected.[14] In Table 2.3 we see great consistency to the previous data. Air pollution moves into the second position, an indication that specific environmental concerns can elevate over the idea of the environment in general. Improving graduation rates, in this case with no specific grade level indicated also parallels the high support for spending on public education. The importance of ethical government, ranked 4th, also follows recent concerns about government and government officials in the region that has been front page news for some time. Reducing taxes also is historically a concern for citizens of almost all backgrounds and, in the case of Texas is especially of note to property owners who carry the burden of no state income tax. Lastly, consistent with the findings in Table 2.2, dealing with immigration issues and reforms do not garner the high level of concern that is seen in other regions of the country and, reflect in part, the make up of the region and the fact that immigrants in the southwest border region are part of their communities and/or share roots in both nations.

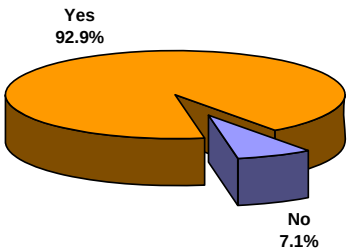
Table 2.4
Ranking of Importance on Key Issues in the Region[15]

	% Extremely & Very Important	% Not Too & Not Important at All	Index	Rank
How impartant is/are:				
Better paying jobs?	86.3	1.5	**84.8**	**1**
Reducing air pollution	81.1	2.5	**78.6**	**2**
Improving graduation rates?	82.5	3.9	**78.6**	**2**
Ethical government?	80.1	3.5	**76.6**	**4**
Reducing taxes?	71.7	6.8	**64.9**	**5**
Immigration issues & reforms?	66.5	9.2	**57.3**	**6**

Citizen Understanding about ASARCO

Following a general policy preference and ordering, participants were asked a series of questions gauge their knowledge about ASARCO. As Figure 2.12 shows, ASARCO is a well known facility in the community with over 90 percent of all respondents indicating that they were aware of its existence. Given the 100 plus year presence this should come as no surprise, but the degree to which citizens are knowledgeable about ASARCO needs to also be considered.

Figure 2.12
Are you aware of the ASARCO facility?



[14] As the general public shows consistent opinions it serves as markers that indeed they are engaged in the policy process or debates and can show some consistency in their values and opinions.
[15] Rank is based on taking the combined total of those who replied "Extremely Important" and "Very Important" and subtracting those who replied "Not Too Important" and "Not Important at All."

The issue of public knowledge about critical issues takes many forms. As a starting point, survey participants were asked if they had heard or read of the permit process that ASARCO has undertaken to renew operations. Of those that answered "Yes" about being aware of the ASARCO facility,[16] 96 percent indicated a response that they knew of the renewal process, reported in Figure 2.13. Regardless of where one may have been in the region, it is probably safe to say that ASARCO has been a topic of discussion and has received its share of media attention.

Figure 2.13
Have you read or heard about ASARCO trying to renew its air permit to renew operations?

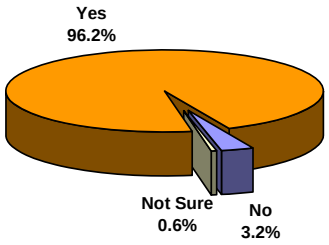


Figure 2.14
How would you describe your understanding of the process that ASARCO must go through to renew its air permit?

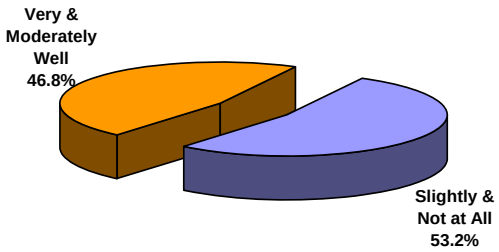
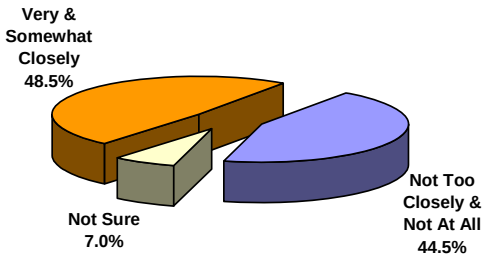


Figure 2.15
How closely would you say that you have followed this permit renewal process?



In Figure 2.14 respondents are asked how well they understand the process in which ASARCO is engaged to renew its air permit. In total, less than one-half felt they understood the process "very well" or "moderately well." Over one-half (53.2 percent) noted that they understand the process only "slightly" or "not at all." The process being followed is in fact quite complex and involves a series of regulatory benchmarks that must be met by ASARCO. Overall, even the most informed often find regulatory procedures difficult to comprehend and this becomes heightened when issues become more technical and scientific in nature, thus it seems a majority not having a high level of understanding would consistently follow. It also is consistent in Figure 2.15 that we find those who self-report following the process "very closely" or "somewhat closely" account for slightly less than one-half, similar to those who understand the process. Attention to the issues at hand, an "attentive public," should parallel understanding. This attentive public who indicate they understand the permit renewal process and follow

[16] If they answered "No" respondents skipped questions about the renewal process.

the permit process can be expected to engage in the public debate, having shed the rational ignorance discussed previously and investing time and energy into tracking the issue, regardless of whether they support or oppose the air permit renewal.

In the course of any public discussion, individuals on both sides are likely to rely on outside information sources. A long history of studies has confirmed that open sources, such as television and newspapers tend to prevail as the most used information resources, even when the level of complexity is extremely high. Table 2.5 examines sources of information about ASARCO and the level of use among the public, as well as the level of trust held in each of the sources. Trust in information sources related to the environment has changed somewhat over time from a high trust in government in the early 1960s and before to low trust in government today and a higher regard for mass media. Trust in sources around controversial projects and activities that are associated with the environment have also shown some change but overall have remained relatively consistent for some time.[17] The findings for the two questions in Table 2.4 reflect what would be similar in almost any survey with the noted logical increase in internet usage over time and a continued lower regard for public officials. Mass media (television, newspapers, radio) remains the main source and are most trusted. ASARCO's position in terms of trust is also most likely linked to the increased coverage of other sources. For an individual respondent there is also a tendency to favor or prefer some sources over others, regardless of the issue, creating a consistency in relationship to how information is obtained and regarded.

Table 2.5
Information Source and Trust Rankings[18]

Do you get your information on ASARCO from:			How much do you trust ... as a source on ASARCO?		
Rank		**%**	**Rank**		**% Yes**
1	Television	73.8	**1**	Television	79.2
2	Newspaper	57.8	**2**	Newspaper	75.0
3	Friends and relatives	22.6	**3**	Friends and relatives	61.0
4	Radio	18.0	**4**	Radio	58.7
5	Internet	15.1	**5**	Internet	45.8
6	Elected officials	9.9	**6**	Elected officials	39.3
7	Other sources	7.1	**7**	ASARCO advertisements	36.2

Attitudes and Individual Characteristics

One of the goals in examining citizen opinions is to ascertain what underlies individual preferences. A variety of characteristics and attitudinal factors have been used in conducting such studies. In this study we have a set of variables that we will employ in following sections as "sources of variations." To begin, Table 2.6 examines what many would hypothesize as a key factor in determining attitudes about issues with environmental consequences. Having been discussed in the first section, the idea of a pro-environmental protection attitude is compared to a pro-developmentalist attitude. In Table 2.5 a composite score from allowing all respondents to comment on each question is reported. El Paso and Sunland Park residents provide an interesting perspective, favoring a middle ground of protection and support for economic growth. Overall, a middle ground and sustainable growth is widely favored in almost all locations. But, unlike some places a controversial project does not appear to have shifted attitudes towards a more environmentally protective stance. Returning to the scale presented in Section I and placing our index scores on the scale in Figure 2.16, those in support of development over the environment score 23.4. Those inclined to protect the environment versus seeking economic growth score 55.9 tilting the scale in their favor, yet both positions fail to over come the possibility of following a

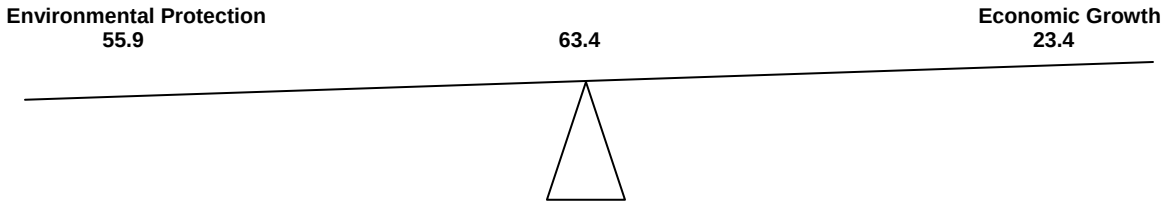
[17] Dennis L. Soden.1995, "Trust in Sources of Technical Information: Issue Specific or Consistency Over Time?", *Journal of Environmental Education* Volume 26 (2).
[18] Trust rankings are based on taking the combined total of those who replied "A Great Deal" and "Some."

dual path in the middle of the scale that scores 63.4. Thus as the issue takes on this added dimension, quality of life concerns trend towards a middle ground and it may well be those in the middle who advocate one way or the other based on what they determine will be the best course for the community to follow in the long run.

Table 2.6
Environmental – Developmentalist Orientation among Survey Respondents in El Paso and Sunland Park[19]

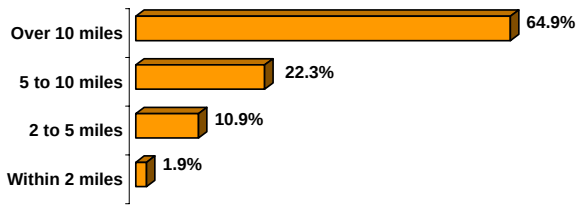
	% Agree & Strongly Agree	% Disgree & Strongly Disagree	Index	Rank
The grow th of the economy should be the only consideration in deciding w hat to do w ith the environment.	31.6	42.5	-10.9	**5**
The grow th of the economy should be the most important, but not the only consideration in deciding w hat to do w ith the environment.	56.2	21.9	34.3	**3**
Protection of the environment and grow th of the economy should be given equal consideration in deciding w hat to do w ith the environment.	74.3	10.9	63.4	**1**
Protection of the environment should be the most important, but not the only consideration in deciding w hat to do w ith the environment.	66.5	14.1	52.4	**2**
The only consideration in the grow th of the economy should be protection of the environment.	40.2	36.7	3.5	**4**

Figure 2.16
Balancing Economic Growth and Environmental Protection



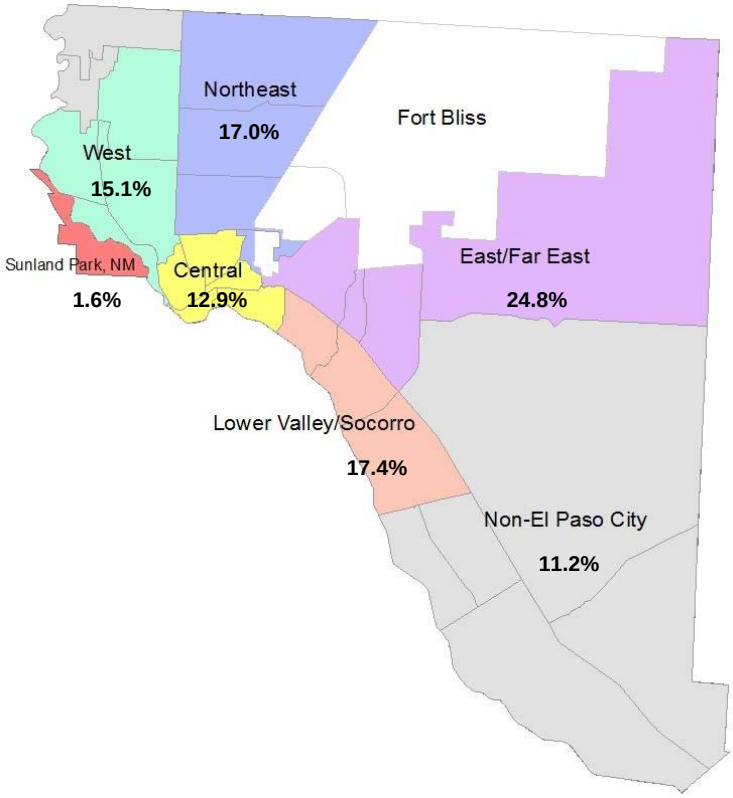
One of the suggested methods for determining individual levels of concern about critical public policy issues is proximity to the issue, which, in the case of this study is examined by looking at residential location. In Figures 2.17 and Figure 2.18 we discover that the survey participants came from the entire community with approximately two-thirds residing more than 10 miles from the ASARCO facility. Approximately one-eighth (12.8 percent) live in what is the near or close-by vicinity of 5 miles or less and 22 percent between 5 and 10 miles. Based on zip codes which were recoded to reflect seven areas of the region, including Sunland Park and county residents not living within the city limits, there is generally even distribution with the largest response category being the East and Far East of El Paso which continues to grow dramatically.

Figure 2.17
How far do you live from ASARCO, which is just across I-10 from UTEP?



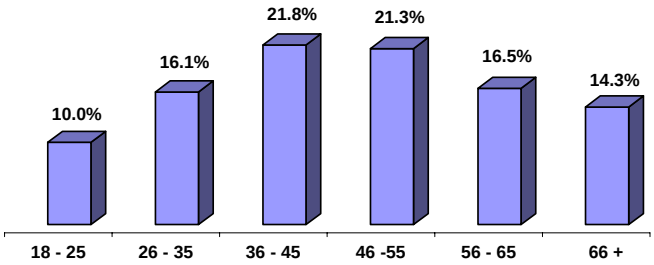
[19] Index is the percent difference between "% Agree & Strongly Agree" and "% Disagree & Strongly Disagree."

Figure 2.18
Respondents by Area of Town[20]



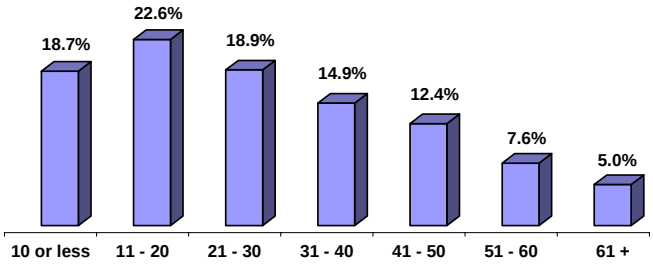
Age and experience in a community also comes to bear on individual preferences. In Figure 2.19 a relatively normal distribution of age categories for residents 18 and older is reported, obtained by asking year of birth. In Figure 2.20 we get an indication of the experience that survey participants have in the El Paso area by seeing how long they have resided in the region. The growth of El Paso in the last decade is reflected by the nearly one-fifth of the respondents who have resided in the region 10 years or less. These newer residents are matched by another one-fifth that has been in the region between 11 and 20 years and an additional one-fifth reporting El Paso residency up to 30 years. Forty percent indicate more than 30 years of residence with 5 percent having called El Paso home for 60 years or more. Overall the range of community bonds based on residence covers a significant period of time and closely aligns with population growth patterns since the 1970s.

Figure 2.19
Age Groups



[20] Sunland Park, NM also includes 3 surveys conducted in Anthony, NM and 1 survey in Santa Teresa, NM as a result of household relocation.

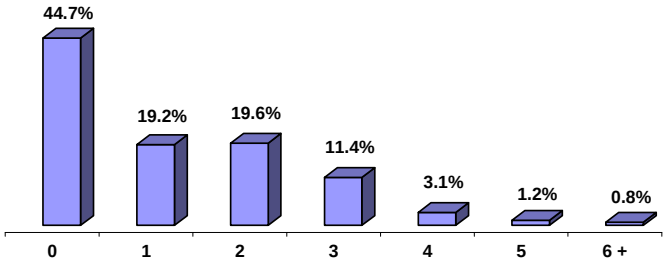
Figure 2.20
Years of Residency



The issue of environmental concerns has often hinged on a variety of household characteristics. Among these are family size, income, and education. The literature surrounding these issues is quite voluminous but consistently views the demographics of a community important in determining the cumulative positions that a community takes in favor of or in opposition to key policy questions. For example, concern for the environment may be positively associated with the number of young children in a household as parents become more protective about the welfare of their offspring.

Figure 2.21 examines the number of children under 18 years of age who live in the household of the respondent. Nearly 45 percent report no children under 18 years of age in the household which would include all families with children beyond the high school years (over 18 years old). Nineteen percent report one child and an additional 20 percent report two children under 18 years of age, resulting in less than 20 percent with three or more children.

Figure 2.21
How many children or young people under 18 live in your household?



Tables 2.6 and 2.7 report the individual educational levels and household incomes of respondents. It is well known that education and income are closely linked and that communities with lower income levels often support job creation of almost any type. Education in El Paso has historically not reached national levels. In our sample we find more than 60 percent have not completed college and over one-quarter report a baccalaureate or advanced degree. The effect of this is seen directly in income levels shown in Table 2.7. We find that 42 percent of households make $30,000 or less in annual income, which is far below the national median of approximately $58,000.[21] In fact, with a median national household income level approaching $60,000, over 70 percent of the region's households fail to achieve the median. Examining these two figures confirms that education and income are linked, and also are reflective of the community at this point in time.

Table 2.6
Education (18 years & over)

	%	Cumulative %
No High School	10.4	10.4
Some High School	8.0	18.5
High School Grduate	18.4	36.9
Vocational Training	3.5	40.4
Some College	20.8	61.2
Associates Degree	8.3	69.5
Bachelor's Degree	17.1	86.6
Postgraduate Degree	10.3	96.8
Other	3.2	100.0

Table 2.7
Household income

	%	Cumulative %
$0 - $10,000	13.3	13.3
$10,001 - $20,000	15.5	28.8
$20,001 - $30,000	13.5	42.3
$30,001 - $40,000	12.7	54.9
$40,001 - $50,000	9.4	64.4
$50,001 - $60,000	7.6	72.0
$60,001 - $70,000	5.0	77.0
$70,001 - $80,000	6.3	83.4
$80,001 - $90,000	3.5	86.9
$90,001 - $100,000	3.6	90.6
$100,001 +	9.4	100.0

Lastly in Figure 2.22 and 2.23 we see that the ethnic breakdown closely parallels the community and that females were more likely to participate than males, in part due to professional homemakers being able to participate during the calling periods (see Appendix C).

Figure 2.22
Ethnicity

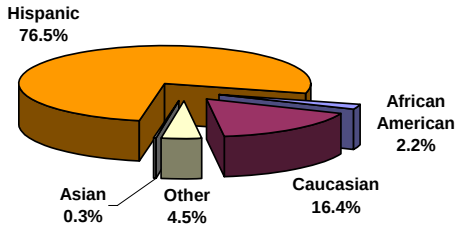
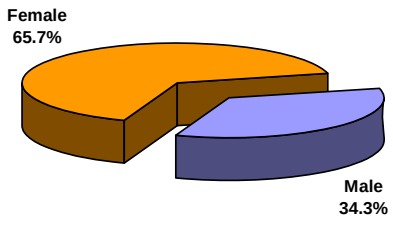


Figure 2.23
Gender



[21] Source: wwww.data360.org

Section III

Ciudad Juárez Citizen's Survey

Methodology

Based on the discussion from the previous section, the methodology utilized for the El Paso and Sunland Park survey was modified slightly for Cd. Juárez. The inclusion of Cd. Juárez in the study stems from the facts that ASARCO operations would occur in a shared air shed, and that the economies are closely intertwined and dependent upon activities that occur on both sides of the border. While the primary jurisdictional question lies with the TCEQ, Cd. Juárez has taken a public position in opposition to re-opening of the ASARCO facility. We also feel it is valid in light of the issue of externalities and the issue of proximity discussed in the previous section to include the residents of Cd. Juárez.

Cd. Juárez Contingent Value Survey

In the case of Cd. Juárez, random–digit-dial surveys are not practical. This is the result of a low telephone connection rate that excludes most low income households from having any probability of being selected for an interview. As such, Geographic Information System (GIS) technology allowed the researchers to obtain a random sample of households by using parcel maps. Parcel maps contain data on every parcel in the city and are useful in that income and other data can be added as separate layers. In this case, several steps were followed to randomly select a sample of housing units in Cd. Juárez. First, the sample was stratified into eight sections by socioeconomic characteristics like income, education, availability of public services, etc. The selection of housing units was weighted according to the numbers of housing units in each section and a sample was drawn proportionally from each, insuring that the sample drawn is representative of Cd. Juárez both in term of population concentration and income levels. Next, census tracks followed by census blocks were randomly generated using GIS Arcview maps developed for the study. Lastly, the individual households were selected using systematic sampling starting with the first housing unit in the northeast part of the census block and the interval dependent on the sample drawn from the census block.

Since the survey required the use of GIS maps to obtain samples, interviewers conducted personal interviews, which is again among the preferred methods for contingent value surveys. A final sample of 352 interviews was obtained.[1] At the 95 percent confidence level, a sample of 352 gives Cd. Juárez-wide (or total sample) findings an accuracy level of plus or minus 6 percent.

The survey instrument (Appendix E) was translated into Spanish for use in Cd. Juárez and included question modifications to accommodate the population, such as income differentials, ethnicity and other relevant issues. The survey was administered by faculty with previous experience conducting surveys in that city and the interviewers were fluent in Spanish and also had previous survey experience with the survey director. Like the El Paso survey, the Cd. Juárez survey was pre-tested prior to implementation to insure integrity of the translation.

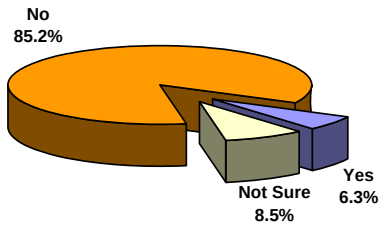
[1] The smaller sample size for Cd. Juárez was affected by both time and budget constraints.

Findings

Citizen Opinions about Reopening ASARCO

In response to the question of whether survey participants favored ASARCO reopening (Figure 3.1), support in Cd. Juárez is almost non-existent, with 85 percent not favoring the possible reopening. Perhaps this is an indication of a more cohesive opposition and the fact that Cd. Juárez will not directly benefit from ASARCO jobs, so citizens acknowledge more the negative externalities associated with such a reopening.

Figure 3.1
Are you in favor of ASARCO reopening?



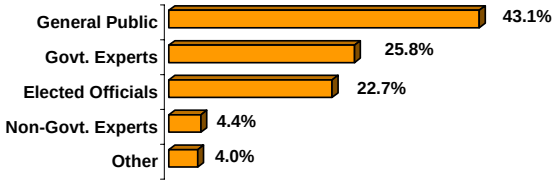
Similar to El Paso, cross tabulations were performed for statistical difference between those who are in favor/against ASARCO reopening and various sample characteristics. The majority of Cd. Juárez residents are against renewed operations. Thus, since most oppose, in all but one there is no statistical difference between groups on how they answered this question. That is, they oppose regardless of 1) gender, 2) area of town, 3) distance from ASARCO, 4) education level, 5) household income, 6) the number of children or minors in their household, or 7) years of residency. The one demographic showing a significant difference with how they answered this question is age group: the age group 26 through 55 is (statistically) more against renewed ASARCO operations, showing similarities with young El Paso respondents also strongly against.

Table 3.1
Cross tabs with question: Are you in favor of ASARCO reopening?

	Chi-Square Significance	Statistically Significant
Age Groups	0.032	All ages are against reopening but age group 26 thru 55 has significantly more persons against.

Public sentiment in Cd. Juárez about who should decide if ASARCO reopens mirrors El Paso preferences in Figure 3.2 with over two-fifths of the respondents believing it is a decision for the general public. Like El Pasoans, Cd. Juárez residents see themselves playing a role in the decision process and do appear capable of voicing their opinion in light of the international ramifications that they perceive.

Figure 3.2
Who do you think has the best ability to decide if ASARCO should reopen?



In this regard, in Figure 3.3 we see that 86 percent believe that there will be impacts, either positive or negative, from a renewed operation at ASARCO. Moreover, in Figure 3.4 and 3.5 we see that Cd. Juárez residents are more strongly associating ASARCO with negative environmental and health concerns. In comparison to El Paso data, Cd. Juárez data shows a far less evenly distributed set of responses and far more cohesion among the public in their attitudes.

Figure 3.3
Do you think there are potential impacts, either positive or negative, if ASARCO reopens?

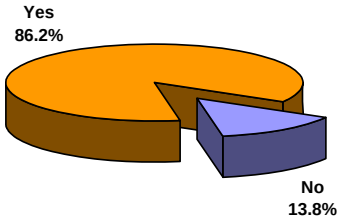


Figure 3.4
Top 4 comments from open-ended question "What are they (potential impacts)"?

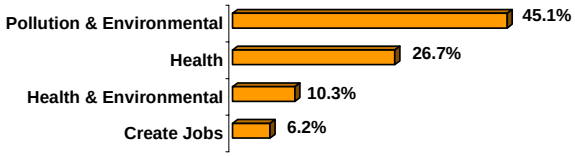
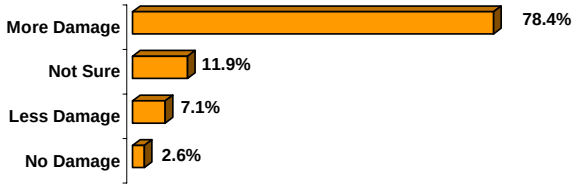


Figure 3.5
In the next ten years, if ASARCO reopens what will be the damage to the environment?



General Policy Issues and Importance

The general policy context for Cd. Juárez, relative to a proposed reopening of ASARCO, requires that we examine several concerns, the list of which are different than El Paso, thereby allowing us to focus on Cd. Juárez. In Table 3.2 seven questions were developed about spending on public goods and services. Similar to the case in El Paso, Cd. Juárez residents do not place the environment at the top of their preferences and also favor increasing funding to create better paying jobs. While Cd. Juárez has a substantial number of jobs in the manufacturing sector, and they pay better than average by Mexico standards, the need for better paying jobs in order to gain some equalized salaries with El Paso as part of the regional economy appears paramount.[2] Crime issues are also salient and score closely with education and health services. The environment ranks fifth, again reflecting a general prominence of economic issues over environmental concerns, a citizen view that holds on both sides of the Rio Bravo.

[2] The El Paso survey asked "how much should we spend on creating jobs" vs. the Cd. Juárez survey asked "how much should we spend on creating better paying jobs." The modification reflects that in Cd. Juárez the issue is not one of more jobs since supply oftentimes outstrips demand. Hence, the issue becomes better paying jobs.

Spending more to fund recreation centers ranks last as a priority of the seven asked, but nonetheless is an issue where four out of five persons asked believe that more spending should be appropriated. Recreational centers and activities are important in particular to allow the city's youth an avenue away from drugs and crime.

The issues confronting the people of Cd. Juárez are indeed different in many ways, while at the same time, overlap. When indicating preferences about key issues and policies, we find in Table 3.3, that Cd. Juárez residents are cognizant of drug-related problems in the community, many of which are accelerated by the city's infamous cartel. Cd. Juárez also has significant air pollution problems, which while common in the desert and subject to inversion as a result of surrounding mountains, is magnified by a large bus system and many cars that do not meet state-of-the-art air pollutions standards. It is not surprising then that reducing air pollution and vehicle congestion rank 2nd and 4th in the list of important issues facing the city. As Cd. Juárez continues to grow, these concerns will no doubt increase in importance.

Table 3.2
Ranking for Spending on Issues in Cd. Juárez[3]

	% Great Deal & Somewhat More	% Great Deal & Somewhat Less	Index	Rank
How much should we spend on:				
Creating better paying jobs?	89.2	1.7	**87.5**	**1**
Fighting crime?	86.9	1.4	**85.5**	**2**
Improving public education?	85.5	1.4	**84.1**	**3**
Improving public health?	85.4	1.7	**83.7**	**4**
Protecting the environment?	81.7	2.0	**79.7**	**5**
Improving public services?	82.6	3.1	**79.5**	**6**
Recreation centers?	79.5	4.8	**74.7**	**7**

Table 3.3
Ranking of Importance on Key Issues in Cd. Juárez[4]

	% Extremely & Very Important	% Not Too & Not Important at All	Index	Rank
How impartant is/are:				
Reducing drug consumption?	86.6	2.3	**84.3**	**1**
Reducing air pollution?	74.4	1.1	**73.3**	**2**
Creating recreational centers?	67.6	7.4	**60.2**	**3**
Reducing vehicle congestion?	66.2	6.3	**59.9**	**4**
Ethical government?	66.5	9.4	**57.1**	**5**
Improving city infrastructure?	59.3	5.1	**54.2**	**6**

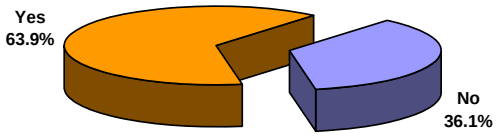
Citizen Understanding about ASARCO

The ASARCO facility all but lies directly on the border between the United State and Mexico, a position it has held for over a century. Cd. Juárez residents by almost two-thirds indicate they are aware of the facility as seen in Figure 3.6. This is far less than El Paso respondents and is likely so for a number of

[3] Rank is based on taking the combined total of those who replied "Great Deal More" and "Somewhat More" and subtracting those who replied "Somewhat Less" and "A Great Deal Less."
[4] Rank is based on taking the combined total of those who replied "Extremely Important" and "Very Important" and subtracting those who replied "Not Too Important" and "Not Important at All."

reasons. First, a main artery does not run through Cd. Juárez by ASARCO in the same way as U.S. Interstate 10. Second, many residents in Cd. Juárez are relatively new to the city from in-migration and have not heard of ASARCO, and third, the name itself may not actually be associated with the site.

Figure 3.6
Are you aware of the ASARCO facility?



In Figure 3.7 we discover that 81 percent of respondents aware of the ASARCO facility have read or heard about ASARCO filing to renew its permit. The Cd. Juárez citizens' permit awareness is less than in El Paso, not surprising given the level of interest and news coverage in El Paso. Following in Figure 3.8 we see that understanding the permit process is at a much lower level in Cd. Juárez, where only 18 percent state they understand the process "very well" or "moderately well" while over 80 percent have slight or no understanding. Inasmuch as the permit process in the United States is a function of a federal system with a strong state role, it is not surprising that the responses favor a lower level of understanding of the permit process in Cd. Juárez where the national government would be more prone to lead.

Figure 3.7
Have you read or heard about ASARCO trying to renew its air permit to renew operations?

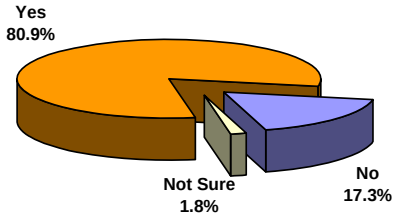
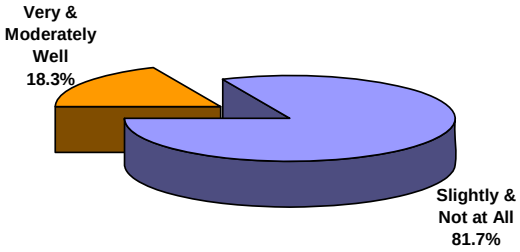
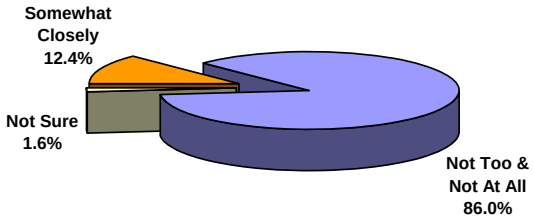


Figure 3.8
How would you describe your understanding of the process that ASARCO must go through to renew its air permit?



The air permit renewal process being undertaken by ASARCO has multiple steps and has been a drawn out process. Cd. Juárez residents are expected to be less inclined to follow the process as closely as El Paso residents might which is reflected in Figure 3.9. Only 12 percent report they have followed the process "somewhat closely" and no one reported that they followed the process "very closely." Eighty-six percent report they were not following the process at all, a very different level of interest than in El Paso.

Figure 3.9
How closely would you say that you have followed this permit renewal process?



In their use of outside sources, Cd. Juárez residents rely almost entirely on mass media, primarily television as indicated in Table 3.4. Television as a source is followed by the newspaper and radio. Shifting to the degree of trust that is held for each of these sources we find television is held in the highest regard well ahead of any other source considered by the survey. Radio, along with friends and relatives, only score average ratings with roughly half distrusting or not sure of trusting these sources. Beyond these three sources trust takes a very serious decline. Elected officials alongside ASARCO advertisements are by far the least trusted sources on the topic of ASARCO. The internet is a relatively new medium for many and also scores low on the trust scale. Newspapers are held in higher regard than the internet but still are suspect on citizens of Cd. Juárez. From any perspective there would seem to be a degree of rational ignorance and cynicism among the citizens of Cd. Juárez making any program, either in favor or in opposition, facing a substantial hurdle in delivering its message.

Table 3.4
Information Source and Trust Rankings [5]

Do you get your primary info. on ASARCO from:			How much do you trust ... as a source on ASARCO?		
Rank		**%**	**Rank**		**% Yes**
1	Television	85.1	**1**	Television	83.1
2	New spaper	23.0	**2**	Friends and relatives	52.2
2	Radio	12.7	**3**	Radio	50.2
4	Friends and relatives	2.9	**4**	New spaper	47.6
5	Internet	0.0	**5**	Internet	16.9
5	Elected officials	0.0	**6**	Elected officials	8.9
			7	ASARCO advertisements	8.4

Attitudes and Individual Characteristics

Public opinion knowledge in relationship to how the Mexican public feels about key policy issues is not well known in the United States. However, in a regionalized area with some isolation, such as the Paso del Norte, academics from both sides of the border have developed a relatively good understanding of what accounts for differences in the two nations.[6] Once again in Table 3.5 we examine the environmental attitudes in light of a series of choices asked of the respondents pertaining to protection of the environment and the need for economic growth. It is interesting that in many nations considered to be in need of development or that are emerging as major global economic players there is a slight edge in

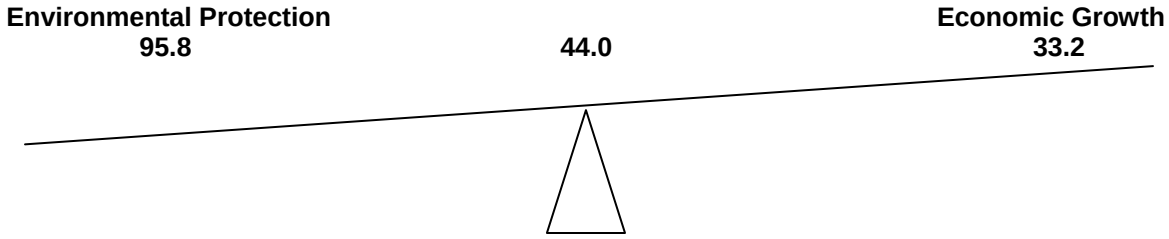
[5] The Cd. Juárez survey only asked for primary source of information vs. the El Paso survey asked for all sources of information. Trust rankings are based on taking the combined total of those who replied "A Great Deal" and "Some."
[6] Dennis L. Soden, Christine Thurlow Brenner, and Janet S. Conary, 2002, "Civic Impression, Civic Culture and Information Factors in a Border Setting: Findings from El Paso and Cd. Juárez," Technical Report 2002-11, Institute for Policy of Economic Development, University of Texas at El Paso **(**prepared as a discussion piece for the international conference "Communicating Borders" on September 26 -29, 2002 in Njimegen, Netherlands) September.

favor of growth of the economy. In Cd. Juárez we see that contrary to some other studies, participants in our study afforded more protection to the environment than their El Paso neighbors. Revisiting once again the scale discussed in Section I, in Cd. Juárez in Figure 3.10 we see a substantial tilting of the scale in favor of environmental protection, a far more extreme position than in El Paso by a ratio of almost three-to-one. As noted in footnote 2, an issue in Cd. Juárez is not so much more jobs but rather better paying jobs, providing some explanation towards this greater tilt.

Table 3.5
Environmental – Developmentalist Orientation among Survey Respondents in Cd. Juárez

	% Agree & Strongly Agree	% Disgree & Strongly Disagree	Index	Rank
The grow th of the economy should be the only consideration in deciding w hat to do w ith the environment.	34.2	44.4	-10.2	**5**
The grow th of the economy should be the most important, but not the only consideration in deciding w hat to do w ith the environment.	63.6	20.2	43.4	**3**
Protection of the environment and grow th of the economy should be given equal consideration in deciding w hat to do w ith the environment.	60.8	16.8	44.0	**2**
Protection of the environment should be the most important, but not the only consideration in deciding w hat to do w ith the environment.	68.1	13.4	54.7	**1**
The only consideration in the grow th of the economy should be protection of the environment.	61.9	20.8	41.1	**4**

Figure 3.10
Balancing Economic Growth and Environmental Protection



The fact that ASARCO lies across the Rio Bravo from Cd. Juárez raises an interesting question about public sentiment concerning jurisdiction in another nation. It also raises the fact that, regardless of the border, citizens in Cd. Juárez are impacted by externalities. Thus, distance to ASARCO, which in many cases may be closer for Cd. Juárez citizens than those in El Paso, becomes of interest. Through Figure 3.11 we see that as a percentage of population, nine percent of the persons surveyed live within two miles of ASARCO, nearly five times more than in El Paso.

Similar to literature review, females are the primary respondents for the Cd. Juárez survey (Figure 3.12). Like in El Paso, the age groups that make up a community and the length of residence tell a lot about service demands and commitment to the community and its values. As Figure 3.13 shows, the Cd. Juárez sample is relatively young, with over one-third of its residents 35 years of age or younger. The border area in its totality is very young,[7] a factor even more pronounced by a majority (65.5 percent) of the population 45 years of age and younger.

[7] Carlos Olmedo. 2006, "Chapter Three: Mexico Border Populations and Policy Linkages," in *At the Cross Roads: U.S./Mexico Counties in Transition*, Dennis L. Soden, (Ed), Technical Report 2006-01, Institute for Policy and Economic Development, University of Texas at El Paso, March.

Figure 3.11
Residential Distance from ASARCO in Cd. Juárez

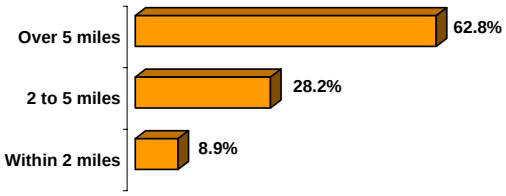


Figure 3.12
Gender

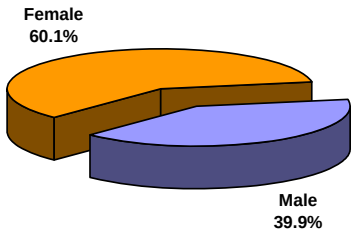


Figure 3.13
Age Group

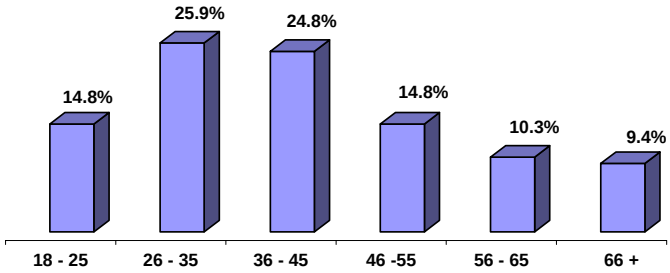
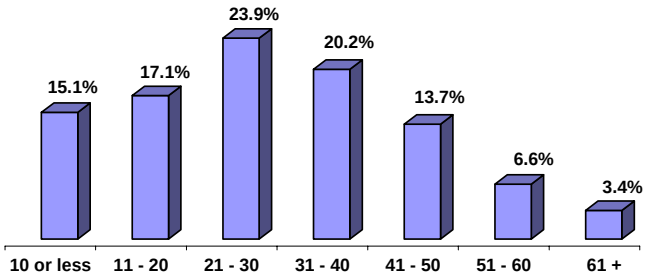


Figure 3.14 shows a majority of participants have resided in Cd. Juárez for 30 years or less. Much of the youthfulness and recent years of residency is linked to the period hallmarked by the maquiladora program and northward migration within Mexico for jobs in the border region. Sustaining this northward migration is not a long term goal of the Mexican government which prefers instead to develop jobs in the hinterlands, but it has led to the current make-up of Cd. Juárez that will remain in place at least until better opportunities arise. By comparison to El Paso, the patterns of time living in the region are remarkably similar suggesting parallel growth patterns of the two cities, a phenomenon likely to continue.

Figure 3.14
Years of Residency



The migration patterns that have marked Mexico in the last three or four decades are also illustrated in Figure 3.15 where we see that fewer than half of the sample reported being born in Cd. Juárez. The number of children under 18 in Cd. Juárez reflects larger households than in El Paso, but not substantially different as seen in Figure 3.16.

Figure 3.15
Area of Nativity

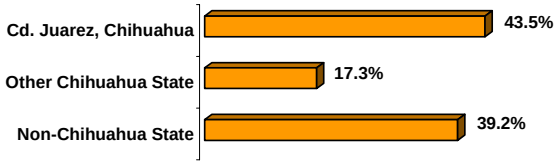
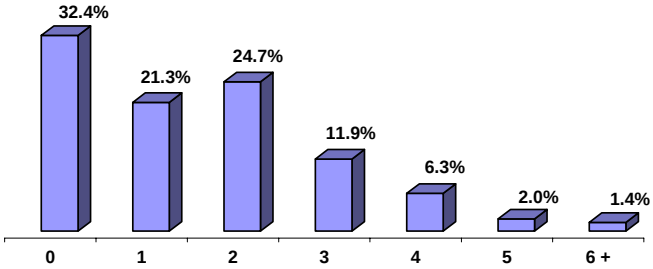


Figure 3.16
How many children or young people under 18 live in your household?



Reflecting low educational attainment is not unusual in a country undergoing rapid development and the Cd. Juárez sample reflects this fact in that only 32 percent of its residents have completed high school or above as seen in Table 3.6. As a result of lower educational levels, college graduates and post-graduate degree recipients are also far lower in number, an additional consideration in light of the issue of technical complexity which one would assume helps assimilate the information about ASARCO. On the other hand, the environmental proclivity exhibited among Cd. Juárez residents may shed light on the fact that this may be more attitudinal and emotional.

Table 3.7 underscores the link between education and income with nearly one-half of the participants reporting household incomes of $5,000 or less and eighty percent with incomes $10,000 or less. By Mexico standards these are not bad income levels, but clearly are not parity with those of workers with the same skills only a few miles away in El Paso

Table 3.6
Education (18 years & over)

	%	Cumulative %
No School	4.3	4.3
Some Elementary	12.5	16.8
Elementary Complete	20.2	36.9
Some Junior High	12.8	49.7
Junior High Complete	18.5	68.2
High School Graduate	19.0	87.2
Bachelor's Degree	12.2	99.4
Postgraduate Degree	0.6	100.0

Table 3.7
Household income

	%	Cumulative %
$0 - $2,500	9.3	9.3
$2,501 - $5,000	35.7	45.0
$5,001 - $7,500	17.0	62.0
$7,501 - $10,000	13.7	75.7
$10,001 - $15,000	10.0	85.7
$15,001 - $20,000	5.7	91.3
$20,001 - $25,000	4.7	96.0
$25,001 - $30,000	1.7	97.7
$30,001 +	2.3	100.0

Section IV

Willingness to Pay and Contingent Valuation Summary

Methodology

In this section we employ a method that helps to determine the value citizens place on resources for which market process are not typically determined. Contingent valuation (CVM)[1] allows researchers to elicit values for commodities and services, in particular those that have no market value (i.e., air quality, life of a species, aesthetics of a shoreline, etc). By employing this method, individuals are typically asked to provide judgments of their willingness to pay (WTP) for a given commodity or outcome. Individuals may also express the value of a commodity by stating the minimum amount of money they would accept as compensation (willingness to accept compensation, WTA) for the forgoing of the commodity or outcome. While economic theory[2] posits that estimates of WTP and WTA should be equivalent, because they would take into account the externalities created and the value of property rights, research in experimental economics and behavioral decision theory demonstrates that estimates of WTA are substantially higher than estimates of WTP.[3] Put another way individuals are more likely to prefer to receive than to give.

The first CVM study occurred in 1963[4], and in the last four decades there have been over 5,000 CVM applications. Moreover, the National Oceanic and Atmospheric Administration (NOAA) commissioned a report in 1993[5] that recommended the use of CVM and some essential guidelines for its use, partly discussed in Section II. Given the disparity between WTA and WTP estimates of economic value, these experts and other experts suggest that respondents provide estimates of WTP in CVM studies as a best practice since they are more conservative.

There are multiple ways of eliciting preferences using CVM, Arrow and his associates[6] recommended the use of a referendum format, which asks respondents whether they would be willing to pay a pre-specified amount for a program to determine a market value for a commodity with no known market value. For example, a referendum type of judgment may ask whether the person would be willing to pay $10 per

[1] R.G. Cummings, DS Brookshire and W.D. Schulze, 1986. *Valuing Environmental Goods: Assessment of the contingent valuation method*. Totowa, NJ: Rowman and Allenheld.

[2] Specifically the Coase Thereom simply states that in a world where there are no transaction costs, an efficient outcome will emerge regardless of the initial allocation of property rights.

[3] J.R. Irwin, 1994. "Buying/selling price preference reversals: Preference for environmental changes in buying versus selling modes," *Organizational Behavior and Human Decision Processes*, 60, 431-457; J.L. Knetsch, 1989. "The endowment effect and evidence of nonreversible indifference curves," *American Economic Review*, 79, 1277-1284; M.E. Walker, O.F. Morera, J. Vining, & B. Orland, 1999. "Disparate WTA-WTP disparities: The influence of human vs. natural causes," *Journal of Behavioral Decision Making,* 12, 219-232.

[4] R.K. Davis, 1963. "The value of outdoor recreation: An economic study of the marine woods," PhD dissertation, Harvard University.

[5] K. Arrow, R. Solow, E.E. Leamer, P.R. Portnoy, R. Randner, and H. Schumann, 1993. "Natural Resource Damage Assessment under the oil pollution act of 1990," NOAA Panel, *Federal Register,* 58, 4601-4614.

[6] et al., op. cit.

month to insure that the Florida shoreline is not impacted by an oil spill. A "yes" response to this item indicates that the person would at least pay $10 per month. Similarly, a person providing a "no" response to this question may be willing to pay less than $10 for this program or pay nothing at all.

In a second variation, the referendum approach can allow the respondent to evaluate a number of responses or "bids." Using the example above, if a respondent indicates if she would be willing to pay $10 per month (i.e., the bid amount), the respondent could also be asked if they would be willing to pay $20 per month and so forth. If, for example, the person indicates that they would be willing to pay $10 per month, but would be unwilling to pay $20, then we have a better idea about the person's willingness to pay. The same would hold true for whatever level of pay the respondent discontinued to support the program.

There are advantages and disadvantages of using the two referendum approaches. In the former approach, fewer questions are asked of the participant and reduces participant burden (i.e., shorter interview). In an environment where respondents are asked numerous items via a telephone survey, for example, increased time answering questions also increases the likelihood that subsequent questions may not be answered or participants will stop the interview (i.e., hang up or quit). Also, there is no consensus for the handling of the situation where a participant indicates unwillingness to pay $10 per month for a program, but a willingness to pay $20 per month into the program.

Another approach for assessing economic value with CVM are open-ended questions, where respondents state how much they would be willing to pay for a program for the commodity under evaluation. For example, a participant might be asked to state the minimum value they would be willing to pay per month to maintain the aesthetic quality of a shoreline, where the respondent would then provide a monetary value. Of the two formats, the referendum format of CVM has demonstrated enhanced external validity[7], primarily because it is deemed more realistic of real-life judgments. Moreover, researchers have found that discrete contingent valuation methods like the referendum approach does not produce higher estimates of WTP in comparison to open-ended questions.[8]

Despite the enhanced external validity of referendum judgments, it is often difficult to estimate one's "true" stated value for WTP. In these referendum judgments, randomly-selected participants are asked to state whether they would pay $10 per month for a program for example, while another group of randomly-selected participants would be asked if they would pay $5 per month for the program, while other randomly-selected participants may be asked if they would pay a different amount. These bid amounts are expected to have increased refusal rates as the bid amount increases.

A number of methods have been proposed to provide an estimate of WTP. Some of these methods specify an underlying mathematical distribution (i.e., a normal distribution), while other methods do not assume an underlying mathematical distribution. When the goal of the project is to provide an estimate of willingness to pay, Haab and McConnell[9] state that distribution-free approaches perform well. One approach that is "distribution free" is the Turnbull non-parametric estimator. The Turnbull non-parametric estimator also provides a conservative estimate of WTP, called the Turnbull lower bound mean WTP.[10] As a conservative approach, it is meant that these estimates tend to be smaller.

[7] External validity refers to the extent to which one can generalize from sample to population and to different places, times and persons.

[8] J.C. Huang and V.K. Smith, 1998. "Monte Carlo Benchmarks for Discrete-Response Valuation Methods," *Land Economics*, 74, 186-202.

[9] T.C. Haab and K.E. McConnell, 1997. "Referendum models and negative willingness to pay: Alternative Solutions," *Journal of Environmental Economics and Management*, 32, 251-270.

[10] B.W. Turnbull, 1976. "The empirical distribution function with arbitrarily grouped, censored and truncated data," *Journal of the Royal Statistical Society*, B38, 290-295.

Figure 4.1
In Summary the Following Findings are Reported

- ✓ ***CVM provides a method for estimating the economic value for commodities with no known market value, a concern related primarily to air quality in the case of ASARCO.***
- ✓ ***Based on a telephone survey in El Paso consisting of 1175 participants, and 352 individuals in Cd. Juárez, estimates for willingness to pay were obtained.***
- ✓ ***Participants were asked whether they would be willing to pay $10/month, $20/month or $40/month.***
- ✓ ***Individuals who indicated they were 'not sure' if they would be willing to pay the specified amount were treated as if they were unwilling to pay the amount.***
- ✓ ***A mean estimate of El Pasoan's willingness to pay into a program that would prevent the opening of ASARCO was $12.80 per month.***
- ✓ ***In Cd. Juárez the mean estimate for participants living there was the equivalent of $12.28 per month (assuming no wage disparity with El Paso; with the wage disparity the mean estimate is 20.82 Pesos per month).***
- ✓ ***The two estimates did not statistically differ from one another.***

Findings

El Paso and Sunland Park WTP

Computation of the Turnbull lower bound mean can be performed for referendum data collected in this study and discussed in the previous sections as shown in Figure 4.2. Following the 12th item on the El Paso and Cd. Juárez surveys (see Appendix D and E), respondents were provided with a script about the possible re-opening of the ASARCO facility and were asked how much money they would be willing to pay per month as part of a government-sponsored program to keep ASARCO from re-opening.

After consultation with a team of local experts in contingent valuation, economic evaluation and phone survey administration, the following decisions were made for the contingent valuation assessments collected from the surveys:

(1) Since WTP assessments are typically lower than WTA assessments, WTP assessments were made as a conservative estimate of how the region values the environment, which is consistent with NOAA recommendations. This was done despite the fact that "if the consumer has a legal entitlement to it and is being asked to give up that entitlement, the correct property right is WTA."[11] In this case, residents of the region are the owners of the environmental amenities as they exist with the smelter closed – and would give up a portion of those amenities with increased emissions associated with reopening. Selection of WTA however, may have been construed as an effort to inflate how the region values the environment.

(2) Moreover, we were also interested in obtaining a conservative estimate of the participant economic valuation of the program and the Turnbull lower bound mean provides for such a conservative estimate.

(3) Referendum judgments were used to assess WTP. The "bid" levels for the referendum judgments were $10/month, $20/month and $40/month. To obtain these bid values, research was conducted to estimate, very roughly, the possible value of ASARCO El Paso operations along with an estimate regarding clean-up/site preparation costs. Once a range was calculated for the total cost, and this figure would be the amount of the bond issue, a monthly payment

[11] Richard T. Carson. "Contingent Valuation: A User's Guide," *Environmental Science & Technology*, 34(8), 1413-18.

required was backed out by each El Paso household (assumptions: a 10-year bond, a current interest rate on such bonds, and roughly 230,000 households in El Paso) to pay off the bond (annual interest and face value upon maturity).[12] The range calculated was from around $10 per month to a high of about $33 per month.[13]

(4) To reduce participant burden, participants were asked to evaluate only one of the three bid levels. Participants were also randomly assigned to one of the three bid levels. Of the 1175 participants, 409 answered the $10/month bid item, 387 answered the $20/month bid item and 378 answered the $40/month bid item. Using software that is available on the web a chi-square test of independence indicated that the bid amounts were not over-sampled ($X^2(2) = 1.3$, $p = 0.52$).[14]

(5) In the WTP assessment, participants were asked if they would vote for a program to prevent ASARCO from re-opening with the following three responses options: (a) For the program, (b) Against the program, and (c) Not sure. Bid voting results regarding the program – "For," "Against" or "Not Sure" – are shown in Figure 4.3.

(6) For the purposes of computing the Turnbull lower bound mean, any participant who indicated that they were "not sure" was treated as if they would vote against the program. In other words, a conservative philosophy was adopted, so that anyone who did not express support the program was treated like a "no" response. (The proposed program read to survey participants is included at the end of this section.)

Figure 4.2
Turnbull Estimate

The computations for the Turnbull lower bound mean are as follows:

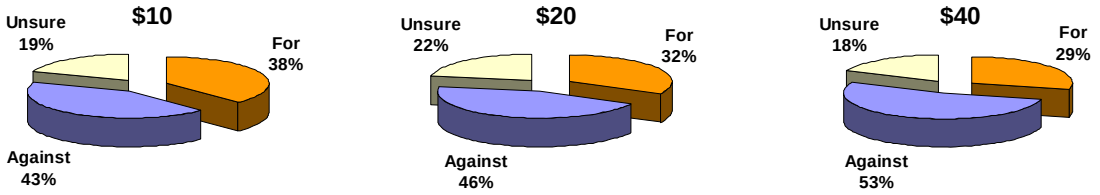
(1) For the lowest bid level, calculate the percentage of "no" responses
(2) For the next bid level, calculate the percentage of "no" responses
(3) If this percentage in (2) is higher, continue. If the percentage of "no" responses is lower, then combine (or "pool") these bid levels
(4) Continue in this manner until the percentage of "no" responses have been calculated for all bid levels
(5) Find the percentage of "no" responses at each bid level. This is called the "cumulative distribution function."
(6) Calculate the "probability density function," by subtracting adjacent probabilities from the cumulative distribution function
(7) Multiply the corresponding probability from the probability density function by the lower bound of the bid level
(8) Sum these products to compute the Turnbull lower bound mean

[12] U.S. Census Bureau, 2004. "Primary Smelting and Refining of Copper: 2002," 2002 Economic Census, Manufacturing, Industry Series (December); Mike Mrkvicka, 2001. "Asarco selling West Side land," *El Paso Times*, (November 4); Dan J. Williams, 2002. "Asarco bankruptcy feared," *El Paso Times*, (July 14); Gary Scharrer, 2004. "Pollution hearing set," *El Paso Times*, ((April 29).

[13] These amounts are consistent with other recent research concerning "referendum" choices and consistent with recent bond referendums from school districts in the region and the implications for the impact on property taxes.

[14] K.J. Preacher, 2001. Calculation for the chi-square test: An interactive calculation tool for chi-square tests of goodness of fit and independence [Computer software]. Available from http://www.quantpsy.org.

Figure 4.3
Would you vote FOR or AGAINST the program if it cost your household … per month?



The following tables provide a summary of responses to the question as to whether the participant would vote FOR or AGAINST the proposed program. Looking at Table 4.1, it is possible to compute the Turnbull lower bound mean, using the eight-step procedure described above. Table 4.2 provides a summary for the computation of the Turnbull lower bound mean.

Table 4.1
El Paso Responses for CVM Evaluation

Bid Amount	Sample Size	FOR	AGAINST	NOT SURE	% AGAINST & NOT SURE
$10 / month	409	154	176	79	**62.3%** = 255/409
$20 / month	387	126	175	86	**67.4%** = 261/387
$40 / month	378	109	200	69	**71.2%** = 269/378
Total	1175				

Table 4.2
Turnbull Lower Bound Mean for El Paso

Bid Group	Bid Amount (bj)	# AGAINST & NOT SURE	Sample Size	Cumulative Distribution Function (CDF) = (Against + Not Sure) / Total	Probability Distribution Function (PDF) = $CDF_j + CDF_{j-1}$	Lower bound bid X probability from PDF
j = 0	0	-------	-------	0	-------	-------
j = 1	10	255	409	0.623	0.623	0.623 * 0 = 0
j = 2	20	261	387	0.674	0.674 – 0.623 = 0.051	0.051 * 10 = 0.514
j = 3	40	269	378	0.712	0.712 – 0.674 = 0.0376	0.0376 * 20 = 0.753
j = 4	infinity (∞)	-------	-------	1	1.000 - .712 = 0.288	0.288 * 40 = 11.53

Turnbull lower bound mean = 0 + 0.514 + 0.753 + 11.53 = $12.80 per month[15]

In other words, an estimate of the amount of money that El Pasoans are willing to pay per month into the program is $12.80 per month calculated by summing the last value in the far right column of Table 4.2. The variance and standard error of the mean can also be computed, allowing for an assessment of the variability around the Turnbull lower bound mean estimate.[16]

Variance of the Mean = 1.4249 – 1.094 = $0.3309
Standard error of the mean = $0.58

[15] Median WTP = $8.03 per month (50th percentile).
[16] W.J. Vaughan and D.J. Rodriguez, 2000. "Obtaining welfare bounds in discrete-response valuation studies: Comment," *Land Economics*, 77, 457-465.

Part of the NOAA recommendations indicated cross tabulations between WTP and various sample demographics and characteristics. Table 4.3 captures these cross tabs with the WTP $10 question which is closest to the mean value of $12.80 per month. In general, the majority in the following groups would be more WTP a $10 tax to push for a program that protects the environment: 1) females, 2) the age groups 18 through 35 and 46 through 55, and 3) those that are against ASARCO reopening. As noted in Section II, of particular interest is the age group that includes younger El Pasoans. Clearly, the more youthful share a different view about valuing the environment than their older counterparts.

Table 4.3
Cross tabs with question: What if the final cost estimates showed that the program would cost your household a total of $10 per month? Would you vote for or against the program?

	Chi-Square Significance	Statistically Significant
Gender	0.006	Greater percent of females are for WTP $10 & greater percent of males are against WTP $10.
Age Groups	0.001	Ages 18 thru 35 & 46 thru 55 have greater percent WTP $10 & 65 & older have greater percent against WTP $10.
Ethnicity	0.051	Hispanics are split about WTP, Caucasians are more against WTP $10, & African Americans are for WTP $10.
Are you in favor of ASARCO reopening?	0.000	Persons against ASARCO reopening form the majority WTP $10.
	Chi-Square Significance	**Not Statistically Significant**
Area of Town	0.099	WTP $10 varied w / area of town.
Distance from ASARCO	0.585	WTP $10 varied w / distance from ASARCO
Education	0.852	WTP $10 varied with education level
Household Income	0.297	WTP $10 varied w / household income.
Number of Children/Persons Under 18 in Household	0.404	WTP $10 varied with number of children/minors in home
Years of Residency	0.616	WTP $10 varied with years of residency

An important note of interest is the reasons why persons voted against the program. It is important as a gauge of the number of persons who are not necessarily in support of ASARCO renewing its air permit, but simply cannot afford the proposed program bids. Figure 4.4 and 4.5 provide some understanding. One-quarter of responses as to why they voted against the program said that they can't afford it (Figure 4.4), while almost one-half indicated other reasons. When the "Other" open ended category was analyzed and recoded (Figure 4.5), one-third indicated answers that were not necessarily in favor of ASARCO renewal of operations, but rather cost considerations, too many taxes, lack of trust in government, and that taxpayers should not cover clean up costs. Two-thirds answered yet "other" reasons including:

- Support for ASARCO reopening and/or favored creation of jobs
- Were against the proposed program, mainly redevelopment of contaminated land
- Believe that government/citizens should not be involved and/or taxes should be better used
- Believe they have no influence on the outcome
- Required more information
- All of the above

Overall, the fact that added costs for residents of a relatively poor community should be a barrier is not surprising. Many of the areas households are near or below the poverty level and $10 or $20 a month is a substantial potential outlay. However, when one examines the costs of providing public goods, it is often the case that those who are in a better position will carry a disproportional burden of the costs to achieve a desired in. In El Paso, this would probably be the case and property owners and those with higher incomes would become the parties bearing a larger cost.

Figure 4.4
If Voted Against WTP, Why?

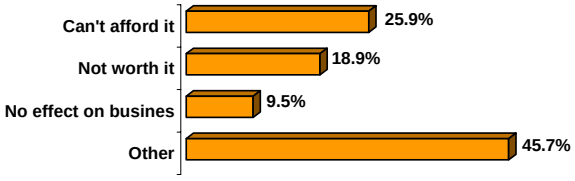
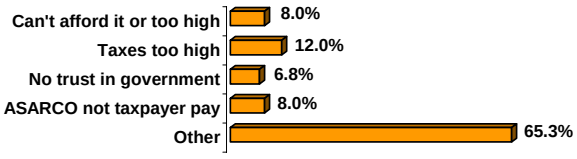


Figure 4.5
"Other" Reasons Why Voted Against WTP



Ciudad Juárez WTP

A random sample of 352 people in Cd. Juárez was collected. It should be noted that the proposed program for Cd. Juárez is different than the one from El Paso (both attached at the end of this section). While the program for El Paso called for a bond issue for the redevelopment of the land, in Cd. Juárez the program called for bid amounts to support a legal defense fund to fight ASARCO's reopening based on the La Paz Agreement's prohibition of contamination or degradation of the environment within 60 miles (100 kilometers) of the border.

Accounting for the discrepancy between living wages in El Paso and Cd. Juárez and the relative exchange rate, participants were also asked to provide CVM estimates of the U.S. equivalent of $10/month (17 pesos), $20/month (34 pesos) and $40/month (68 pesos). The formula applied to calculate WTP in pesos from dollar amounts is:

$$WTP(Pesos) = WTP(\$) \times ExchangeRate \div \frac{Avg.Wage_{ElPaso}}{Avg.Wage_{Cd.Juarez}}$$

The rational for this equivalency was to obtain a WTP estimate from our sister city that mirrored a relative amount for El Paso, taking away differences between living wages and currency. The ratio between the El Paso average wage and the Cd. Juárez average wage for private employment is 6.36 while the exchange rate used is 10.789.[17] Once again, there was no statistical evidence that any of the bid amounts were over-sampled in Table 4.4 ($X^2(2) = 0.722$, $p = 0.69$).

Table 4.4
Cd. Juárez Responses for CVM Evaluation

Bid Amount	Sample Size	FOR	AGAINST	NOT SURE	% AGAINST & NOT SURE
$10 / month	111	32	62	17	**71.2%** = 79 / 111
$20 / month	124	56	49	19	**54.8%** = 68 / 124
$40 / month	117	28	69	20	**76.1%** = 89 / 117
Total	352				

[17] 2003 data was used for these calculations to obtain a measure that takes into account private employment and wages. The only valid source for Cd. Juárez is Censos Economicos which last published 2003 employment and wages data – INEGI only performs its Censos Economicos every five years, last year represented was 2003. To remain consistent, 2003 average wages for El Paso were used as well as the 2003 peso/dollar exchange rate.

The refusal rate for $20/month is less than the refusal rate for $10/month. Economic theory indicates that the refusal rates should increase with increases in bid amounts. Despite this contradiction, the calculation of the Turnbull lower bound mean is unaffected, as we will pool the $10/month and $20/month bids into one category. The Turnbull lower bound mean was calculated, where Table 4.5 provides a summary for the computation of the Turnbull lower bound mean.

Table 4.5
Turnbull Lower Bound Mean for Cd. Juárez

Bid Group	Bid Amount (bj)	# AGAINST & NOT SURE	Sample Size	Cumulative Distribution Function (CDF) = (Against + Not Sure) / Total	Probability Distribution Function (PDF) = $CDF_j + CDF_{j-1}$	Lower bound bid X probability from PDF
j = 0	0	-------	-------	0	-------	-------
j = 1	20	147	235	0.626	0.626	0.626 * 0 = 0
j = 2	40	89	117	0.761	0.761 – 0.626 = 0.135	0.135 * 20 = 2.703
j = 3	infinity (∞)	-------	-------	1	1.000 - .761 = 0.239	0.239 * 40 = 9.572

Turnbull lower bound mean = 0 + 2.703 + 9.572 = $12.28 per month[18]
Variance of the Mean = $1.0178
Standard error of the mean = $1.01

In other words, an estimate of the amount of money that participants in Cd. Juárez are willing to pay per month into the program is $12.28 per month. The $12.28 amount assumes parity in average wages between El Paso and Cd. Juárez. Taking into account wage differentials and the WTP peso bid amounts asked to respondents – 17, 34 and 68 – the Cd. Juárez results are:

Turnbull lower bound mean = 20.82 Pesos per month[19]
Variance of the Mean = 1.73 Pesos
Standard error of the mean = 1.71 Pesos

To test whether the two Turnbull lower bound mean estimates differ from one another, Welsh's approximate t test was conducted and there were no differences in WTP estimates between participants in Cd. Juárez and participants in El Paso ($t(423.9) = 0.45$, p = ns).[20]

Similar to El Pasoans, the two key characteristics of those WTP $10 to promote a program to protect the environment is age groups and those against renewed ASARCO operations (Table 4.6).

Table 4.6
Cross tabs with question: What if the final cost estimates showed that the program would cost your household a total of $10 per month? Would you vote for or against the program?

	Chi-Square Significance	Statistically Significant
Age Groups	0.005	Ages 26 thru 55 have the greatest percent for WTP $10.
Are you in favor of ASARCO reopening?	0.046	Persons against ASARCO reopening form the majority WTP $10.

[18] Median WTP = $15.97 per month (50th percentile).
[19] Median WTP = 27.07 Pesos per month (50th percentile).
[20] J.H. Zar, 1996. *Biostatistical Analysis*., 3rd edition, London: Prentice Hall.

Hypothetical Bond Program

In consideration of the potential of an average household to pay for a bond-like municipal purchase of the ASARCO facility we can do some relatively simple calculations to determine how much of a bond could be developed. Employing the scenario presented to respondents in the El Paso household survey, municipal bonds with a 10-year maturity would be issued to finance the purchase of the ASARCO facility and redevelop the land for public use. The WTP value, based on an average rate of $12.80 per month emerging from the survey, combined with additional assumptions, can provide insight concerning the amount of funds that, in reasonable probability, could be raised for such a project. The relevant assumptions and conclusions are presented in Table 4.7.

The first bond issue scenario considered by Table 4.7 is based upon the WTP figure of $12.80 per month, the average among El Paso household units. As previously discussed, this is a reasonable, if not conservative value. The current number of El Paso households is calculated at 230,000.[21] The present analysis assumes no growth in the number of household units over the next 10 years. Given these assumptions, a 10-year municipal bond paying 6.0 percent interest, the recent rate on municipals rated below BBB (that is, below investment grade),[22] could be issued in the amount of $260.0 million. This amount would be allocated to cover security issue fees, the purchase of the ASARCO facility and costs associated with site preparation for public use. The analysis does not consider revenues received by the sale of the site to the ultimate developer of the property, if any. The annual $35 million-plus paid by local households would cover interest and principal/sinking fund payments associated with the bond issue. Finally, for every 50 basis point (one-half of one percentage point) decline in the bond rate, an additional $6.5 million could be raised. If the local government financing rate was 4.5 percent, the current yield on A-rated, 10-year municipals nationwide, almost $280 million ($279.5) could be raised as a fund to purchase the ASARCO site.[23]

Table 4.7
Municipal Bond Issues Under WTP Assumptions

WTP	$12.80 / month	$11.64 / month
Number of El Paso Households	230,000	230,000
Tax/Payment Receipts Per Year	$35.328 million	$32.126 million
Municipal Bond Rate	6.0%	6.0%
Maturity of Bonds	10 years	10 years
Feasible Bond Issue	$260.0 million	$236.5 million
Change in Feasible Bond Issue Per 50 Basis Point Change in Rate	$6.5 million	$5.9 million

The second bond issue scenario reduces the WTP figure by two standard errors to $11.64 per month. Given this even more conservative WTP value, along with the same set of additional assumptions, local government could raise $236.5 million via a 10-year bond issue. And, if the financing rate could fall to 4.5 percent, approximately $255 million ($254.2) could be raised.

A similar scenario can be developed for Cd. Juárez. The WTP value generated from the Cd. Juárez household survey indicates a WTP amount of 249.84 pesos per year for the typical household. Employing a 10.93 exchange rate, the dollar-equivalent WTP value is $22.86 per year per household over a 10 year period. Assuming there are 246,750 households in Cd. Juárez (Juárez localidad which is city equivalent and not the Juárez municipio which is the county equivalent), $5.64 million per year over 10

[21] IPED estimate from: U.S. Census. 2005. El Paso County Fact Sheet; and, Thomas Fullerton, Brain Kelley and A. Molina, Jr., 2007 "Borderplex Long-Term Economic Trends to 2026," Border Region Modeling Project, Business Report SR07-1, The University of Texas at El Paso (March).
[22] Standard & Poor's. 2007. "High Yield Index," accessed at http://www.kennyweb.com.
[23] FMS, 2007. Accessed at http://www.fmsbonds.com.

years could be contributed to a legal defense fund to "purchase" the perceived environmental-health benefits associated with the El Paso ASARCO facility remaining closed.[24]

The WTP of El Paso residents can generate a substantial amount of capital that could be used to purchase the ASARCO site and return it to some other use either through public, private or a combined private/public development. If the community participated in such a referendum negotiations would no doubt be far more complicated than what has been presented here, evidenced in part by the range of opinions we saw in earlier sections. However, it is a proposition that the city might consider if indeed not reopening ASARCO is the chosen course[25].

Regardless of the course of action undertaken by ASARCO and the City of El Paso, the above analyses indicate that regional residents do place a substantial monetary value on the environmental amenity of cleaner air resulting from keeping ASARCO from reopening. As noted, the program selected is not the critical issue since any number of potential programs could be created. Instead, the critical issue is the economic value that residents place on the environment (specifically, ASARCO reopening). The specific hypothetical program used in this study is simply a means of obtaining that economic value.

Program Description

Several notes about the program description below:

1) While the referendum program is hypothetical in nature, it was important that respondents take the scenario seriously and believe the program and its underlying assumptions to be a real tax scenario that took into account the economic sacrifice they would have to make to support it. Otherwise those who cannot afford such a tax but vote for the program would overestimate the "real" willingness to pay since they do not take into account their budget constraint relative to their disposable income.

2) As mentioned in Section II, interviewers received approximately four hours of paid training prior to beginning work. This included detailed explanation of the bond issue program and reading a prepared package of hundreds of articles on the topic of ASARCO obtained from local newspapers from 1991 to July 2007 via the UTEP library. This was done as part of the NOAA recommendations that called for exceeding a minimum standard of information in the case participants asked specific questions about ASARCO or the program.

3) Immediately following the program description, interviewers asked participants whether they understood the information that was read to them and clarified or answered any questions they may have had about the program. Again, this was done to ensure that participants understood that they would be voting for or against a tax on themselves based on the information provided and that their willingness to pay would reduce their expenditures for private goods or other public goods (i.e., leisure and substitutes).

4) Reducing bias from all sources is an important part of a valid research design. Throughout the course of the survey interviewers were reminded that:
   - Personal opinions or comments, no matter how insignificant, had no place during the interview process. A means to diminish the scientific validity of the survey is to have interviewers impose subjective reasoning during their conversations with respondents, in addition to low interviewer motivation. They were reminded to maintain objectivity at all times to provide the client with valid results.
   - The calling list is a randomly generated list and any deviation to incorporate others who may be of homogeneous thought would diminish the validity of our design. When respondents asked whether we could contact other persons to participate, we were not able to survey persons not on our list.
   - This is not your typical opinion survey and the program script and questions were purposely written in a particular order and in a manner that incorporates the key features of the CVM. They were reminded to follow the program description as written.

[24] Banco de Mexico; Instituto National de Estadisticas, Geografia e Informatica.
[25] This option does not include the bankruptcy condition of ASARCO which is a legal question outside the scope of this study.

Program Description Read to El Paso Respondent by IPED Interview Personnel

{Interviewer: Now I'm going to read to you some information about ASARCO and then ask you some questions}

Information:

In 2002 ASARCO began the process of renewing its air permit through the Texas Commission on Environmental Quality, also known as TCEQ. Since then, parties on both sides have been involved in a series of legal debates. At issue are the potential health impacts and ASARCO's ability to achieve compliance with environmental standards. In May of 2007, TCEQ issued a report that would give ASARCO permission to reopen provided it addresses various shortcomings at the plant.

As background you should know that in 1996, ASARCO completed an upgrade to its copper smelting process that reduced sulfur dioxide emissions from 49,200 tons per year to less than 6,700 tons per year when it closed in 1999. TCEQ also notes that ASARCO reopening would increase emissions to higher levels in the region compared to being shut down.

We are conducting a survey to find out how much people in the region value the environment. One way to do this is to measure how much individuals are Willing To Pay as part of a government-sponsored program to keep ASARCO from re-opening.

Under this program, the City of El Paso would purchase the current site from ASARCO and redevelop the land for public use. The cost of buying the land plus the cost of redevelopment would be passed on to taxpayers. Given the potential size of the project, municipal bonds would have to be the primary financing vehicle and would be paid off over 10 years. As a taxpayer we will be asking you in the following questions if you would be Willing To Pay for this program through a simple vote.

Those who vote for the program believe it is worth the money to prevent the potential damage to the environment if ASARCO reopens, believe that other businesses may not come to El Paso if ASARCO reopens, or believe that current businesses may leave El Paso if ASARCO reopens.

Those who vote against the proposal believe the program is more than they can afford, believe they would be left with less money for more important things, believe there would be no effect on current or potential businesses, or believe that there are not serious enough environmental impacts associated with ASARCO reopening.[26]

[26] The order in which the last two paragraphs highlighted in grey were asked was random – generated by the electronic survey – in order to reduce respondent bias sometimes introduced by the order of statements.

Program Description Read to Cd. Juárez Respondent by Interview Personnel

(Entrevistador: A continuación voy a leerle algo de información sobre ASARCO y luego le haré unas preguntas)

Información:

En el 2002, ASARCO comenzó el proceso de renovación de su permiso a través de la Comisión de Calidad Ambiental de Texas, también conocida como TCEQ por sus siglas en inglés. Desde entonces, ambas partes han estado envueltas en una serie de batallas legales. En cuestión, está el impacto potencial en la salud y la posibilidad de ASARCO de cumplir con los requisitos conforme a las normas que regulan el medio ambiente. En mayo del 2007, TCEQ dio a conocer un reporte en el cual autoriza a ASARCO a reanudar operaciones, siempre y cuando modernice la planta.

Como antecedente, en 1996, ASARCO concluyó la actualización a su proceso de fundición de cobre que redujo la emisión de dióxido de sulfuro de 49,200 toneladas por año a menos de 6,700 toneladas por año cuando cerró sus puertas en 1999. Sin embargo, TCEQ también menciona que la reapertura de ASARCO incrementaría el número de emisiones en la región en comparación a que la planta permanezca cerrada.

Estamos llevando a cabo esta encuesta para saber que tanto valoran las personas el medio ambiente en la región. Una forma de hacerlo es evaluando que tanto están dispuestas a pagar las personas para evitar que ASARCO reanude operaciones.

Existe una propuesta del Fondo de Defensa Legal en Contra de ASARCO (FDLA) la cual va a ser creada como una organización de la sociedad civil. FDLA representaría a los ciudadanos mexicanos en acciones legales que podrían mantener ASARCO cerrada. La defensa legal se basará en que la contaminación causada por la fundición de cobre a lo largo de la frontera viola Los Acuerdos de La Paz firmados por Estados Unidos y México en 1983, los cuales prohíben la degradación ambiental dentro de sesenta millas de la frontera internacional. El costo de la defensa legal será pagada en parte por el sector público, privado y los ciudadanos de Ciudad Juárez. La batalla legal podrá tomar hasta un periodo de 10 años.

Los que voten en contra de la propuesta creen que vale la pena pagar para prevenir el daño potencial que ASARCO causaría al medio ambiente si reabre, creen que nuevas empresas no vendrían a Ciudad Juárez si ASARCO reabre o creen que empresas que actualmente están en Ciudad Juárez se irían de la ciudad si ASARCO reanuda operaciones.

Los que voten a favor de la propuesta creen que la iniciativa está fuera de sus posibilidades económicas, creen que tendrían menos dinero para cosas importantes, creen que la reapertura de ASARCO no tendría ningún efecto en las empresas que actualmente están en Ciudad Juárez o en las empresas que estén considerando venir a la ciudad, o creen que la reanudación de operaciones de ASARCO no tendría ningún impacto potencial en el medio ambiente.[27]

[27] The order in which the last two paragraphs highlighted in grey were asked was random – randomly asked by interview staff – in order to reduce respondent bias sometimes introduced by the order of statements.

Section V

El Paso and Sunland Park Business Survey

Methodology

In this section we discuss the findings related to a business survey conducted with business establishments from El Paso, TX and Sunland Park, NM. A Random Digit Dial (RDD) sample of NAICS-based businesses was obtained from a leading national sample provider.[1] Various NAICS sectors and industry groups were eliminated from the sample based on the goal of obtaining feedback only from private establishments with ties to the region and with no apparent special interest or link to ASARCO. Those excluded include:

- Local, state and federal government, including educational
- Various retailers and accommodation and food places with non-local representation
- Private education and training providers
- Special interest associations and organizations

All calls were made between July 23rd and July 27th, 2007, on weekdays between the times of 8:00 am and 6:00 pm. By employing the same staff and supervisors from the El Paso and Sunland Park household survey no additional training was required. As before, IPED staff members were used as supervisors, with at least one supervisor on hand at all times.

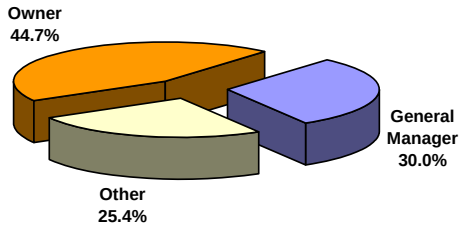
Contingent valuation was not used for the business feedback. Instead, the decision was made to make the business survey instrument considerably shorter to accommodate employer time constraints for participation (see Appendix H). Many of the same questions asked of the general public were once again examined relating to issues facing the region, but the survey also included specific questions to gauge business perception about ASARCO's impact on their individual business, their suppliers and potential new businesses seeking to relocate or expand into the region. The final version of the survey was also converted to electronic format for use by interviewers in the IPED Survey Research Center and verified with regard to data integrity and accuracy. A final sample size of 564 completed surveys was captured for a margin of error of plus or minus 4 percent.[2]

In order to insure that we were obtaining valid responses from the perspective of the business and not opinions of a random employee, interviewers asked specifically for the owner, general manager or someone with decision making authority, depicted in Figure 5.1. One-quarter reported being a decision maker other than an owner or general manager. These respondents ranged from various types of supervisors and managers to directors and presidents.

[1] NAICS - the North American Industry Classification System is the nation's 6-digit industry classification system. Every business establishment is grouped into an industry based on the activity in which it is primarily engaged.

[2] A survey was deemed complete if respondents went through the entire survey and answered the last question (Q16). However, respondents were given the option of not answering if they felt uncomfortable about a specific question. Therefore, a survey could be complete but have missing answers to questions (except for the last question). Incomplete surveys were disregarded regardless of how far respondents went through the survey.

Figure 5.1 What is your title?



Findings

Business Opinions about Reopening ASARCO

Businesses were asked about their support for ASARCO reopening in Figure 5.2. Forty-seven percent indicated that they favored ASARCO renewing operations while 30 percent opposed renewal. This a stronger support than exhibited by the general public, a position that may be linked to a belief in pro-industry or that the individual business itself may benefit. Once again, of considerable interest is that more than one out of five business respondents were unsure of their position. Figure 5.3 shows that of those who only had a "yes" and "no" opinion in Figure 5.2, the ratio is 3:2; that is, three-fifths favor and two-fifths are against ASARCO's reopening.

Figure 5.2
Are you in favor of ASARCO reopening?

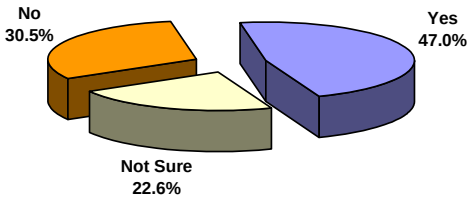
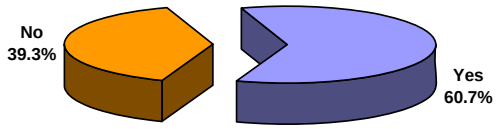
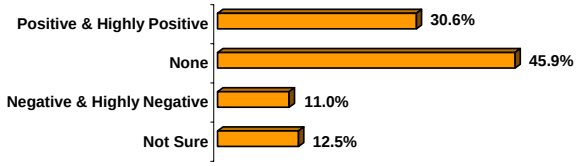


Figure 5.3
Considering only "yes" or "no" answers from Figure 5.2, are you in favor of ASARCO reopening?



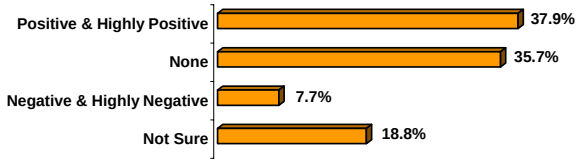
Questions were also asked about the types of impact ASARCO's reopening would have on business and business decisions to relocate or expand to El Paso. Figure 5.4 shows that just fewer than 50 percent feel ASARCO will have no impact on their business, with another 11 percent believing it will have a negative impact and another 12 percent unsure about any impacts. Slightly over 30 percent indicate they see a "positive" or "highly positive" effect, reinforcing a link that the proposed facility might provide positive spillovers for a variety of businesses. This link is not broadly picked up among the business survey participants, but it could also be argued that to date there is not enough evidence either in support or opposition to the proposed reopening of ASARCO to actually convince business owners or key business decision makers of the economic rewards that would come either directly or indirectly to them.

Figure 5.4
If ASARCO were to reopen, how would you describe its impact on your business?



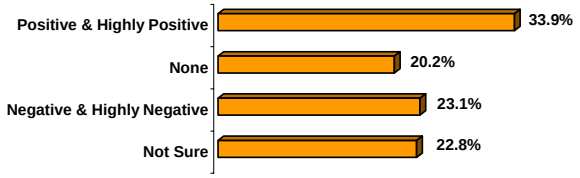
In Figure 5.5 businesses are split between whether ASARCO's reopening will either have a positive impact or no impact at all on local suppliers if TCEQ approves the permit to renew smelter operations, while those unsure about any impact reach almost 20 percent. This suggests a few points. First, at least locally, ASARCO may not be a point of discussion between members of the business community to the degree that it is the "hot" topic that the business community is trying to debate and discuss in a commercial level of civic engagement. Second, ASARCO in the bigger scheme of business strategic planning in El Paso has been over shadowed by other growth issues such as troop deployment to Fort Bliss, the Medical Center of the Americas, and general urban growth that has a far greater or potential impact on their own enterprises.

Figure 5.5
What kind of impact would you say ASARCO reopening would have on your local suppliers?



When asked about their thoughts about the potential impact of ASARCO's reopening on businesses looking to relocate to El Paso in Figure 5.6, the responses for a potential negative impact rises to almost one-quarter, but these are off-set by one-third who see a positive or highly positive impact. Regarding whether ASARCO would affect business relocation into El Paso, the business community has both pro- and anti-ASARCO segments but also a very significant neutral and undecided segment that reaches 43 percent. The degree to which this large portion of the business community remains out of the discussion suggests a lack of interest that is quite substantial, something that we may label business community apathy for the issue for which an explanation is not easy to identify.

Figure 5.6
What kind of impact would you say ASARCO reopening would have on businesses looking to relocate to El Paso?



Many decisions go into a business decision, especially in choosing a new location in which to operate and these factors make up a community's tool kit in recruiting industry and its suppliers to the region. Among these factors are many quality of life issues and location concerns. Some of these are worth noting inasmuch as they capture some of the discussion and comments about ASARCO that are reported and are captured in Figure 5.7. Moreover, for some this is as close to a scorecard of pluses and minuses on the ASARCO issue that can be developed within a broader overall economic development strategy.

Figure 5.7
Important Factors in Site Selection

Transportation and Logistics Infrastructure:

- ✓ Depending on where transportation costs can be minimized, a company will typically choose to locate either near its market or near the source of its raw materials or suppliers.
- ✓ Determining transportation costs is a multi-faceted task, including: interstate highway access, road and bridge conditions, road density and congestion, vehicle taxes and fees, road, railroad, water port and air cargo infrastructure, as well as cost and availability of services and labor involved in the transportation and warehousing industry.

Labor Force Availability:

- ✓ Quality and quantity of workers available at the potential location are an important consideration in site selection.
- ✓ Different companies will have different labor requirements. For instance, a company involved in the manufacturing sector may want to consider the quality of public education at the prospective site, because it is expected that higher performing school districts produce higher performing workers.
- ✓ Capital-intensive companies may be more concerned with the availability of a college-educated work force. Such things as adult education levels among college graduates, number of scientists and engineers, number and quality of universities and colleges, as well as research and development spending within those institutions become important considerations.
- ✓ Additionally, similar companies often choose to locate near one another in order cut back worker training costs.

Good Business Climate/Environment:

- ✓ The government often plays an important role in determining the nature of the business climate.
- ✓ Tax rates and environmental regulations should be considered as they mean more expenses and lower profits.
- ✓ State debt is an important consideration; the higher the debt, the higher future taxes may be.
- ✓ Spending patterns ought to be noted; for example, transportation is important to companies and so they may look for a government that allocates a large portion of its budget to this factor.
- ✓ A location's willingness to offer incentive packages is also conducive to a good business climate.
- ✓ Also, by looking at the success level of other companies located in the potential site, a company may determine whether or not that site has a good business climate.

Quality of Life:

- ✓ Quality of life is an important factor in bringing in and keeping quality workers. This is a broad category that can have many definitions, for example, a good quality of life may be the ability to afford a middle class lifestyle.
- ✓ It follows that, affordable housing, good public schools, low crime levels, standard of living, traffic and commuting, continuing education opportunities, as well as commercial air access all become important factors in site selection.
- ✓ Prevailing wage rates must be considered; a company will want to choose a location where salaries and wages are minimized while still allowing employees to have a good quality of life.
- ✓ Quality of life can also refer to recreational opportunities. For instance, "The San Antonio Riverwalk is often used as an example of the high quality of life and livability of San Antonio, Texas.
- ✓ Pollution, scenic beauty and open space all factor into a company's site selection process.

Other Costs:

- ✓ Healthcare costs are of major concern to companies and these costs vary from state to state; choosing a state with lower healthcare costs will lower expenses.
- ✓ Locating where there is affordable and available healthcare will help attract and retain workers.
- ✓ Other costs to be considered are those of day-to-day concern, such as power costs and lease rates of potential sites.

Reputation and Perception:

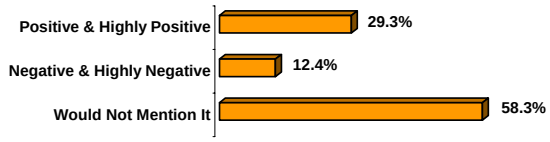
- ✓ This factor may not initially be especially important when choosing a site location, it can easily become a deciding factor.
- ✓ While this element of site selection is far more subjective than the previously discussed factors, it becomes apparent that "As the list of potential sites narrows to the final two or three, you'll likely find that each one ranks very high in your criteria…at this point it comes down to perception." (Krizner, 2007)

Source: *www.expansionmanagement.com*

When asked in what perspective they would mention ASARCO if a business contact was considering El Paso as a relocation or expansion target, a majority, almost three-fifths would fail to even mention the smelter operations as seen in Figure 5.8. This can be interpreted in at minimum two ways. First, as previously discussed, businesses don't deem it a relevant part of the decision making process for other businesses. Second, that if it is viewed as a negative externality of the El Paso market it is better to fail to

mention it, especially if businesses believe that industry recruitment would be affected by quality of life issues and location concerns.

Figure 5.8
How would you mention ASARCO if a business contact were to tell you they were considering El Paso as a relocation or expansion target? In what kind of light?



In sum, Figure 5.4 through 5.8 shows that while more businesses believe ASARCO's air permit renewal will have positive effects over negative effects, a majority believes that renewed operations will have no impact or are indifferent or unsure about any impact at all. As business organizations themselves have also been relatively silent about ASARCO, the rank and file business owner and decision maker are also not taking a position that would tilt the scale either in favor or opposition.

General Policy Issues and Importance

Similar to the residential surveys, businesses were asked about a set of issues facing the region. In Table 5.1 businesses were asked about how spending on six issues was needed and in Table 5.2 they were asked about the importance of five public policy issues. The ranking of whether the region needs to spend more or less mirrors what the citizenry responded in Section II, with the exception that protecting the environment moved up one spot over fighting crime. Investing in creating jobs was ranked as the most important followed by improving education and public health. Protecting the environment and fighting crime were fourth and fifth, respectively, and issues regarding increased expenditures on border security ranked last among the six. Businesses much like the general public have an appreciation for the border and the role of Mexico in El Paso's economy, thus border security among the business community is viewed as a much lower concern in the Paso del Norte than other parts of the nation. Noteworthy is that business in general believes that spending on these important issues is about right, answering that the same amount should be spent (see Appendix I), possibly due to their economic motive of controlling costs or a better understanding of budgetary and fiscal matters.

Table 5.1
Ranking for Spending on Issues in the Region[3]

	% Great Deal & Somewhat More	% Great Deal & Somewhat Less	Index	Rank
How much should we spend on:				
Creating jobs?	81.5	3.9	**77.6**	**1**
Improving public education?	79.4	3.8	**75.6**	**2**
Public health?	77.8	3.2	**74.6**	**3**
Protecting the environment?	71.8	5.7	**66.1**	**4**
Fighting crime?	67.6	3.5	**64.1**	**5**
Border security?	58.7	12.0	**46.7**	**6**

Unlike residents whose most important issue is better paying jobs, consistent with their number one ranking of greater spending to create jobs, Table 5.2 illustrates that businesses feel that the most important issue facing the border region is ethical government. This is certainly influenced by the recent

[3] Rank is based on taking the combined total of those who replied "Great Deal More" and "Somewhat More" and subtracting those who replied "Somewhat Less" and "A Great Deal Less."

FBI investigations on various county commissioners and perhaps influenced by the proximity to Cd. Juárez where corruption has been an issue beyond the recent past, especially in the business press (i.e., *Wall Street Journal*). While reducing air pollution is the least important issue facing the region of the five asked for private employers, three-fifths report they believe it is a very important or extremely important issue, versus only 11 percent that believe it is not important.

Table 5.2
Ranking of Importance on Key Issues in the Region[4]

	% Extremely & Very Important	% Not Too & Not Important at All	Index	Rank
How impartant is/are:				
Ethical government?	77.6	6.4	**71.2**	**1**
Better paying jobs?	73.5	6.5	**67.0**	**2**
Improving graduation rates?	71.2	9.3	**61.9**	**2**
Reducing taxes?	67.4	5.6	**61.8**	**4**
Reducing air pollution	61.6	11.0	**50.6**	**5**

Business Understanding about ASARCO

The following questions were asked to assess the business community's understanding about ASARCO. Beginning with Figure 5.9, we find that 97 percent of businesses are aware of the ASARCO facility and of these, 98 percent, as reported in Figure 5.10, are aware that ASARCO is trying to renew its permit. Also, of those aware of the ASARCO facility, Figure 5.11 shows that only three-fifths indicated that they understood the process "very well" or "moderately well" while the remainder has little to no understanding about the actual air permit renewal process. Overall, the level of self-reported understanding among the business sector is almost 13 percent greater than what was found among residential respondents.

Figure 5.9
Are you aware of the ASARCO facility?

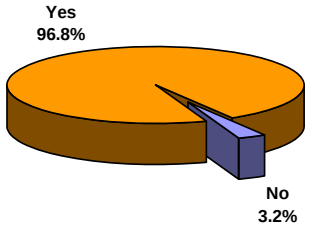
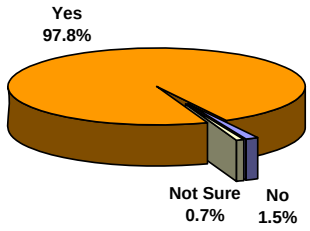
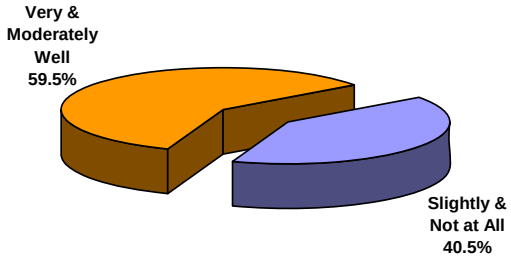


Figure 5.10
Have you read or heard about ASARCO trying to renew its air permit to renew operations?



[4] Rank is based on taking the combined total of those who replied "Extremely Important" and "Very Important" and subtracting those who replied "Not Too Important" and "Not Important at All."

Figure 5.11
How would you describe your understanding of the process that ASARCO must go through to renew its air permit?



Business Characteristics

Two-thirds of businesses surveyed employed 10 or fewer employees (small sized) and another one-quarter employed between 11 and 50 persons (small to medium sized) as shown in Figure 5.12. Two-fifths are relatively new in operations, having been in business 10 years or less (Figure 5.13).

Figure 5.12
How many people does you business employ?

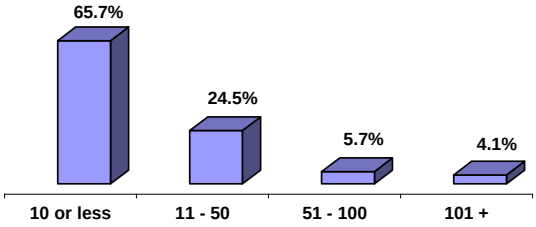


Figure 5.13
How many years have you been in business?

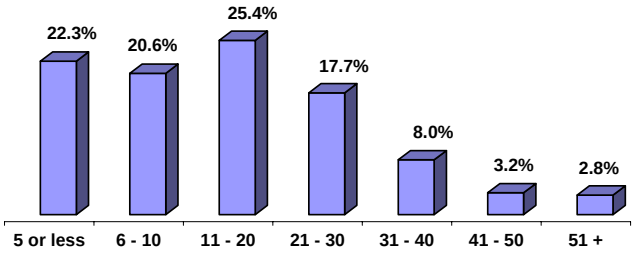
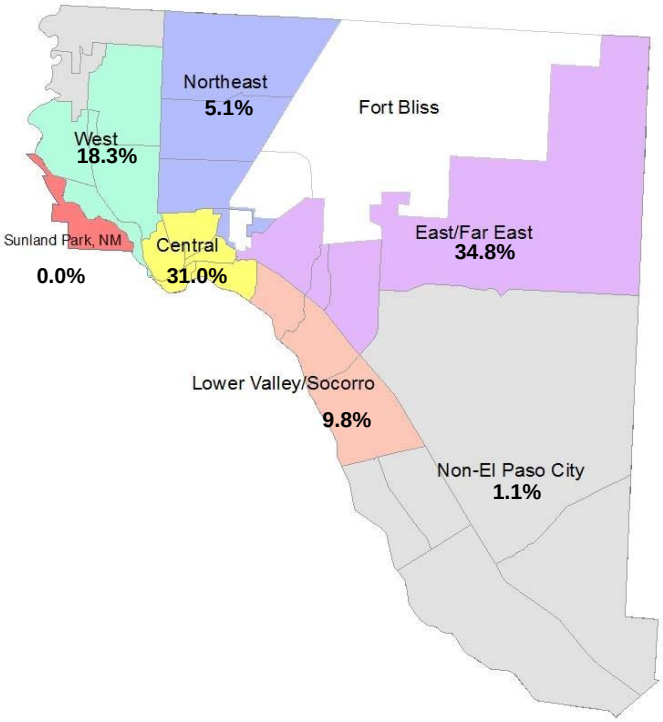


Table 5.3 shows the breakdown of respondents by type of industry and shows a relatively good reflection of our economy when compared to establishments data from the Bureau of Labor Statistics. Only four businesses were unable to be placed in their respective industry sector. Figure 5.14 shows business representation by area of town. The majority of surveys were captured from businesses in the East/Far East and Central areas, followed by the West side and Lower Valley. This follows the dynamics of business locations around the county, with Central and West El Paso being well-known business districts and the East/Far East becoming a larger portion as a result of growth in that area.

Table 5.3
Comparison between Industry Type of Survey Respondents and 2006 BLS Establishments

Industry Sector (%)	BLS	Census
Agriculture, Forestry, Fishing & Hunting	0.8	0.9
Mining, Quarrying, & Oil & Gas Extraction	0.1	0.0
Utilities	0.2	0.5
Construction	8.8	6.0
Manufacturing	5.1	8.7
Wholesale Trade	7.9	4.8
Retail Trade	15.0	12.2
Transportation & Warehousing	5.7	5.0
Information	1.3	2.0
Finance & Insurance	5.5	7.1
Real Estate & Rental & Leasing	4.8	7.4
Professional, Scientific & Technical Services	8.8	10.8
Management of Companies & Enterprises	0.3	0.2
Admin. & Support & Waste Mgmt. & Remediation	4.8	2.5
Educational Services	0.8	0.5
Health Care & Social Assistance	9.1	11.5
Arts, Entertainment & Recreation	0.9	2.0
Accommodation & Food Services	8.5	5.1
Other Services (except Public Administration)	9.7	12.1
Not Sure	1.9	0.7
Total	100.0	100.0

Figure 5.14
Businesses by Area of Town



Section VI

ASARCO's Impact on the Housing Market of El Paso

In this section we provide an evaluation of the impact of a potential re-opening of ASARCO on the housing market of El Paso. The first part presents a brief discussion of the theoretical framework for this exercise. The second part presents an overview of the El Paso housing market and the third presents a brief discussion of the methodology used to evaluate the likelihood of impacts. The final portion presents the results and conclusions associated with an examination of the housing market.

Theoretical Framework

Air pollution is one of the primary considerations among many citizens if ASARCO is allowed to reopen its smelter activities in El Paso. Air pollution, from the perspective of economists, is an example of a negative externality where the costs of a firm's production activities are not completely reflected in transactions in the market place. That is, the total costs of production faced by the members of a regional economy are greater than the production/operation costs bared by the business firm. In the case of ASARCO, an increase in air pollution from renewed operations will have negative externalities to a subset of the population, especially those that may be closest to the source. Negative externalities can be evaluated from different perspectives, including but not limited to public health and property values, more specifically housing.

In this regard we focus on the housing market. Experts agree that decisions about where to live reveals a great deal regarding their individual preferences.[1] The decision to buy a home is multidimensional; that is, the purchase of a home not only is a financial decision (i.e., buying a physical asset) but also is a location decision (i.e., access to certain school districts, jobs, socioeconomic status or class, etc). Location is an attribute of the home that allows the household to be near preferred amenities (e.g., mountain view) and to be as far as possible from "eye sores" (e.g., landfill). Location is one factor that contributes to determining the price differential of similar homes in different locations in the housing market. In other words the housing market captures people's willingness to pay for amenities.

It can be argued that the value of a home is a function of physical characteristics (size, age, materials, etc.) as well as neighborhood characteristics (socioeconomic status, ethnic composition, etc.) and locational characteristics (distance from amenities or "eye sores"). This is expressed in Equation 1:

$$\mathbf{Y = f \{ P ; N ; D \}} \qquad \textbf{(Equation 1)}$$

such that Y = Price ; P = physical characteristics; N = neighborhood characteristics; and D = location

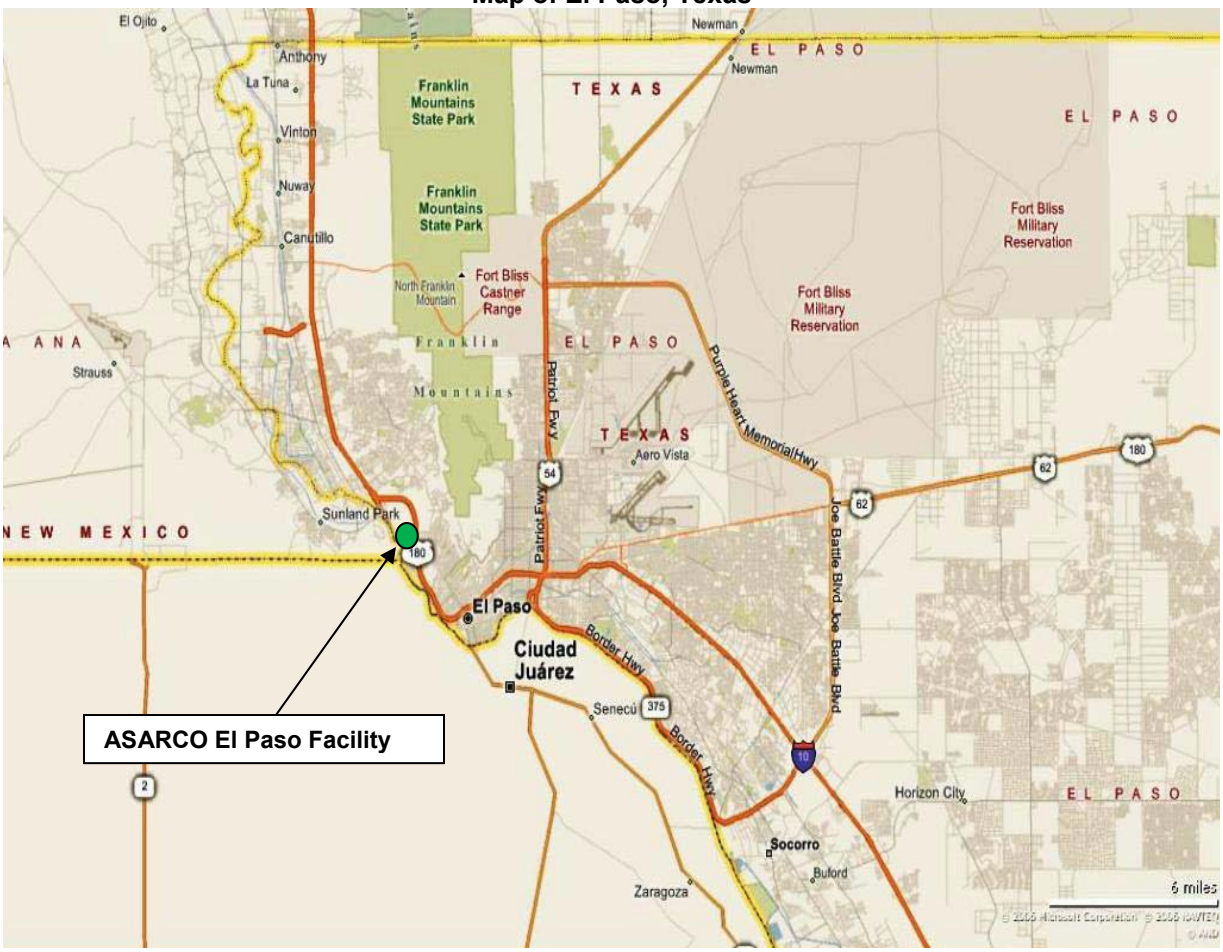
One of the interesting issues in El Paso is that the location of ASARCO is near the Franklin Mountains, one of the region's outstanding attributes that consistently gains favor as adding to the quality of life

[1] Ronald Ridker & John Henning, 1967. "The Determinants of Residential Property Values with Special Reference to Air Pollution," *Review of Economics and Statistics;* Myrick A. Freeman III, 1979. "Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues," *The Scandinavian Journal of Economics*: 81(2): pp. 209-227. Boyle; Melissa A. & Katherine A. Kiel, 2001. "A Survey of Price Hedonic Studies of the Impact of Environmental Externalities," *Journal of Real Estate Literature:* 9(2): pp. 117-144.

(Figure 6.1).[2] In light of this, homeowners may face a location dilemma by choosing between an amenity (Franklin Mountains) and the potential of a negative externality or "eye sore" if ASARCO is allowed to reopen smelter operations (this latter perspective differs among individuals). The decision to allow ASARCO to resume operations may play a role in the homeowner's risk perception. Based on this homeowners' dilemma, the following can be hypothesized:

> H_1: If Asarco remains closed the housing premium of the amenity will increase ($P_a \geq P_b$), such that P_a = Price of homes near mountain and P_b = Price of homes elsewhere in El Paso.

Figure 6.1
Map of El Paso, Texas



Source: Real Estate Center at Texas A&M

Overview of the Housing Market in El Paso

Figure 6.2 shows the trend of the housing market in El Paso since 1990, based on the housing price index which, according to the Office of the Federal Housing Enterprise Oversight "is a measure designed to capture changes in the value of single-family homes in the United States as a whole, in various regions of the country, and in the individual states and the District of Columbia."[3]

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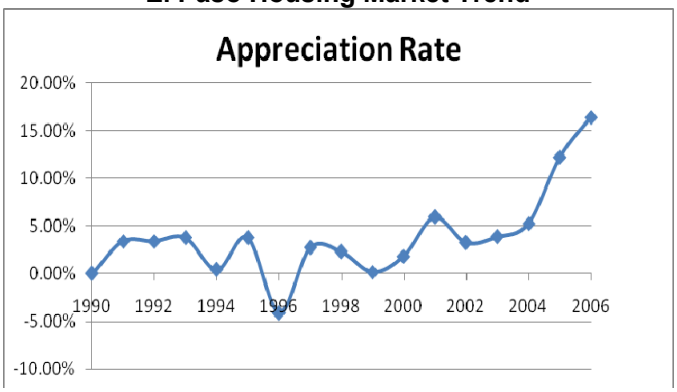
[2] See, for example, Dennis L. Soden and America Tirado. 2004, Technical Report 2004-07, **"***Vision 2004: El Paso Citizen Survey*," Institute for Policy and Economic Development, University of Texas at El Paso, June; America Tirado and Dennis L. Soden. 2006, Technical Report 2006-02,"*Vision 2006 El Paso Citizen Survey for the City of El Paso*," Institute for Policy and Economic Development, University of Texas at El Paso, February.

[3] The HPI is published by the Office of Federal Housing Enterprise Oversight (OFHEO) using data provided by Fannie Mae and Freddie Mac. http://www.ofheo.gov/HPI.asp (accessed August 13,2007).

Figure 6.2 shows that in 1995 home values declined and remained below a 5 percent appreciation rate for the next five years. Also, it is clear that 2000 through 2001 showed a rebound leading to appreciation at a higher rate than the previous ten years. This is evidenced by the average appreciation rate from 1990 to 2006 recorded as 4 percent compared to 11.3 percent appreciation from 2004 to 2006. The El Paso housing market was able to enjoy a share of the national housing boom with appreciation in 2005 and 2006 at levels exceeding national trends.

Figure 6.2
El Paso Housing Market Trend



Source: Office of the Federal Housing Enterprise Oversight

Based on this information we can return to the working hypothesis. Based on the hypothesis, after the closure of Asarco in 1999, home values in the nearby neighborhoods would have been expected to increase at a rate above the average appreciation since the area would have become more attractive for its closeness to what people perceive as valued amenities, including the scenery of the Franklin Mountains, the University of Texas at El Paso and its education spillovers, and the entertainment district (restaurants, bars, etc.) surrounding UTEP. Thus it follows they would be willing to pay a premium for these locational characteristics. (The study uses distance to the University of Texas at El Paso as a location proxy for its closeness to the Franklin Mountain.)

Methodology

The hypothesis was tested using a hedonic regression model. Hedonic models are a recognized method to measure the value of amenities or externalities that are not being measured through market transactions; among these is clean air. As stated, home values are a proxy for people's willingness to pay for environmental goods and services as well as amenities. In this regard, the following model was used to test the above hypothesis:

$$\ln Y = \beta_0 + \beta_1 * \ln X_1 + \beta_2 * \ln X_2 + \beta_3 * \ln X_3 + \beta_4 * \ln X_4 \qquad \textbf{(Equation 2)}^4$$

such that
Y = Predicted home value
X_1 and X_2 = Vectors of home structure characteristics (age and size of home)
X_3 = Vector of neighborhood characteristics (median household income)
X_4 = Vector of location (distance from UTEP)
ln = Natural logarithm
β = Coefficient estimates of the intercept and parameters X_1, X_2, X_3, and X_4

[4] The model uses natural logarithms (ln) on both sides of the equation for two reasons. First, it is a common procedure to be able to transform nonlinear functions, such as logarithmic into linear functions, to estimate the parameter coefficients more accurately through ordinary least squares (OLS) or multivariate regression. Second, transforming variables into natural logarithms allows for easier interpretation of the results – the coefficient estimates or betas (β) can be simply interpreted as percentage changes or elasticities. For instance if beta is 0.5 this mean that if the value of the independent variable (i.e., neighborhood characteristics) changes by one percentage point the dependent variable (home value) will change by 0.5 percent.

The hypothesized direction of the different variables (sign of the coefficient estimates) is presented in parentheses as follows: 1) it is expected that the value of a home will decline as the home gets older (-); 2) the bigger the home the more valuable it is (+); 3) the higher the percentage of households with higher income levels the greater the value of the homes in that particular neighborhood (+); and 4) the farther the home is located from the mountains and the university the lower the value (-).

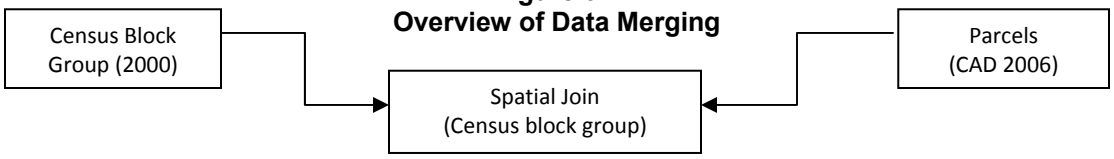
Data used are a combination of data from Census and the EL Paso Central Appraisal District (CAD). Census data were used to estimate the model for the year 2000 and CAD data for 2006 to compare how values may have changed.[5] Using defined census blocks, Geographic information Systems (GIS) was used to combine data from these two different sources to create a common unit of analysis. GIS applications were also used to calculate the distance of each census block group with respect to UTEP. The Pythagorean theorem[6] was used as a procedure to calculate the distance using the latitude (lat) and longitude (long) points of the center point of each census block group (Equation 3).

$$c = \sqrt{a^2 + b^2} \qquad \textbf{(Equation 3)}$$

Figure 6.3
Model Operationalization

Variable	Operationalization	Source
Home value (Y)	Census block group median value	Census Bureau 2000 (file sf3)
Home structure (P)	Age of home (-)	Calculated 2000-Year built based Census Bureau 2000 (file sf3)
	Size (+)	Median number of rooms Census Bureau 2000 (file sf3)
Neighborhood (N)	Census block group median household income (+)	Census Bureau 2000 (file sf3)
Location (L)	Distance from UTEP (-)	IPED calculations using GIS

Figure 6.4
Overview of Data Merging



Findings

As background, the range of the year that an individual home was built in El Paso goes back to 1939 and as recently as 1999. Most of the housing stock is made of 5 rooms. The median value of the homes (1999) is about $70,000 with a wide variance that ranges from as low as $17,500 and as high as $275,000. Given the large variance in the value of homes, it was important for the purpose of this study to understand the geographic distribution of the values. Figure 6.5 provides a mapping of z-scores[7] for

[5] Census data are reported every decennial and CAD data are updated every year for tax purposes. Unfortunately, data limitations (more specifically, lack of CAD data availability from the source) prevented us from utilizing solely CAD data which would have allowed us multiple years of comparison, including points in time when ASARCO was open. While a pre- and post-ASARCO (before and after it closed in 1999) comparison would have been optimal, we were left with the next available option – two different datasets discussed above and merged for compatibility.

[6] C= Distance a= (Lat2 - Lat1)69.1 b= (Long2 - Long1)53.0. The difference between latitudes and longitudes of the two points had to be multiplied by a factor to transform decimal degrees (geographic unit) into miles (distance unit). For instance if point one has a latitude longitude location of (-106, 81) and point two (-106, 82) the distance in miles between the two points is about 53 miles: SQRT [0 $(69.1)^2$ + $1(53)^2$)] = 53. See http://www.meridianworlddata.com/Distance-calculation.asp (Accessed August 10, 2007).

[7] Z score is a normalized value, which tells the difference between the observation and the mean with respect to the standard deviation of the distribution. The score can be interpreted as to how many standard deviations from the

each census block group in El Paso. Visually this map tells us that the highest home values, those that deviate substantially from the central tendency in Figure 6.5, are located in the West side and in some parts of the East, particularly the triangle made by I-10, Montana and Lee Treviño. Lower valued properties are located farther East and closer to the New Mexico border. High value property also exists near UTEP in areas that include the Kern Place, Rim-University and Mission Hill neighborhoods.

Figure 6.5
Census Block Groups: El Paso

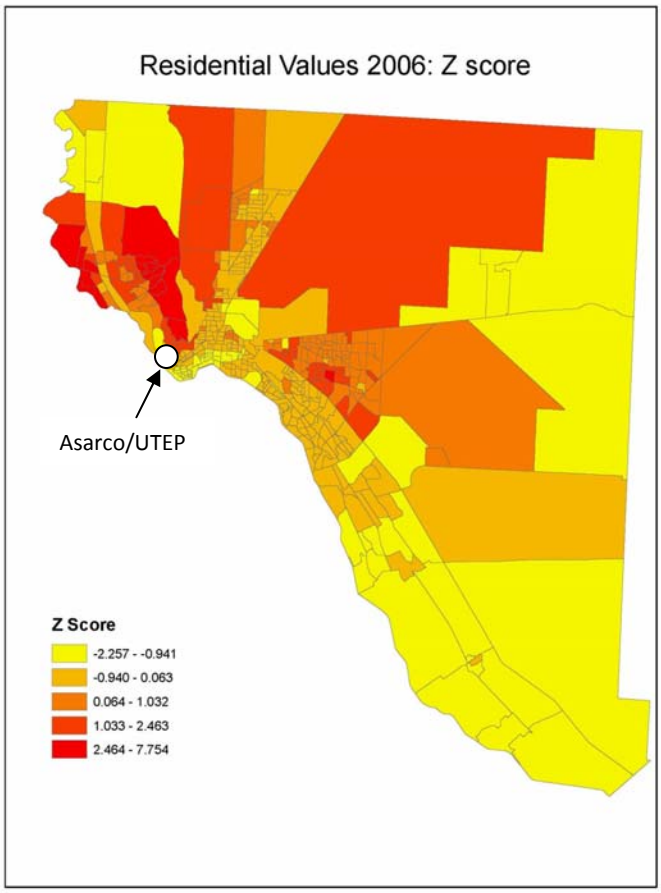


Figure 6.5 reports the geographic distribution of home values throughout El Paso but it does not provide insight about the physical structure (size) of the property, neighborhood or location. As noted before, home values are a function of the structure, neighborhood and location. Thus, models are estimated to control for those aspects, described in Table 6.1 through 6.2, which report results based on Census 2000 (Model 1) and 2006 CAD data (Model 2). These models are developed to analyze whether residents of El Paso are willing to pay a premium to be close to a natural amenity (Franklin Mountains) or, in reverse, locate away from a negative externality (ASARCO).

Model 1 in Table 6.1 shows statistical significance (F = 140.4) at the 0.05 level. The variables (age of the house, size of the house, household income, and distance) explained about 58% of the variance of the value of a home (Adjusted R square = 0.572). All the variables, except for the size of the house (LN MEDROOMS), are statistically significant at the 0.05 level. Similarly, all variables, except home size, have the expected signs as established by the working hypothesis.

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mean a particular observation is located. A Z-score of ±2 indicates that the observation is not different from the mean at the 95% confidence interval.

The negative coefficient in the age of the house appears to be capturing a depreciation rate due to time as hypothesized. Household income in the census block is positively correlated with the value of the house as expected – as incomes increase household housing expenditure is likely to rise as well. Interpreting the elasticity of the household income parameter, the coefficient of 0.542 means that as household income in the block group increases by 1 percent their housing values go up by a half percentage. The variable distance, which is the proxy used to capture location, has a negative coefficient and is telling us that the closer or smaller the distance to UTEP or the mountain the higher the value of the home. As the distance to the amenity (UTEP and the mountain) is reduced by a percentage point, the value of the house increases by almost a quarter of a percentage point (.238).

The standardized coefficients tell us the relative importance of each variable in the model; that is, which of the variables explained the most variability of home value. Household income and location, in that order of importance, explain most of the value of the residential property.

Table 6.1
Model 1: LN Home Value using Summary Census 2000

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	6.379	.413		15.437	.000
	LN AGEHOUSE	-.301	.105	-.114	-2.865	.004
	LN MEDROOMS	-.019	.087	-.011	-.213	.831
	LN MEDHHINC	.542	.040	.701	13.390	.000
	LN Distance	-.238	.024	-.382	-9.964	.000

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F - Statistic
1	.759(a)	0.576	0.572	0.24802	140.445

Table 6.2 presents the results for 2006 using CAD data. The model in general is reliable (F = 134) and explains 56 percent (Adjusted R Square = 0.559) of the variance of housing values. Once again, the sign for the number of rooms (LN MEDROOMS) is not the expected or contrary to the hypothesis. However, it is not statistically significant. Of more importance is that *the location premium in this model increases (in magnitude) to -0.266 from -0.238 in Model 1, meaning that the location premium has become of greater value since 2000.* Overall, as in Model 1, in Model 2 household income and location continue to be the most important factors for explaining home values.

Table 6.2
Model 2: LN Home Value using Summary CAD 2006

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	4.377	.553		7.916	.000
	LN AGEHOUSE	-.300	.144	-.084	-2.088	.037
	LN MEDROOMS	-.035	.114	-.016	-.307	.759
	LN MEDHHINC	.751	.054	.733	13.789	.000
	LN Distance	-.266	.033	-.315	-8.073	.000

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F - Statistic
1	.750(a)	0.563	0.559	0.33802	133.96

Conclusion

Relative to location, El Paso residents behave in the same way as other urban residents in the United States; they will pay a premium to be located near areas that enhance their quality of life. As demonstrated in the model parameter "location," there is still a premium being located near UTEP and the Franklin Mountains. This location premium has increased as an explanatory variable of housing value from 2000 to 2006. The areas near ASARCO, which happen to be closest to UTEP and the mountain, such as Rim-University and Kern, appreciated faster than any other area in the city. These areas continue to retain value and have seen increases since the closure of ASARCO that have exceeded other areas of El Paso.

From one perspective, ASARCO's 1999 closing conceivably changed the risk perception people in the area had held and, therefore the area became more attractive for its location near UTEP and the Franklin Mountains. Thus, this view would support the hypothesis that if ASARCO were to open in the near future it would eliminate at least part of the premium that people are willing to pay to live near UTEP and the Franklin Mountains. The case can also be made that despite a premium adjustment, the highly desirable neighborhoods in Kern Place and Rim Road are still going to be in high demand regardless of the ASARCO outcome and exceed median home values by a substantial amount. However, with growth, infrastructure and amenities in El Paso going eastward, homebuyers now have a desirable option if in fact they see ASARCO as a negative externality and wish to move far from it. This would result in a slower home value appreciation rate in and around the UTEP area relative other parts of the region which can be tracked through time.

Section VII

Alternative Economic Impact: Pharmaceuticals and Medical Device Manufacturing

The City of El Paso requested an alternative economic impact investigation that considers the *possibility* that ASARCO does not reopen and the land is redeveloped for other purposes. Any alternative at this point is hypothetical and does not promote recruitment of specific industrial activity onto the land currently owned by ASARCO. Rather, it serves as an example that potential economic activity (such as smelter manufacturing operations) is not an "all" or "nothing" proposition. That is, while ASARCO's economic impact is substantial, in the case that it does not reopen there exist substitute operations for job creation. It should be noted, however, that activities such as this impact simulation are now more likely than before given the structural changes our regional economy is witnessing. Economic impacts are measured using the same input-output analysis tool – IMPLAN – that was used in a previous ASARCO study.

Choice for Alternative Operations

In selecting alternative impacts, the primary criterion was to introduce industry activity that was deemed a "good fit" with the structural changes that are taking shape in our region. Specifically, two key events are changing the landscape of our regional economy: 1) BRAC expansion and 2) the proposed Medical Center of the Americas (MCA – includes the four year medical school) in combination with UTEP's health sciences complex. Two scenarios were selected that incorporate industries associated with the health and life sciences and require development of only a portion of the current land occupied by ASARCO:

1. Construction investment and operations for a mid-sized pharmaceutical manufacturing plant.
2. Cluster of plants in pharmaceutical and medical devices manufacturing.

A demolition and remediation/capping (brownfield site clean up or cover up) phase would precede any construction and operations activities regardless of the type of industry that could potentially reside on the ASARCO site. However, the present alternative impact analysis is only hypothetical since a full feasibility study would be required to accurately capture the magnitude of every phase's investment. For example, one plan for development could call for a complete leveling of the site while another plan may consider salvaging selected existing structures for reuse. Similarly, different parts of the site may require greater remediation than others, and depending on use, some parts of the site could simply be capped off. Consequently, *demolition and clean up scenarios are omitted from this exercise (too many assumptions) even though their economic impact would be sizeable given the scale of the site preparation that would have to take place*.

Investment and recruitment of industries in the above scenarios, in addition to biosciences, will be crucial for the vision of a full-fledged MCA. An essential part of this vision has been realized through funding of the four-year medical school; "a research-based college of medicine plays a crucial role for any region that aspires to develop a life science cluster," providing valuable infrastructure, both physical and human-

based.[1] However, industry participation is critical, regardless of where it locates, for the development of a vibrant cluster in life sciences, from research and development to product testing and commercialization. While hypothetical, the above scenarios provide an initial analysis of these critical sectors – biotechnology, pharmaceuticals, medical devices, and associated R&D activities.

Alternative Economic Impacts

It is important to emphasize that no specific information is available in terms of the expenditures associated with such alternatives. Consequently, several assumptions about space and operations are made based on similar operations[2] and the remaining necessary inputs for the impact analysis are captured by the IMPLAN model. (All values below are in 2004 dollars.)

Scenario 1: Construction and Operations for a Mid-sized Pharmaceutical Manufacturing Plant

The fist scenario involves a $70 million one-time construction investment for a mid-sized pharmaceutical manufacturing plant housed in an approximately 10-acre area. The economic impact of this type of on-site investment is substantial, supporting region-wide over 1,100 construction jobs and another 400 workers in various other industries with a supplementary output of nearly $109 million (Table 7.1). In addition, it would create more than $50 million in employee compensation and proprietors' income.[3]

Table 7.1
Construction Impact for a Mid-sized Pharmaceutical Manufacturing Plant

El Paso	Direct	Indirect	Induced	Total
Employment	1,116	95	301	1,513
Output	70,000,000	11,096,694	27,870,999	108,967,694
Value Added	45,544,576	5,555,114	16,398,209	67,497,896
Labor Income	38,584,808	3,635,584	8,409,866	50,630,258

Table 7.2
Operations Impact for a Mid-sized Pharmaceutical Manufacturing Plant

El Paso	Direct	Indirect	Induced	Total
Employment	291	473	248	1,012
Output	225,761,648	58,380,241	22,982,563	307,124,452
Value Added	35,191,260	31,367,452	13,522,091	80,080,804
Labor Income	15,893,889	18,310,173	6,934,644	41,138,705

[1] Perry Wong and Armen Bedroussian, March 2006. "Economic Benefits of Proposed University of Central Florida College of Medicine," Milken Institute; Ross DeVol, Perry Wong, Junghoon Ki, Armen Bedroussian, and Rob Koepp, June 2004. "America's Biotech and Life Science Clusters," Milken Institute.

[2] Lisa Wesel, 2007. "University of Kentucky Builds State's First Sterile Research Facility." *Tradeline Inc.* ISSN: 1096-4894; Deloitte & Touche USA LLP, June 2007. "New Jersey Biotechnology…A Robust State of Health," Biotechnology Council of New Jersey Economic Impact Study; *Caribbean Business ,* 2001. "Johnson & Johnson ups local investment $63 million," v29:41, pp. 2.

[3] Employee compensation includes wages, salaries, other labor income, and employer and employee contributions to social insurance; proprietor's income includes income received by the self-employed.

In terms of the plant's operations, it is no coincidence that 291 employees are selected as depicted in Table 7.2 (that is, 291 employees match the projected ASARCO direct employment).[4] The initial 291 employees would generate over 700 additional jobs annually in the El Paso area. This translates into almost 3.5 additional jobs per direct hire in pharmaceutical plant operations. On an annual basis, the increase in regional economic output and labor income are more than $307 million and $41 million, respectively.

Scenario 2: Cluster of Pharmaceutical and Medical Devices Manufacturing Plants

The second scenario involves a cluster of businesses in the following industries:

1) Pharmaceutical and medical manufacturing – 100 employees
2) Surgical and medical instruments manufacturing – 70 employees
3) Surgical appliance and supplies manufacturing – 50 employees
4) Gasket, packing and sealing device manufacturing – 50 employees
5) Dental laboratories – 20 employees

Employment and production differences between the above five industries means space requirements for each establishment will also differ. Hence, this analysis does not include construction impacts (too many assumptions – *as with the omission of demolition and remediation/capping activities, omission of construction reduces the true economic impact as it relates to the true series of events that would have to take place for development*). Table 7.3 shows annual aggregate impacts of the defined cluster operations. A total direct employment is again chosen that matches ASARCO's estimated employment if it is allowed to reopen.

The economic impacts of this second alternative, although lower than the first alternative, are also substantial. The combined cluster employment (290 jobs) would produce a total of 782 jobs region-wide or 2.7 jobs per direct cluster employee. Output would be expanded by nearly $181 million and labor income would increase to more than $40 million.

Table 7.3
Operations Impact for a Cluster of Pharmaceutical and Medical Devices Manufacturing Plants

El Paso	Direct	Indirect	Induced	Total
Employment	290	248	244	782
Output	126,951,013	31,254,437	22,574,949	180,780,400
Value Added	38,338,941	16,638,747	13,282,307	68,259,997
Labor Income	23,316,987	9,900,693	6,811,551	40,029,231

Conclusion

Both alternatives selected in this exercise would generate significant economic impacts for the El Paso region based on the IMPLAN impact analysis. Moreover, the space requirements would not be as demanding since these operations would only require a fraction of the current ASARCO site. This means that excess land would be available for further development and job and income creation beyond these alternatives. Redeveloped properly and given its strategic location, a clustering of industries (through recruitment and economic gardening) at the ASARCO site has the *potential* to outweigh its current heavy manufacturing use.

[4] More than 14 percent of establishments in the pharmaceuticals manufacturing industry fall into this mid-size category. See the career guide to industries at www.bls.gov .

More importantly, as an alternative that is closely linked to the MCA, the Texas Tech Medical School and UTEP's health sciences complex, these scenarios encompass benefits that extend beyond the quantified economic measures. Such intangible benefits include the economic stimulus created by spin-off businesses, contributions to community and individual quality-of-life, and greater research that is a magnet for greater funding and breakthroughs in the field. These intangibles are strongly correlated to higher paying jobs.

As noted above, this exercise simply shows that other forms of potential operations also contribute to economic stimulus and in no way infers that the ASARCO site is even a candidate for such investment. If TCEQ does not approve ASARCO's air permit renewal, a more detailed analysis will prove beneficial to measure economic gains of the development strategy selected for the site if in fact ASARCO parts with it.

Section VIII

Economic Impacts in Perspective: Data Processing and Clusters

This section analyzes the economic impact from the data processing sector, which has created substantial employment and investment in the region and is expected to continue expanding. It is based on capital investment, employment and wages data provided by the city's Economic Development Department for Automatic Data Processing (ADP), Inc. It serves as an example of a services-based impact on the economy that complements current recruitment and workforce training efforts as well as serves as a comparison to smelting operations. In addition, cluster analysis is performed to evaluate data processing and smelting industries. Results show that promoting output of an impact study tends to overestimate the "true economic impact" to the region, and value added or labor income is recommended as a better measure of the influence of an industry on the regional economy. Cluster analysis also shows that services-based clusters are the primary drivers and productive core of our regional economy, and that there exists greater "value-added" industry and occupational linkages in clusters associated with data processing than with clusters associated to smelting operations.

Economic Impacts in Perspective

Much debate has centered on whether ASARCO can be a mainstay of the El Paso economy. While there is no question that the economic impact from allowing ASARCO to reopen could be substantial, the industry with the most to gain from renewed smelter operations in El Paso is the smelter industry itself. Industries such as those in wholesale trade and transportation services would also benefit, but their gain is far less significant when compared to that of the smelter. To understand this, consider Table 8.1 based on the study performed by IPED that shows the operations impact if ASARCO is allowed to reopen.

Table 8.1
Operations Impact for ASARCO

El Paso	Direct	Indirect	Induced	Total
Employment	291	1,092	437	1,819
Output	917,448,512	202,110,982	40,390,284	1,159,949,788
Value Added	74,607,248	72,294,592	23,764,058	170,665,897
Labor Income	20,544,832	41,204,197	12,187,713	73,936,742

The ASARCO impact study, captured in Table 8.1, shows a significant number of jobs and estimated output from renewed operations. The study reported an increase in "*regional economic output by $1.159 billion.*" Output, however, should not be misinterpreted or thought of as a true measure of economic "impact" because output is only the total value of production, which is traditionally greater than the goods and services that go into production. The reason for this is that output multipliers account for sales by other industries who are feeding into the directly impacted industry. Thus, final output includes sales from other industries – i.e., it can double count (in the same way that t-accounts in accounting track two sides

of a ledger).[1] In economic terms, the production function of smelter industries indicates that more than half of every dollar spent goes to buy from the industry itself. In general terms, a majority of sales are intra-industry (or intra-firm), meaning that there are stages of production within the same industry – i.e., transfers from one plant or unit to another.

Consequently, while output is a useful measure for sales or production volume and is primarily important when there are a diversity of industries contributing, solely promoting output of an impact study tends to overestimate the "true economic impact" to the region. The IPED study on the impact of ASARCO states that labor income, the biggest component of value added, is a more important measure as it relates to the true economic impact (see Appendix A-4) since it measures income going to people in the region rather than measure business or production inputs. The importance in interpretations is captured with the following example.

Services-based Economic Impact: ADP Operations

ADP began operations in El Paso in the summer of 2006, has hired over 1,000 employees and is considering expanding (constructing a second building). Each of the company's business units – Employer Services, Brokerage Services, Dealer Services, and Claims Services – is an industry leader. ADP, with over $7 billion in revenues and more than 570,000 clients worldwide, is one of the largest providers of a broad range of critical and cost-effective transaction, processing and information-based business solutions such as payroll, benefits, human resource, other business process management services, and automotive software solutions and dealer services.

In one year of operations, the firm has injected $9.5 million in building improvements to a property that is roughly one-sixth the size of the ASARCO site, and has created roughly 1,028 jobs. The employment impact from building improvements alone totaled 190 (Table 8.2), while the operations impact on employment totals an estimated 2,168 new jobs (Table 8.3). Output from operations surpassed $244 million, including $110 million in value added and $75 million in payroll and related benefits.

Table 8.2
Construction Impact for ADP

El Paso	Direct	Indirect	Induced	Total
Employment	129	25	37	190
Output	9,500,000	2,332,424	3,409,475	15,241,899
Value Added	5,174,600	1,224,184	2,006,001	8,404,785
Labor Income	4,373,638	799,461	1,028,786	6,201,885

Table 8.3
Operations Impact for ADP

El Paso	Direct	Indirect	Induced	Total
Employment	1,028	706	435	2,168
Output	149,018,080	54,950,434	40,209,997	244,178,505
Value Added	55,078,056	31,372,656	23,658,125	110,108,834
Labor Income	42,664,360	20,722,494	12,134,154	75,521,007

[1] Doug Olson, developer of Minnesota IMPLAN Group, Inc.

Comparing Table 8.1 (ASARCO operations impact) with Table 8.3 (ADP operations impact), we see a large difference in estimated total output ($1.159 billion vs. $244.2 million). However, as noted above, the best measures for the "true economic impact" in a region is value added (equivalent to gross metropolitan product, widely accepted as a measure of economic well being) or labor income.[2] Taking this into account, we see a different picture – in terms of labor income, ADP has a slightly higher impact than ASARCO within the region. Simply isolating one number (output) tells a different story from isolating a different number (labor income). To complement impacts, we turn to another useful tool for industry evaluation – cluster analysis.

Cluster Analysis

Clusters are useful based on a variety of factors ranging from employment size, specialization, wage levels, the diversity of industries, and linkages to other clusters. For this subsection we utilize the cluster methodology developed by Dr. Edward Feser of the University of Illinois at Urbana-Champaign.[3] The Feser method is preferred over others because it incorporates detailed information on how industries are related using the national input-output (I-O) accounts, which track in detail what industries sell to and buy from other industries.

Each cluster is made up of a set of industries where purchases from and sales to one another are more important within the cluster than for any other set of industries. For the cluster to be successful, the set of industries must have access to each other to ensure that they have access to supplies for production and customers for their products. Clusters built on strongly associated linkages among industries (via sales and purchasing patterns) provide insight into areas that can be developed to promote regional economic expansion and competitiveness. Moreover, these clusters each have narrowly defined industries that employ specific occupations that can be used by regional training providers to match industry development with occupational skills sets.

The way the clusters are built is directly related to the pure notion of value chains. Feser groups industries with their strongest customers and suppliers, creating a distinct value chain for each industry. For example, given the Motor Vehicle Parts industry, all suppliers and buyers linked to that industry are identified. The result is a value chain for Motor Vehicle Parts. Using statistical cluster and factor analysis, detailed industries are then grouped into aggregate categories – these are called "core" or "primary" industries. The chains (industries) are then identified for each set of "primary" industries using an input-output (IO) linkage algorithm. High values denote a strong buyer-seller association between the core group and the chain. Feser identifies 45 clusters as "Benchmark Value Chain" (denoted VC) and 15 clusters as "Technology Based" (denoted TVC).[4]

Top Clusters of El Paso

Proponents of ASARCO argue that the jobs provided by the smelter have been and can be again a mainstay of the regional economy. Figure 8.1 and 8.2 both illustrate the top 10 private employment clusters in El Paso in the 3rd quarter of 1998 and 2006, respectively, along with employment for smelter related clusters. Figure 8.1 shows that before ASARCO closed in early 1999 and laid off almost 400 workers, smelting and related manufacturing was far less significant than the primary drivers of El Paso's economy – service industries.[5] By 2006 (Figure 8.2), with the exception of the garment industry, the same clusters dominate the El Paso economy.

[2] Value added measures all forms of labor income or payroll (employee compensation including benefits and contributions to social insurance and proprietor's income), other property income (dividends, interest and rent), and indirect business taxes (such as sales and gasoline taxes) recaptured by the region.

[3] Feser, Edward, 2005. "Benchmark value chain industry clusters for applied regional research," Dept. of Urban and Regional Planning & Regional Economics Applications Laboratory, University of Illinois at Urbana-Champaign.

[4] Industries are not mutually exclusive to any cluster.

[5] Service sector employment overtakes manufacturing jobs in the national economy in 1982; in El Paso the crossover comes seven years later, in 1989. See Cañas, Jesus. "A Decade of Change: El Paso's Economic Transition of the 1990s," Federal Reserve Bank of Dallas, El Paso Branch, Issue 1, 2002.

In 2006 all top clusters including those associated with smelting paid above El Paso's average wage for private employment. However, while the top employment clusters witnessed healthy growth rates since 1991, smelter related clusters contracted with the closure of ASARCO and businesses dependent on their operations.[6] This does not mean that the latter clusters and their high paying jobs are not important, but it does put into perspective what types of industries dominate and drive our private sector economy.

Figure 8.1
El Paso Top Private Employment Clusters – 1998:Q3

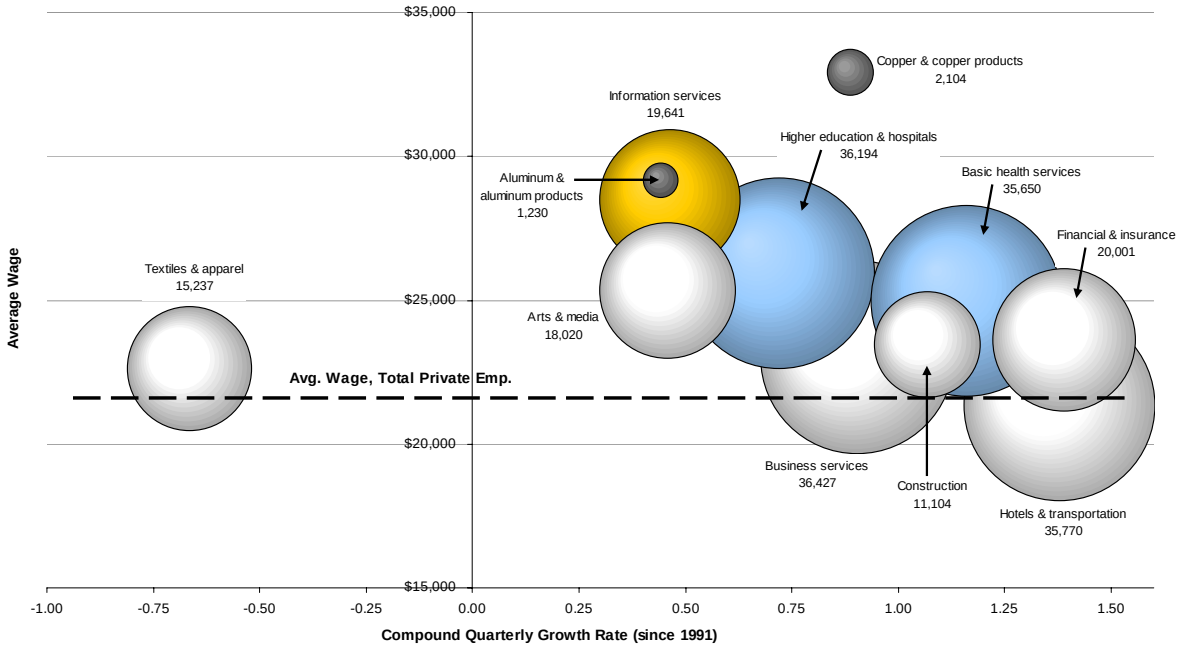
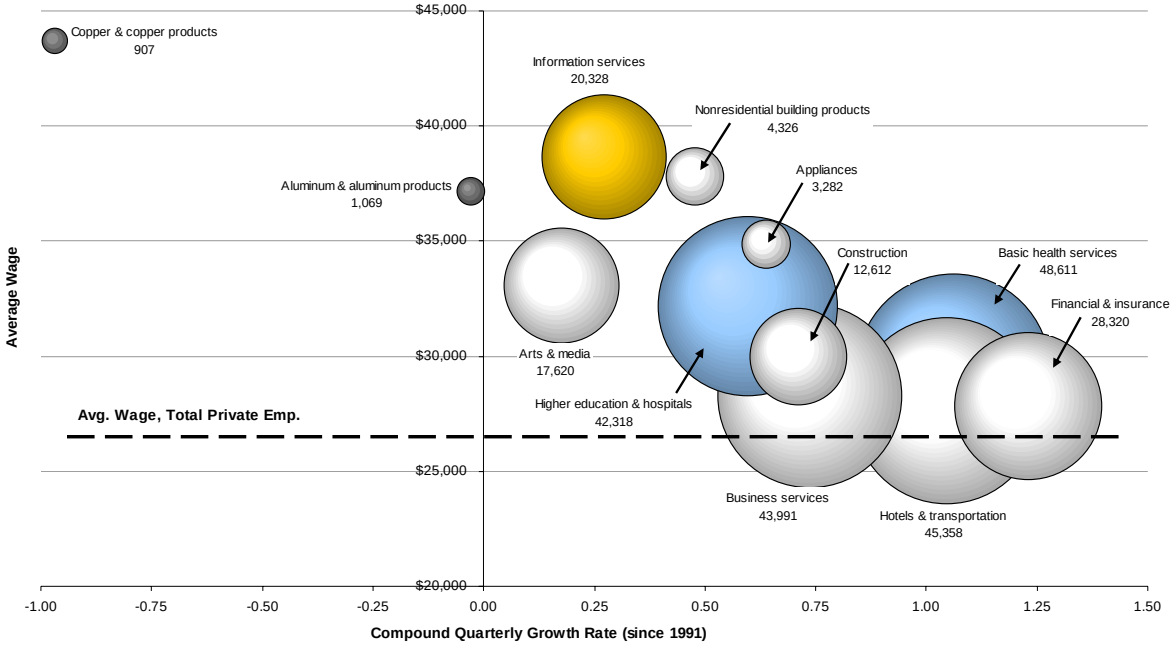


Figure 8.2
El Paso Top Private Employment Clusters – 2006:Q3



[6] 1991:Q3 is selected to avoid economic effects from the U.S. and global recession of the late 1980s

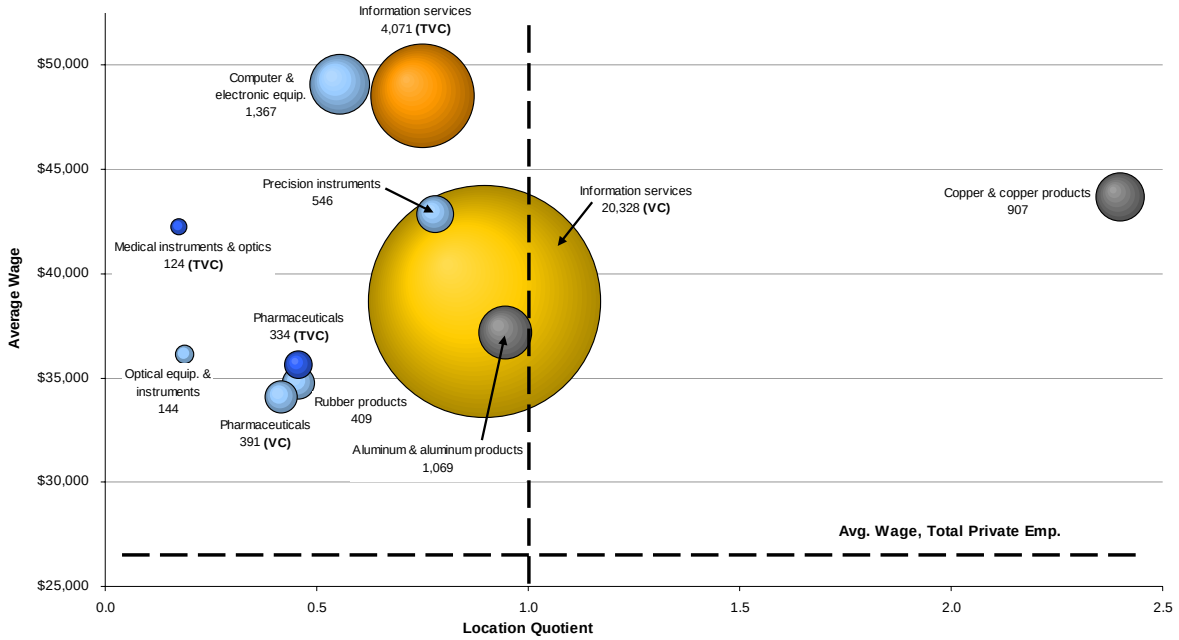
Comparing Data Processing and Smelter Value Chains

Smelter operations are tied to two clusters – as a primary industry in Copper and Copper Products and as a secondary industry in Aluminum and Aluminum Products. Similarly, data processing is also tied to two clusters – Information Services (VC) and Information Technology (TVC). This is where the similarities end. The bubble graph in Figure 8.3 compares clusters associated with information (orange) with clusters associated with smelting (grey), and includes medical-related clusters (blue) from Section VII to complete the overview. (Basic Health Services and Higher Education and Hospitals are also medical-related clusters but are not included in Figure 8.3 because their size will make some of the other clusters too small to view. However, they are in Figure 8.2 as two of the top employment cluster in El Paso.)

A brief overview of location quotients (LQs) is warranted. A key tool in economic base theory, the LQ is a measure of an industry's or cluster's concentration in an area. Levels below 1 suggest that a region does not meet local demand for a certain good or service and must import the remaining demand. Levels above 1 suggest not only concentration but specialization that allows the region to export a portion of the industry's or cluster's production. Returning to Figure 8.3, we see the following for El Paso:

- Copper and Copper Products has a LQ of 2.4, meaning that El Paso serves as an exporter of this cluster's end product.
- Information Services, both "Benchmark" and "Technology-based," have a significantly greater concentration of employment than smelter related clusters.
- Medical clusters are less specialized with LQs below one, meaning that these higher value added sectors have not yet developed in El Paso. Nonetheless, as discussed in Section VII, these types of industries will be critical to the development of a vibrant life sciences cluster in El Paso.
- Industries that serve as key suppliers to or purchasers from multiple industries have greater ties to various clusters. Figure 8.3 shows that medical and related industries are closely tied to many clusters, from important services in health and higher education to high technology value added manufacturing in pharmaceutical and medical devices.

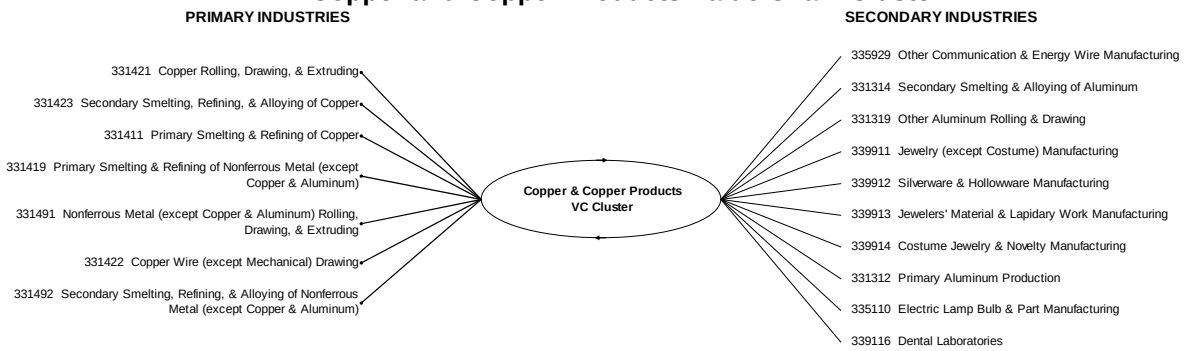
Figure 8.3
El Paso Data Processing, Medical and Smelting Related Clusters



The relatively small employment size of the clusters related to ASARCO results from the cluster's high degree of intra-industry stages of production. This leads to few value chain linkages with other industries and to other clusters and is illustrated in Figure 8.4 – the Copper and Copper Products cluster consists of

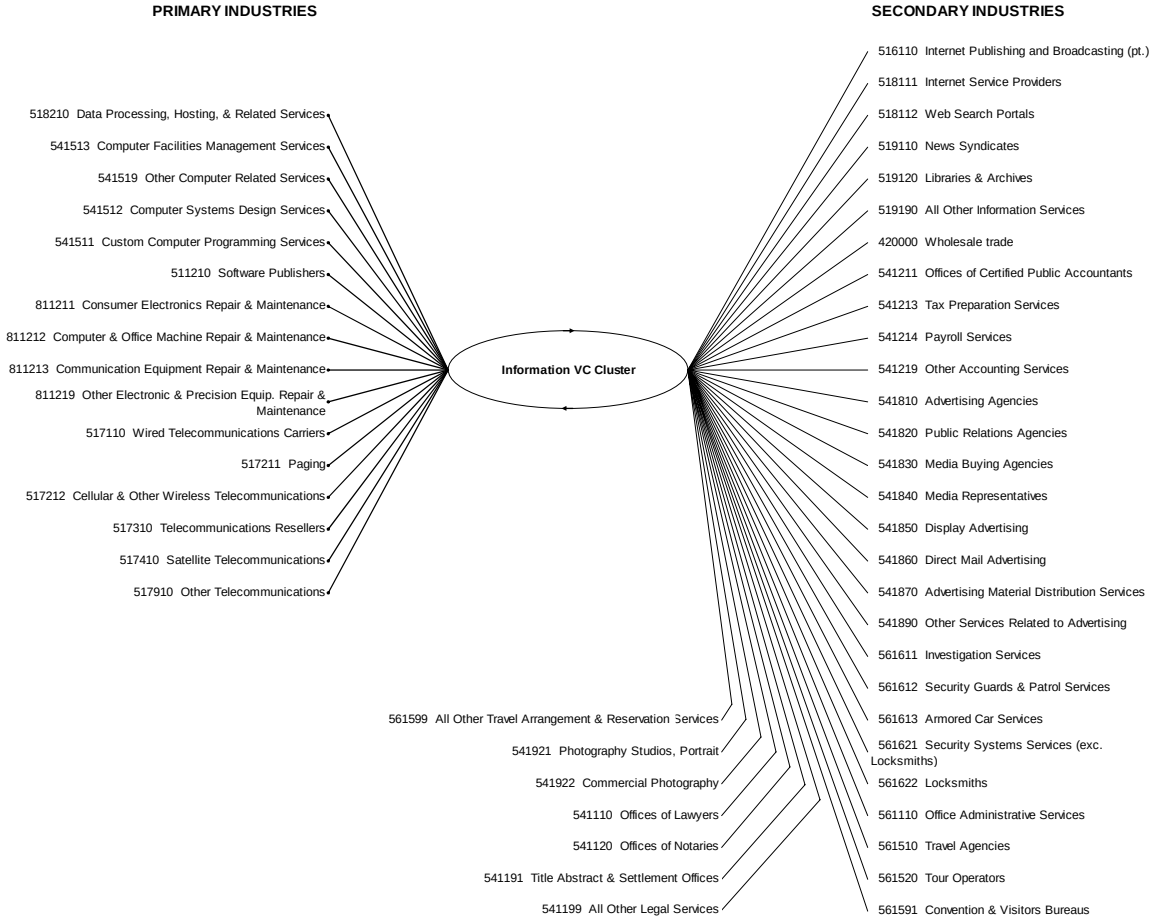
seven primary industries and ten secondary industries. By comparison, the value chain for (ADP) data processing shows a larger concentration of services-oriented industries and is illustrated in Figure 8.5 – the Information Services cluster consists of 16 core industries and 35 secondary industries to the cluster of core industries.

Figure 8.4
Copper and Copper Products Value Chain Cluster



Note: Industries organized from high to low in strength of association or linkage score to the cluster of core industries.

Figure 8.5
Information Services Value Chain Cluster

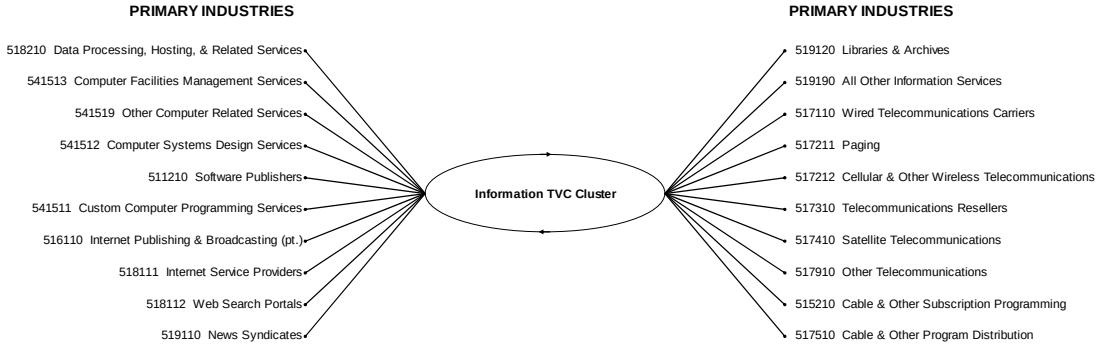


Information Services is one of five clusters identified as "Existing" in a previous study for the Upper Rio Grande Workforce Development Board (URGWDB).[7] Existing clusters tend to have a large, diversified number of firms operating in the region (in terms of industry and absolute number), a large number of employees, and a high level of concentration (as measured by location quotient). Existing clusters typically represent a region's productive core and also have strong wage performance and stability. Clusters that exhibit several of these characteristics (i.e., high wages and high LQs), but show rapid decline or unstable performance (i.e., employment based on world market prices for copper) make them poor candidates as a focus for economic development planning.

The Information Services cluster, whose strongest core industry is data processing, is not only a major employer in the region (over 20,000) but is well diversified (almost 1,900 firms) (see Figure 8.3 and detailed cluster tables in Appendix J-1). Categorizing Information Services as an existing cluster has been bolstered by focus group comments which suggest that local firms are beginning to outsource information technology functions at a higher rate than over the past decade. Since the time of the URG study using 2005 1st quarter data the results have been positive – at the time the LQ for Information Services was 0.81 and "positive growth" seemed "promising" from focus group feedback. 2006 3rd quarter data shows a location quotient of 0.9, signifying greater specialization in the region as predicted.

As noted above, data processing is also the primary industry in one of the fifteen technology-based clusters. Figure 8.6 shows that the Information Technology cluster consists of 20 core industries, all strongly associated to one another. This cluster has the second largest employment of any technology-based cluster, employing over 4,000 among 159 firms (see Figure 8.3 and Appendix J-2). Information Technology in the region has grown in specialization between 1995:Q1 and 2006:Q3, from a LQ of 0.72 to 0.75, a very positive outcome.

Figure 8.6
Information Services Technology Value Chain Cluster



Beyond the different types of industries that are comparable in Figure 8.4 (smelting related cluster) and Figure 8.6 (data processing related cluster), the types of occupations these industries are expected to hire is found in Table 8.4. It examines the top 20 occupations (in terms of jobs) related to data processing and smelting manufacturing. Comparing the industry-occupational mix, different skills sets, knowledge requirements and training are apparent. For example, most of the top occupations in data processing require computer use while many of the top occupations in smelting manufacturing are labor intensive. There are other benefits beyond the direct relationship between technology use and wages found in information services. The benefits also extend to transferable skills that can be used from one job to the next – the more a skill is transferable, the easier it is to obtain employment in various industries. Put in other terms, skills that can be used across industries provide more economic stability as opposed to being dependent on one industry.

[7] The other "Existing" clusters include Basic Health, Higher Education and Hospitals, Construction, Hotels and Transportation, and Finance and Insurance Services. See McElroy, Mathew S. and Carlos Olmedo, w/ Ed Feser and Ken Poole. "Upper Rio Grande Workforce Development Board Industry Cluster Analysis," Institute for Policy and Economic Development, Technical Report 2006-01.

Table 8.4
Top 20 Occupations for Data Processing and Smelter Manufacturing

Data Processing, Hosting & Related Services		
SOC	SOC Title	Median Hrly. Wage ($)
439021	Data entry keyers	n/a
151051	Computer systems analysts	27.86
151032	Computer software engineers; systems software	28.64
434051	Customer service representatives	11.27
151031	Computer software engineers; applications	31.70
151021	Computer programmers	21.96
439061	Office clerks; general	8.62
151041	Computer support specialists	16.29
113021	Computer and information systems managers	40.43
151071	Network and computer systems administrators	20.97
439011	Computer operators	10.41
439071	Office machine operators; except computer	11.09
431011	Firstline supervisors/managers of office and administra	16.80
151081	Network systems and data communications analysts	27.42
111021	General and operations managers	29.32
131111	Management analysts	24.71
433031	Bookkeeping; accounting; and auditing clerks	11.67
439051	Mail clerks and mail machine operators; except posta	12.01
436011	Executive secretaries and administrative assistants	13.45
132011	Accountants and auditors	22.83

Nonferrous Metal (exc. Aluminum) Smelting & Refining		
SOC	SOC Title	Median Hrly. Wage ($)
514021	Extruding and drawing machine setters; operators; and	11.90
511011	Firstline supervisors/managers of production and operal	18.65
514051	Metalrefining furnace operators and tenders	0.00
519061	Inspectors; testers; sorters; samplers; and weighers	8.09
514023	Rolling machine setters; operators; and tenders; metal	14.27
499042	Maintenance and repair workers; general	9.55
514031	Cutting; punching; and press machine setters; operator	7.97
514041	Machinists	10.57
519198	Helpersproduction workers	6.84
499041	Industrial machinery mechanics	15.14
537051	Industrial truck and tractor operators	8.04
537062	Laborers and freight; stock; and material movers; hand	6.99
414012	Sales representatives; wholesale and manufacturing; ex	21.64
512021	Coil winders; tapers; and finishers	10.93
512099	Assemblers and fabricators; all other	6.88
435071	Shipping; receiving; and traffic clerks	9.33
472111	Electricians	12.85
512092	Team assemblers	6.87
111021	General and operations managers	29.32
113051	Industrial production managers	34.13

Conclusion

The El Paso area has changed significantly over the past several decades, and has undergone structural changes since 1999 when the ASARCO smelter ceased operations. Whereas smelter operations were once a key employer, the region's economic viability has recently been driven by different and more diverse types of operations. For example, employers in the El Paso area now include information technology-based operations like ADP and medical facilities, and more in the life sciences such as suppliers of pharmaceutical and medical devices are considering the region for investment. The impact of BRAC will also have a profound impact on the region in terms of population and the businesses and services that will develop to serve this growing population. For policy makers, promoting the right employment opportunities as the structure of our economy changes is a prime opportunity to tackle the severe case of underemployment faced by our region's college educated and highly trained professionals.