The Effects of Enforcement on Illegal Markets: Evidence from Migrant Smuggling along the Southwestern Border

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Abstract

Little is known about how enforcement affects prices for illegal commodities. In this paper, we analyze how enforcement along the U.S.-Mexican border has affected the prices and demand for illegal migrant smugglers. Using a unique dataset that links border crossing histories from illegal Mexican migrants to aggregate enforcement and punishment statistics, we find that the effect of enforcement on smuggling prices is small. Though enforcement has more than tripled over the past fifteen years, smuggling prices have increased by at most 30 percent. Unlike estimates from illegal drugs, the demand for border smugglers is however price elastic. We also show that illegal migrants have substituted away from heavily patrolled areas to more remote and dangerous crossing routes. We calculate that these avoidance costs are roughly three times the direct costs of enforcement on smuggling prices.

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1 Introduction

Governments around the world spend a sizeable fraction of their budget on enforcement and deterrence of illegal activities. In the United States, federal expenditures to fight the supply and use of illegal drugs alone exceeded $6 billion in 2003. A primary motivation for the 'war on drugs' is the belief that stricter enforcement deters supply and drug consumption.

To evaluate the actual impact of these policies, we need to know how enforcement affects the price and volume of activity in illegal markets. A large literature demonstrates that enforcement has indeed a deterrence effect on criminal behavior (for example, Ehrlich, 1977; Levitt, 1997; Tauchen, Witte and Griesinger, 1994; Viscusi, 1986; Witte, 1980). For illegal drugs and similar markets, deterrence depends on two parameters: the effect of enforcement on prices and the price elasticity of demand. Many studies have shown that illegal drug use does respond to market prices but that demand is typically inelastic[1].

We know however very little about how market prices respond to enforcement. Miron (2003) calculates that the price margin between retail and farmgate prices for heroin and cocaine is between 2 and 80 times that for legal agricultural goods. In contrast, DiNardo (1993) does not find any effect of drug seizures on cocaine prices using state-level data. Kuziemko and Levitt (2001) in turn provide evidence that state-level proxies for enforcement and punishment increased cocaine prices by 10 to 15 percent.

Though innovative, these studies suffer from several limitations. First, the quality of available data on drug prices and enforcement is questionable. The results could thus be driven by measurement error or other factors shifting prices and enforcement. Further, there might be an endogeneity bias. If enforcement adjusts to demand or supply shocks, the estimates are upward or downward biased depending on the nature of the shock. Finally, we do not know whether the results can be applied to other illegal markets and how differences in enforcement policies affect market demand and equilibrium prices.

In this paper, we estimate the effects of enforcement in a different illegal market - that for illegal migrant smugglers. We do so by using a unique dataset on the border crossing histories of over 2,000 illegal Mexican migrants. In particular, we observe whether an illegal migrant used a smuggler if he crossed the border into the United States and how much he paid for the service. Linking the individual survey to enforcement and punishment statistics provides a unique opportunity to estimate the effect of enforcement on market prices and demand for border smugglers.

[1] Estimates for drug participation range between -0.3 and -0.5 for cocaine or opium and -0.8 to -0.9 for heroin (Saffer and Chaloupka, 1995; Van Ours, 1995). In contrast, DiNardo (1993) finds a price elasticity close to zero using state-level data. A third parameter that potentially matters for the effectiveness of enforcement is the availability of close substitutes.

An estimated 600,000 illegal migrants enter the United States each year, the vast majority along the Southwestern border to Mexico. Anecdotal evidence suggests that most migrants rely on border smugglers for the often dangerous trip. Smugglers have better information about where and when to cross the border without getting detected by the border patrol. Among migrants, they are known as 'coyotes' because, like their animal counterparts, they leave no trace behind - or so illegal migrants hope.

Over the last fifteen years, efforts to curb illegal migration and smuggling along the U.S.-Mexican border have increased dramatically. Figure 1 shows that since 1986, the budget of the border patrol has increased sixfold while the hours federal agents spend patrolling the border have almost tripled. This made the Border Patrol Unit was the fastest growing federal agency as the federal budget rose by only 12 percent over the 1990s. Relative to the Drug Enforcement Agency, the Border Patrol budget was only 45 percent in 1986 but increased to 107 percent in 1998.

Tighter border enforcement, by raising the probability of apprehension, increases the costs of crossing the border for illegal migrants and smugglers. If the smuggling market is perfectly competitive, prices rise to compensate coyotes for the increased risk of providing smuggling services. The effect on the demand for smugglers is ambiguous: while more enforcement increases the demand as migrants substitute from crossing alone to using a coyote, higher prices reduce it. Finally, enforcement also deters people from migrating to the United States illegally, which in turn tends to reduce both smuggling demand and prices.

Previous studies on illegal migration have focused on the deterrence effect. Espenshade (1994; 1995) finds that tighter border enforcement did increase the probability of apprehension, but had no effect on the number of illegal migrants entering the United States. Similar results are reported by Kossoudji (1992), Donato, Durand and Massey (1992) and Massey and Singer (1995)[2]. In contrast, the focus of our paper is how enforcement affects the market for smuggling services. The only prior study suggests that the fraction of migrants using a coyote increases with tighter enforcement but does not control for changes in smuggling prices or the endogeneity of enforcement (Donato, Durand and Massey, 1992).

We begin by estimating the effect of enforcement on smuggling prices. One advantage of our dataset is that we are able to control for many observable characteristics of the smuggled migrant in the estimation. To break the simultaneity between smuggling prices and government enforcement,

[2] In contrast, Hanson and Spilimbergo (1999) find an elasticity of apprehension with respect to enforcement between 0.5 and 1.2 using aggregate data. Apprehension data however are a noisy measure of the number of illegal migrants entering the country for two reasons. First, most illegal migrants are never caught at the border or if apprehended cross illegally at some later point. In the former case, apprehensions will underestimate the number of people attempting to enter the United States illegally. In the latter case, we potentially overestimate the number of people entering. Second, though more enforcement increases the probability of apprehension, it also deters people from migrating illegally to the United States. The net effect on the number of apprehensions is therefore ambiguous.

we use the drug budget of the Drug Enforcement Agency (DEA) as an instrument for border enforcement. The drug budget affects enforcement resources since the border patrol also fights drug trafficking along the Southwestern border. However, it has no direct effect on the price for experts since migrant and drug smuggling have traditionally been separate businesses[3].

Our estimates suggest that expert prices increase by 17 to 31 percent in response to the threefold increase in border enforcement. The elasticity of enforcement is with 0.24-0.48 very inelastic. This implies that the costs of smuggling migrants has changed little despite the massive expansion of border enforcement. According to our calculations, the risk of capture for coyotes has changed by at most 3-5 percent in the 1990s.

We then examine how enforcement affected the demand for border smugglers. Since both enforcement and prices are potentially endogenous, we again employ instrumental variables. In addition to the drug budget as instrument for enforcement, we use the punishment for smugglers upon prosecution as instrument for smuggling prices. The expected punishment is a cost shifter of the supply of smugglers while it has no direct effect on the demand for experts conditional on the control variables.

We find that the demand for smuggling services is responsive to price changes. Our calculated price elasticities are around -1. These are on the high end of the estimated price elasticities for illegal drugs. In contrast, the direct effect of enforcement on the propensity to use a smuggler is very small. Thus, few migrants substitute with tighter enforcement from crossing on their own to coyotes keeping prices constant.

Our estimates also show that the deterrence effect in the illegal border crossing market is small. The border build-up has reduced the propensity to migrate illegally by around 10 percent. This translates into a decline in the inflow of temporary migrants of around 130,000. The numbers are higher than found in previous studies on deterrence effects, potentially because our estimation extends to the 1993-98 period when enforcement efforts tightened considerably.

We provide however evidence that illegal migrants substitute along other margins to avoid tighter enforcement. In particular, we find that over the past decade migrants have shifted to more remote areas to cross the border into the United States. Since crossing is more dangerous in those areas, migrants now face a higher risk of dying while crossing as reflected in the rising death toll along the Southwestern border. In addition, migrants spend altogether more time to cross the border and more money on coyotes. The time costs and higher coyote prices amount to an additional expenditure of US$110 to 130 - more than three times the estimated direct effect of enforcement on smuggling prices. This finding highlights that enforcement can have important indirect effects along other

[3]The instrument was first proposed by Angelucci (2003). One rationale for the division of labor between the two markets is that knowledge of smuggling routes spreads with the number of migrants smugglied across the border. This in turn puts the success of the high-profit drug smuggling at a considerable risk.

margins, which might strengthen (as in the smuggling business) or weaken the enforcement effect (as in the drug market). These need to be taken into account when evaluating the effectiveness of enforcement policies.

The results are shown to be robust to changes in specifications and the inclusion of additional controls. Since our dataset contains individuals never migrating and those crossing the border without experts, we can control for selection into illegal migration and expert use. This is important if shifts in costs or benefits unrelated to increases in enforcement induce changes in the demand for smugglers and illegal migration. Exploiting the panel structure of our data, we also provide evidence that unobserved heterogeneity on the migrant or smuggler side does not explain why the enforcement effects are so small. Finally, we show that our estimates based on temporary illegal migrants, are very similar to those for permanent illegal migrants. This suggests that our results are representative for the whole population of illegal migrants.

The structure of the paper is as follows. In the next section, we provide background information on illegal migration and changes in enforcement efforts over the last two decades. Section III presents a simple model of the illegal border crossing market and derives the effect of enforcement on prices and demand for migration and smuggling services. Section IV describes our dataset of illegal Mexican migrants. Section V reports the estimates of the effect of enforcement on smuggling prices, the demand for coyotes, deterrence effects and changes in geographic migration patterns. Section VI provides additional specification and robustness tests. Section VII discusses the implications of our results for enforcement in illegal markets, while Section VIII concludes.

2 Enforcement and the Illegal Border Crossing Market

2.1 Characteristics of the Border Crossing Market

The Southwestern border with Mexico is the main point of entry for illegal migrants into the United States. The 1,989 miles, divided into nine border sectors (see Figure A1 for their geographic locations), account for over 97 percent (1998) of all migrant apprehensions, of which around 96 percent are Mexicans.

Legal and illegal migration from Mexico to the United States has a long tradition facilitated by geographic proximity and fueled by substantial differences in wealth and economic growth[4]. Since legal channels of entry are limited, many Mexicans cross the Southwestern border illegally[5]. Estimates

[4] In addition, population growth was 3.5 percent until the 1970s. The fertility rate decreased from 43 births per 1,000 population (1973) to 32 births per 1,000 population (1986) slowing annual population growth to 2.5 percent. However, since most individuals start migrating only at around age twenty, the pool of potential migrants increased well into the 1990s.

[5] The end of the *Bracero program* and the *Immigration and Nationality Act Amendment* in 1965 severly limited

based on census data suggest that between 250 and 350 thousand permanent migrants from Mexico enter the United States illegally each year (Warren, 2000). An even larger number of Mexicans cross the border as temporary illegal migrants. Estimates based on aggregate apprehension data and individual migration propensities amount to roughly 1,300,000 illegal border crossings annually during the 1980s (Espenshade, 1995; Angelucci, 2003). The latter typically work in agriculture or the service industry for part of the year and then return home to their families in Mexico.

Most illegal migrants rely on coyotes to help them enter the United States. Anecdotal evidence suggests that illegal migrants usually arrange their smuggling in the Mexican border towns[6]. Coyotes or their assistants, so called recruiters, contact illegal migrants at major bus and train stations or in hotels popular with illegal migrants. There or at a later meeting, the parties agree on the price and desired destination in the United States. At night, the coyote would meet a group of migrants in a safe place on the Mexican side and guide them across the border outside the legal crossing points to the prearranged place in the United States[7].

The smuggling price typically depends on whether the migrant is brought only across the border or all the way to his destination in the United States and how difficult the border crossing is. More walking or swimming means a lower price. Usually, migrants pay half the price up front and the rest upon safe arrival in the United States. Before border enforcement tightened, the average fee of a smuggler was around US$ 300 in 1983 constant dollars. This is roughly equivalent to three weeks of paid work in the United States as an illegal migrant. In many cases, part of the cost is paid by family members residing in the United States[8].

On the other side of the market, the detection and apprehension of illegal migrants is the main task of the border patrol. While immigration inspectors handle the border traffic at legal points of entry, most of the border patrol's resources (63 percent in 1994) is devoted to patrolling the border in search of illegal migrants. These "linewatch hours", the number of hours per mile agents spend watching the border, are our measure of enforcement used in the estimation below. Other activities

the opportunities of Mexicans to legally enter the United States on a temporary or permanent basis. The Bracero program had supplied up to 400,000 Mexicans per year to US agriculture as temporary workers. The Immigration and Nationality Act Amendment abolished the national origins quota system from 1924. Immigration visa were now allocated through a preference system favoring relatives of U.S. citizens or permanent residents and persons with special occupational skills. Since few Mexicans were naturalized at that time, this limited legal immigration of Mexicans to the United States. Both policies increased the pool of potential illegal migrants since the change in laws was not accompanied by a change in migration incentives.

[6] In some cases, the smuggler, usually an illegal migrant himself with substantial border crossing experience, takes people from the same town or region with him across the border (Lopez Castro, 1999).

[7] An alternative, though little used crossing method is to enter at legal points of entry with false documents. Coyotes would distribute legal papers and send migrants one by one, separated by 50 to 100 other individuals, across the border. On the other side, they would hand over the documents to another smuggler. He would then return them back across the border for the next group of illegal migrants.

[8] The price appears high especially given that coyotes take several people across the border per trip. One reason could be that part of the fee is only paid upon successful arrival. The total price thus has to include the coyote's expected time cost of apprehensions by the border patrol. Beyond that, little is known about other cost components and overall profitability of the smuggling business.

include traffic and transportation checks (19 and 4 percent in 1994 respectively) to detect illegal migrants further inland[9].

Most illegal migrants captured (98 percent of the 1,2000,000 Mexicans apprehended in 1994) enter the country without proper documentation, that is with no legal or false documents for the United States. Those apprehended usually spend little time in U.S. custody. The vast majority agrees to be deported voluntarily and are simply returned back to Mexico (95.3 percent in 1994). The rest faces a formal deportation hearing and is later deported to their home country or prosecuted in court. Prison sentences or fines however remain the exception.

Illegal border crossings have traditionally been concentrated in a few urban areas, where migrants just needed to jump over a fence. In more rural areas in contrast, migrants would have to walk for several hours or even days until reaching their destination. Before the large-scale increase in border enforcement, the most popular entry route was the city borderline between Tijuana and San Diego. Of all illegal migrants apprehended, 45 percent were arrested in the San Diego sector, followed by 21 percent in the El Paso sector, in particular between the border cities Ciudad Juarez and El Paso. An additional 17 percent were captured in the Laredo sector, especially at the border between the cities of Nuevo Laredo and Laredo. Microdata on actual migration flows support this pattern and show that more than fifty percent of illegal migrants entered through the San Diego sector.

2.2 Changes in U.S. Immigration and Enforcement Policy

The *Immigration and Control Act* (IRCA) of 1986 marked a major shift in how the U.S. government approached illegal migration. First, almost 3 million undocumented residents became legalized[10]. Further, the resources spent on border enforcement, especially along the Southwestern border, were increased substantially[11]. Following IRCA, the border patrol budget more than doubled between 1986 and 1992.

The main expansion of enforcement efforts however began in 1993 when several regional initiatives were launched to seal popular illegal crossing routes. In 1993, *Operation Hold-the-Line* in the El Paso sector focused its efforts on a 20-mile stretch of the border in the El Paso metropolitan area.

[9] Between 92 and 97 percent of illegal migrants are apprehended by the border patrol unit. The remaining apprehensions are captured by the investigations and examination unit dealing with criminal activity by aliens, work site enforcement and anti-drug smuggling activities within the United States.

[10] Illegal migrants who could prove they were residing continuously in the United States before January 1, 1982 were given permanent resident status. In addition, temporary agricultural workers were also granted resident status if they had worked for at least 90 days in the agricultural sector in 1984, 1985 and 1986. 1.8 million undocumented workers qualified for the larger "pre-1982" legalization program of which 1.6 million obtained lawful permanent residence. 71 percent of those were from Mexico. An additional 1.3 million farm workers obtained lawful permanent resident status through IRCA's legalization program for Special Agricultural Workers (SAWs) of which 81 percent were Mexicans.

[11] A third provision of IRCA required employers to verify their employees' eligibility of work and imposed civil and criminal penalties in case of violations. The goal was to eliminate employment opportunities and therefore lower the benefit of illegal migration. In reality however, worksite enforcement by the INS has been very limited.

The second big initiative, *Operation Gatekeeper* started in San Diego in October 1994. Within four years, enforcement staff in San Diego increased by 150 percent. Initially, the additional resources were deployed along a 14 mile stretching from the Pacific Ocean eastward into San Diego. The initiative was later extended all the way to Yuma, Arizona. Big fences were constructed that covered 42.2 miles in 1998 compared to only 19 miles in 1994[12]. By 1998, the border patrol budget was six times its 1986 level. In addition, capital equipment expenditures rose by 45 percent between 1988 and 1996. Large numbers of motion detectors, infrared night scopes and "thermal imaging devices" were installed to track down migrants through their movements or body heat.

The *Illegal Immigration Reform and Immigrant Responsibility Act* of 1996 further increased the number of border patrol officers, such that in 2002, 9,094 of the total 9,700 border patrol officers were assigned to the Southwestern border[13]. While in 1975, there was one border patrol officer for every 1.1 miles, today, there is one for roughly every 1,000 feet or 0.2 miles. Along the border with Canada for comparison, there is one border patrol agent for every sixteen miles. In addition, automated control systems were installed to facilitate detection of illegal repeat offenders and migrant smugglers.

Also for the first time criminal prosecution of illegal migrants apprehended was expanded. According to INS sources, the median prison term of those convicted of immigration violations increased from 2 months in 1992 to 15 months in 2000. The caseload of immigration violations rose by 50 percent from 13,068 in 1994 to 22,071 in 2000. Of those, 70.25 percent (9,180) in 1994 and 90.65 percent (20,007) were convicted. Despite the increase, these numbers remain small relative to the more than one million border apprehensions each year.

3 Theoretical Model

3.1 Border Enforcement

Our framework builds on the standard model of crime (Becker, 1968) and illegal migration (Ethier, 1986). Law enforcement, by raising the probability of apprehension and potentially punishment, decreases the net benefit from illegal migration. The probabilities of apprehension for migrants ($prob$) and smugglers ($prob^E$) are determined by the resources and efforts of the border patrol. We denote enforcement, measured by the hours spent patroulling the border, by L. Thus, we can write

[12] Other operations include *Operation Safeguard* in Arizona in 1995, further extended in 1999, and *Operation Rio Grande* launched in 1997 to secure the southern Rio Grande Valley.

[13] It also increased the number of Immigration and Naturalization Service (INS) investigators for worksite enforcement, visa overstayers and alien smuggling. More detention space for criminal and other deportable aliens was built and a three- to ten-year ban imposed for apprehended illegal aliens. Further restrictions were imposed on the eligibility of aliens for welfare or other program benefits. Program participants now require proof of citizenship and access to driver's licenses has been restricted to legal aliens.

$prob = prob(\theta, L)$ and $prob^E = prob^E(L)$. We assume that $prob_L > 0$ and $prob_{LL} < 0$ and $prob^E_L > 0$ and $prob^E_{LL} < 0$, so there are decreasing returns to enforcement.

Given its resources and the productivity of the border patrol, we can derive a supply function for tolerated illegal border crossings. As a first approximation, we assume that enforcement levels are determined exogenously[14].

3.2 Supply of Expert Services

The decision to provide border smuggling services is similar to the supply decision of a criminal. Potential smugglers have to evaluate the tradeoff between potential rewards and opportunity costs from alternative legal activitiy and expected punishments in the case of apprehension. For an income maximizing coyote, the expected net benefit is

$$P^E(L) - w^{alt} - prob^E(L)F^E - C(L)$$

where F^E denotes the punishment in case of apprehension. $P^E(L)$ is the price paid to the expert[15] and w^{alt} denotes the opportunity wage of the coyote in a legal occupation. For simplicity, we assume that smugglers provide a homogenous smuggling service and face the same alternative legal opportunities.

Finally, C denotes the cost of border smuggling. This includes any direct costs of smuggling people across the border like transportation or the costs of acquiring information about smuggling routes, as well as psychic costs of engaging in an illegal activity, i.e a "distaste for crime"[16]. Smuggling efforts or costs might increase with enforcement or just be a fixed cost, $C'(L) \geq 0$. The supply of expert services is increasing in $P^E(L)$ and nonincreasing in the probability of apprehension ($prob^E(L)$), the fine upon apprehension (F^E) and the opportunity cost of working in the legal sector (w^{alt}).

We assume that coyotes supply their services in a perfectly competitive market. Anecdotal evidence suggests that this provides a good description of the supply side over the sample period. Most coyotes had been illegal migrants themselves who later switched occupations or tried to earn extra

[14] We derive optimal border enforcement levels with and without the presence of experts in Appendix C. We abstract from a derivation of optimal punishment levels through legislation and the local courts since punishment levels have traditionally played a minor role.

[15] The fact that migrants pay up to 50 percent up front complicates the calculation somewhat, but does not alter the basic result. Also, since a coyote usually takes several people at once across the border, the number of migrants also matters for total earnings.

[16] In principle, all the cost components could be individual-specific since smugglers differ in their border smuggling abilities as well as in the skills valued in legal labor markets. Also, they also might differ in their distaste for engaging in illegal activities and their cost of being punished (time spent in jail). We abstract from these potential heterogeneities here.

money by smuggling. Since there are many illegal migrants with long border crossing experience, the pool of potential suppliers is large. In the case of perfect competition, the market price is defined by

$$P^E(L) = MC = w^{alt} + prob^E(L)F^E \tag{1}$$

In addition to the opportunity costs he incurs (first term), the smuggler also has to be compensated for the risk of being detected and punished (second term)[17].

3.3 Decision Problem of Illegal Migrants

An individual in Mexico has to make two decisions: whether to migrate to the United States illegally or stay in Mexico and whether to use an expert for crossing the border. A person decides to migrate illegally to the United States if the present value of migration is greater than total migration costs. We follow the previous literature and assume that migrants are risk neutral and maximize expected income.

The benefit from migration is the real earnings differential between an attainable job in the United States and a job in Mexico ($\triangle w = w^{US} - w^{MX}$)[18]. The costs in turn are primarily determined by the difficulty of crossing the border. Since these migrants engage in an illegal activity, the propensity to migrate will decrease in the probability of getting caught, $prob(L)$, and the punishment upon apprehension, F. For simplicity, we assume that an illegal migrant can attempt to cross the border only once.

Potential illegal migrants differ in their ability to cross the border and their benefit from working in the United States. We model this heterogeneity as a one-dimensional ability parameter denoted by θ. Assume that ability θ is distributed according to a continuous and differentiable cumulative distribution function $G(\theta)$ with support $[\theta_{\min}; \theta^{\max}]$. Individuals with high θ are smarter in crossing the border therefore facing a lower probability of apprehension, i.e. $prob(\theta, L)$ with $prob'(\theta, L) < 0$. High-ability illegal migrants also have a larger benefit from migrating because they get better jobs in the United States. Thus, $\triangle w = \triangle w(\theta)$ with $\triangle w'(\theta) \geq 0$[19].

[17] Here, we take the choice of becoming a smuggler as given. The model could be extended such that potential coyotes have to accumulate border crossing experience (for example, by learning from other smugglers) before becoming a smuggler themselves. Learning decreases the probability of apprehension. In a world where $prob^E$ is determined endogenously, the equilibrium price under perfect competition would have to reflect these investments in border crossing skills.

[18] The model assumes that experts only influence the cost of border crossing, not the net benefit from migration. Less than 5 percent of migrants in the data report that border smugglers helped them finding a job. This is true for both temporary and permanent migrants. We also ignore other potential benefits from migration such as the higher standard of living and availability of better schools in the United States. Most migrants in our sample are temporary migrants that leave their families in Mexico. Anecdotal evidence (Conover, 1987) suggests that they do not enjoy a much better lifestyle than in Mexico.

[19] The model could be generalized to the case where migrants differ along two dimensions. Net benefits from migration and costs are then driven by two different parameters. The setup here is a special case of a more general

The unique feature in this market is that migrants can make an investment to lower their probability of apprehension. If hiring an expert, he pays the price P^E and purchases the smuggler's probability of apprehension, $prob^E(L)$. Since coyotes have better information about smuggling routes, easier access to false documents and other border crossing technology, their probability of apprehension is lower than for the migrant crossing alone ($prob^E(L) \leq prob\,(\theta, L)$ for most or all θ).

The illegal migrant hires a coyote as long as the expected benefit from doing so is higher than crossing the border alone. Thus,

$$(1 - prob^E(L))\left(\triangle w(\theta) - P^E(L)\right) - prob^E(L)F \geq (1 - prob(\theta, L)) \triangle w(\theta) - prob\,(\theta, L)\,F \qquad (2)$$

Rearranging (2) yields that a migrant hires an expert as long as

$$P^E(L) \leq \left(\frac{prob\,(\theta, L) - prob^E(L)}{1 - prob^E(L)}\right)(\triangle w(\theta) + F) \qquad (3)$$

The right-hand side is the expected benefit from hiring an expert, whereas the left-hand side measures the cost. The willingness to pay for a coyote increases in the wage differential, the expected punishment and the migrant's probability of apprehension[20]. The larger the difference in the probabilities of apprehension between expert and migrant, the higher the benefit from hiring an expert. In contrast, if the difference is small, expert and migrant are close substitutes.

(3) defines a threshold θ^{**} where the equation holds with equality[21]. Migrants with $\theta > \theta^{**}$ try to cross the border alone whereas those with $\theta < \theta^{**}$ hire an expert. In our model, smuggling services are therefore an inferior good.

The decision to migrate illegally ($D^M = 1$) is in turn based on the costs and benefits of migrating illegally. An individual migrates illegally as long as

$$\triangle w(\theta) - (1 - D^E)prob(\theta, L)(\triangle w(\theta) + F) - \qquad (4)$$
$$-D^E\left[prob^E(L)\,(\triangle w(\theta) + F) + (1 - prob^E(L))P^E(L)\right] \geq FC$$

model where the two parameter are perfectly correlated.

[20] The derivative with respect to migrant ability θ is ambiguous. It is negative for high-ability people and potentially positive for low-ability migrants. Also note that the term in brackets can go to zero at very high or low enforcement levels but be strictly positive in between. This captures the fact that the value of hiring an expert is zero if there is either no or prohibitive enforcement.

[21] See Appendix B for a derivation. To ensure that the expert market is covered, we assume that

$$P^E \leq \left(\frac{prob\,(\theta_{\min}) - prob^E}{1 - prob^E}\right)(\triangle w(\theta_{\min}) + F)$$

The individual of lowest ability would always prefer to hire an expert (though he might choose not to migrate). This together with the observation that the smartest person (where $prob\,(\theta_{\max}) \leq prob^E$) will never hire an expert for a nonnegative price, implies that the threshold exists. If coyote prices are very high, this assumption might not hold.

where FC are fixed costs to cross the border, for example transport costs, and $D^E = 1$ if the migrant hires an expert and zero otherwise. We show in Appendix B that the two choices divide the suppport of the ability parameter θ into three subsets: individuals with $\theta < \theta^*$ remain at home, those with $\theta^* \leq \theta \leq \theta^{**}$ migrate and hire an expert. Finally, individuals with ability $\theta > \theta^{**}$ migrate and cross the border alone.

Aggregate demand for experts is given by those migrating and willing to pay for a coyote

$$D^E = \int_{\theta^*}^{\theta^{**}} g(u)du = G(\theta^{**}) - G(\theta^*)$$

Similarly, market demand for illegal migration is then defined by aggregating over all individuals that migrate

$$D^M = \int_{\theta^*}^{\theta^{\max}} g(u)du = 1 - G(\theta^*)$$

3.4 Comparative Statics

Increases in enforcement L raise the probability of apprehension for both self-crossing migrants and coyotes. Because the latter are experts, we assume that smugglers are less affected by the additional enforcement. Thus, $prob^{E\prime}(L) < prob'(\theta, L)$. Increasing enforcement has two effects on the smuggling market. First, the effectiveness of experts increases relative to the self-crossing migrant. As smuggling services become more valuable (see (3)), some former self crossers switch to using an expert (substitution effect).

A higher risk of apprehension however also increases the marginal cost of experts. Thus, the price of expert services goes up to compensate smugglers for the higher risk they face. Alternatively, if experts increase their smuggling effort in response to enforcement, such as crossing in more remote areas, marginal costs and therefore the price has to increase. This decreases the substitution effect since expert services have become more expensive. It also increases the threshold for illegal migration (θ^* increases) because some individuals refrain from migrating illegaly.

The net effect of enforcemet on the demand for experts is ambiguous. If the price increase is small, the substitution effect might dominate the deterrence effect and the demand for experts goes up. In contrast, if the price increase is large, for example because the enforcement is very effective in raising the expert's probability of apprehension, but demand for smugglers among migrants increases little with enforcement (the substitution effect is small), deterrence dominates and the overall demand for experts declines.

Formally, the derivative of the price for expert services with respect to enforcement

$$\frac{\partial P^E}{\partial L} = \frac{w^{alt} + F^E}{(1 - prob^E(L))^2} \left(\frac{\partial prob^E}{\partial L} \right) > 0 \tag{5}$$

In the model, the effect on smuggler prices is larger the more enforcement increases the expert's probability of apprehension. The derivative is also increasing in the punishment upon apprehension. We exploit this relationship between the price and the smuggler's punishment upon apprehension to derive an instrumental variable for the smuggling price in the empirical section below[22].

The substitution effect between expert use and self crossing is defined as the derivative of expert demand among migrants with respect to enforcement ignoring changes in smuggling demand through deterrence is.

$$\frac{\partial D^E}{\partial L} = g(\theta^{**}) \frac{\partial \theta^{**}}{\partial L}$$

where

$$\frac{\partial \theta^{**}}{\partial L} = \frac{(1 - prob^E(L)) \frac{\partial P^E}{\partial L} - P^E(L) \frac{\partial prob^E}{\partial L} - (\triangle w(\theta^{**}) + F) \left(\frac{\partial prob(\theta^{**})}{\partial L} - \frac{\partial prob^E}{\partial L} \right)}{(prob\,(\theta^{**}, L) - prob^E(L)) \frac{\partial \triangle w}{\partial \theta^{**}} + (\triangle w(\theta^{**}) + F) \frac{\partial prob}{\partial \theta^{**}}} \tag{6}$$

The substitution effect increases with the probability of apprehension of the marginal migrant $(prob\,(\theta^{**}, L))$ and the relative effectiveness of coyotes $\left(\frac{\partial prob(\theta^{**})}{\partial L} - \frac{\partial prob^E}{\partial L} \right)$. It decreases in the expert price $\left(P^E(L) \right)$ and price changes due to tighter enforcement $\left(\frac{\partial P^E}{\partial L} \right)$.

Finally, the deterrence effect of enforcement for illegal migration in turn is given by

$$\frac{\partial D^M}{\partial L} = -g(\theta^*) \left(\frac{\triangle w(\theta^*) + F + F^E}{(1 - prob^E(L)) \frac{\partial \triangle w}{\partial \theta^*}} \right) \left(\frac{\partial prob^E}{\partial L} \right)$$

The size of the deterrence effect crucially depends on whether enforcement increases the probability of apprehension for the expert ($\frac{\partial prob^E}{\partial L}$). If the expert's probability of apprehension is not affected by enforcement, the threshold stays the same and deterrence in the model is zero.

[22] There are two other potential explanations why prices increase with enforcement. Suppose expert services are a heterogeneous good with some experts providing higher quality. As enforcement increases, low-ability smugglers are driven out of the market which would increase the average ability and therefore average price in the market. Instead, we could also imagine the extreme case of a monopolized supply side where the price is inversely related to the elasticity of demand. If the change in the composition of expert demand induced by stricter enforcement decreases the price elasticity, then the equilibrium price would also increase. We return to the relevance of the supply effects when we discuss the empirical results below.

4 Data and Descriptive Evidence

To examine the effects of enforcement on the border crossing market empirically, we use a unique dataset on illegal Mexican migrants. Each year since 1982, the Mexican Migration Project interviews a random sample of 200 households in two to five Mexican communities[23]. The communities represent a wide range of regions, ethnic compositions and economic conditions (see Figure A2 for a map of the areas included in the survey). The sample covers isolated rural towns and large farming communities as well as big metropolitan areas. All have a long tradition of sending migrants to the United States.

Most individuals are interviewed in their communities in Mexico in December and January. The survey design oversamples temporary migrants, who are more likely to return home in the winter months. The survey records wages earned in the United States, on the last job in Mexico and land ownership in Mexico. Demographic information on the individual migrant, his economic situation, family composition and ties to the United States are also available.

Most importantly, detailed information about the household head's illegal migration history including the year, geographic location of border crossing, the number of apprehensions, smuggler use and the price paid for a coyote are collected. The structure of the survey allows us to derive the whole border crossing history of each respondent resulting in an individual-level panel of illegal migrations. To avoid recall bias, we delete all observations occurring more than ten years before the survey date.

We match the survey data to enforcement records from the Immigration and Naturalization Service and punishment records from the United States Sentencing Commission. The enforcement variable is a measure of the hours border patrol agents spend patrolling the border per border mile ("linewatch hours") for each of the nine border crossing sectors from 1976 until 1998. We also construct the mean prison terms and fines for immigration violations and migrant smuggling for each year and each of the five district courts at the Southwestern border (California South, New Mexico, Arizona, Texas South, Texas West).

We restrict our sample to household heads between the age of 16 and 55, for which we have a positive wage earned in the last job in Mexico. Among migrants, we exclude those who did not work in the United States or report a wage of zero. Of the 9184 household heads between sixteen and fifty-five, two-thirds are 'stayers', that is they never migrated to the United States. Roughly 3,000 household heads had some migration experience, of which 2,185 (or 74 percent) entered the US illegally at least once. In our sample, 51 percent migrated to the United States five or more times. Another 33 percent went to the United States between two and five times, while the remaining 16

[23] See the data appendix for more detailed information on how we constructed the dataset.

percent went only once. The median number of trips by illegal migrants is 4 and the median duration 12 months.

On average, 77 percent of illegal migrants in our data use an expert to cross the border. Table 1 compares the characteristics of coyote users and self crossers over the sample period. Self crossers are on average older and more educated than coyote users. They also have accumulated more border crossing expertise. Coyote users in contrast are much more likely to be on their first illegal trip to the United States. Self crossers live in households with more US migration experience, are more likely to cross the border alone and have more extended family members in the United States[24]. Expert users in contrast originate from smaller communities where a larger fraction of males has prior migration experience. This probably facilitates access to information about border smugglers.

5 Estimation Results

5.1 Enforcement and Smuggling Prices

How did the border build-up affect the price of migrant smugglers? Table 2 compares smuggling prices and linewatch hours by the border patrol before and after the dramatic increase in enforcement. The first two columns show that as border enforcement tightened after 1986, smuggling prices increased by 55 percent from $264 to $410. Most of the increase is concentrated in the period after 1993 when the border patrol began to seal popular crossing routes.

Subsequent columns exploit the cross-sectional variation to compare smuggling prices across high and low enforcement with the threshold being defined by the median. Enforcement is on average six times higher in sectors with tougher enforcement while smuggling prices are actually much lower. In part this is explained by the fact that traditional high enforcement sectors like San Diego cover mainly urban areas where border miles are more difficult to monitor. As mentioned above, crossing the border there is however considerably easier and faster than in the desert or mountains. Thus, marginal costs for coyotes and therefore smuggling prices would be much higher in low enforcement sectors.

After 1986, border patrol efforts rose by 190 percent in high but only 60 percent in low enforcement sectors. However, prices changes are with roughly 50 percent similar across sectors. The last row again shows that most of the price changes are concentrated in the period after 1993.

One explanation might be that additional linewatch hours are very effective in traditionally

[24] The fact that self crossers report less deportations merits some discussion: if a migrant reports several attempts to cross the border, we do not observe whether he uses a smuggler each time but only whether he employed one in any of the attempts. We then overestimate the probability of apprehension by expert users if low-ability migrants first try to cross the border alone and then switch to experts after they are caught. Alternatively, since smugglers cross with larger groups and migrants of low border-crossing ability, their risk of detection is generally higher .

low enforcement sectors thus driving up the smuggling price. However, the correlation between changes in prices and enforcement is very low in these sectors (see bottom part of last column). Whereas most of the border build-up occur prior to 1993, prices change very little. In contrast, while the increase in linewatch hours after 1993 is modest (16.5 percent), prices rise by 44 percent. This suggests an alternative explanation: as the border patrol seals popular crossing routes in high enforcement sectors (for example, San Diego), illegal migrants switch to more remote areas with little enforcement. This in turn increases the market demand for coyotes in low enforcement sectors and therefore smuggling prices. We return to the role of sectoral switching in more detail below.

To estimate the effect of enforcement on smuggling prices while controlling for observable characteristics of illegal migrants as well as aggregate shocks and sectoral differences, we specify the following hedonic equation

$$P_{ijt}^{E} = \alpha_P + \beta_P L_{jt} + \gamma_P X_{it} + u_{it}^{P}$$

where the dependent variable P_{it}^{E} is the smuggling price reported by migrant i using a coyote to cross in sector j in year t. The enforcement variable (L_{jt}) is the linewatch hours per border mile in a given sector and year and X_{it} denotes control variables. Our primary paramter of interest is β_P measuring how enforcement affects smuggler prices.

Table 3 reports the results. All standard errors are corrected for clustering at the sectoral level. Column (1) shows that enforcement levels are positively correlated with smuggling prices, but the correlation is weak. In column (2), we add dummies for the border crossing sector and year of migration as well as migrant characteristics. Since natural conditions make crossing in some sectors longer and more dangerous, sector fixed effects absorb all time-constant sector characteristics. Year fixed effects in turn control for unobservable aggregate shocks that affect both smuggling prices and border enforcement. Both sets of fixed effects are jointly highly significant (not reported).

Observable characteristics of the migrant provide a way to control for heterogeneity in access to coyotes and smuggling costs. They include the individual's age, gender, education, whether he is a first-time or repeat migrant and whether a migrant crosses alone or with family or friends. We also include characteristics of the community of origin and state dummies. The latter mainly control for transport costs to the border, the former for differential access to information about smugglers. Anecdotal evidence suggests that many illegal migrants are referred to border coyotes by friends and family or use coyotes originating from their village. Though the enforcement effect increases dramatically, it remains statistically insignificant.

If migrants switch border crossing sectors in response to tighter enforcement, this induces a negative correlation between enforcement and smuggling prices. As enforcement increases, migrants and border smugglers substitute to sectors with less intense enforcement. This in turn would decrease

the price for smugglers in the popular sectors. In fact, if migrants are perfectly mobile across sectors, an increase in enforcement in any one sector would leave the price in that sector unchanged as the enforcement effect is just offset by migrants switching to less guarded sectors. In column (3), we therefore include the mean linewatch hours of the two neighboring sectors. As expected, the coefficient on enforcement increases and is now statistically significant. Finally, column (4) uses aggregate control variables instead of year dummies. The enforcement effect is further increased.

Other variables largely have the expected sign. Migrants crossing the border without their family pay lower smuggling prices. Older migrant, women and those with more education pay higher prices, while first-time migrants pay less for the service. Finally, migrants from households with a lot of migration experience pay lower prices, probably because they have better access to coyotes.

The estimates in column (3) and (4) imply that an increase in enforcement of one standard deviation or 4,850 hours per border mile would increase smuggling prices by only \$31-\$35. The post-IRCA increase in enforcement by roughly 2,700 hours between 1986 and 1998 per sector and year could thus rationalize a mere \$17-\$20 rise in smuggling prices. Translated into elasticities reported in the last row of Table 3, a 10 percent increase in border enforcement evaluated at mean enforcement levels increases smuggling prices by only 1.2 percent.

If enforcement responds to changes in the smuggling market, the above results suffer from endogeneity bias. Depending on what shifts enforcement efforts, β_P might be an upper or lower bound of the true coefficient. For example, larger incentives to migrate illegally because of a boom in the U.S. economy would raise the price but also potentially increase enforcement though we expect the latter to respond with a time lag. In that case, the least-squares coefficient is upward biased.

To account for the potential endogeneity of enforcement, we estimate the price hedonic by two-stage least squares. As an instrument, we use the budget of the Drug Enforcement Agency (DEA). According to DEA estimates, a large fraction of drugs smuggled into the United States enter along its Southwestern border. With the *Anti-Drug Abuse Act* of 1988, the states along the Southwestern border became the first to be designated as a High Intensity Drug Trafficking Area (HIDTA). In HIDTA areas, substantial efforts were undertaken to coordinate and strengthen local, state, and federal law enforcement. The fight against drugs, in most part financed by the DEA, thus also increases enforcement against illegal migration. Anecdotal evidence however suggests that coyotes are in general not involved in drug smuggling. One reason is that smuggling migrants spreads information about successful drug routes, which in turn increases the risk of detection for the highly profitable drug trade.

The first-stage results of the instrumental variable estimator are reported in Table 4(a). The instrument has a strong positive and significant effect on the number of linewatch hours per border

mile across all specifications. Table 4(b) shows the results of the instrumental variable estimator. For comparison, odd columns contain results from OLS, in which enforcement varies over time only. All standard errors are corrected for clustering by year.

Enforcement has again a positive effect on smuggling prices but the effect remains small. The IV estimate is smaller than the OLS estimate based on time series variation in enforcement consistent with better economic opportunities in the United States in the 1990s. The second specification adds characteristics of migrants as well as community characteristics and state dummies. The inclusion reduces the enforcement effect of both the least squares and instrumental variable estimator.

In the third specification, we include a linear time trend to control for factors affecting both enforcement and smuggling prices. The OLS estimate remains small and significant while the instrumental variable estimate turns negative and is not statistically significant. If we add a quadratic time trend, the standard error increases sharply but the enforcement estimate remains negative. This suggests that time trends absorb most of the variation in the instrumented enforcement variable. The correlation between the linear and quadratic time trend and the enforcement variable is with 0.83 and 0.87 respectively very high. As an alternative, we add several variables to control for aggregate shocks to smuggling prices: Mexico's population and GDP, the number of Mexicans naturalized in the United States in a given year and the US unemployment rate. This further reduces the OLS estimate. The instrumental variable estimate is even smaller but not significant.

The estimates from our preferred fourth specification imply that the post-IRCA border build-up raised smuggling prices between \$25 (IV) and \$45 (OLS). Thus, enforcement only explains between 17 and 31 percent of the overall \$145 price increase from the pre-IRCA period to after 1993 (see Table 2). The elasticities reported in the last row show a similar pattern. Smuggling prices do not respond much to enforcement once we control for characteristics of the migrants and aggregate shocks. Note that they are not directly comparable to the cross-sectional elasticities because there enforcement at neighbouring sectors is held constant. Therefore, elasticities from the time series should be larger than those based on cross-sectional variation. Indeed, the elasticities in Table 4 are between 2 and 5 times larger than those reported in Table 3.

The enforcement estimates suggest that the border build-up had a very small effect on smuggling prices. To see whether the change in smuggling prices is reasonable, we provide a back-of-the-envelope calculation of how much risk increased for the coyote. If the market for smuggling services is perfectly competitive, changes in the smuggling price just compensate the coyote for changes in the costs of apprehension[25].

[25] An alternative interpretation of the price increase is that after 1986 experts can extract higher rents from illegal migrants, for example, if smugglers have market power and the demand function for smugglers becomes less elastic in the post-IRCA period.

From our model, the smuggling price changes according to $\triangle P^E = \triangle prob^E * F$. The median prison term in the early 1990s was 2 months which translates into $840 of earnings lost measured in 1983 prices. Using the calculated changes in smuggling prices, this implies that the apprehension probability for coyotes has changed by only 3-5.4 percent. Note that this calculation assumes that punishment levels do not change. The increased risk of apprehension is thus an upper bound to the change in the probability of apprehension for coyotes because F rose during the 1990s.

One explanation for the small change in the probability of apprehension for coyotes is that smuggling methods have also become more sophisticated. As one smuggler remarked: "It's a game between cat and mouse. We adjust and they [the border patrol] adapt; they adjust and we adapt". Cell phones used to warn smugglers of current locations of border patrol agents have replaced the traditional flashlight. The organization of smuggling has also become more specialized. Now, the coyote business consists of several people each of which has a specialized task: the recruiter in the Mexican border town, the guide across the border and the delivery person that drives migrants to their U.S. destination if desired. This decreases the risk of apprehension for each individual smuggler and allows use of low-wage individuals for less demanding tasks such as recruiting illegal migrants.

5.2 Enforcement and the Demand for Coyotes

Overall, the fraction of illegal migrants using smugglers to enter the United States is high. As shown in the first row of Table 5, over 75 percent on average cross the border with the help of a coyote. There is on average little change in the propensity to hire a smuggler over time (column (1) of Table 5). Theoretically, this makes sense if the increase in demand following the border build-up is just compensated by demand reduction from higher smuggling prices.

There are however large differences in demand across border sectors (column (2) and (3) of Table 5). In particular, migrants crossing in high enforcement sectors are much more likely to cross with a smuggler than those crossing in less patrolled areas. This suggests that smuggler services are primarily valuable for avoiding apprehension by the border patrol. In contrast, sectors with lower enforcement are those where crossing is made difficult by natural conditions. Here, coyotes might be less useful in reducing the border crossing risk for illegal migrants. Anecdotal evidence even suggests that some smugglers rob their customers or tell muggers about potential prey.

In low enforcement sectors, coyote demand decreases immediately after IRCA. It then rises sharply after 1993 reaching similar levels as in high enforcement sectors. This is consistent if migrants switching to low enforcement sectors after 1993 are more likely to use coyotes. For example, prior to 1993, migrants crossing in remote areas might have been those with long crossing experience and familiar with the territory. After 1993, more coyotes offer their services along more remote routes

to avoid the highly patrolled areas, which increases the fraction of coyote users in those sectors.

To estimate the effect of prices and enforcement on the propensity to use a coyote, we specify a linear probability model

$$\Pr\left(D^E = 1\right) = \alpha_E + \beta_E P_{jt}^E + \gamma_E L_{jt} + \delta_E' X_{it}^E + u_{it}^E$$

where i denotes the individual, j the border sector and t the year. Our parameters of interest are the price elasticity of the demand for coyotes derived from β_E and the substitution effect between self crossing and expert use, γ_E. We expect the former to be negative and the latter to be positive. X_{it}^E are other variables that affect whether an individual crosses with a coyote or alone. For now, we estimate the demand function conditional on illegal migration. We address composition changes from deterrence effects in the robustness section below.

The price of expert services and enforcement are potentially endogenous. If experts can price discriminate between migrants, for example based on characteristics unobservable to the econometrician, the expert price is correlated with the error term ($Cov\left(P_{jt}^E, u_{it}^E\right) \neq 0$). This leads us to understate the marginal effect of price on demand and therefore the price elasticity. Similarly, if enforcement responds to migration flows and thus market demand for smugglers, the coefficient on enforcement will also be biased.

To account for endogeneity in our model, we again employ instrumental variables. For enforcement, we use the budget of the Drug Enforcement Agency as before. For the expert price, we require a variable that shift the supply of experts but has no direct influence on migrants' demand for experts. Our theoretical model suggests one candidate: the punishment for experts in the case of apprehension (F^E). The expected punishment shifts the cost of providing the smuggling service making it an important determinant of expert supply. As punishment for experts increases, the price of smuggling increases in the case of perfect competition or, in the case of imperfect competition, the supply of experts decreases because of deterrence and incapacitation effects. The punishment for experts however has no direct influence on the demand for smugglers except through prices[26]. Since the punishment for smugglers only varies across the five court districts along the border, we only use variation across districts and time. All standard errors are corrected for clustering by year.

Table 6(a) reports the first-stage results from the instrumental variable estimation. As expected, tougher punishment for smugglers increases coyote prices while a larger drug enforcement budget also raises enforcement. The OLS and IV estimates from the linear probability model are shown in

[26] A potential concern with the instrument is that the punishment level is itself endogenous as it is determined by the district courts in the border region. If courts adjust their sentencing practice to changes in migration flows or if there is a third factor changing both enforcement at the border and sentencing in court, our instrument is not valid. In that case, the instrumental variable estimate is a lower bound and the true price effect lies between OLS and IV.

Table 6(b). The instrumental variable estimate of the price effect is negative across all specifications. As expected, it is much larger in absolute value than the OLS estimate. The effect of enforcement on smuggling demand is in contrast very small though the IV estimates are somewhat larger.

Subsequent columns add more characteristics of the individual, the sending community and the macroeconomic environment. To control for individual heterogeneity in the demand for experts, we include education, age, gender, marital status, whether the migrant crosses alone or with friends and family and the potential benefit from migration[27]. Since people with more border crossing experience are less likely to use expert, we also control for whether the migrant is on his first trip, the total number of prior trips to the United States and the total migration experience of the migrant's original household in Mexico.

The third specification adds variables for wealth and prior migration experience in the migrants' community, state dummies proxying for transportation costs to the border and a linear time trend to control for aggregate shocks to smuggling demand. Finally, the last columns include controls for macroeconomics changes in the two countries like the unemployment rate, the number of Mexicans naturalized in the current year, Mexico's GDP and Mexican population. The control variables have the expected sign though very few are statistically significant. For example, married and female migrants are more likely, while those with higher education are less likely to use a coyote. Prior migration experience of the migrant or its household reduce the demand for coyotes.

The implied elasticities shown at the bottom of Table 6 suggest that coyote demand is quite elastic. Price elasticities from our preferred specifications (3) and (4) are with -1.03 and -1.11 slightly above one. These are at the high end of estimates from the illegal drug market, where elasticities range from about -0.3 to -0.9. The enforcement elasticities in contrast are very low. This suggests that enforcement induces few migrants to switch from crossing alone to using coyotes holding smuggling prices fixed. The post-IRCA border build-up would have increased the demand for smugglers by only 4 percent.

5.3 Deterrence of Illegal Migrants

The main goal of the massive expansion of border patrol resources has been to deter potential migrants from travelling to the border. This affects the market size for border smugglers and therefore equilibrium prices. In addition, if those dropping out of the market are not a random sample of the population of illegal migrants, our estimates could be affected by selection bias. To

[27] The sign on the potential benefit from migrating is a-priori ambiguous. As noted in the last section, migrants with higher benefits are more likely to cross alone. However, if the differential increases, say because of a boom in the United States, then we would expect more people to migrate. Our model predicts that those entering the market are more likely to hire an expert than the average migrant.

estimate the deterrence effect of the border build-up, we exploit the fact that our data also contains individuals never migraiting to the United States.

Table 9 provides summary statistics for the sample of illegal migrants and those not migrating to the United States in a given year. Illegal temporary migrants are negatively selected with repect to observable market characteristics and income. Stayers are better educated, more likely to own a business and live in larger and wealthier communities with higher educational attainment. The differences between stayers and illegal migrants are largest with respect to prior migration experience. In the communities of illegal migrants, 54 percent of the male population has had some migration experience but only 38 percent of the males in the communities of stayers. Migrant households have on average six times the migration experience than staying households and are much more likely to have family in the United States.

To estimate the deterrence effect of enforcement, we specify the following linear probability model

$$\Pr(D_{it}^{M} = 1) = \alpha^{M} + \beta^{M} L_t + \gamma^{M} X_{it} + u_{it}^{M}$$

where the dependent variable is the propensity that individual i begins a new illegal trip to the United States in year t. L_t denotes total enforcement along the border in year t and X_{it} are control variables that affect the illegal migration decision.

Since enforcement efforts are endogenous, we again use the drug budget of the DEA as our instrument. If more Mexicans migrate, for example because of a crisis in the Mexican economy, enforcement would also increase. Endogeneity of enforcement biases β^{M} toward zero leading us to underestimate the deterrence effect of enforcement. We therefore expect the instrumental variable estimate to be larger in absolute value than least-squares, which ignores endogeneity.

The first-stage of the instrumental variable estimator in Table 9(a) shows that the budget of the Drug Enforcement Agency has a positive and significant effect on border enforcement. Table 9(b) reports the least-squares and instrumental variable estimates of the propensity to migrate illegally. All standard errors are corrected for clustering by year. The enforcement effect is negative across all specifications but not significant once we include a wide set of controls. As expected, the instrumental variable estimate is larger in absolute value suggesting that accounting for endogeneity of enforcement is important.

The deterrence effect actually becomes more negative as we include controls for individual heterogeneity, the community and Mexican state of residence and a linear time trend to control for aggregate shocks to migration incentives. It is however sharply reduced once we add aggregate controls such as the US unemployment rate, the number of Mexicans naturalized in the US, Mexican

GDP and size of its population. The OLS estimate in contrast changes little across specifications.

Other variables have the expected sign. Higher earnings prospects in the US have a large positive, while potential earnings in Mexico a somewhat smaller negative effect on the propensity to migrate. Older and more educated individuals are more likely to migrate to the United States illegally. This confirms that most illegal temporary migrants are young and unskilled. Family in the US and overall migration experience of the household increases the likelihood of travelling north, while owning a business and land in Mexico reduces it. Finally, domestic migrations appear to be a substitute for migration to the United States. Surprisingly, women are more likely to migrate once we control for other characteristics though only 1.5 of all women in our sample migrate compared to 6.5 percent of men.

The estimates of our preferred specification in the last two columns suggest that the total border build-up has reduced the propensity to migrate by roughly 10 percent (OLS and IV). Based on estimates of the annual inflow of temporary migrants, this translates into a reduction of the gross inflow by around 130,000 temporary migrants. These results are one the higher end of previous estimates. One reason is the difference in sample coverage since most previous studies use data before the major border build-up in 1993. The deterrence elasticity in the last row show that illegal migration is indeed responsive to enforcement but in general not very elastic[28].

While interesting in its own right, the result also suggests that deterrence might bias our estimates of the hedonic and demand function since both are estimated on the subsample of illegal migrants. We address the robustness of our estimates to selection along the migration margin in more detail below.

5.4 Changes in lllegal Crossing Routes

Our results thus far suggest that the effect of enforcement on the smuggling market has been modest. In this section, we provide evidence that the border build-up shifted migrants away from the popular crossing routes in San Diego and El Paso where enforcement increased sharply after 1986. Instead, more migrants instead began to cross in the less patrolled but more remote areas of Arizona, New Mexico and the Rio Grande Valley in Texas.

Before enforcement tightened, two-thirds of illegal migrants in our sample crossed the border in the San Diego or El Paso sector, in particular in Tijuana and Nuevo Laredo. Between 1996 and 1998,

[28] Recent evidence also suggests that illegal migrants stay longer in the United States in response to increased enforcement (Angelucci, 2003; Reyes et al., 2002). Longer duration of illegal trips lowers the demand for illegal migration and therefore the size of the smuggling market. If there is positive selection into duration of stay, the more able migrants remain longer in the United States. Since these have higher border crossing ability than the average migrant, they are less likely to use an expert and pay a lower price if they do. An increase in duration of stay would then result in an upward bias in the effect of enforcement on smuggling prices while the substitution effect in the smuggling demand is downward biased.

the fraction of migrants entering through sectors other than California increased from 39 percent to 58 percent. Migrants also substituted within each sector from crossing in cities to more rural and desolated areas. Before 1993, almost 90 percent of migrants crossing in the San Diego sector did so in Tijuana. The fraction decreased to 70 percent in the late 1990s.

Apprehension data, though a very noisy measure of migration flows, support this pattern. Table 8 shows that apprehensions in the two most popular crossing sectors, San Diego and El Paso, decline dramatically in the second half of the 1990s in absolute number and also in terms of the fraction of total apprehensions. Whereas in 1993, 68 percent of all apprehensions were made in these two sectors, by 2000 the number had dropped to 16 percent. In contrast, apprehensions in Arizona, where migrants have to walk long stretches of desert have more than quadrupled, from 10 percent in 1993 to 44 percent in 2000.

As a final piece of evidence, the fraction of migrants crossing in sectors with less than the median enforcement per border mile increases by more than 70 percent in the period after 1986. Whereas before 1986, roughly 16 percent cross in low enforcement sectors, the number increases to 30 percent after 1986. Given that smuggling is much cheaper at the traditionally highly patrolled crossing routes in San Diego and El Paso, one might conclude that most of the change in average prices is driven by sectoral reallocation from low to high-price sectors. This however is not the case as smuggling prices also increase within sectors. For example, coyote prices for Tijuana in the San Diego sector increase by on average 24 percent (from US$240 to US$300) from the pre-IRCA to the post-IRCA period. This is however much less than the 55 percent increase in overall prices (see Table 2) suggesting that sectoral reallocation might indeed be important[29].

Tighter enforcement, if effective, increases the probability of apprehension and thus the average number of attempts necessary to cross the border. If migrants substitute toward less patrolled areas in response, this reduces the impact of enforcement on the demand and price for coyotes. In our data, the overall number of attempts migrants need to cross the border actually decreased from 1.6 before 1986 to 1.35 in the post-IRCA period in our dataset (T-statistic: 4.71). This implies a reduction of more than 15 percent. For those reporting at least one apprehension, the number of attempts went down from 2.41 to 1.97 after 1986 (T-statistic: 2.31). The same pattern emerges if we control for migrant demographics, aggegate time shocks and heterogeneity across border sectors. The number of border crossing attempts also decreases if we look at the same migrant over time. This rules out that the observed decrease is purely driven by selection along the migration margin.

[29] Another source of increasing smuggling prices besides enforcement and sectoral switching is the rising number of relatives residing legally in the United States. Since they have typically more resources than the average illegal migrant from Mexico, the willingness to pay for experts would go up. If the smuggling market is imperfectly competitive (for example, if smugglers collude or there is price discrimination), we expect coyote prices to go up.

Everything else constant, we expect that migrants adjust their crossing behavior as to keep their probability of apprehension constant. The decline in border crossing attempts however makes sense if the new crossing routes are more dangerous for migrants[30]. That this is indeed the case is reflected in the rising death toll along the Southwestern border. Between 1994 and 2000, the number of deaths reported by the border patrol have risen almost sixfold (Reyes et al, 2002). Today, around 500 illegal migrants die each year during their attempts to cross the border. These numbers are a conservative estimate since these only include bodies detected by the U.S. border patrol or the Mexican police.

That the rising death toll is in part the consequence of changing migration patterns can be seen by looking at the causes of border deaths: in the late 1990s, more people die from hypothermia, heat stroke or drowning. For example, 67 persons along the Californian border died due to hypothermia or heat stroke in 1998 compared to only 2 in 1994. Similarly, 53 people drowned in 1998 whereas only 9 did so in 1994 (Eschbach et al, 2001). In contrast, other causes of death like accidents or homicides have declined or remained constant over the same period.

In sum, substitution away from well guarded crossing routes has decreased the risk of getting caught by the border patrol. However, more dangerous conditions in the new areas have increased time costs and health risks facing illegal migrants. As one illegal migrant puts it: "When you arrive at the border and there they ask you, "Where are you going?" and there are many dishonest people, many who rob, many who attack you just to take the little money you have, and since you can no longer cross the line in Tijuana, you have to go through the desert, where you have to walk three or four or six days and sometimes even more.... And in the desert, you run out of water, of food, of everything, because you can't carry much, because of the distance. The safer routes are longer, you have to walk longer and although it's safer it's uglier, with more desert. And the heat is intense, and the water runs out" (Reyes, Johnson and Van Swearingen, 2002).

To get a rough estimate of the size of the additional costs from changes in crossing routes, we assume that migrants now require three to four days instead of one to cross the border. The additional time cost is US $40-60 in foregone earnings measured in 1983 prices. In addition, using a coyote in the remote areas is more expensive because crossing conditions are more difficult. We use the mean difference between high and low enforcement after 1993 as our measure of the additional costs. These add an additional US$ 70 (see Table 2). Without considering the costs from the additional health risk, crossing in remote sectors increased crossing costs by US $110-130. This is roughly three times the direct effect of enforcement on smuggling prices estimated above. Thus, enforcement did increase the costs of border crossing from apprehension but more importantly

[30] As noted in Section III, punishment upon apprehension and prosecution also increased after 1996. However, the fraction of cases prosecuted remains small and the increase occurred only toward the end of our sample period. Changes in punishment thus cannot explain why border crossing attempts go down after 1986.

imposed additional costs as illegal migrants try to avoid heavily patrolled crossing routes.

6 Robustness Analysis

The results in the last section suggest that the massive expansion of enforcement along the Southwestern border had only modest effects on market prices and demand for smuggling services. This section shows that the results are not driven by unobserved heterogeneity or composition effects in the population of illegal migrants. Finally, our estimates are shown to be robust to changes in the estimating sample and the inclusion of additional controls.

6.1 Unobserved Heterogeneity

If the hedonic equation contains unobserved characteristics correlated with the regressors, our estimates suffer from omitted variable bias. Two sources of unobservables could affect smuggling prices: first, we do not observe the border crossing ability of migrants. Even if enforcement is uncorrelated with the average border crossing ability, its estimate is still biased if enforcement is correlated with another regressor that is. Similarly, unobserved heterogeneity among migrants could also bias our estimates of the price elasticity and the substitution effect in the demand equation.

To control for unobserved migrant ability in the hedonic and demand equation, we estimate a fixed effects model. The fixed effects estimator uses observations on repeat migrants that make illegal trips in two subsequent years. Since the fixed effects model absorbs all time-constant variation, we delete all individual characteristics that do not vary over time. The result of the fixed effect model are reported in the first columns of Table 10. Panel A shows the result for the smuggling price: the estimates are similar to the main results reported in Table 3 (OLS) and 4 (IV) and the enforcement elasticity remains very inelastic. In Panel B on the right hand-side, we report fixed effects estimates of the demand for smugglers. The enforcement effect becomes actually negative and the price effect is very small and even positive for the OLS estimate. Overall, the estimates controlling for unobserved heterogeneity of migrants are even smaller than the main results in Section 5. This suggests that unobserved heterogeneity cannot explain why enforcement and price has only little impact on the smuggling market.

A second source of bias in the hedonic equation arises from unobserved quality on the supply side. If coyotes differ in their ability to smuggle migrants across the border and the quality is priced out in the market, high quality experts demand a higher price. The enforcement variable is then correlated with unobserved expert quality if tighter enforcement drives low-ability experts out of the

market[31]. In this case, the coefficient on the enforcement variable is upward biased. Since we do not have any information on the supply side of the market, there is no direct way of controlling for the quality of smuggling services in the estimation. However, if more able experts are more successful in smuggling across the border, we can use the information whether a coyote user was caught at the border as a proxy for expert quality.

Reestimating the hedonic equation with an indicator, which equals one if the migrant had been caught at the border and zero otherwise (columns (4)-(6) of Table 10), we find that the estimate of the enforcement effect is somewhat smaller than before as expected. The coefficient on the quality proxy suggests that expert users caught at least once at the border pay between US$11-14 less than those crossing without delay. Overall, this suggests that differences in smuggling quality may not be important factor for explaining the small effect on prices.

6.2 Composition Effects

The effects of enforcement on prices and demand of smuggling services reported above were estimated conditional on illegal migration and in the case of smuggling prices also conditional on using a smuggler. As shown in the last section, enforcement deters people from migrating. In contrast, aggregate shocks like the economic expansion in the US during the 1990s increase the propensity to migrate illegally to the United States. If those leaving or entering the market in response to enforcement and economic shocks are not a random sample of the pool of potential illegal migrants, our estimates could be driven by selection bias.

Since the propensity to use experts remains roughly constant, we focus here on selection bias along the illegal migration margin[32]. Our model in Section III predicts that those deterred are 'low-quality' migrants, which might pay a higher or lower price than the average illegal migrant. Controlling for selection along the illegal migration margin could therefore decrease or increase the enforcement effect on smuggling prices. To check whether our results are sensitive to changes in composition, we estimate a selection model for the smuggling price of the form

$$P_{it}^{E} = \alpha_P + \beta_P L_{jt} + \gamma_P X_{it}^{P} + K(D_{it}^{M*}) + \varepsilon_{it}^{P}$$

$$D_{it}^{M*} = P(D_{it}^{M} = 1 \mid L_{jt}, X_{it}^{M}) = \alpha_M + \beta_M L_{jt} + \gamma_M X_{it}^{M} + \varepsilon_{it}^{M}$$

[31] Experts of different qualities enter the market until the benefits from providing expert services equal the marginal costs of doing so. Low-ability experts have higher marginal costs since their probability of apprehension is higher. In equilibrium, there exists a marginal coyote who is just indifferent between supplying the services and not. Stricter enforcement, by increasing the probability of apprehension for everybody, crowds out the lowest-ability experts. This increases the average ability of expert supply and therefore the average market price.

[32] We also experimented with a double selection model that accounts for selection along illegal migration and demand for coyotes simultaneously. The results were very similar to those obtained from selection for illegal migration suggesting that deterrence is the main source of selection bias.

where β_M measures the deterrence effect and X_{it}^M are other variables affecting the demand for illegal migration. $K(D_{it}^{M*})$ denotes the control function in the hedonic equation while D_{it}^{M*} is an indicator equal to one if the individual made an illegal trip to the United States in period t and zero otherwise.

We include polynomials in the predicted propensity of illegal migration to approximate the control function in the hedonic equation. As an exclusion restriction in the migration equation, we use indices of fruit and vegetable prices in US agriculture. Agriculture is still the dominant sector of employment for temporary migrants. Changes in the prices of agricultural products change the demand for illegal migrants and thus affect the incentives to migrate illegally to the United States[33].

The results are shown the first three columns of Table 11. Sel (1,2) reports the estimates of the corresponding selection equations while subsequent columns show the least-squares results for the smuggling price using sectoral (Out (1)) and time series variation (Out (2)). In both cases, the polynomials of the propensity score are jointly highly significant. Overall, the estimates are quite similar to the one reported in Table 3 (OLS) and Table 4(b) (OLS). While the selection-corrected estimate using cross-sectional variation is roughly half the one reported in column (4) of Table 3, the least-squares estimate using time series variation is close to the one ignoring composition changes.

Selection along the migration margin might also bias the results in the demand function for smugglers. In the model, those dropping out of the market have the lowest border crossing ability and are therefore least likely to cross by themselves. This would lead us to underestimate the substitution effect while the bias for the price effect is ambiguous. Using a similar approach as before and with a slight abuse of notation, the model we estimate is

$$\Pr\left(D_{it}^E = 1 \mid D_{it}^M = 1, P_{jt}^E, L_{jt}, X_{it}^E\right) = \alpha_E + \beta_E P_{jt}^E + \gamma_E L_{jt} + \delta_E' X_{it}^E + K(D_{it}^{M*}) + \varepsilon_{it}^E$$
$$D_{it}^{M*} = \Pr\left(D_{it}^M = 1 \mid L_{jt}, X_{it}^M\right) = \alpha_M + \beta_M L_{jt} + \gamma_M' X_{it}^M + \varepsilon_{it}^M$$

where $K(D_{it}^{M*})$ is the control function for the market size effect and X_{it}^M again denotes variables affecting the propensity to migrate illegally. The demand for illegal migration is estimated using a linear probability model again using the price indices for fruit and vegetables as exclusion restrictions.

The results for both the selection (illegal migration) and outcome (expert use) equations are shown in column (4) and (5) of Table 11 respectively. Fourth-order polynomials in the propensity to migrate illegally are used to control for composition changesn. Both equations also include characteristcs of the individual and community of origin as well as state dummies and aggregate migration incentives (see notes to tables for details).

[33] We also experimented with the average rainfall in California, Florida and Texas. Rainfall affects the size of the harvest and thus the demand for illegal migrants. The results were similar to the ones reported here and available upon request.

As expected, correcting for selection increases the substitution effect substantially. We also find that the demand function becomes somewhat more price elastic once we control for selection into illegal migration. This suggests that those dropping out of the market pay above average prices for smugglers. Overall, the results show that the small effect of enforcement on prices and demand for coyotes is not driven by selection effects though accounting for the illegal migration margin changes the estimates in the expected direction.

6.3 Legalization or Enforcement?

In addition to increased border enforcement, the Immigration and Control Act of 1986 also implemented one of the largest legalization programs in U.S. history. Between 1986 and 1989, roughly 3 million illegal aliens were granted permanent resident status of which 80 percent were Mexicans (see Section II for details).

The large-scale legalization has two effects on our estimates: first, it reduces the size of the market for illegal migration. Given, the propensity to migrate remains unchanged, this implies a decline in the fraction migrating illegally. Anecdotal evidence suggests that many people eligible for legalization refrained from illegal migrations until they obtained their legal documents in 1988 or 1989. In contrast, if Mexicans expect future legalizations to follow the current policy, this might actually increase the propensity to migrate. Overall, we expect legalization to decrease the propensity to migrate after 1986 since the first effect is likely to dominate the latter. Note that this is independent of enforcement and should not be counted as a deterrence effect.

Legalization also reduces the number of people using an expert. Since those legalized are all repeat migrants and thus less likely to use an expert, we expect the propensity to use an expert among remaining migrants to increase. If stayers now start migrating in expectation of future legalizations, this would further increase the propensity to use an expert. Thus, legalization and enforcement work in the same direction: they lower the demand for illegal migration and increase the demand for experts among illegal migrants. However, the policies have different predictions with respect to the expert price. Whereas enforcement increases the price for experts, legalization might increase or decrease smuggling prices. Our estimate of the enforcement effect on smuggling prices could thus be an upper or lower bound on the true effect.

To distinguish the effects of enforcement from those of legalization, we reestimated the price hedonic and demand function using only first-time migrants. First-time migrants are strongly affected by stricter enforcement but their composition should not be affected by legalization, since eligibility applied to repeat migrants only[34]. This assumes that enforcement affects prices of first time and

[34] The only effect of legalization could arise if migrants expect future legalizations and thus increase their propensity

repeat migrants in the same way.

The results on the subsample of first-time migrants are shown in Table 12. The estimates and implied elasticities are again very similar to those reported for the whole sample in Section 5.1 (prices) and 5.2 (demand). Overall, first-time migrants appear less price elastic (column (5) and (6)) than the whole sample including repeat migrants. This is consistent with the model since more border crossing experience allows repeat migrants to substitute away from coyotes to self service if prices increase. The results thus suggest that legalization is not driving the estimated enforcement effects

6.4 Additional Specification Tests

If there are decreasing or increasing returns to enforcement, the impact of enforcement on prices might be nonlinear. For example, if enforcement needs to reach a certain level before it becomes effective in rising smuggling costs, we would expect a convex relationship between enforcement and smuggling prices.

Panel A of Table 13 shows estimates of the hedonic equation while Panel B reports the results of the demand for smuggling services. The first-stage of the instrumental variable estimates in column (3) and (6) are shown in Table A1 in the appendix. For smuggling price, the effect of enforcement is convex for the time series OLS estimate ((2)OLS) but not for the cross-sectional OLS ((1)OLS) or the IV estimate ((3)IV). In none of the cases are the quadratic terms statistically significant. We also estimate separate enforcement effects before and after the change in 1986. We find that enforcement had a larger effect on prices before the major border build-up after 1986. This is consistent since substitution to more remote sectors, which induces a downward bias in the enforcement effect on smuggling prices, only became important in the later period.

In Panel B, we run the same specifications for the demand for smugglers. Here, the IV estimate for enforcement is convex whereas the OLS estimate is concave. Again, none of the higher-order terms are statistically significant from zero. For the period-specific effect of prices, we find the demand function to be more price elastic in the early period. If the border buildup increased the relative effectiveness of coyotes relative to self crossers, they become less substitutable, which decreases the price elasticity.

We also reestimated both equations using lagged enforcement variables and including alternative sets of controls (not reported). The results were similar for different sets of controls. For smuggling prices, including lagged enforcement turns the IV estimate for current enforcement negative while

to migrate. This in turn raises the overall propensity to use an expert because our model predicts that the new migrants are below-average border crossers. Using a similar argument, we also expect the average smuggling price to be lower.

lagged enforcement is positive. None of these specifications yielded statistically significant results and the effects were found to be small.

6.5 Temporary and Permanent Migrants

Our estimates of the enforcement effect, price and substitution elasticity above are based on a sample of temporary migrants. However, many illegal border crossers settle permanently in the United States. We expect permanent migrants to be more likely to use experts because they have a higher gain from migrating and no prior border crossing experience. Both factors should also increase their willingness to pay for experts. Permanent migrants would then pay a higher price if using a coyote[35].

To check whether our results also apply to permanent illegal migrants, we use the nonrandom sample of permanent migrants from the Mexican Migration Project. Descriptive statistics of the nonrandom permanent and temporary sample are reported in Table 14. As expected, the fraction of coyote users among permanent migrants is higher than in the temporary migrant sample and the difference is statistically significant. Permanent migrants also pay on average slightly higher prices than temporary migrants though the difference is small and not statistically significant. Permanent migrants are younger and better educated than temporary migrants. A higher fraction of permanent migrants report having family members in the United States and they are more likely to have a father or mother that has migrated to the United States in the past.

We then reestimated the hedonic and demand for smugglers using only the permanent migrant sample. The results are shown in Table 15. Enforcement has a smaller effect on smuggling prices for both OLS estimates (column (1) and (2)) and even turns negative for the IV estimate (column (4)). For the demand for smugglers, we find that the substitution effect of enforcement is larger for permanent migrants. This implies that in reponse to tighter enforcement, more permanent migrants switch from being a self crosser to using a coyote at given prices. We also find that the demand for smugglers by permanent migrants is less price elastic though the difference is small. This is to be expected because for permanent migrants, crossing by themselves is only a poor substitute to a coyote since most have little or no prior border crossing experience. In sum, the estimates from the permanent sample are close to those reported for the temporary migrant sample. Though these results are based on a the small and nonrandom sample, the results suggest that the estimates reported in this paper might be valid for the wider population of illegal migrants.

[35] We also expect the demand for illegal migration among permanent migrants to be less responsive with respect to enforcement since the benefits from crossing the border are much larger. The deterrence effect estimated on a sample of temporary migrants would then overstate the true deterrence on all migrants and therefore the impact of enforcement.

7 Implications for Enforcement Policy

7.1 Too Much or Too Little Border Enforcement?

Between 1986 and 1998, the budget of the border patrol increased more than sixfold. Our estimates suggest that the effect of this massive expansion on coyote prices, the demand for smugglers and deterrence has been small. We calculate that the risk of getting caught and punished increased only slighly in the 1990s. Most additional costs incurred by migrants arise because migrants now travel to more remote areas where crossing is more dangerous and requires more time.

There are however several reasons why the effect of border enforcement on illegal border crossings and the number of illegal migrants in the United States will remain small. First, despite the increase in migration costs, the benefit of working illegally in the United States are large. Earnings prospects north of the border are more than three times those in Mexico for our sample of migrants. It is therefore unlikely that enforcement will turn the net benefit zero or negative unless the probability of apprehension reaches one.

As one illegal Mexican migrant in the United States puts it: "I tell you something, with that you make here in a day, you can eat the entire week. There [in Mexico], they pay you 70 pesos a day, on a good day. Seventy pesos are about $7. A kilogram of meat, which is equivalent to two pounds, costs 47 pesos; so if you buy one kilogram of meat and tortillas, with that are you going to buy a pair of pants? Here if you make $50 in a day, you can buy five pounds of meat for about $10. You can still go to a second-hand store and buy a pair of pants for two quarters" (Reyes, Johnson and Von Swearningen, 2002).

Second, even if the border heavily patrols some crossing routes, migrants can substitute easily to less guarded areas or simply stay longer in the United States. Estimates suggest that sealing the whole 2,000 mile long border might require more than 20,000 border agents, roughly double its current level.

Further, though crossing has become harder, the costs associated with an apprehension remain low. Of the 1,600,000 apprehensions made in 1998, only about 20,000 or 1.25 percent are prosecuted in court. For the vast majority of migrants, the cost of apprehension is simply the value of a day lost working in the United States (less than $ 20 in 1983 prices). The policy of enforcement without punishment has made the Southwestern border a revolving door where those apprehended and deported back to Mexico - rather than being deterred- simply try to cross the next night.

Finally, there is also evidence that part of the border patrol's resources are used for alternative activities. Trade and legal border crossings following NAFTA have rapidly increased since the late 1980s. The top line in Figure 2 shows that the number of people crossing legally at the Southwestern

border has more than doubled since the late 1970s, from 100 million to over 200 million per year (see Massey et al, 2002 for additional evidence). However, legal border traffic is handled by immigration officers and not by the border patrol. Since the vast majority of illegal migrants cross outside of the legal points of entry, the increase in legal border traffic should not affect the border patrol's efforts to fight illegal migration.

In addition however, the 1986 Anti-Drug Abuse Act extended the duties of the border patrol to fight drug smuggling along the border. The bottom line of Figure 2 shows that the value of drugs seized skyrocketed after 1986. Fighting drug smuggling might have diverted some of the additional border enforcement away from illegal migrants though the magnitude of this effect is not clear. This would provide an alternative explanation for the small enforcement effects found in the paper.

7.2 Temporary Legal Permits

In the light of our results, the question arises whether the government can do better. In what follows, we argue that the current policy of high enforcement and low punishment is potentially dominated by two alternative policy instruments.

The vast majority of additional resources went into raising the probability of apprehension, which is costly to society. Instead, the government could consider to impose fines on illegal migrants as a substitute for higher enforcement levels. These are costless to society and bring revenue to the government. Given that illegal migration is not a severe crime compared to for example drug smuggling, fines should be preferred over imprisonment. However, imposing a fine would not eliminate the market for smuggling services and society would still have to bear the costs of border enforcement.

A second alternative policy instrument is to charge a fee in return for allowing legal migration on a temporary basis. Suppose the fee was chosen such that the same number of migrants enter the United States than under the current enforcement policy. Denote the number of migrants with a temporary legal permit as M^{leg}. Define the damage to society from additional migrants as $D\left(M^{leg}\left(fee, L\right)\right)$ where $D_M > 0$ and $D_{MM} > 0$. Thus, the damage to society increases with the number of migrants at an increasing rate. Also, the number of legal migrants decreases in the fee and border enforcement levels, in both cases at a decreasing rate: $M_L < 0$, $M_{fee} < 0$ and $M_{LL} > 0$, $M_{feefee} > 0$.

The cost to the US society under the temporary permit would then equal

$$D(M^{leg}(fee, L)) + w^{BP}L - (fee + \tau w^{Mig})M^{leg}$$

where w^{BP} is the wage of border patrol officers, w^{Mig} the wage rate of legal temporary migrants and

τ the tax rate on labor earnings. The second term represents the costs of enforcement and the third term the revenues from selling the permit and taxing labor earnings of the temporary migrants. In contrast, with the current policy of enforcement and punishment, the cost is

$$D(M^{ill}(L)) + w^{BP}L$$

where $M^{ill} = M^{leg}$ by assumption. Unless the cost of temporary legal migrants is much higher than for illegal migrants, for example because they have easier access to welfare benefits, the costs to the US society with the temporary permit are lower than under the current policy for two reasons: first, under the permit policy, the government receives additional revenues from the sale of the permits and the tax on migrant's labor earnings. Second, as we show formally in Appendix C, the government will choose a lower enforcement level L under the new policy and therefore has lower enforcement expenditures[36].

To calculate the fee the US government could charge, we multiply the mean wage differential between the United States and Mexico with the average duration of the permit chosen at the mean duration and subtract the average living expenses for food and lodging reported in our dataset. The resulting US$2,200 (in 1983 prices) should be considered an upper bound since it represents the maximum amount the average migrant is willing to pay for the permit. Note that our calculations does not include that migrants with temporary legal permits could get better paid jobs and thus have higher gains from migration. Alternatively, the government could simply charge the average smuggling price which was roughly US$300 before 1986.

To get a rough estimate of the additional revenue for the government, we multiply the fee per migrant with the number of users assuming that the annual inflow of temporary migrants remains at current levels of 1,000,000-1,300,000. This yield additional revenues between US$300-390 million (lower bound) and 2.2-2.86 billion extra revenues (upper bound) for the government, which represents between 15 and 100 percent of the INS budget in 1998. The numbers are still a conservative estimate since we ignore potential tax revenues from temporary legal migrants and additional savings from reduced enforcement.

8 Conclusion

Using a unique dataset on illegal migrants from Mexico, we estimate the effects of government enforcement on prices and demand for border smuggling services. We find that the direct effect of enforcement on smuggling prices is low. Our back-of-the envelope calculation suggests that enforce-

[36] However, prevention of drug smuggling still rationalizes some enforcement.

ment had only a small effect on the risk of apprehension and therefore cost function of smugglers. In addition, the price elasticity of demand for border smugglers is found to be more elastic than prior estimates based on the illegal drug market. Our estimates are shown to be robust to unobserved heterogeneity, composition effects, changes in the estimation sample and alternative specifications of the enforcement variable.

Enforcement has however changed illegal crossing patterns pushing migrants to use more remote and dangerous routes. We estimate that additional migration costs from more time spent crossing the border, higher prices for coyotes in those remote areas and associated increased health risk are more than three times the direct effect of enforcement on smuggling prices. The observed increase in average smuggling prices by 50 percent or almost US$150 after 1986 can thus be decomposed into a direct enforcement effect (around 25 percent), the indirect substitution effect from sector switching (roughly 45 percent) and a residual component. The latter might be related to a higher willingness to pay for smugglers following the rising number of legalized relatives in the United States.

These changes in the border smuggling market demonstrate that the effectiveness of enforcement policies crucially depends on whether individuals can substitute away from the activity that is being sanctioned. It also implies that any meaningful cost-benefit analysis needs to take into account these indirect effects of enforcement efforts.

Though migration costs have overall increased, earnings potentials in the US among temporary migrants in our sample are more than three times those in Mexico. It is unlikely that a further expansion enforcement without punishment will drive the net benefit from illegal migration to zero. Instead of the current enforcement policy, we propse a temporary legal permit. This not only yields additional revenues to the government but also allows further savings from lower enforcement levels.

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A Data Appendix

The Mexican Migration Project, a collaborative research project between the University of Pennsylvania and the University of Guadalajara, is a repeated cross-sectional survey conducted since 1982. Each year, with the exception of 1984 to 1986, 200 households in two to five communities

in Mexico are interviewed[37]. The communities typically in traditional sending regions of legal and illegal migrants to the United States, such as Baja California and Zacatecas (see Figure A2 for their geographic location).

The survey structure is as follows: in a first round of interviews, all members of the selected household were interviewed. Questions include whether, when and how often each household member has migrated to the US, their occupation and wages earned in the US and their last formal job in Mexico along with demographic information about individual household members. Household heads that reported migration experience were then reinterviewed in more depth about their migration experience. The survey compiles a full year-to-year history of migration to the United States, including the amount paid to a coyote if used, the border crossing sector and the number of apprehensions at the border. In addition, information about housing, land holdings and businesses in Mexico and existing family ties in the US are collected on an annual basis.

We restrict the dataset to household heads between age 16 and age 55 who were interviewed in Mexico. However, we make use of the permanent migrant sample in the robustness section. We drop observations with missing information on age, education and wage earned in the last formal job in Mexico. We also drop everybody that does report zero wages in Mexico and those migrants who did not work or reported zero earnings in the United States. To avoid recall error, we only use information for ten years prior to the survey date. To deflate the wage and price data, we use the standard Consumer Price Index (base year 1982 - 1984). We adjust variables denoted in Mexican Pesos by the exchange rate taken from the International Financial Statistics. The price paid for a border smuggler is observed for each expert user in each year he made a trip to the United States. Less than 10 percent of the illegal migrants surveyed report missing values whether they crossed with a coyote or not. Roughly the same amount do not remember the place where they crossed the border. Almost 30 percent however do not recall the price they paid the expert.

The enforcement variable, the number of linewatch houres the border patrol spends patrouling the border, varies across year and the nine border patrol sectors. The punishment data is taken from the Federal Court Cases: Integrated Data Base, 1970-2000 (various files). The data base contains all federal court cases for each year and each court district. We construct the mean prison term in days imposed for immigration violations (illegal entry and illegal reentry) for each year and each of the five district courts at the Southwestern border (California South (CS), New Mexico (NM), Arizona(AZ), Texas South(TS), Texas West(TW)). These are then matched to the border patrol sectors (San Diego and El Centro (CS), El Paso (NM), Tucson and Yuma (AZ), McAllen and Laredo (TS), Del Rio and Marfa (TW)).

[37] If the community surveyed had less than 500 households, a smaller sample was chosen.

Similarly, we construct a measure for the punishment of migrant smugglers, from data of the United States Sentencing Commission for the years 1991 to 1998. For each year and court district, we calculate the mean prison term and fine for smuggling aliens and match them to the nine border patrol sectors as above.

In our dataset, we only observe the wages of the first and last trip to the United States. We also know the wage of the last formal job in Mexico for everybody in our sample. We therefore face two missing data problems. First, we do not observe wages earned in the United States for those not migrating. In addition, we have to construct wages earned in Mexico and the United States for each year and each person in the sample.

For wages earned in Mexico, we predict wages for each person and year from a Mincer regression. The independent variable is the log hourly wage in Mexico while the regressors include education, experience, experience squared, dummies for the year and state of residence, marital status and gender of the person and occupational dummies. We proceed in the same way to get annual observations of US wages for individuals reporting a trip to the United States in that year. To construct missing US wages for stayers, we use a standard selection model. The participation equations include the number of household members, the number of children and minors in the household and whether the father and mother ever migrated to the United States, the migrant's education, age and state of residence as regressors. We use two different exclusion restrictions: first, we take the number of family members in the United States in each year as an instrument. The existence of family ties in the United States increases the probability of migrating to the United States. However, it might also increase the wage a migrant earns in the US if family members can assist in finding a better job. In that case, the instrument is not valid. As a second instrument, we use an indicator variable whether the household head has a business in Mexico in a certain year. Owning a business in Mexico should decrease the propensity to migrate to the United States while there is no direct influence on the wage earned once in the United States[38].

B Derivation of Thresholds

We start with the demand for illegal migration (4):

$$\triangle w(\theta) - (1 - D^E) prob(\theta) \triangle w(\theta) + F - D^E prob^E (\triangle w(\theta) + F) - D^E (1 - prob^E) P^E - FC \geq 0$$

[38] The results reported in the paper use the demographic variables as instruments. Estimates based on the alternative instrument were very similar.

For those hiring an expert ($D^E = 1$), the threshold for migrating illegally is

$$\theta^* : (1 - prob^E)(\triangle w(\theta^*) - P^E) - prob^E F - FC = 0 \tag{7}$$

Individuals with $\theta < \theta^*$ will choose not to migrate whereas those with $\theta \geq \theta^*$ migrate.

For demand for experts to be positive, we need to show that $\theta^* < \theta^{**}$. The threshold for hiring an expert versus crossing alone is

$$\theta^{**} : \left(prob\left(\theta^{**}\right) - prob^E\right)\left(\triangle w(\theta^{**}) + F\right) - \left(1 - prob^E\right) P^E = 0$$

Solving for the price yields

$$\theta^{**} : P^E = \frac{prob\left(\theta^{**}\right) - prob^E}{1 - prob^E}\left(\triangle w(\theta^{**}) + F\right) \tag{8}$$

Rewrite (7) using the fact that for $\theta^* < \theta^{**}$, $\triangle w(\theta^*) \leq \triangle w(\theta^{**})$:

$$(1 - prob^E)(\triangle w(\theta^{**}) - P^E) - prob^E F - FC \geq 0$$

Substituting for the price from (8) and simplifying gives the condition

$$\left(1 - prob\left(\theta^{**}\right)\right) \triangle\, w(\theta^{**}) - prob\left(\theta^{**}\right) F - FC \geq 0 \tag{9}$$

This is the condition that self crossers ($D^E = 0$) find it optimal to migrate. We show below that (9) is indeed satisfied for $\theta \geq \theta^{**}$.Thus, all individuals who are self-crossers also choose to migrate.

Substituting in (9) for $prob(\theta^{**})\left(\triangle w(\theta^{**}) + F\right)$ from (8) and rearranging yields

$$(1 - prob^E) \triangle\, w(\theta^{**}) - prob^E F - FC(1 - prob^E)P^E \geq 0$$

Since the equation holds for θ^* with equality and $\triangle w(\theta^{**}) \geq \triangle w(\theta^*)$, this is always satisfied.

C Optimal Enforcement

We derive optimal enforcement levels in a market with experts (as under the current policy of enforcement and punishment) and without experts (under the new policy of temporary legal permits) and show that optimal enforcement is lower without experts. Since prosecution of apprehended illegal migrants has changed little over most of our sample period, we keep punishment levels constant.

A social planner chooses enforcement (L or $prob$) to maximize the welfare of the US population. As in the main text, migration imposes a cost on society denoted by $D(M(L))$ where $M(L)$ is the number of migrants entering each year with $D_M > 0$ and $D_{MM} > 0$[39]. The marginal damage from illegal migrants increases with their number either because the benefits from having migrants go down or the marginal costs go up. We also assume that $M_L < 0$ and $M_{LL} \geq 0$. Increasing enforcement decreases the number of illegal entries either because of a deterrence or enforcement effect but at a decreasing scale.

In addition, there are costs to enforcement. In the absence of capital expenditures, these are simply[40]

$$C^{BP} = w^{BP} * L$$

where w^{BP} is the wage of a border patrol agent. The decision problem of the social planner is then to choose enforcement levels to minimize the sum of damages to society and enforcement costs. The first-order condition for this problem is

$$-D'(M(L))\frac{\partial M(L)}{\partial L} = w^{BP} \tag{10}$$

and the second-order condition is

$$-D''(M)\frac{\partial M}{\partial L} - D'(M)\frac{\partial^2 M}{\partial L^2} > 0 \tag{11}$$

(10) and (11) define two enforcement levels: $\widetilde{L}$ (without experts) and L^* (with experts). To show that $\widetilde{L} < L^*$ is equivalent to showing that

$$\left|\frac{\partial M}{\partial L}\right|_{\widetilde{L}} > \left|\frac{\partial M}{\partial L}\right|_{L^*} \tag{12}$$

To simplify the derivation, we make the following assumptions:

$$\begin{aligned} prob^E &= (1-\theta^E)prob \quad \text{where } \theta \in [\theta^*;1] \\ prob(\theta) &= (1-\theta)prob \quad \text{where } \theta \in [0;1] \\ \triangle &\quad w(\theta) = \theta \triangle w \end{aligned} \tag{13}$$

[39] There is a debate about what costs (illegal) migration imposes on society. Some actually argue that (illegal) migration is welfare-increasing. All we require for our analysis is that the costs (like wage effects, increased welfare, school and health expenditures or costs from a rise in crime rates) are larger than the benefits (cheap labor for agriculture and personal services and potentially higher returns to capital).

[40] We abstract from indirect costs of enforcements arising from the distortionary taxes to finance enforcement. Since the expenditures for the border patrol are a very small fraction of GDP, the distortion is negligible.

where $\triangle w$ is the benefit from migration for the smartest person ($\theta = 1$) and $prob$ is determined by the resources of the border patrol (L). Given that migrants can try to cross the border only once, the number of successful illegal entrants in the absence of experts is

$$M_{NoExp} = \int_{\widetilde{\theta}(L)}^{\theta^{\max}} (1 - prob\,(u, L))g(u)du$$

which given our assumptions (13) is equivalent to

$$M_{NoExp} = (1 - prob(L)) \left(1 - G\left(\widetilde{\theta}(L)\right)\right) + prob(L) \int_{\widetilde{\theta}(L)}^{\theta^{\max}} ug(u)du \tag{14}$$

where

$$\widetilde{\theta} : \triangle w(\widetilde{\theta}) - prob(\widetilde{\theta}) \left(\triangle w(\widetilde{\theta}) + F\right) = FC$$

is the threshold in the absence of experts such that individuals with $\theta \geq \widetilde{\theta}$ choose to migrate illegally. With fixed L, the threshold satisfies $\theta^* \leq \widetilde{\theta} \leq \theta^{**}$. That is, all individuals that cross alone will still choose to migrate in a world without experts ($\widetilde{\theta} \leq \theta^{**}$). Some individuals who would be deterred from migrating alone do so with the help of an expert ($\theta^* \leq \widetilde{\theta}$).

Note that the last term in (14) is simply the average ability of migrants

$$\int_{\widetilde{\theta}(L)}^{\theta^{\max}} ug(u)du = E\left[\theta \mid \theta \geq \widetilde{\theta}\right]$$

In the presence of experts, the number of illegal migrants is instead

$$M_{Exp} = \int_{\theta^*(L)}^{\theta^{**}(L)} (1 - prob^E)g(u)du + \int_{\theta^{**}(L)}^{\theta^{\max}} (1 - prob\,(u, L))g(u)du$$

Using our assumptions (13), we can simplify this to

$$\begin{aligned} M_{Exp} \quad = \quad & \left(1 - prob^E\right)\left[G(\theta^{**}(L)) - G(\theta^*(L))\right] + \\ & + (1 - prob(L))\left(1 - G(\theta^{**}(L))\right) + \\ & + prob(L)E\left[\theta \mid \theta \geq \theta^{**}\right] \end{aligned}$$

Taking the derivative with respect to enforcement level L yields for the market without experts

$$\begin{aligned}\frac{\partial M_{NoExp}}{\partial L} &= -(1-prob(L))g(\widetilde{\theta})\left(\frac{\partial\widetilde{\theta}}{\partial prob}\right)\left(\frac{\partial prob(\widetilde{L})}{\partial L}\right)- \\ &\quad -\left(1-G(\widetilde{\theta})-E\left[\theta \mid \theta\geq\widetilde{\theta}\right]\right)\left(\frac{\partial prob(\widetilde{L})}{\partial L}\right) \\ &\quad +prob(L)\frac{\partial E\left[\theta \mid \theta\geq\widetilde{\theta}\right]}{\partial L}\end{aligned}$$

Substituting for the derivative of the conditional expectation yields

$$\begin{aligned}\frac{\partial M_{NoExp}}{\partial L} &= -\left[1-G(\widetilde{\theta})-E\left[\theta \mid \theta\geq\widetilde{\theta}\right]+(1-prob(\widetilde{\theta},L))g(\widetilde{\theta})\frac{\partial\widetilde{\theta}}{\partial prob}\right] \\ &\quad \times\left(\frac{\partial prob(\widetilde{L})}{\partial L}\right)\end{aligned}$$

Similarly, with experts, we have

$$\begin{aligned}\frac{\partial M_{Exp}}{\partial L} &= -(1-prob^{E}(L))g(\theta^{*})\left(\frac{\partial\theta^{*}}{\partial prob^{E}}\right)\left(\frac{\partial prob^{E}}{\partial L}\right)+ \\ &\quad +(prob(\theta^{**},L)-prob^{E}(L))g(\theta^{**})\left(\frac{\partial\theta^{**}}{\partial prob}\right)\left(\frac{\partial prob(L^{*})}{\partial L}\right)- \\ &\quad -\left(1-G(\theta^{**})-E\left[\theta \mid \theta\geq\widetilde{\theta}\right]\right)\left(\frac{\partial prob(L^{*})}{\partial L}\right)- \\ &\quad -(G(\theta^{**})-G(\theta^{*}))\left(\frac{\partial prob^{E}}{\partial L}\right)+prob(L)\frac{\partial E\left[\theta \mid \theta\geq\theta^{**}\right]}{\partial L}\end{aligned}$$

and substituting for the derivative of conditional expectation and simplifying yields

$$\begin{aligned}\frac{\partial M_{Exp}}{\partial L} &= -\left[(1-G(\theta^{**})-E\left[\theta \mid \theta\geq\theta^{**}\right])-(prob(\theta^{**},L)-prob^{E}(L))g(\theta^{**})\left(\frac{\partial\theta^{**}}{\partial prob}\right)\right]\times \\ &\quad \times\left(\frac{\partial prob(L^{*})}{\partial L}\right)- \\ &\quad -\left[(1-prob^{E}(L))g(\theta^{*})\left(\frac{\partial\theta^{*}}{\partial prob^{E}}\right)+G(\theta^{**})-G(\theta^{*})\right]\left(\frac{\partial prob^{E}}{\partial L}\right)\end{aligned}$$

The second term is nonnegative. A sufficient condition for (12) to hold is then

$$\begin{aligned}&\left[1-G(\widetilde{\theta})-E\left[\theta \mid \theta\geq\widetilde{\theta}\right]+(1-prob(\widetilde{\theta},L))g(\widetilde{\theta})\frac{\partial\widetilde{\theta}}{\partial prob}\right]\left(\frac{\partial prob(\widetilde{L})}{\partial L}\right) \\ >\ &\left[1-G(\theta^{**})-E\left[\theta \mid \theta\geq\theta^{**}\right]-(prob(\theta^{**},L)-prob^{E}(L))g(\theta^{**})\frac{\partial\theta^{**}}{\partial prob}\right]\left(\frac{\partial prob(L^{*})}{\partial L}\right)\end{aligned}$$

If there are decreasing returns to enforcement such that $\frac{\partial^{2}prob(L)}{\partial prob^{2}}<0$,then $\widetilde{L}<L^{*}$ implies $\frac{\partial prob(\widetilde{L})}{\partial L}>$

$\frac{\partial prob(L^*)}{\partial L}$. We then only need to compare the terms in square brackets.

Assume that $\widetilde{\theta} < \theta^{**}$ such that the threshold for self crossers at the higher enforcement level L^* is still above the threshold for migrants at the lower enforcement level $\widetilde{L}$. Then, $G(\theta^{**}) > G(\widetilde{\theta})$ and $E\left[\theta \mid \theta \geq \theta^{**}\right] > E\left[\theta \mid \theta \geq \widetilde{\theta}\right]$. Rearranging the terms in square brackets yields

$$G(\theta^{**}) - G(\widetilde{\theta}) + E\left[\theta \mid \theta \geq \theta^{**}\right] - E\left[\theta \mid \theta \geq \widetilde{\theta}\right] +$$
$$+(1 - prob(\widetilde{\theta}, L))g(\widetilde{\theta})\frac{\partial \widetilde{\theta}}{\partial prob} + (prob(\theta^{**}, L) - prob^E(L))g(\theta^{**})\frac{\partial \theta^{**}}{\partial prob} > 0$$

The first three terms are all positive. The change in thresholds in the fourth term is

$$\frac{\partial \theta^{**}}{\partial prob} = \left(\frac{\triangle w(\theta^{**}) + F + F^E}{(prob(\theta^{**}, L) - prob^E)\frac{\partial \triangle w(\theta^{**})}{\partial \theta^{**}} + \left(\triangle w(\widetilde{\theta}) + F\right)\frac{\partial prob(\theta^{**}, L)}{\partial \theta}}\right)\left(\frac{\partial prob^E}{\partial prob}\right)$$

The denominator is positive as long as experts are better border smugglers than the person just indifferent between self crossing and using an expert, that is $prob^E(L) \leq prob(\theta^{**}, L)$. Thus, $\frac{\partial \theta^{**}}{\partial prob} > 0$ which in turn implies $(prob(\theta^{**}, L) - prob^E(L))g(\theta^{**})\frac{\partial \theta^{**}}{\partial prob} > 0$. Q.e.d.

Table 1: Characteristics of Expert Users and Self Crossers

		Self Crosser		Coyote User		T Statistic
		Mean	Std. Dev	Mean	Std. Dev	Difference
Individual	Age	37.07	8.40	36.06	8.28	2.6
	Married	0.94	0.23	0.97	0.18	-2.7
	Female	0.01	0.11	0.02	0.13	-1.2
	Education	5.00	3.19	4.81	3.19	1.3
	_no years of formal education	0.08	0.27	0.08	0.28	-0.6
	_some primary education	0.46	0.50	0.47	0.50	-0.8
	_primary education (6 years)	0.24	0.43	0.26	0.44	-0.8
	_more than primary education	0.23	0.42	0.18	0.39	2.3
	Mexican Occupation in Agriculture	0.54	0.50	0.44	0.50	4.5
	Mexican Occupation in Manufacturing	0.34	0.48	0.36	0.48	-0.9
Household	Total Members	5.55	2.29	5.65	2.27	-0.9
	Number of Workers	1.74	1.24	1.58	1.14	3.0
	Number of Children	3.15	2.85	3.09	2.80	0.5
	Total US Experience Household	8.94	7.15	6.99	6.57	6.3
	Total Domestic Experience Household	1.78	3.46	1.23	2.55	4.2
Community	Population	41804	126941	22201	84102	4.4
	_Metropolitan	0.10	0.30	0.04	0.20	5.5
	_Small Urban	0.24	0.43	0.27	0.44	-1.1
	_Small Town	0.33	0.47	0.34	0.47	-0.1
	_Rancho	0.33	0.47	0.36	0.48	-1.5
	Fraction of Males with Migration Experience	0.53	0.23	0.57	0.23	-3.6
Migration History	On First Trip?	0.22	0.02	0.30	0.01	-3.7
	Total Number of Trips	8.07	5.83	6.65	5.67	5.4
	Mean Trip Duration	25.85	1.99	26.87	0.98	-0.5
	Total Months of US Experience	76.55	2.58	68.30	1.24	3.0
	Domestic Migrations?	0.52	0.50	0.40	0.49	5.3
	Family in US	0.75	0.02	0.71	0.01	2.1
	Father Ever Migrated to US?	0.33	0.47	0.30	0.46	1.5
	Mother Ever Migrated to US?	0.05	0.22	0.04	0.19	1.9
	English Language Skills (0: bad, 4: good)	1.48	1.30	1.17	1.21	5.3
Crossing Experience	Fraction Crossing Alone	0.50	0.50	0.45	0.50	2.3
	Fraction Crossing With Family	0.19	0.39	0.16	0.37	1.6
	Fraction Deported at Least Once	0.18	0.38	0.23	0.42	-2.7
US Employment	Fraction Working in Agriculture	0.60	0.49	0.47	0.50	5.6
	Fraction Working in Manufacturing	0.31	0.46	0.34	0.47	-1.3
	US Wage	2.59	0.04	2.67	0.02	-1.6
	Hours per Week Worked	47.88	15.55	47.80	14.09	-1.4
	Observations	604		2114		

Notes: The descriptive statistics are reported for household heads that are illegal migrants interviewed in Mexico. Classification into subgroups is based on whether the individual started a new trip in a given year. This implies that a migrant can be in both categories if he uses a coyote in one year but crosses by himself in another. Hourly Mexican wages for each year are expressed in US dollars and predicted from Mincer earnings regressions based on information about the last wage earned in Mexico. Community characteristics are interpolations between decennial observations from the Mexican Census.

Table 2: Smuggling Prices Increase Over Time

	All Sectors		High Enforcement		Low Enforcement	
	Prices	Enforcement	Prices	Enforcement	Prices	Enforcement
Levels						
Overall	291.5	2,950	278.4	6,494	349.3	923
Pre-IRCA (1977-1985)	264.2	2,150	252.7	4,396	308.7	717
Post-IRCA I (1986-1992)	275.3	2,570	267.6	6,794	319.1	1,012
Post-IRCA II (1993-1998)	409.5	4,620	389.3	12,714	460.3	1,179
Growth Rates						
Overall	55.0	114.9	54.1	189.2	49.1	64.4
Pre-IRCA to Post-IRCA I	4.2	19.5	15.1	54.5	3.4	41.1
Post-IRCA I to Post-IRCA II	48.7	79.8	45.5	87.1	44.2	16.5

Notes : The table reports levels and growth rates (in %) of average enforcement and smuggling prices paid by illegal migrants in the Mexican Migration Project from 1976 to 1998. Enforcement levels are measured in border patrol linewatch hours per border mile in a given year and sector while smuggling prices are in 1983 US$ prices. Prices are weighted by the number of crossing migrants. The pre-IRCA period denotes the years prior to the major increase in border enforcement. Post-IRCA I is the time period after the Immigration Reform and Control Act (IRCA) but before regional border enforcement initiatives were launched in 1993. Finally, post-IRCA II includes the years of the regional border enforcement initiatives from 1993 to the end of our sample period in 1998. Enforcement and smuggling prices are averages over these subperiods. Columns (3)-(6) report mean comparisons separately for sectors with enforcement levels above ("High Enforcement") and below ("Low Enforcement") the median in a given year.

Table 3: Hedonic of Coyote Prices (OLS)

	(1)	(2)	(3)	(4)
Sectoral Enforcement (in 1,000 hours)	0.003	0.041	0.064	0.074
	(0.034)	(0.024)	(0.026)*	(0.025)*
Alone		-0.357	-0.355	-0.342
		(0.065)**	(0.064)**	(0.068)**
Age		0.007	0.007	0.009
		(0.005)	(0.005)	(0.006)
Female		0.142	0.114	0.094
		(0.611)	(0.618)	(0.595)
Married		0.815	0.810	0.829
		(0.330)*	(0.331)*	(0.328)*
Some Primary School		0.164	0.151	0.119
		(0.185)	(0.186)	(0.177)
Finished Primary School		0.303	0.299	0.281
		(0.211)	(0.208)	(0.204)
More than Primary Education		-0.056	-0.048	-0.068
		(0.224)	(0.216)	(0.201)
First-Time Migrant		-0.465	-0.468	-0.49
		(0.169)*	(0.171)*	(0.167)*
Indicator Whether Family in the US		0.001	0.002	-0.001
		(0.138)	(0.137)	(0.131)
US Experience Household Members		-0.032	-0.032	-0.030
		(0.008)**	(0.008)**	(0.008)**
Mean Enforcement Adjacent Sectors			0.171	0.243
			(0.065)*	(0.101)
Other Individual Characteristics	No	Yes	Yes	Yes
Year Dummies	No	Yes	Yes	No
Sector Dummies	No	Yes	Yes	Yes
Community Characteristics	No	Yes	Yes	Yes
State Dummies	No	Yes	Yes	Yes
Aggregate Controls	No	No	No	Yes
Observations	1408	1385	1385	1397
R-squared	0.00	0.41	0.41	0.4
Enforcement Elasticity	0.006	0.079	0.124	0.142

Notes: The table reports coefficients from an OLS regression of the price for smuggling services paid by an individual in a given year (measured in US $100 at 1983 prices). Our measure of enforcement is the number of linewatch hours (in 1,000 hours) in the border sector and year the individual migrated to the United States. Standard errors are corrected for clustering at the sectoral level. Coefficients with * are significant at the 5 percent level, with ** at the 1 percent level. Column (2) includes sector, year dummies and individual characteristics of the migrant. The latter control for differences in the individual costs of smuggling and prior migration experience. In addition, state dummies and characteristics of the migrant's community of origin are added to control for differences in geographic distance and access to information about border smugglers. Column (3) adds the mean enforcement of the two neighboring sectors as additional control. Finally, column (4) uses the US unemployment rate, Mexico's GDP, its population and the number of Mexicans naturalized to control for aggregate shocks. Elasticities in the last row are evaluated at mean enforcement levels.

Table 4(a): First-Stage of the IV Estimator for Smuggling Prices

	(1)	(2)	(3)	(4)
Budget of the DEA (in million US$)	0.044	0.043	0.022	0.026
	(0.001)**	(0.001)**	(0.003)**	(0.002)**
Individual Characteristics	No	Yes	Yes	Yes
Community Characteristics	No	No	Yes	Yes
State Dummies	No	No	Yes	Yes
Linear Time Trend	No	No	Yes	No
Aggregate Migration Incentives	No	No	No	Yes
R-squared	0.71	0.71	0.75	0.84

Notes: The table reports the first-stages of the instrumental variable estimates for the price hedonic and demand for coyotes. Column (2) adds age, gender, marital status, education dummies, whether the migrant crosses alone, whether the individual is a first-time migrant, an indicator equal to one if the migrant has family memebers residing in the United States and the total migration experience of the migrant's household of origin (measured in months). Column (3) adds dummies for the state of origin as well as community characteristics in which the migrant lives (fraction of people with more than primary education, fraction of males working in agriculture and manufacturing, fraction earning less than the Mexican minimum wage and fraction earning more than twice the Mexican minimum wage) and a linear time trend. In column (4), we include variables controlling for the aggregate incentives to migrate (Mexican GDP, number of Mexicans naturalized in the United States in a given year, US unemployment rate and Mexican population) instead of the linear time trend. Coefficients with * are significant at the 5 percent level, those with ** at the 1 percent level.

Table 4(b): Hedonic of Coyote Prices (OLS and IV)

	OLS (1)	IV (1)	OLS (2)	IV (2)	OLS (3)	IV (3)	OLS (4)	IV (4)
Enforcement (in 100,000 hours)	0.076	0.073	0.063	0.057	0.038	-0.019	0.029	0.016
	(0.007)**	(0.008)**	(0.009)**	(0.012)**	(0.012)**	(0.079)	(0.010)**	(0.036)
Alone			-0.512	-0.521	-0.367	-0.369	-0.345	-0.343
			(0.119)**	(0.121)**	(0.085)**	(0.084)**	(0.087)**	(0.089)**
Age			0.014	0.014	0.007	0.006	0.007	0.007
			(0.009)	(0.009)	(0.006)	(0.006)	(0.005)	(0.005)
Female			-0.269	-0.278	0.345	0.313	0.235	0.231
			(0.463)	(0.463)	(0.517)	(0.525)	(0.520)	(0.520)
Married			0.331	0.338	0.927	0.929	0.901	0.902
			(0.201)	(0.202)	(0.290)**	(0.293)**	(0.289)**	(0.290)**
Some Primary School			0.258	0.258	0.059	0.03	0.078	0.079
			(0.164)	(0.165)	(0.175)	(0.181)	(0.169)	(0.170)
Finished Primary School			0.51	0.517	0.183	0.155	0.214	0.214
			(0.186)*	(0.187)*	(0.140)	(0.140)	(0.137)	(0.138)
More than Primary Education			0.083	0.094	-0.234	-0.258	-0.197	-0.196
			(0.209)	(0.209)	(0.199)	(0.208)	(0.189)	(0.192)
First-Time Migrant			-0.586	-0.598	-0.597	-0.601	-0.522	-0.528
			(0.096)**	(0.095)**	(0.082)**	(0.085)**	(0.099)**	(0.101)**
Indicator Whether Family in the US			-0.162	-0.165	-0.031	-0.02	-0.021	-0.021
			(0.080)	(0.081)	(0.076)	(0.083)	(0.079)	(0.079)
US Experience Household Members			-0.036	-0.037	-0.023	-0.023	-0.027	-0.027
			(0.009)**	(0.008)**	(0.005)**	(0.005)**	(0.006)**	(0.006)**
Other Individual Characteristics	No	No	No	No	Yes	Yes	Yes	Yes
Community Characteristics	No	No	No	No	Yes	Yes	Yes	Yes
State Dummies	No	No	No	No	Yes	Yes	Yes	Yes
Linear Time Trend	No	No	No	No	Yes	Yes	No	No
Aggregate Migration Incentives	No	No	No	No	No	No	Yes	Yes
Observations	1458	1460	1443	1443	1434	1434	1434	1434
R-squared	0.09	0.09	0.14	0.14	0.33	0.32	0.34	0.34
Enforcement Elasticity	0.63	0.61	0.52	0.48	0.32	-0.16	0.24	0.13

Notes: The table reports least-squares and instrumental variables estimates of a hedonic price equation. The dependent variable is the smuggling price paid by individual migrants on their trips to the United States denoted in US $100 at 1983 prices. The enforcement variable is the number of hours the border patrol controls the Southwestern border in a given year (measured in 100,000 hours). In the even columns, the enforcement variable is instrumented by the budget of the Drug Enforcement Agency. Standard errors are corrected for clustering by year. Coefficients denoted by * are significant at the 5 percent level, those by ** at the 1 percent level. The first-stage results of the instrumtenal variable estimates are shown in Table 4(a). The educational reference category is no education. See notes to Table 4(a) for a detailed list of variables included in the estimation.

Table 5: Demand For Border Smugglers

	All Border Sectors	High Enforcement Sectors	Low Enforcement Sectors	T Statistic Difference
Overall	77.8	80.6	68.9	-5.98
Pre-IRCA (1977-1985)	79.7	81.2	75.1	-1.95
Post-IRCA I (1986-1992)	74.9	80.0	59.2	-7.18
Post-IRCA II (1993-1998)	82.1	81.1	85.1	0.81

Notes: The table reports levels and growth rates in average enforcement and smuggling prices paid by illegal migrants in the Mexican Migration Project from 1976 to 1998. Enforcement levels are measured in border patrol linewatch hours per border mile in a given year and sector while smuggling prices are in 1983 US$ prices. The pre-IRCA period denotes the years prior to the major increase in border enforcement. Post-IRCA I is the time period after the Immigration Reform and Control Act (IRCA) but before regional border enforcement initiatives were launched. Finally, post-IRCA II includes the years of the regional border enforcement initiatives from 1993 to the end of our sample period in 1998. Columns (2) and (3) shows mean comparisons separately for sectors with enforcement levels above ("High Enforcement") and below ("Low Enforcement") the median in a given year. The last column reports the t-statistic of mean differences across the two types of sectors.

Table 6(a): First-Stage of the IV Estimator for Smuggling Demand

	(1) P^E	(1) L	(2) P^E	(2) L	(3) P^E	(3) L	(4) P^E	(4) L
Budget of the DEA (in million US$)		0.157		0.149		0.106		0.093
		(0.003)**		(0.0031)**		(0.0021)**		(0.0029)**
Prison Term for Migrant Smuggler (in days)	0.001		0.001		0.001		0.001	
	(0.0002)**		(0.0002)**		(0.0002)**		(0.0002)**	
Individual Characteristics	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Community Characteristics	No	No	No	No	Yes	Yes	Yes	Yes
State Dummies	No	No	No	No	Yes	Yes	Yes	Yes
Linear Time Trend	No	No	No	No	Yes	Yes	No	No
Aggregate Migration Incentives	No	No	No	No	No	No	Yes	Yes
Observations	519	519	498	498	483	483	483	483
Adjusted R-Squared	0.23	0.85	0.30	0.87	0.42	0.98	0.38	0.95

Notes: see notes to Table 6(b) for details on variables included in estimation. Coefficients denoted by * are significant at the 5 percent level, those by ** at the 1 percent level. Standard errors are corrected for clustering.

Table 6(b): Estimation of the Demand for Smuggling Services (OLS and IV)

	OLS (1)	IV (1)	OLS (2)	IV (2)	OLS (3)	IV (3)	OLS (4)	IV (4)
Expert Price (in US$100)	0.055	-0.636	0.009	-0.265	-0.034	-0.382	-0.031	-0.354
	(0.070)	(0.965)	(0.043)	(0.382)	(0.015)	(0.394)	(0.018)	(0.280)
Enforcement (in 100,000 hours)	0.006	0.031	0.002	0.011	0.000	0.006	-0.001	0.01
	(0.005)	(0.039)	(0.003)	(0.015)	(0.008)	(0.016)	(0.006)	(0.017)
Alone			-0.054	-0.045	-0.039	-0.037	-0.036	-0.039
			(0.043)	(0.048)	(0.051)	(0.052)	(0.050)	(0.049)
Age			0.000	-0.001	0.000	0.000	-0.001	0.000
			(0.001)	(0.002)	(0.004)	(0.002)	(0.004)	(0.003)
Female			-0.029	-0.041	0.265	0.456	0.273	0.432
			(0.109)	(0.039)	(0.032)**	(0.168)	(0.039)**	(0.130)*
Married			0.098	0.081	0.145	0.244	0.139	0.234
			(0.049)	(0.080)	(0.047)*	(0.097)	(0.049)*	(0.085)
Some Primary School			-0.072	-0.083	-0.074	-0.083	-0.067	-0.087
			(0.146)	(0.074)	(0.067)	(0.080)	(0.068)	(0.085)
Finished Primary School			-0.096	-0.106	-0.094	-0.099	-0.089	-0.103
			(0.103)	(0.044)	(0.070)	(0.086)	(0.073)	(0.088)
More than Primary Education			-0.157	-0.169	-0.141	-0.156	-0.138	-0.16
			(0.125)	(0.074)	(0.074)	(0.096)	(0.077)	(0.099)
Trip Number			-0.009	-0.010	-0.010	-0.008	-0.011	-0.009
			(0.012)	(0.015)	(0.010)	(0.014)	(0.010)	(0.013)
Domestic Migrations			-0.014	-0.013	-0.009	-0.018	-0.009	-0.017
			(0.017)	(0.017)	(0.017)	(0.027)	(0.017)	(0.026)
Predicted US Wage			0.003	0.000	0.004	-0.010	0.003	-0.006
			(0.009)	(0.008)	(0.002)	(0.022)	(0.001)	(0.007)
Predicted Mexican Wage			-0.071	-0.065	-0.030	-0.026	-0.019	-0.030
			(0.051)	(0.062)	(0.045)	(0.028)	(0.051)	(0.045)
Family in the United States			0.004	0.011	0.011	0.012	0.01	0.016
			(0.041)	(0.036)	(0.046)	(0.050)	(0.044)	(0.047)
US Experience Household Members			-0.023	-0.022	-0.019	-0.025	-0.019	-0.024
			(0.009)*	(0.010)	(0.010)	(0.019)	(0.011)	(0.017)
Community Characteristics	No	No	No	No	Yes	Yes	Yes	Yes
State Dummies	No	No	No	No	Yes	Yes	Yes	Yes
Linear Time Trend	No	No	No	No	Yes	Yes	No	No
Aggregate Migration Incentives	No	No	No	No	No	No	Yes	Yes
Observations	519	519	498	498	483	483	483	483
R-squared	0.03		0.14		0.26		0.27	
Price Elasticity	0.17	-1.92	0.03	-0.78	-0.10	-1.11	-0.09	-1.03
Substitution Elasticity	0.22	1.24	0.07	0.43	0.00	0.21	-0.05	0.37

Notes: The independent variable is whether a migrant uses an expert or not. The table reports the coefficients from a linear probability model for the period 1991-98. In the even columns, both linewatch hours and expert price are instrumented using the budget of the Drug Enforcement Agency and the mean prison terms for experts as instruments. Standard errors are corrected for clustering at the annual level. Column (2) and (3) add individual characteristics like number of prior trips, wages earned in Mexico and the United States. Column (4) and (5) also include community characteristics (fraction of males with migration experience, fraction with more than 6 years of education, fraction earning below and more than twice the minimum wage), dummies for the migrant's state of residence in Mexico and a linear time trend to control for aggregate shocks to demand. Instead of the linear time trend, columns (7) and (8) include the US unemployment rate, the number of Mexicans naturalized in the US, Mexican GDP and Mexican population to control for shocks to the demand for smugglers. Coefficients with * are significant at the 5 percent, those with ** are significant at the 1 percent level.

Table 7: Changes in Border Crossing Patterns

	1993		2000	
	Apprehensions	% of Total	Apprehensions	% of Total
San Diego, CA	531,689	44	151,681	9
El Paso, TX	285,781	24	115,696	7
Yuma, AZ	23,548	2	108,747	7
Tucson, AZ	92,639	8	616,346	37
El Centro, CA	30,058	2	238,126	14
Marfa, TX	15,486	1	13,689	1
Del Rio, TX	42,289	3	157,178	10
Laredo, TX	82,348	7	108,973	7
McAllen, TX	109,048	9	133,243	8
Total	1,212,886	100	1,643,679	100

Source : Immigration and Naturalization Service

Notes : The table reports the number and fraction of apprehended illegal migrants in a given border sector.

Table 8: Characteristics of Ilegal Migrants and Stayers

		Stayers		Illegal Migrants		T Statistic
		Mean	Std. Dev	Mean	Std. Dev	Difference
Individual	Age	36.81	10.42	32.54	9.63	28.6
	Female	0.11	0.32	0.03	0.16	19.4
	Married	0.86	0.35	0.95	0.22	-19.2
	Education	6.01	4.72	5.00	3.40	15.2
	_no education	0.14	0.34	0.11	0.31	6.2
	_some primary	0.32	0.46	0.41	0.49	-14.9
	_primary (6 years)	0.23	0.42	0.27	0.44	-6.3
	_more than primary	0.32	0.47	0.21	0.41	16.1
	MX Occupation: Agriculture	0.30	0.46	0.42	0.49	-17.9
	MX Occupation: Manufacturing	0.32	0.47	0.38	0.49	-8.7
Household	Total Members	5.36	2.44	5.50	2.30	-4.0
	Number of Workers	1.73	1.26	1.67	1.29	3.3
	Number of Children	3.73	3.00	3.34	3.06	9.0
	Hectars of Land	1.89	21.82	1.18	4.54	2.3
	Own a Business?	0.17	0.38	0.09	0.29	15.1
Community	Population	139563	263701	36395	127260	27.6
	_Metropolitan	0.26	0.44	0.06	0.24	31.4
	_Small Urban	0.29	0.45	0.28	0.45	0.5
	_Small Town	0.27	0.45	0.34	0.47	-10.0
	_Rancho	0.18	0.39	0.32	0.46	-23.4
	Males with Migration Experience	0.38	0.26	0.54	0.24	-42.0
Migration Experience	Total US Exp Household	1.11	2.69	7.42	7.77	-140.0
	Total Domestic Exp Household	1.59	3.05	1.50	3.25	2.1
	Family in US	0.38	0.48	0.67	0.47	-42.8
	Father Ever Migrated to US?	0.14	0.00	0.29	0.01	-30.2
	Mother Ever Migrated to US?	0.03	0.00	0.04	0.00	-5.8
	Observations	80,840		5,139		

Notes: Descriptive statistics for household heads that are illegal migrants interviewed in Mexico or those remaining in Mexico. Classification into subgroups based on the individual state in a given year. This implies that a migrant can be in both categories if he chooses to migrate temporarily in one yar but to stay in Mexico in another. Hourly wages earned in Mexico expressed in US dollars are predicted from Mincer earnings regressions. Community characteristics are interpolations between decennial observations.

Table 9(a): First-Stage Estimation of the Demand for Illegal Migration (IV)

	(1)	(2)	(3)	(4)
Budget of the DEA (in million US$)	0.047 (0.0001)**	0.034 (0.0004)**	0.018 (0.0003)**	0.022 (0.0002)**
Individual Characteristics	No	Yes	Yes	Yes
Community Characteristics	No	No	Yes	Yes
State Dummies	No	No	Yes	Yes
Linear Time Trend	No	No	Yes	No
Aggregate Migration Incentives	No	No	No	Yes
Adjusted R-Squared	0.67	0.67	0.69	0.82

Notes: See notes to Table 9(b) for variables included in the estimation. Standard errors are corrected for clustering by year. Coefficients with ** are significant at the 1 percent level.

Table 9(b): Deterrence of Illegal Migrants

	OLS (1)	IV (1)	OLS (2)	IV (2)	OLS (3)	IV (3)	OLS (4)	IV (4)
Enforcement (in 100,000 hours)	-0.0018	-0.0028	-0.0017	-0.0053	-0.0012	-0.0084	-0.0021	-0.0024
	(0.00040)**	(0.00066)**	(0.00054)**	(0.0048)	(0.0009)	(0.0108)	(0.0020)	(0.0047)
Age			-0.0043	-0.0044	-0.0045	-0.0045	-0.0045	-0.0045
			(0.00017)**	(0.00020)**	(0.00018)**	(0.00020)**	(0.00017)**	(0.00017)**
Female			0.0872	0.0888	0.0992	0.1028	0.0999	0.1000
			(0.00711)**	(0.00692)**	(0.00844)**	(0.00818)**	(0.00738)**	(0.00687)**
Some Primary School			-0.0156	-0.0169	-0.0179	-0.0196	-0.0170	-0.0170
			(0.00265)**	(0.00286)**	(0.00230)**	(0.00285)**	(0.00249)**	(0.00249)**
Finished Primary School			-0.0341	-0.0361	-0.0368	-0.0390	-0.0355	-0.0355
			(0.00333)**	(0.00333)**	(0.00342)**	(0.00342)**	(0.00377)**	(0.00379)**
More than Primary Education			-0.1105	-0.1143	-0.1146	-0.1186	-0.1126	-0.1126
			(0.00699)**	(0.00734)**	(0.00752)**	(0.00770)**	(0.00747)**	(0.00748)**
Indicator Whether Family in the US			0.0153	0.0146	0.0113	0.0111	0.0118	0.0119
			(0.00185)**	(0.00190)**	(0.00163)**	(0.00168)**	(0.00179)**	(0.00176)**
US Experience Household Members			0.0300	0.0300	0.0292	0.0293	0.0292	0.0292
			(0.00119)**	(0.00119)**	(0.00121)**	(0.00123)**	(0.00122)**	(0.00121)**
Number Domestic Migrations			-0.0020	-0.0021	-0.0018	-0.0019	-0.0017	-0.0017
			(0.00040)**	(0.00039)**	(0.00034)**	(0.00034)**	(0.00034)**	(0.00034)**
Business Owned in MX			-0.0233	-0.0230	-0.0213	-0.0210	-0.0212	-0.0212
			(0.00162)**	(0.00152)**	(0.00175)**	(0.00159)**	(0.00173)**	(0.00164)**
Hectar of Land Owned in MX			-0.0001	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002
			(0.00002)**	(0.00002)**	(0.00003)**	(0.00003)**	(0.00003)**	(0.00003)**
Potential US Wage			0.2057	0.2114	0.2239	0.2303	0.2249	0.2251
			(0.01025)**	(0.01063)**	(0.01287)**	(0.01292)**	(0.01074)**	(0.01013)**
Potential Wage in MX			-0.0107	-0.0116	-0.0123	-0.0136	-0.0154	-0.0157
			(0.0075)	(0.0101)	(0.0089)	(0.0130)	(0.00658)*	(0.00657)*
Other Individual Characteristics	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Community Characteristics	No	No	No	No	Yes	Yes	Yes	Yes
State Dummies	No	No	No	No	Yes	Yes	Yes	Yes
Linear Time Trend	No	No	No	No	Yes	Yes	No	No
Aggregate Migration Incentives	No	No	No	No	No	No	Yes	Yes
Observations	85604	85604	73495	73495	71060	71060	71060	71060
R-squared	0.00		0.3		0.31		0.31	
Elasticity of Deterrence	-0.75	-1.20	-0.66	-2.01	-0.43	-3.05	-0.75	-0.87

Notes: * significant at 5%; ** significant at 1%. The independent variable is whether a migrant begins an illegal trip to the United States in a given year. The table reports the coefficients from a linear probability model over the whole sample period (1978-1998). In the even columns, linewatch hours are instrumented using the budget of the Drug Enforcement Agency as instruments. Standard errors are corrected for clustering at the annual level. Column (2) and (3) add individual characteristics like number of prior trips, wages earned in Mexico and the United States. Column (4) and (5) also include community characteristics (fraction of males with migration experience, fraction with more than 6 years of education, fraction earning below and more than twice the minimum wage), dummies for the migrant's state of residence in Mexico and aggregate controls, such as the US unemployment rate, the number of Mexicans naturalized in the US and Mexico's GDP. Column (7) and (8) include a linear time trend instead of the aggregate controls to control for aggregate shocks to the demand for smugglers.

Table 10: Controlling for Unobserved Heterogeneity of Illegal Migrants and Smuggler Services

	Illegal Migrants			Smuggler Services				Illegal Migrants	
	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) OLS	(6) IV		(7) OLS	(8) IV
A: Smuggling Price							**B: Demand for Smugglers**		
Sectoral Enforcement (in 1,000 hours)	0.039			0.059			Sectoral Enforcement (in 1,000 hours)	-0.007	-0.024
	(0.027)			(0.029)				(0.004)*	(0.027)
Enforcement (in 100,000 hours)		0.042	0.057		0.03	0.015	Smuggling Price (in 100 US$)	-0.004	0.054
		(0.013)**	(0.054)		(0.011)*	(0.035)		(0.021)	(0.748)
Indicator whether caught				-0.14	-0.11	-0.111			
				(0.0830)	(0.1160)	(0.1150)			
Enforcement Elasticity	0.07	0.35	0.47	0.11	0.25	0.12	Price Elasticity	-0.011	0.156
							Substitution Elasticity	-0.274	-0.891
Other Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Other Individual Characteristics	Yes	Yes
Community Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Community Characteristics	Yes	Yes
Sector Dummies	Yes	No	No	Yes	No	No	Aggregate Controls	Yes	Yes
Year Dummies	Yes	No	No	Yes	No	No			
Aggregate Controls	No	Yes	Yes	No	Yes	Yes			
Enforcement Neighboring Sector	Yes	No	No	Yes	No	No			
Observations	1397	1434	1434	1350	1381	1381	Observations	660	483
R-squared	0.19	0.14	0.12	0.41	0.33	0.33	R-squared	0.15	0.11

Notes: The table reports fixed effects estimates to control for unobserved heterogeneity of illegal migrants. Column (4)-(6) use the number of border apprehensions to proxy for smuggler quality. In Panel A (column (1)-(6)), the independent variable is the smuggling price paid by the illegal migrant over the whole sample period (1978-1998). The variables included are the same as specification (4) in Table 3 and Table 4 respectively. In Panel B, the independent variable is whether an illegal migrant uses a smuggler to cross the border from 1990-1998. The same specification as in the last columns of Table 5 are used. Column (1), (4) and (6) report least-squares estimates where the enforcement variable varies across sectors and years. Column (2) and (5) report least-squares estimates where enforcement varies across time only. Finally, column (3), (6) and (8) show the instrumental variable results where the DEA budget is used as an instrument for enforcement and in the case of smuggling demand, punishment of smugglers upon prosecution as instrument for the smuggling price. Standard errors are corrected for clusering. Coefficients with * are significant at the 5 percent, those with ** significant at the 1 percent level. The first-stage results are reported in Table A1 in the appendix. Also see notes to previous tables.

Table 11: Accounting for Composition Changes along the Migration Margin

	Smuggling Price			Smuggler Demand	
	Sel (1,2)	Out (1)	Out (2)	Sel (3)	Out (3)
Sectoral Enforcement (in 1,000 hours)		0.0338			
		(0.0246)			
Enforcement (in 100,000 hours)	-0.0053		0.0346	-0.0064	0.0065
	(0.0027)		(0.01105)**	(0.0031)	(0.0103)
Smuggling Prices					-0.0568
					(0.0159)*
Fruit Price Index U.S. Agriculture	0.0001				0.0001
	(0.0001)**				(0.0001)
Vegetable Price Index U.S. Agriculture	-0.0003				-0.0003
	(0.00012)*				(0.0001)*
Enforcement Elasticity		0.07	0.29		0.24
Price Elasticity					-0.16
F-Test of Polynomial Propensity Score		68.59	13.77		4.85
		(0.0000)	(0.0000)		(0.0778)
Other Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Community Characteristics	Yes	Yes	Yes	Yes	Yes
District Dummies	No	No	No	No	Yes
Year Dummies	No	No	No	No	Yes
Aggregate Controls	Yes	Yes	Yes	Yes	Yes
Observations	61323	1168	1196	63401	630
R-Squared	0.24	0.45	0.38	0.31	0.27

Notes: The table reports least-squares estimates from a selection model where the choice equation is whether a person migrates illegally to the United States in a given year. The outcome equations are the smuggling price paid by migrants using a coyote (Out (1) and Out (2)) and the propensity to use a smuggler among migrants (Out (3)). Out (1) reports the estimates when enforcement varies across both border sectors and years, whereas Out (2) shows the results when enforcement varies across time only. The exclusion restriction for the selection equation are lagged fruit and vegetable price indices in U.S. agriculture. A fourth-order polynomial in the predicted propensity score to migrate illegally is used to approximate the control function in the outcome equations. Standard errors are not corrected for first-stage estimation but corrected for clustering. Coefficients with * are significant at the 5 percent, those with ** at the 1 percent level. The independent variables included are the same as in the last specification of Table 3 (Out (1)), Table 4(b) (Out (2)) and Table 6(b) (Out (3)) respectively.

Table 12: Estimation on Subsample of First-Time Migrants

	Smuggling Price			Smuggling Demand	
	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) IV
Sectoral Enforcement (in 1,000 hours)	0.042			-0.013	-0.005
	(0.035)			(0.007)	(0.005)
Enforcement (in 100,000 hours)		0.063	0.115		
		(0.027)*	(0.094)		
Price Expert (in 100 US$)				-0.002	-0.187
				(0.011)	(0.060)*
Enforcement Elasticity	0.11	0.58	1.06		
Price Elasticity				-0.01	-0.48
Substitution Elasticity				-0.44	-0.16
Other Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Community Characteristics	Yes	Yes	Yes	Yes	Yes
Sector Dummies	Yes	No	No	No	No
Year Dummies	Yes	No	No	No	No
Aggregate Controls	No	Yes	Yes	Yes	Yes
Observations	433	453	453	218	143
R-squared	0.44	0.35	0.34	0.26	0.3

Notes:In the first three columns, the independent variable is the smuggling price paid by first-time migrants over the whole sample period (1978-1998). In the last two columns, the independent variable is whether an illegal migrant uses a smuggler to cross the border from 1990-1998. In both cases, the variables included are the same as in specification (4) of Tables 3, 4 and 5 respectively. Column (1) reports least-squares estimates where the enforcement variable varies across sectors and years. Column (2) and (4) report least-squares estimates where enforcement varies across time only. Finally, column (3) and (5) show the instrumental variable results where the DEA budget is used as an instrument for enforcement. Standard errors are corrected for clusering. Coefficients with * are significant at the 5 percent, those with ** significant at the 1 percent level. The first-stage results are reported in Table A1 in the appendix. See also notes to previous tables.

Table 13: Additional Specification Tests

	Nonlinear Enforcement			Period-Specific Effect		
	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) OLS	(6) IV
A: Smuggling Prices					**Before 1986**	
Sectoral Enforcement (in 1,000 hours)	-0.083			-0.007		
	(1.840)			(0.037)		
Enforcement (in 100,000 hours)		0.031	-0.048		0.035	0.052
		(1.330)	(0.460)		(0.011)*	(0.049)
Quadratic Enforcement Term	0.004	0.000	0.001			
	(2.130)	(0.070)	(0.860)			
					After 1986	
Sectoral Enforcement (in 1,000 hours)				0.046		
				(0.027)		
Enforcement (in 100,000 hours)					0.025	0.042
					(0.010)*	(0.048)
Other Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Community Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummies	Yes	No	No	Yes	No	No
Year Dummies	Yes	No	No	Yes	No	No
Aggregate Controls	No	Yes	Yes	No	Yes	Yes
Observations	1397	1434	1434	1397	1434	1395
R-squared	0.35	0.34	0.33	0.34	0.34	0.41
B: Demand for Smugglers						
Enforcement (in 100,000 hours)		0.012	0.003		-0.004	0.003
		(0.011)	(0.015)		(0.006)	(0.020)
Quadratic Enforcement Term		-0.0001	0.000			
		(0.000)	(0.000)			
Smuggling Prices (in US$ 100)		-0.031	-0.351			
		(0.019)	(0.12)*			
Price Effect before 1986 (in US$100)					-0.02	-0.025
					(0.019)	(0.022)
Price Effect after 1986 (in US$ 100)					-0.006	-0.012
					(0.03)	(0.03)
Other Individual Characteristics		Yes	Yes		Yes	Yes
Community Characteristics		Yes	Yes		Yes	Yes
Aggregate Controls		Yes	Yes		Yes	Yes
Observations		660	483		747	747
R-squared		0.25	0.09		0.12	0.11

Notes: The table reports results from including linear and quadratic enforcement terms as well as period-specific effects. In Panel A, the independent variable is the smuggling price paid by the migrant from 1978 to 1998. The variables included are the same as specification (4) in Table 3 and Table 4 respectively. In Panel B, the independent variable is whether an illegal migrant uses a smuggler to cross the border from 1990 to 1998. The same specification as in the last columns of Table 5 are used. Column (1) and (4) report least-squares estimates where the enforcement variable varies across sectors and years. Column (2) and (5) report least-squares estimates where enforcement varies across time only. Finally, column (3) and (6) show instrumental variable estimates where the DEA budget is used as an instrument for enforcement and in the case of smuggling demand, punishment of smugglers upon prosecution to instrument for smuggling prices. In Panel B, the price effect is period-specific while enforcement is not. Since our instrument for coyote prices is available since 1990, we only instrument enforcement. Standard errors are corrected for clustering. The first-st

Table 14: Characteristics of Permanent and Temporary Migrant Sample

	Permanent Migrant		Temporary Migrant		T Statistic
	Mean	Std. Dev.	Mean	Std. Dev.	Difference
Use a Coyote	0.84	0.36	0.78	0.42	-3.28
Price Paid for Coyote	303.67	233.88	291.50	170.09	-1.14
Age	31.87	9.50	36.55	10.38	37.17
Female	0.05	0.23	0.10	0.31	13.46
Married	0.87	0.34	0.87	0.34	-1.11
Education	7.32	3.99	5.95	4.63	-24.45
_no education	0.04	0.20	0.13	0.34	22.63
_some primary	0.24	0.42	0.32	0.47	15.32
_primary (6 years)	0.25	0.43	0.23	0.42	-2.61
_more than primary	0.48	0.50	0.31	0.46	-28.85
Family in US	0.85	0.36	0.41	0.49	-74.89
Father Ever Migrated to US?	0.46	0.50	0.16	0.37	-65.01
Mother Ever Migrated to US?	0.22	0.41	0.03	0.18	-73.55
Observations	508		2,718		

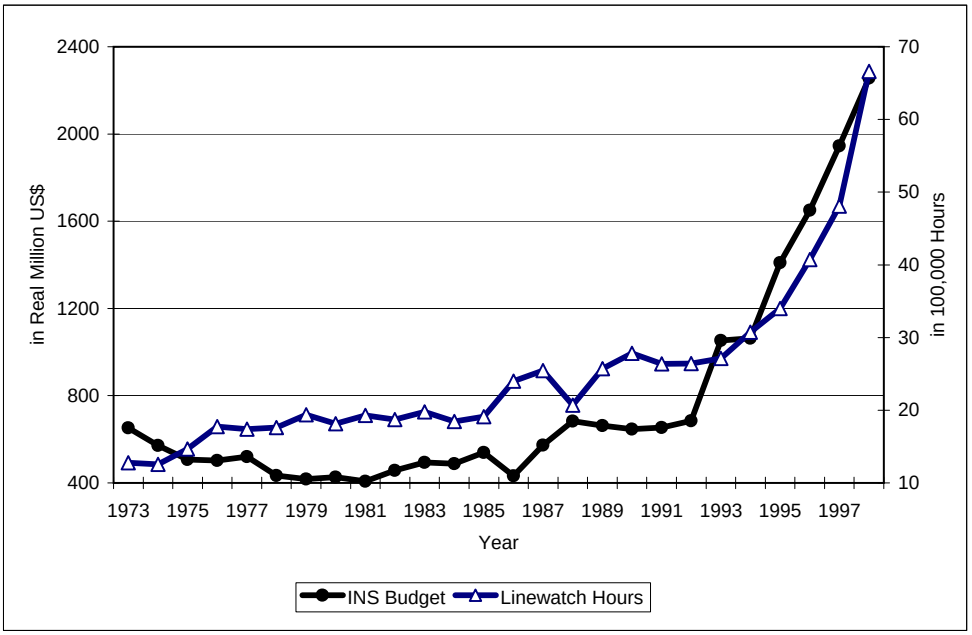
Notes : The table shows summary statistics of the nonrandom permanent and temporary migrant sample in the Mexican Migration Project. Respondents in the permanent sample are interviewed in their residence in the United States. The sampling is done by snowball principle at the annual interviews in the Mexican communities.

Table 15: Results from Permanent Migrant Sample

	Smuggling Price				Smuggling Demand		
	(1) OLS	(2) OLS	(3) 1st	(4) IV	(5) OLS	(6) 1st	(7) IV
Sectoral Enforcement (in 1,000 hours)	0.0549						
	(0.1323)						
Enforcement (in 100,000 hours)		0.0146		-0.0341	0.0029		0.0053
		(0.0449)		(0.0980)	(0.0118)		(0.0206)
DEA Budget (in million US$)			0.0339			0.1022	
			(0.0038)**			(0.006)**	
Smuggling Price (in US$ 100)					-0.2949		-0.1715
					(0.0657)**		(0.3862)
Prison Term for Coyotes (in days)						0.0017	
						(0.0005)**	
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Community Chcaracteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummies	Yes	No	No	No	No	No	No
Year Dummies	Yes	No	No	No	No	No	No
Aggregate Controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	360	361	361	361	80	80	80
R-Squared	0.24	0.21	0.86	0.21	0.68	0.7	0.67

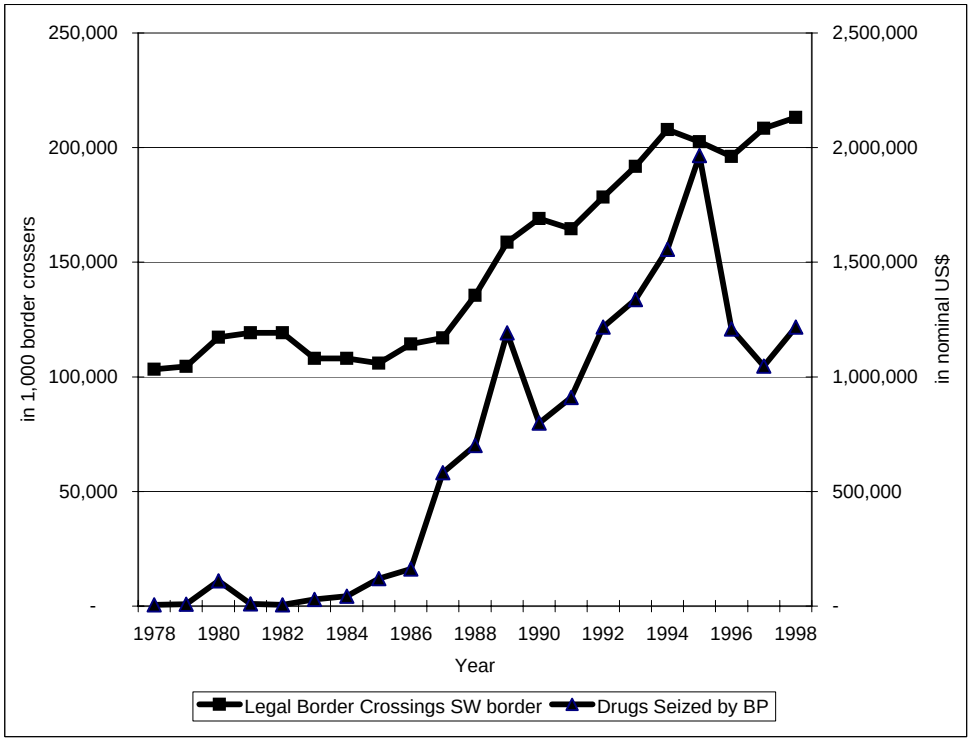
Notes: The results are based on the nonrandom sample of permanent migrants in the United States. The dependent variable in column (1)-(4) is the price paid for smugglers measured in US$100 and the controls included are described in Table 3 and Table 4(b) respectively. Column (1) reports least squares result where enforcement varies across time and sectors, while column (2) contains least squares results from time series variation. The first-stage of the instrumental variable estimator is reported in column (3) where the DEA budget is used as an instrument for enforcement. Column (4) reports the instrumental variable estimates. The dependent variable in column (5)-(7) is the propensity to use smuggler for crossing the border and the independent variables included are described in Table 6(b). Column (6) reports the least-squares results while column (8) reports the instrumental variables estimates. Column (7) shows the first-stage where the DEA budget is used as an instrument for enforcement and the median prison term for coyotes as an instrument for smuggling prices. Standard errors are corrected for clustering at the annual level. Coefficients with ** are significant at the 1 percent, those with * significant at the 5 percent level.

Figure 1: Border Patrol Resources, 1965 - 1998



Source: Mexican Migration Project

Figure 2: Legal Border Crossings and Drugs Seized by the Border Patrol



Source: Mexican Migration Project

Table A1: First-Stage of Instrumental Variable Estimates in Robustness Section

	Linewatch Hours					Smuggling Price		
	6.1 col(3)	6.1 col(6)	6.3	6.4 col(3)	6.4 col(6)	6.1	6.3	6.4 col(3)
A. Smuggling Price								
Linear Term DEA Budget (in million US$)	0.0207	0.0257	0.021	-0.1088				
	(0.0034)**	(0.0020)**	(0.003)**	(0.0052)**				
Quadratic Term DEA Budget (in million US$)				0.0001				
				(0.0000)**				
DEA Budget before 1986 (in million US$)					0.0568			
					(0.0014)**			
DEA Budget after 1986 (in million US$)					0.0355			
					(0.0018)**			
Individual Characteristics	Yes	Yes	Yes	Yes	Yes			
Migrant Characteristics	Yes	Yes	Yes	Yes	Yes			
Aggregate Controls	Yes	Yes	Yes	Yes	Yes			
Observations	1434	1381	453	1434	1434			
R Squared	0.40	0.84	0.85	0.89	0.98			
B. Smuggler Demand								
Linear Term DEA Budget (in million US$)		0.0999	0.1074	0.1057	0.0236			
		(0.0043)**	(0.0044)**	(0.0055)**	(0.0015)**			
Quadratic Term DEA Budget (in million US$)					0.1092			
					(0.0002)**			
Prison Term for Coyotes (in days)						0.0002	0.0023	0.0016
						(0.0005)	(0.0006)**	(0.0002)**
Individual Characteristics		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Migrant Characteristics		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aggregate Controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations		483	143	483	2577	483	143	483
R Squared		0.5	0.97	0.99	0.83	0.0001	0.34	0.43

Notes : The table reports the first-stage of the instrumental variable estimates in the robustness section. Standard errors are corrected for clustering. Panel A contains results for the smuggling price with linewatch hours (measured in 100,000 hours) as the dependent variable. Control variables are those included in the last column of Table 4(b). Column (1) estimates fixed effects for illegal migrants, while (2) includes whether the illegal migrant has been caught at the border to proxy for unobserved smuggler quality. Column (3) is based on first-time migrants while (4) includes linear and quadratic terms of the DEA budget as instruments. Column (5) uses the budget of the DEA before and after 1986 to instrument for period-specific enforcement effects. Panel B reports the first-stages for the demand for coyotes. The dependent variable in column (2)-(5) is the linewatch hours while in column (6)-(9) it is the price for smugglers. The independent variables included are the same as in the last column of Table 6(b). Columns (2) and (6) report fixed effects estimates for unobserved migrant heterogeneity while (3) and (7) use first-time migrants only. In columns (4) and (8), prices enter nonlinearly. Column (5) allows the price effect to vary before and after 1986 but only enforcement is instrumented.

Figure A1: Enforcement Districts along the Southwest Border

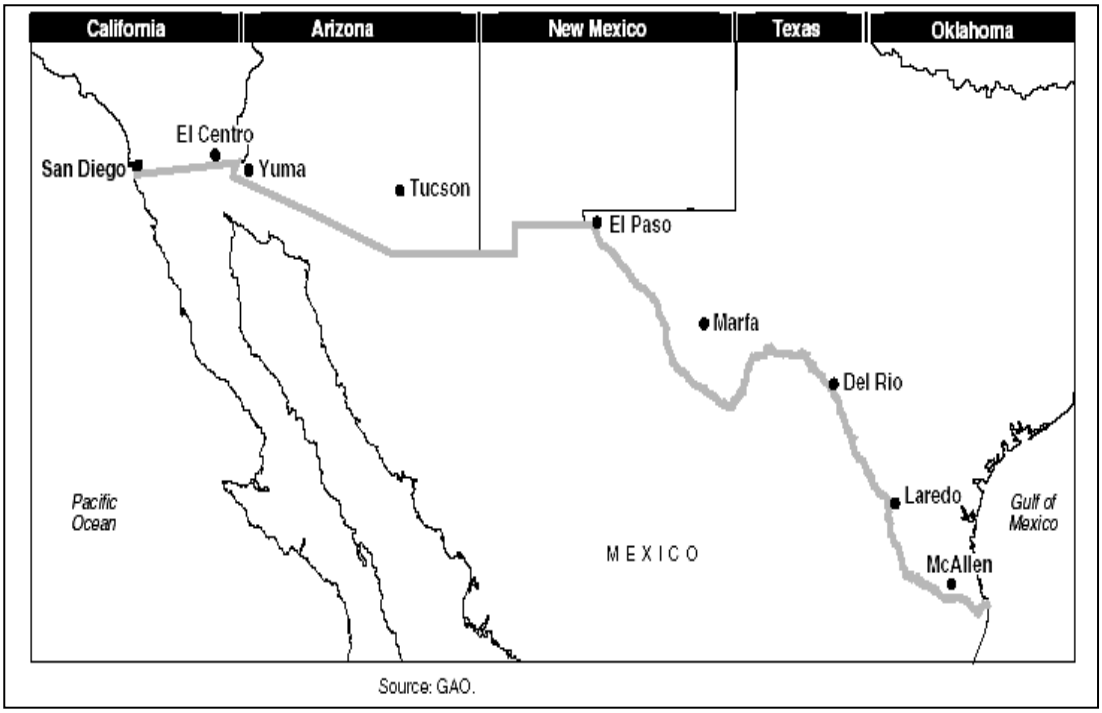


Figure A2: Map of Mexican States Covered by Mexican Migration Project

Source : Mexican Migration Project