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An Economic Analysis of Prison Labor

Robynn Joyce Afi Cox

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AN ECONOMIC ANALYSIS OF PRISON LABOR

BY

ROBYNN JOYCE AFI COX

A Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree

of

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in the Andrew Young School of Policy Studies

of

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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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ABSTRACT

AN ECONOMIC ANLAYSIS OF PRISON LABOR

By

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AUGUST, 2009

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This dissertation will focus on prison work programs and prisoner rehabilitation. In particular, a program evaluation of the federal inmate labor program, the Prison Industry Enhancement Certificate Program (PIE), will be conducted in order to investigate how this program affects recidivism and labor market outcomes of offenders.

This dissertation will contribute to the literature in two ways. First, it develops a simple theoretical model that incorporates prison labor into its framework in order to analyze how prison labor affects crime participation. The model suggests that the criminal's problem is recursive. Therefore, the criminal will first decide how much time to allocate to legal activities, and then choose the optimal time allotment to illegal endeavors. The model shows that it is theoretically possible that participation in PIE could increase recidivism through wages if an increase in the wage rate causes the consumption of illegal activity to increase by more than the consumption of legal endeavors. The decision to commit a crime will be a function of the expected unemployment rate, the subjective probability of detection and conviction, legal labor market activity, the penalty for illegal activity, gains from illegal activity, nonwage income or wealth, the subjective probability of legal work while in prison, severity of punishment, and tastes.

Second, it will empirically investigate how prison labor programs that approximate real world employment opportunities affect the decision to commit a crime upon release from prison, as well as post-release employment outcomes of the offender. In particular, using a unique dataset collected on participants in the PIE program across various states, this dissertation investigates how the PIE program affects recidivism and labor market outcomes compared to those who do not participate in the program. While, Smith, Bechtel, Patrick, Smith, and Wilson-Gentry (2006) is the only other research to use these data to analyze the effects of this program on recidivism and labor market outcomes, their analysis does not fully utilize control variables. The results of this study indicate that the PIE program significantly increases the time from release to arrest, significantly increases employment duration, and significantly increases earnings of the ex-offender.

Chapter I
Introduction

Motivation

Although Gary Becker won the Nobel Prize in Economics in part due to his groundbreaking work in modeling crime in a rational economic framework, crime continues to be an unpopular topic in economic research. Therefore, this section is included in order to highlight why crime is an important area of research not only for the fields of sociology and criminology but also for economics. The section begins by illustrating how the criminal justice system has expanded over the years. In particular, it presents evidence on the current state of incarceration in the U.S., as well as the economic and social impacts of incarceration. It then goes on to analyze inmate labor, the social costs and benefits to utilizing inmate labor, and why inmate labor is important to this thesis.

The Bureau of Justice Statistics (BJS) estimates that in 2005 there were over 7 million people under correctional supervision; and as of June 30, 2006 there were 2,245,189 prisoners held in federal or state prisons, or in local jails. The incarceration rate has been steeply increasing from 1980 to 2005: there were roughly 150 inmates per 100,000 U.S. residents in 1980 compared to approximately 500 inmates per 100,000 U.S. residents in 2005. In a BJS Special Report (Bonczar & Beck,1997) written on the lifetime likelihood of being incarcerated in a state or federal prison, it is found that 5.1% of all persons in the United States will be incarcerated during their lifetime. This figure increases when it is broken down by sex, race, and ethnicity. Nine percent of all men will be incarcerated in their lifetime compared to 1.1% of women. When comparing by race and ethnicity the rates are even more astounding with 16.6% of all blacks, 9.4% of Hispanics, and 2.5% of whites projected to being incarcerated over their lifetimes. However, when these numbers are further dissected by race and sex they increase even more: 1

out of every 4 black men, 1 out of every 6 Hispanics, and 1 out of every 23 white men will be incarcerated over their lifetime. When the numbers are examined by race and age it is evident that "[b]y age 25, 15.9 percent of black males, 6.3 percent of Hispanic males, and 1.7 percent of white males are expected to have served some time in State or Federal prison" (p.3, Ibid).

As Witte and Witt (2001) accurately state "[c]rime is like basketball; it's a young man's game. By the age of 18 possibly 90 percent of young males have participated in delinquent acts and approximately half have been arrested for nontraffic offenses by the time they are 30." In fact, the BJS (2008) estimates that, in 2001, 57 percent of state inmates were under the age of 35.

Nonetheless, the growth in incarceration has less to do with changes in behavior or tastes of criminals, and has more to do with harsher prison terms for repeat criminals and drug offenders and a more disciplinary method to postrelease regulation (Western, Kling, & Weiman, 2001). In fact, since 1980 the United States congress has approved a key section of criminal statutory law every two years (DiIulio, 1996).

Due to the ever increasing current and former prison population it is important to analyze the effects that this "sector" has on the economy and society as a whole. Direct expenditures on the criminal justice system have greatly increased. From 1982 to 2005: there was a 396% increase in police expenditures, 619% increase in outlays on corrections, and a 474% increase in spending on the judicial system. These disbursements are not the only costs of crime to society. Additional costs include the loss of property, lives, and misery caused by crime; the loss of productivity due to incarceration; and the opportunity costs of resources spent on crime control (Freeman, 1996).

The reality that so many young, low-skilled, minority men are being incarcerated will have dire effects on this population's employment prospects, racial disparities, and the ability to

become productive law abiding citizens. Western and Petit (2005) argue that "[w]hile public policy may have significantly reduced discrimination in hiring, labor market inequality may still be affected by racial disparities in the criminal justice system" (p.559). They find that the black-white wage inequality gap is actually larger than what has been estimated due to selection bias resulting from joblessness. There are two types of joblessness: noninstitutionalized characterized by the unemployed and those not in the labor force, and institutionalized comprised of incarcerated young men. Once the high levels of joblessness and incarceration are taken into consideration among young black men, sample selection explains two-thirds of the convergence in black-white wages from 1980 to 1999. Thus, their "…analysis suggests that improvements in black relative wages are not…because of improvements in the market position of black workers. Instead, jobless rates increased among black low-wage workers, and incarceration rates increased among black workers, removing those with little earnings power from standard labor market accounts" (p.574, Ibid). In fact, incarceration is viewed "…as a long-run rather than a temporary setback that can be repaired by spending more time in the labor market. A prison record… has a stigmatizing effect that hampers former prisoners from entering the labor market on an equal footing with those never incarcerated" (p. 595, Western, 2007).

Proponents of prison labor believe that the effects of imprisonment on labor market outcomes can be tempered by teaching inmates skills while incarcerated through prison work programs. Kling and Krueger (2002) look at the economic impact of employing inmate labor. They estimate that employing prison labor would increase GDP by an upper bound of less than 0.2 percent. While this number is very minuscule, they believe it is more important to compare the social costs and the social benefits to prison labor in determining whether or not the

government should encourage inmate labor because many of the benefits of prison labor are not incorporated in the monetary value of the goods produced.

They list social benefits from inmate labor as: reduced rates of recidivism; security cost reductions for prisons; inmates still being able to support their families while incarcerated; transfers made to victim compensation programs and to the government through taxes and payments for room and board; and increases in the supply of low-skilled labor causing a decrease in wages of low-skilled workers. Nonetheless, Kling and Krueger state that the most important social benefit accrues to consumers in the form of lower prices and to firms with large supplies of less-skilled labor in the form of lower wages. The major social cost to prison labor is a possible reduction in wages of high school dropouts by up to 5%. Moreover, these lower wages could increase costs even more if the decrease in the payoff to legal activity leads to a rise in criminal activity.

When analyzing the distributional costs and benefits one must take into consideration that those who are affected by the costs will also receive some of the benefits. Moreover, the relative social cost effectiveness of expanding prison work programs to that of education and vocational training should also be considered, especially because these programs won't have the same adverse effects on low-skilled labor.

Thus, prisoner rehabilitation is a very important topic to consider. This thesis will address the connection between work and crime. In particular, a program evaluation of the federal inmate labor program, the Prison Industry Enhancement Certificate Program (PIE), will be conducted in order to evaluate how this program affects recidivism and labor market outcomes of offenders.

Legislative History of the Prison Industry Enhancement Certificate Program

There is a long history of prison labor in the United States. Amendment XIII Section 1 of the United States Constitution states "[n]either slavery nor involuntary servitude, except as a punishment for crime whereof the party shall have been duly convicted, shall exist within the United States, or any place subject to their jurisdiction." From the early colonial period until the early 1900s many state officials believed that prisons could be self-sufficient and even lucrative for the state. As a result, there were many public-private partnerships between the states and businesses to lease prisons and their labor (Schneider, 1999).

There are three basic types of partnerships throughout history: "ownership of the facility in which the prisoners are kept; private use of prison labor and taking of profits from their labor; and private management of the facility, including the day-by-day supervision of prisoners" (Schneider, 1999, p.193). Case studies suggest that private-public partnerships began due to similar interest among reformers, public officials, and local businesses (Ibid). Beginning in the colonial period through the early 20th century public officials "…believed that prisons could be self-supporting or even profitable for the state, and businesses were interested in those profits" (Ibid, p. 193).

Prison Industries was one of these partnerships. However, inmate labor was concentrated in those industries that utilized vigorous physical activity and low-skill levels because these sectors could utilize inmate labor more effectively. Nonetheless, the advantages of using prison labor also caused it to compete directly with free labor, thus leading to its demise. When prison goods were introduced into the market wages decreased, prices dropped, and unemployment climbed (Ibid). While it was the protest of free labor and manufacturers that eventually led to the

erosion of prison labor, the record unemployment levels of the Great Depression ultimately led to the abolition of private sector involvement in prison industry (Ibid).

Beginning in 1929 with the Hawes-Cooper Act, there were a series of federal laws passed prohibiting private sector involvement in the production of prison made goods so that public-private alliances in prisons had disappeared by the start of World War II (Ibid). The following are a list of these laws:

> **1929** Hawes-Cooper Act "mandated that prison-made goods transported from one state to another be subject to the laws of the destination state."
>
> **1935** Ashurst-Sumners Act "made shipping prisoner-made goods to a state where state law prohibited the receipt, possession, sale or use of such goods a federal offense."
>
> **1936** Walsh-Healy Act banned convict labor on federal procurement contracts in the "manufacture…production or furnishing of any materials, supplies, articles, or equipment used in government contracts where the amount thereof exceeds $10,000."
>
> **1940** Sumners-Ashurst Act "made it a federal crime to knowingly transport convict-made goods in interstate commerce for private use, regardless of laws in the states."
>
> **1973** Executive Order 11755 restricted the purchase of inmate-made tools by the federal government. (pp.14-15, Reynolds, 1996)

After the 1978 Pontiac, Illinois prison riot,[1] Senator Charles Percy (R-Ill) sponsored a bill to create the Prison Industry Enhancement Act, Section 827 of the Justice System Improvement Act of 1979. Senator Percy stated his concerns with the corrections system as follows:

> The shopping list of problems and deficiencies in our prison system is long and well known. Overcrowding, old and obsolete facilities, lack of training or educational programs, crime within prison walls, frustration on the part of guards and inmates are all a part of the dreary picture… Recidivism is now a substantial element in our overall crime rate, and prisons are often accurately characterized as a 'school for crime,' rather than a deterrent to crime…125 Cong. Rec. S11834 (1979) (Bureau of Justice Assistance, 1999).

This bill, and subsequent amendments, created what is known as the Prison Industry Enhancement Certificate Program:

> **1979** Prison Industry Enhancement Act: Allows exemptions of Federal restrictions on the marketability of prisoner-made goods, among them the Ashurst-Sumners Act and the Walsh-Healey Act for 7 pilot projects (Bureau of Justice Statistics, 1999)
>
> **1984** Justice Assistance Act: expanded PIE from seven to twenty projects (Bureau of Justice Assistance, 1999)
>
> **1990** Crime Control Act: raised PIE to 50 pilot projects. (Bureau of Justice Assistance, 1999)

The Prison Industry Enhancement Act is codified at 18 U.S.C. 1761(c) and states the following:

---

[1] In this riot three guards were killed, three were seriously injured, and $4 million were lost in property damage (Bureau of Justice Assistance, 1999)

[2] These results should be interpreted as short-run estimates since prices are kept fixed.

(a) Whoever knowingly transports in interstate commerce or from any foreign country into the United States any goods, wares, or merchandise manufactured, produced, or mined, wholly or in part by convicts or prisoners, except convicts or prisoners on parole, supervised release, or probation, or in any penal or reformatory institution, shall be fined under this title or imprisoned not more than two years, or both.

(b) This chapter shall not apply to agricultural commodities or parts for the repair of farm machinery, nor to commodities manufactured in a Federal, District of Columbia, or State institution for use by the Federal Government, or by the District of Columbia, or by any State or Political subdivision of a State or not-for-profit organizations.

(c) In addition to the exceptions set forth in subsection (b) of this section, this chapter shall not apply to goods, wares, or merchandise manufactured, produced, or mined by convicts or prisoners who—

(1) are participating in—one of not more than 50 non-Federal prison work pilot projects designated by the Director of the Bureau of Justice Assistance;

(2) have, in connection with such work, received wages at a rate which is not less than that paid for work of a similar nature in the locality in which the work was performed, except that such wages may be subject to deductions which shall not, in the aggregate, exceed 80 per centum of gross wages, and shall be limited as follows:

(A) taxes (Federal, State, local);
(B) reasonable charges for room and board, as determined by regulations issued by the chief State correctional officer, in the case of a State prisoner;
(C) allocations for support of family pursuant to State statute, court order, or agreement by the offender;
(D) contributions to any fund established by law to compensate the victims of crime of not more than 20 per centum but not less than 5 per centum of gross wages;

(3) have not solely by their status as offenders, been deprived of the right to participate in benefits made available by the Federal or State Government to other individuals on the basis of their employment, such as workmen's compensation. However, such convicts or prisoners shall not be qualified to receive any payments for unemployment compensation while incarcerated, notwithstanding any other provision of the law to the contrary; and
(4) have participated in such employment voluntarily and have agreed in advance to the specific deductions made from gross wages pursuant to this

> section, and all other financial arrangements as a result of participation in such employment.
>
> (d) For the purposes of this section, the term "State" means a State of the United States and any commonwealth, territory, or possession of the United States.

Moreover, the note added at the end of this law, although not codified, states that:

> Pub. L. 90–351, title I, § 819(c), formerly § 827(c), as added Pub. L. 96–157, § 2, Dec. 27, 1979, 93 Stat. 1215, renumbered and amended Pub. L. 98–473, title II, § 609B(f), (o), Oct. 12, 1984, 98 Stat. 2093, 2096, provided that: "The provisions of section 1761 of title 18, United States Code, and of the first section of the Act of June 30, 1936 (49 Stat. 2036; 41 U.S.C. 35), commonly known as the Walsh-Healey Act, creating exemptions to Federal restrictions on marketability of prison-made goods, as amended from time to time, shall not apply unless—
>
> > "(1) representatives of local union central bodies or similar labor union organizations have been consulted prior to the initiation of any project qualifying of any exemption created by this section; and
> > (2) such paid inmate employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services." (Cornell University Legal Information Institute, 2008)

The PIE program essentially did two things: it addresses the historical concerns of "…unfair competition with private sector business and labor;" and provides inmates with work opportunities that approximate private sector employment in order to increase their marketable job skills, which should increase their chances of successfully reintegrating back into society (Bureau of Justice Assistance, 1999; Misrahi, 1996). The Bureau of Justice Assistance (2004) lists the following as the primary objectives of the program:

1. Generate products and services that enable inmates to make a contribution to society, help offset the cost of their incarceration, compensate crime victims, and support their families.
2. Reduce prison idleness, increase inmate job skills, and improve the prospects for successful inmate transition to the community upon release.

Many of the benefits listed above are not specific to the PIE program, they can also be thought of as the advantages of inmate labor in general.

Prison labor continues to be a very unpopular topic even today. Present adversaries of prison labor still have much the same arguments as their predecessors for opposing the employment of inmates. They claim "low wage prisoners undermine competitive unskilled and semi-skilled labor markets and decrease living standards of those who remain employed by reducing wage rates" (Derrick et al., 2004). Industry critics argue that because prison industries "…are exempt from the Fair Labor Standards Act that dictates minimum hourly wages and imposes constraints on employer behavior[,] [p]risoners have no means of filing a grievance or voicing complaints concerning hiring, firing, or reassignment" (Ibid). Nonetheless, proponents contend that the threat of prison labor is overstated for various reasons. They assert that

> [t]he value of the prisoner marginal product is low due to a lack of job skills, low socialization skills, high labor/capital ratio, and high turnover rates with forty percent of state prisoners released in less than three years…Costs are higher due to inefficient shipping and production time lost due to security–especially that lost due to lockdowns and the need to carefully control tools…Economies of scale are often restricted due to limited market access. In addition, they argue that unskilled and semi-skilled jobs are being transferred out of the country to developing countries. To the extent that prison labor repatriates these jobs, there will be minimal negative employment effect of prison labor. [Moreover], Prison laborers may develop a work mentality including time accounting, productivity, and economic reward, which improve employment opportunities; increased future earnings; improved behavior in prison, and lower recidivism (Ibid).

Nonetheless, the purpose of PIE was to create a program that allowed private industry to take advantage of prison labor while at the same time addressing the historical human rights and labor market concerns of using such labor.

The effect of prison labor should be similar to the increase in labor supply stemming from growth in free trade and immigration (Derrick et al., 2004). In addition, "[i]mmigrants in

the United States, while small in number relative to the host population, are likely to make up a significant portion of the low income and low skilled workers. Prisoner demographics are similar to those of immigrants in that they tend to be younger, less educated, and a larger percentage male than the population" (Ibid). As a result, the authors use an immigration model along with conventional approximations of the elasticities of labor supply and labor demand to analyze the labor market consequences of prison labor. They conclude that their results are comparable to the findings in the immigration literature. In particular, they discover that prison labor has a small influence, if any, on wages and employment (Ibid). Moreover, they suggest that the negative impact of prison labor estimated by Kling and Krueger (2001) is overestimated because they do not take into consideration secondary effects that prison industries will create through providing additional free-labor jobs via business-to-business purchases and tax revenue. They conclude from their results that existing prison labor has had no effect on the labor market or the economy. Moreover, a four-fold increase in inmate labor would have no impact on the economy (Ibid).

Scott and Derrick (2006) estimate net local economic effects of prison labor for Ohio Prison Industries by incorporating the secondary influences and crowding out effect of prison labor using a circular flow of income model.[2] Using this model they are able to take into consideration that "[l]ocal labor is not displaced if the goods and services produced would have been produced out-of-state, or internationally. Furthermore, to the extent that industry selection minimizes competition with the local community, this generates secondary (input) purchases to the local community without significant crowding out of local labor" (p.541, Ibid). They find that the net impact of prison labor on the Ohio economy is actually positive. Under the most

[2] These results should be interpreted as short-run estimates since prices are kept fixed.

realistic conjecture that prison labor only crowds out goods produced in-state, "…prison labor created 322 jobs and $14.8 million in income in Ohio in FY 2004" (p.549, Ibid). Moreover, inmate labor added $39 million to output and $4.1 million to tax revenue once secondary effects of prison labor are included. They also discover that Ohio does a good job of choosing which products to produce because over two-thirds of the goods generated in prisons would have been manufactured out-of-state, minimizing the impact of prison labor on the local economy.

Other philosophical reasons for prohibiting private use of inmate labor are how lawmakers define the role of prisons. This is the punishment versus rehabilitation debate. For example, various conservative policy makers preferring retribution over rehabilitation view the employment of prisoners by the private sector as a privilege inmates are unworthy of possessing (Atkinson & Rostad, 2003). Using a logistic regression in a public choice model, Gallagher and Edwards (1997) attempted to explain the likelihood that a state would participate in the PIE program using data from 1985-1992. They find that "...states with stronger union membership, democratic governors, and high unemployment rates will be less likely to allow PIE projects" (p. 97, Ibid). However, states with a rehabilitative view of prisons would be more likely to participate in PIE.

Prison Industry Enhancement Certificate Program

Since the beginning of the program in 1979, 45 certificates[3] have been awarded across 39 states and 6 localities.[4] In the 4th quarter ending in 2007, 38 states and 4 localities were currently certified in PIE[5] employing 5,401 inmates in 204 active cost accounting centers.[6]

[3] "Certificate Holder refers to a department of corrections, or an alternate umbrella authority, which is approved by BJA for PIECP Project Certification. Certificate Holders assume monitoring and designation responsibilities with respect to their designated Cost Accounting Centers [(CAC)]. All PIECP prisoner-made goods are produced within cost account [CAC] that a certificate holder designates within itself, private prisons located in the same state or jurisdiction or, in the case of an umbrella authority within its membership agencies…Umbrella Authority refers to a

There are three models of employment in which the private sector can operate within PIE: manpower, customer, and employer.[7] Inmates working in the manpower model are employed by the department of corrections but are managed by the private company (Smith et al., 2006). With the customer model, the private company purchases all or part of the output from a CAC enterprise. However, "[a] customer model private sector partner assumes no major role in industry operations, does not direct production, and has no control over inmate labor" (p. 17008, BJA, 1999). Finally, with the employer model "…the private sector owns and operates the CAC by controlling the hiring, firing, training, supervision, and payment of the inmate work force. The department of corrections assumes no major role in industry operations, does not direct production, and exercises minimum control over inmate labor performance" (p. 17008, Ibid). As mentioned above, the program "[e]xempts certified state and local department of corrections from normal restrictions on the sale of prisoner-made goods in interstate commerce. In addition the program lifts restrictions on these certified entities permitting them to sell prisoner-made

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type of Certificate Holder which is authorized by law to administer a PIECP Project and which consists of state and/or local departments of correction located within the same state. A certified umbrella authority may designate CACs within its membership agencies, as well as within members' private prisons, and assumes responsibility for monitoring CAC compliance" (BJA, 1999)

[4] Please see Table 1 of the Appendix for a complete listing of certified states.

[5] Delaware, Missouri, and the Texas Red River County Department of Corrections no longer hold certificates. On May 13, 2004 the Washington State Supreme Court found inmates working in Class 1 free venture industries to be unconstitutional. However, the legislature proposed to the people an amendment to the constitution that would allow the state to employ such labor. This amendment passed in the November 2007 elections.

[6] "Cost Accounting Center (CAC) refers to a distinct PIECP goods production unit of the industries system that is managed as a separate accounting entity under the authority of a Certificate Holder. All PIECP production activities are conducted within the context of a designated CAC which, generally is structured either as a customer or employer model for purposes of determining PIECP inmate benefits

[7] Note that the type of model the private sector uses will determine the benefit structure of the inmate. According to the BJA PIE Federal Guidelines (1999), "PIECP projects must provide inmate workers appropriate benefits comparable to those made available by the Federal or State Government to private sector employees, including workers' compensation and, under certain circumstances, Social Security." Nonetheless, some states prohibit inmates from receiving workers compensation. However, "[p]rovision of comparable workers compensation benefits is acceptable as long as the CAC can demonstrate comparability of such benefits with those secured by the Federal or State Government for private sector employees" (Ibid). Moreover, if the employer model is used, then social security benefits must be provided to the inmate. However, if the customer model is used then "…the BJA recognizes the applicability of other provisions of Federal law which may operate to preclude the provision of PIECP inmates with certain benefits, including Social Security."

goods to the Federal Government in amounts exceeding the $10,000 maximum normally imposed on such transactions" (p.1, BJA, 2004). This program encourages state and local governments to establish employment opportunities for prisoners that approximate private-sector work.

The National Correctional Industries Association (NCIA) highlights several benefits of the program to society. For example, the program offers:

1. Corrections administrators: A cost-effective way to reduce idleness and productively occupy a portion of the ever-growing correctional population.
2. Crime Victims: The program provides a means of partial repayment for harm.
3. The private sector: The program provides a stable and readily available workforce. In addition, many correctional agencies provide low cost manufacturing space to private sector companies involved in the program.
4. The public: Because of inmate worker contributions to room and board, family support, victim compensation and taxes, the program provides a way to reduce escalating cost of crime.
5. Inmates: The program offers a chance to work, meet financial obligations, increase job skills, and increase the likelihood of meaningful employment on release from incarceration. (NCIA, 2006)

Companies participating in this program have to pay prisoners the prevailing local wage for similar labor but no less than the minimum wage (Auerbach, 2001). In 2001 PIE wages were typically set at the Federal minimum wage ($5.15 per hour) (Ibid). In a sample of State PIE programs and employers, Petersik, Nayak, and Foreman (2003) found the median average wage to be the Federal minimum wage of $5.15 per hour, the mean wage to be $5.35 per hour, and the

maximum wage to be $8.50 per hour. Roughly 72 percent of the inmates sampled earned the federal minimum wage.

Petersik et al. (2003) researched the major beneficiaries of state ran PIE programs. The study is limited to financial benefits and immediate beneficiaries of PIE inmate payrolls and does not represent a comprehensive assessment of PIE, nor does it account for other benefits or costs associated with PIE. The authors use weighted data by participant States, revised by research staff to reflect employer contributions, tax liabilities, and other adjustments peculiar to the respondent states for one calendar year between 1998 and 2001. The results are heavily dependent on assumptions about income levels, tax rates and distribution policies and are not representative of gender, race, or other demographic, criminal justice, or employment characteristics of PIE inmates.

They estimate that from 1998 to 2001 "53 to 57 cents of every dollar earned by PIE inmates goes to non-inmate recipients via PIE deductions" (p.xii, Petersik et al., 2003).[8] Thus, the majority of PIE inmates' income goes to other parties. However, the largest single beneficiary of the PIE income is the PIE worker, receiving an average of 43 percent of gross employer payouts and 47 percent of his gross income. Moreover, "the single largest non-inmate beneficiary group benefiting from PIE incomes includes State household and business taxpayers and all State programs benefiting from State income tax payments, accounting for about one

[8] These [n]on-inmate beneficiaries include crime victims, State and Federal household and business taxpayers, all persons or businesses paying for Social Security and Medicare, and all persons and programs dependent upon State and Federal income tax funding or the social safety net (Social Security, Medicare, Workers Compensation, Unemployment compensation), including elementary, secondary, and college education, welfare, a wide range of State and Federal programs supporting medical and retirement services, and other goods and services (Petersik et al., 2003).

third of PIE inmate incomes" (p.xiii, Ibid).[9] In addition, as mentioned above, it is also believed by administrators of the program and policy makers that work programs lower recidivism, thereby also lowering the cost to crime.[10]

Table 1 provides updated calculations to those presented in Petersik et al. (2003) from cumulative data and quarterly data collected from NCIA. From 1979 through the 4th quarter of 2007, the PIE program has paid a total of $445,575,659 in gross wages to participants. Over these years, 10 percent has been paid to victims programs, 29 percent has been administered towards costs of room and board, 6 percent has gone to supporting the families of inmates, and 13 percent has been paid towards federal and state taxes. Once again, Inmates do not appear to be the primary recipients of their incomes. In the fourth quarter of 2007, inmates received 39 cents for every dollar earned. They paid 10 cents for every dollar in victims' programs, 31 cents for every dollar in room and board, 7 cents for every dollar in family support, and 13 cents for every dollar in taxes. This sums to 61 cents in total deductions going to non-inmate beneficiaries. Moreover, if mandatory savings are considered, then PIE inmates receive 30 cents for every dollar they are paid, and are required to save 9 cents per dollar earned. Comparing these to figures obtained from the Bureau of Labor Statistics Consumer Survey for 2007 consumer expenditures on food, housing, apparel, transportation, and healthcare consumers have roughly 22.9 percent of their income remaining.[11]

[9] Child welfare support, contributions to state crime victim compensation programs, unemployment, and workers' compensation programs are indirect individual payments that reduce state taxpayer burdens in so far as tax payers are supporting these programs. Most PIE inmates cannot take advantage of workers' compensation and unemployment programs while incarcerated (Petersik et al., 2003).

[10] However, as will be seen later the empirical evidence on whether or not work programs lower recidivism is inconclusive.

[11] While PIE inmates are not deducted for healthcare expenses and do not have to worry about transportation issues, these figures are presented for the average consumer to highlight that the prison system subsidizes/eliminates the need for expenditures these inmates may accrue if they were to operate in the free world.

Table 1: Breakdown of PIE Earnings and Deducations

	1979-4th qtr 2007		4th Quarter 2007	
Category	**Cumulative $**	**Percent**	**$**	**Percent**
Number of Certificates	43		42	
Inmates Employed	-		5401	
Gross Wages	$445,575,659	100	$10,658,389	100
Victims Programs	$43,079,993	0.10	$1,115,142	0.10
Room & Board	$127,869,979	0.29	$3,304,024	0.31
Family Support	$28,324,218	0.06	$771,657	0.07
Total Taxes	$58,964,295	0.13	$1,334,251	0.13
Total Deducations	$258,238,486	0.58	$6,525,074	0.61
Residual	$187,337,173	0.42	$4,133,315	0.39
Net Wages	$187,337,173	0.42	$4,133,315	0.39
Mandatory Savings	$21,795,328	0.12	$964,543	0.23

Source: NCIA

** Mandatory Savings taken as a percent of net wages*

Hypothesis

Although there are many benefits to tapping into this idle labor force, there is a potential drawback to employing prison labor often overlooked: theoretically, it is possible that prison work programs could actually increase the level of crime in society. Prison labor may lower the monetary and psychic costs to imprisonment thereby increasing the supply of offenses. Moreover, if prisoners cannot find jobs with the skills they acquire upon release from prison,[12] it is possible that the only place the inmate can earn a legitimate living is in prison, providing more incentive for the prisoner to be in prison rather than to integrate back into the community, thus perpetuating the cycle of recidivism.

This thesis will theoretically and empirically explore the effects PIE and other prison labor programs have on recidivism and labor market outcomes of offenders across 5 states. In particular, a theoretical model will be developed analyzing how prison labor affects the decision

[12] This could be due to stigma or it could also be due to low-skill sets, or having skills in a dying industry.

of the criminal to supply offenses. Next, using a unique dataset collected on participants in the PIE program, this study will investigate how the PIE program affects recidivism and labor market outcomes compared to those who do not participate in the program. These data are the first nationally representative dataset to be collected on PIE. While, Smith, Bechtel, Patrick, Smith, and Wilson-Gentry (2006) is the only other research to use these data to analyze the effects this program has on recidivism and labor market outcomes, their research did not fully utilize control variables in order to better isolate the true outcome of the program from unobserved heterogeneity. Aside from Smith et al. (2006), this will be the only analysis to investigate the effects of the PIE program on recidivism, employment and earnings using a nationally representative dataset.

Thus, this thesis will contribute to the literature in two ways. First, it will develop a simple theoretical model that incorporates prison labor into its framework in order to investigate how prison labor affects crime participation. Second, using the theory as a guide it will empirically investigate how private prison labor affects the decision to commit a crime upon release from prison, as well as employment outcomes of the offender.

The study is organized as follows: Chapter II will develop the link between work and crime and the connection between prison program participation and recidivism, as well as present empirical findings on these relationships; Chapter III will present the theoretical model and its findings on the effects of incorporating prison labor into the model; Chapter IV will introduce the empirical methods, Chapter V will provide the results of the empirical analysis, and chapter VI will conclude the study with a recap of the findings, limitations to the analysis and policy implications.

Chapter II
Establishing the Link Between Work and Crime: Recidivism and Labor Market Outcomes

Introduction

In this chapter, various theories will be presented that connect work and crime. In addition, numerous empirical findings from a variety of research will be introduced on this relationship. Work and crime are intricately connected. Bushway and Reuter (2002) note four theories that link work to crime: economic choice theory, control theory, anomie, and labeling theory. Economic choice theory purports that individuals weigh the relative costs and benefits of engaging in crime and choose the option that would maximize the individual's utility. Employment increases the opportunity cost to committing a crime and is not mutually exclusive to crime. Moreover, "[t]he individual, particularly in adolescent years, also has to decide how much to invest in human capital (education and other workforce relevant skills). If the legal labor market opportunities appear weak, a youth is less likely to make adequate investment in acquiring the human capital necessary for success in the legal labor market" (p. 201, Ibid). Thus, with economic choice theory it is possible to have investment in criminal human capital and underinvestment in legal human capital, thereby reducing future legitimate earnings (Ibid).

Control theory argues that "employment…is the main builder of pro-social bonds and institutions in a community and its absence results in large-scale disorder" and increased participation in criminal activity, both income-generating and violent (p. 201, Ibid). Anomie contends that frustration due to income inequality, and other macro level problems such as unemployment, leads individuals to resort to crime. Finally, labeling theory says that "[i]ndividuals who participate in crime acquire stigmatic labels (both to others and to themselves) and are then denied opportunities because of these labels. What is intriguing about

this theory is that it suggests the possibility of feedback between employment and crime" (p. 201, Ibid).

Labeling theory is very similar to segmented labor market theories (SLM). This theory is often referred to as a theory of dual labor markets because it argues that there are two distinct labor markets: the primary labor market and the secondary labor market. The primary labor market consists of "…jobs in large firms and/or unionized jobs, which tend to be better jobs– higher paying, more promotion possibilities, better working conditions, and more stable work. The secondary labor market which roughly overlaps large sections of the external labor market, contains the low-paid jobs that are held by workers who are discriminated against and who have unstable working patterns" (p. 1222, Cain, 1976). Traditionally, economists view tastes for work as exogenous variables that help to explain one's labor market achievements. However, SLM theorists argue that taste are actually endogenous and can be determined by success in the labor market (Ibid). In particular, discrimination and other systematic or random influences that cause individuals to enter the secondary labor market can trigger anti-work sentiments among low-income workers, thereby keeping them in a position of hardship (Ibid).

Both labeling theory and SLM are also similar to the notion of state dependence where past crime causes future crime. The theory is that once a crime is committed this influences the criminal's behavior such that it alters the probability of engaging in future crime (Sampson and Laub, 1992). This notion is used as an explanation of continuity in crime over the life course. Moreover, "…the idea that official labels, incarceration experiences, and rejection by institutions of informal social control are criminogenic is a classic state-dependence interpretation of the link between past and future crime" (p. 78, Ibid).

Literature Review

Crime and Employment.

There is empirical evidence that supports SLM, labeling theory and state dependence. Freeman (1996) investigates the high crime rates of young men and whether anything can be done to change these trends. Many offenders leaving correctional facilities return to society with weakened skills and prospects in the legitimate labor market, but gain increased opportunities and abilities in crime. Although criminality declines with age, "…the population of offenders is a relatively permanent part of American society—an 'underclass' problem group that will not disappear naturally" (p.27, Ibid). Freeman finds that statistics on criminal involvement do not paint the true picture of criminal activity because they only capture the activities of those individuals that have been caught. In the 1980 National Longitudinal Survey of Youth, 41% of young males interviewed admitted to having committed a crime in the previous year (Ibid).

If the number of criminals remains constant, then incarceration should reduce the level of crime in society by reducing the number of individuals who undertake criminal activities in society. Therefore, because the number of men in prison tripled in the United States from the mid 1970s to the mid 1990s, one would expect such mass incarceration to decrease the level of crime in society. However, the number of crimes reported to the police during that time actually stabilized leading Freeman to conclude that there must have been an increase in the number of noninstitutionalized men committing crimes. He develops an "…index of the 'Propensity to Commit [a] Crime'" in order to analyze this trend (p.29, Ibid). This measure reflects an increase in criminal participation "[i]f the number of crimes committed per criminal remains constant,…" and at the same time there are changes in the propensity to carry out an offense. He finds that

the propensity to commit a crime by men that were not incarcerated increased by 163 percent and the rate of criminal activity had a sharp increase (p.29, Ibid).

Freeman argues that the supply of youths to crime is very elastic and that young men are very responsive to the monetary returns of crime. From his survey of the literature, he provides six reasons for this argument:

1. [T]he demographics of the criminal population show that those who commit crimes consist disproportionately of persons with low legitimate earnings prospects—the young, the less educated, persons with low test scores, and so on.
2. [J]oblessness seems associated with greater crime.
3. [G]reater inequality is associated with higher rates of crime.
4. [I]ndividuals who commit crime have lower perceptions of the riskiness of crime, higher assessments of the relative earnings of criminal behavior and lower legitimate hourly pay
5. [T]ime worked by men in the lower deciles of the earnings distribution fell in the 1980s as their earnings fell…with a magnitude that suggests a nonnegligible supply elasticity.
6. [M]any youths combine crime and work or shift between them readily.

(pp.33-34, Ibid)

In addition, he finds "…that earnings from crime increased relative to earnings from legal work in the 1980s, and that the hourly rewards to crime exceeded the hourly rewards from legal work" (p.33, Ibid). However, because an infinitely elastic supply of crime implies that incarceration has no effect on the level of crime, focusing crime prevention on the individual rather than the market will overstate the effect of imprisonment on deterring crime. He concludes that if his analysis is true, long-term solutions to crime must also include increasing labor market opportunities for less-skilled youth.

Grogger (1998) also discovers that young men are sensitive to wages and that the increase in crime among young men is largely due to declining real wages during the 1970s and 1980s. Moreover, "…the racial differential in crime rates is in part a labor market phenomenon.

Blacks typically earn less than whites, and this wage gap explains about one-fourth of the racial difference in criminal participation rates" (p.787, Ibid). Finally, wages explain the inverse relationship between crime and age. Wages represent the opportunity cost to committing a crime and increase with age. As a result, crime also tends to decrease as age increase.

Witte and Tauchen (1994) examine the relationship between criminal activity and employment using a panel dataset of a 10 percent random sample of young men. An economic model of crime is developed where "…the optimal level of criminal activity, c*, depends on total income from legal activities, the preferences of the individual, and exogenous factors that cause the probability or sanctions functions to shift" (p.6, Ibid). However, unlike previous research, they do not assume crime and employment to be substitutes. Using a random probit model (the dependent variable is a binary variable for whether or not the individual is arrested during the year) the economic model of crime is tested. The main result is employment and school attendance significantly lead to reduced amounts of criminal activity in the same way.

Western and Pettit (2000) find that incarceration has contributed to racial inequality in young men's unemployment. In particular, "[w]hen prison and jail inmates are included in the labor force statistics, joblessness among disadvantaged young black men rose even as unemployment dropped to a thirty-year low in 1996" (p.10, Ibid). Moreover, Western and Pettit (2005) show that the penal system helps to mask unemployment inequality by removing low income men from the workforce (Ibid). In fact, they find that two-thirds of black-white wage convergence from 1985-1999 is accounted for by black joblessness. In particular, "…a third of all jobless young black men are in prison or jail compared to just 10% of white men. Incarceration is a major source of employment inequality, contributing significantly to selection bias in the estimation of black relative wages" (p. 574, Ibid).

The Revolving Door: Recidivism.

As part of the Urban Institute Roundtable on Prisoner Reentry Freeman (2003) "…summarizes the basic facts about the characteristics of prisoners and ex-offenders, the rate of recidivism in recent years, and the skill deficits and employer decisions that limit the employment prospects of ex-offenders" (p.3). This article is mostly qualitative, summarizing facts about prisoner characteristics and recidivism from other research.

He finds that approximately 7% of noninstitutionalized men were incarcerated at some point in their life. This number rises to 22% when looking specifically at black males. In the 1990s the flow of prisoners into civil society was approximately 30% of the annual growth of the labor force. In 1994, roughly 2/3 of released prisoners are rearrested and 50% are reincarcerated. In addition, rates of recidivism were higher for blacks.

Moreover, 19% of released prisoners had less than 8 years of education, and 67% of released prisoners had less than a high school education. Prisoners face a difficult job market because demand has shifted towards more educated workers and because of the influx of unskilled immigrants. Despite the economic expansion of the 1990s, the tight job market did not reduce recidivism. Ex-offenders have a harder time finding employment due to stigma and less work experience.

In addition, a disproportionate share of ex-offenders has some sort of medical condition that limits their ability to work: 10%-16% of inmates have been diagnosed or reported themselves as mentally ill. However, only 2% of the general population is estimated to be mentally ill. He mentions research by Gaes et al. (2000) that find on average behavior/cognitive treatments are more effective than educational, vocational training, or prison labor programs.

This leads him to conclude that addressing medical/mental problems should take precedence over work training programs.

Chen and Shapiro (2007) estimate how prison conditions affect recidivism. In particular, they investigate "the effect on recidivism of being assigned to a higher security level.[13] Since both the physical and social conditions of confinement vary dramatically with security level, this setting provides a quasi-experiment for identifying the effect of prison on post-release outcomes" (p.3). Using regression-discontinuity design, the authors find no evidence that harsher prison sentences decrease recidivism. However, they do find some support that recidivism may be higher for those inmates housed in more severe facilities.

Bales, Bedard, Quinn, Ensley, and Holley (2005) find similar results. They research the effect of private prisons on recidivism rates. Proponents of private prisons argue that they "…obtai[n] faster and cheaper bed capacity, lowe[r] operational costs, and improve[e] quality of service" (p.58). Thus, if private prisons are better facilities, then inmates assigned to private prisons would have a less severe punishment than those inmates designated to public facilities. Moreover, policy makers also believe they may be more effective in rehabilitating inmates. The authors "…us[e] a post hoc, quasi-experimental design to compare recidivism rates of inmates exposed to private prisons to comparable inmates without such exposure" (Ibid, p.66). Using survival analysis (proportional hazard model), they find that there is no statistically significant difference in recidivism rates among adult males, adult females, and youthful offenders.

If recidivism is viewed as a measure of social failure then it should be expected that communitarian societies that use "reintegrative shaming" as deterrence to have lower rates of

[13] They use arrest as their measure of recidivism

recidivism. Theories of deterrence argue "…that as the severity, certainty, and swiftness of sanctions increase the perceived risk of detection and punishment for future offenses increases, which in turn reduces reoffending (Gibbs, 1975). In contrast labeling theory predicts that formal sanctions increase reoffending by promoting a criminal self concept, limiting access to legitimate economic opportunities, and disrupting interpersonal relationships (Paternoster and Iovanni, 1989)" (Baumer, Wright, Kristinsdottir, and Gunnlaugsson, 2002, p.41). Baumer et al. (2002) suggest Braithwaite (1989) contends that communitarian societies should have lower rates of recidivism because, while they use formal and informal expressions of shame, they "exhibit a strong tendency towards reintegrative shaming. This is so because in communitarian societies offenders, victims, and other community members are deeply embedded in relationships of interdependency and mutual obligation. These conditions increase substantially the likelihood that community members will view offenders as total personalities rather than merely as criminals who should be excluded from social life" (p.42, Ibid). Two hypothesis fall out of Braithwaite's theory: 1) Communitarian societies should have lower rates of crime, and 2) Communitarian societies should have lower rates of recidivism (Ibid).

Baumer et al. (2002) tests the second hypothesis for the case of Iceland, "a society that possesses many of the social organizational hallmarks of communitarianism, that relies heavily on shaming as a means of social control, and features a shortage of human capital that creates strong economic incentives to reintegrate lawbreakers" (p.40, Ibid). Using survival analysis, they find that rates of recidivism are similar to countries that have less of a communitarian structure. However, prior research has found support for lower crime rates in Iceland. Thus, it appears as though these results suggest that shame may cause lower crime rates but does not work to deter recidivism. Moreover, these findings may also suggest "…that the functional

aspects of exclusion may override prevailing reintegrative forces, even in communitarian societies characterized by low crime rates" (p.54, Ibid).

Bayer, Hjalmarsson, and Pozen (2007) seek to investigate how social networks and interactions affect "human capital" in criminal behavior. They do this by analyzing the "influence that juvenile offenders serving time in the same correctional facility have on each other's subsequent criminal behavior" (p.21, Ibid). They include fixed effects for facility and facility-by-prior offense in their regressions in order to control for the non-random assignment of youthful offenders to particular facilities. This insures that identification of their model is solely on the variation in the length of time any two individuals are housed in the same facility during the same time. Peer groups in juvenile facilities are constantly changing over time, due to the release and admittance of new offenders. Therefore, as long as the date that the individual is assigned to the facility is random in relation to the assignment of other offenders in the facility during the sample period then this method will control for the non-random assignments of juvenile offenders to facilities. The main data they use is the internal database maintained by the Florida Department of Juvenile Justice. They collect data on youths released from correctional facilities between July 1, 1997 and June 30, 1999. The final dataset contains 8,216 youthful offenders who are seventeen years old or younger.

The authors are most interested in determining "…whether exposure to peers with a criminal history in a particular crime category increase an individual's propensity to recidivate in that same crime category" (p. 6, Ibid). As a result, they use recidivism defined as a subsequent criminal charge after release from custody in a correctional institution, as their dependent variable. There are three right hand side categorical variables of interest: two interaction terms that capture whether the individual was exposed to a peer who committed the same offense or a

different offense, and a dummy for whether or not an individual has a history of the particular offense. They run regressions of their main model for ten crime categories simultaneously using seemingly unrelated regression analysis as their framework.

They find that when juveniles are exposed to peers who commit the same crime as they do, their probability to recidivate increases. This effect is significant. However, there is no evidence that exposure to peers who have committed different offenses has any effect on a youth's likelihood to recidivate in that particular offense, i.e., there is no evidence that youths learn different criminal trades while in confinement. They also find that peer effects may vary for different offenses depending on the type of facility, i.e. residential or nonresidential. Nonresidential facilities have a strong reinforcing effect for auto theft, robbery, and felony drug crimes. The residential facilities have reinforcing effects for burglary and misdemeanor drug offenses. This leads the authors to conclude that nonresidential facilities may enhance criminal social networks.

Sirakaya (2006) investigates how social interactions affect recidivism among a national sample of female, male, black, white, and Hispanic felony probationers. A cox-proportional hazard model is first used including social interactions, and then Bayesian model averaging is applied to account for model uncertainty and to select relevant covariates. There are three types of social effects: endogenous, contextual, and correlated. Endogenous effects are when individual choices are affected by the actions of others; they "imply that the net benefit of recidivating increases as others also recidivate (e.g., while one person is being arrested, it might be harder to arrest someone else for the police)" (p.865, Ibid). Contextual effects occur when exogenous characteristics of the faction in which the individual belongs influences behavior. For example, contextual effects would be seen if recidivism rates differ by socioeconomic status.

Finally, correlated effects would occur if those in the same cohort conduct themselves similarly due to having similar traits or having to confront the same institutional environments. Distinguishing "…between exogenous social effects and social interactions is important because social interactions generate social multipliers, causing a singular change in one individual's decision to culminate in a multiple change in the population behavior" (p.865, Ibid).

The results indicate that social interactions are important influences on recidivism. In particular, "social interactions as measured by the percent recidivists in the neighborhood and the mean time to rearrest among them, are significant. The higher the percentage of probationers who recidivate in the jurisdiction of a probationer (the lower the mean time to rearrest among them), the higher will be the risk of recidivism for the probationer" (p. 872, Ibid). Covariates that indicate a lower risk of recidivism are: being female, having a high school diploma or GED, being employed for a higher percentage of time, and having a higher percentage of individuals below the poverty line within the probationer's neighborhood. Explanatory variables that increase the risk of recidivism are: being Black or American Indian/Pacific Islander, being Hispanic, being young, having a prior felony conviction, more intensive drug abuse, a shorter probation term, a more stringent supervision level, and increasing the percentage of Hispanics in the neighborhood.

Kim, Benson, Rasmussen, and Zuehlke (1993) investigate recidivism among drug offenders in Florida to see if they are affected by incentives and constraints hypothesized by economic theory. The determinants of recidivism are grouped into four categories: 1) opportunity costs, 2) Disincentives and enforcement, 3) control variables, 4) duration effects (Ibid). Opportunity costs are covariates that affect forgone earnings due to incarceration. Those used in the study are employment status at arrest, county of release, average wage and salary

earnings, race, and age.[14] Disincentives and enforcement variables are those produced by the criminal justice system through the probability of arrest, probability of conviction, and prison terms. Disincentive effects included in this analysis are the number of sworn officers per 1000 population and the proportion of drug arrest over total arrest as proxies for probability of arrest, probability of conviction given arrest measured as the conviction/arrest ratio, and time served quantified as the number of days served in the prior incarceration.

Control variables include individual and neighborhood characteristics that affect a criminal's decision to commit a crime. Those included in the model are number of prior probations, number of prior incarcerations, supervised release, marital status, gender, proportion of prior sentence served, crime committed, and population density. Finally, "duration effects measure how the conditional probability of recidivism changes with time away from prison, given that the person has not already returned to Department of Corrections (DOC) control" (p. 173, Ibid). Duration effects are captured by the duration elasticities of the hazard models employed. Two methods were used to calculate duration: "[f]irst, every drug offender with a release date prior to April 2, 1990 was identified. Two variables were created. (1) A dummy variable…takes a value of 1 if the offender has returned to DOC custody; if the person remains free the variable takes a value of zero. (2) Duration of completed spells… is the difference between the release date and the readmission date. For incomplete spells duration is the difference between the release date and the survey date (April 2, 1990)" (pp. 176-177, Ibid).

Hazard models based upon Lancaster's (1979) reduced-form Weibull models are used to estimate the effect of recidivism for drug offenders. Moreover, unobserved heterogeneity is

[14] There was no reliable direct measure for opportunity costs in their sample, thus all of the measures are indirect measures of the opportunity costs Kim et al. (1993).

controlled for via non-parametric estimation. Unobserved heterogeneity has no bearing on the robustness of the results for the coefficients measuring the baseline hazard rate. The opportunity costs variables found to be significant are age and race. They both had the negative expected sign. However, those variables reflecting employment opportunities were not found to be significant. Thus, " [o]pportunity costs appear to be more significantly influenced by individual characteristics (e.g., age, race) than local labor market characteristics" (p.177, Ibid). Among the disincentive variables the only one that was statistically significant was the number of sworn officers per capita; it has a negative relationship with recidivism. Moreover, the propensity to recidivate is higher among those individuals who were placed on probation instead of incarcerated. Drug enforcement, measured as the proportion of drug arrests to total arrests, has a positive significant effect on recidivism. Variables measuring individuals' prior tendencies to commit a crime, prior prison term, prior probation, proportion of time served, and crime committed under the influence, all had positive significant effects on recidivism except for prior probation.

Duration elasticities are sensitive to heterogeneity in the data. While duration elasticities for those sentenced to prison terms are positive and significant whether or not heterogeneity is controlled for, the duration elasticity for those sentenced to probation is not resilient to heterogeneity, implying that probationers are a heterogeneous group. Once heterogeneity is controlled for, probationers have positive and significant duration elasticities. Offenders sentenced to probation have a higher probability of recidivating than do those sentenced to prison. In conclusion, the results of this study provide support that "…the economic theory of crime can appropriately be applied to drug criminals" (p.180, Ibid).

Gendreau, Little, and Goggin (1996) perform a meta-analysis on 131 studies generating 1,141 effect sizes in order to determine the strongest predictor domains of adult offender recidivism. There are two types of risk factors for recidivism: static and dynamic. Static predictors are characteristics that cannot be changed such as age, criminal history, etc. Dynamic factors, or criminogenic needs, can be changed and are those that should serve as targets of treatment such as antisocial cognitions, values, and behaviors (Ibid). There has been substantial controversy and/or lack of interest surrounding dynamic predictors of recidivism. The authors provide three main reasons for this: 1) ideological concerns and professional self-interest has caused criticism over the use of individual differences as controls; 2) some researchers believe they are unreliable because they can change over time and their measurement is more subjective in nature; and 3) opposition by criminal justice professionals that inclusion of criminogenic needs will enhance forecasts of recidivism (Ibid). The predictors of recidivism analyzed are:

Static Predictors

1. Age: at time of data collection/assessment
2. Criminal history: adult prior arrest, probation, jail, conviction, incarceration, prison misconducts.
3. History of antisocial behavior: preadult–prior arrest, probation, jail, conviction, incarceration, alcohol/drug abuse, aggressive behavior, conduct disorder, behavior problems at home and school, delinquent friends.
4. Family criminality: parents and/or siblings in trouble with the law.
5. Family rearing practices: lack of supervision and affection, conflict, abuse
6. Family structure: separation from parents, broken home, foster parents
7. Gender.
8. Intellectual functioning: WAIS/WISC, Raven, Porteous Q score, learning disabilities, reading level.
9. Race: white vs. black/Hispanic/native
10. Social class of origin: socioeconomic status (SES) of parents (parental occupation, education, or income).

Dynamic Predictors

11. Antisocial personality/sociopathy/psychopathy scales: MMPI Pd, Megargee system, EPI-Psychoticism, Socialization scale of the California Personality Inventory (CPI-Soc), Psychopathy Checklist (PCL-R), DSM-III personality disorders, any indices of egocentric thinking.
12. Companions: identification/socialization with other offenders
13. Criminogenic needs: antisocial attitudes supportive of an antisocial lifestyle and behavior regarding education, employment.
14. Interpersonal conflict: family discord, conflict with significant others.
15. Personal distress: anxiety, depression, neuroticism, low self-esteem, psychiatric symptomatology (i.e., psychotic episodes, schizophrenia, not guilty by reason of insanity, affective disorder), attempted suicide, personal inadequacy.
16. Social achievement: marital status, level of education, employment history, income, address changes.
17. Substance abuse: recent history of alcohol/drug abuse.

Composite Measures

18. Level of Service Inventory (LSI-R), Salient Factor Score (SFS), Wisconsin, Other risk scales

(Ibid)

Since composite measures are not used in this research, focus is placed on static and dynamic predictors. Pearson product-moment correlation coefficients were calculated for each predictor (Ibid). The findings indicate that all 17 domains were significant forecasters of recidivism, with adult criminal history, antisocial personality, companions, and criminogenic needs having the largest correlations with recidivism.

Imprisonment and Labor Market Outcomes.

As noted above the decision to commit a crime and labor market outcomes are intricately connected. It may be "…that poor education, job prospects, and wages can lead to imprisonment, which in turn becomes a life-changing event and, in itself, leads to lower wages,

poor wage growth, and unemployment" (p. 594, Western, 2007). According to labeling theories, state-dependence, and SLM theory this in return can lead to a vicious cycle where former offenders become embedded in a life of crime. Thus, crime itself becomes criminogenic.

Western et al. (2001) review research on the effects of imprisonment on labor market outcomes of offenders and highlights the endogeneity behind incarceration and employment. The "…historically unprecedented growth in the penal population is highly concentrated among young, low-skill, minority men" (p. 411, Ibid). Two issues affect the reentry of prisoners into the labor market:

1. First, if spending time behind bars seriously damages the employment prospects of criminal offenders, the massive growth in the penal system will have a devastating impact on the economic opportunities of minorities and those with little education. Because prison time has become pervasive among low-skill minority males, a large earnings of employment penalty incurred by incarceration will significantly deepen racial and educational inequality among men (p. 411, Ibid).
2. Second, incarceration rates have reached astonishing levels at the margins of the labor market among men whose employment prospects are extremely poor even in the absence of incarceration…Incarceration may not be undermining the economic opportunities of ex-inmates; it may simply be officially earmarking severely disadvantaged men who would otherwise have poor job prospects, although without the dubious distinction of membership in a policy-relevant population (p. 411, Ibid).

Nonetheless, it is imperative to note that these shifts in incarceration have not been due to changes of offender behavior, but rather changes in policy: harsher sentences and a more disciplinary attitude toward postrelease supervision (Ibid). Thus, the shift in incarceration reflects exogenous policy shifts, making incarceration not only an indicator of behavior but also changes in public policy.

Incarceration affects labor market outcomes through three mechanisms: stigma, acquiring human capital, and obtaining social capital. Incarceration marks offenders as untrustworthy making it difficult for them to find employment. In fact, offenders with felony records may be temporarily unable to find employment in licensed or professional positions, as well as public sector employment in some states. In addition, incarceration may weaken offenders' job skills, hinder their attainment of job skills compared to those who are free, and lower their productivity through attrition of human capital. Incarceration may also worsen physical and mental disabilities of inmates. In addition, behaviors that are consistent with survival in a prison environment are incompatible with work environments. Finally, offenders are unable to build social capital that would enhance legitimate employment prospects while imprisoned. In this view, they are unable to build relationships that help to connect workers to employers, but may strengthen criminal networks that aid in increasing criminal activity.

When analyzing incarceration over the life course it is evident that "…the incarceration of young men disrupts entry into stable career jobs with strong earnings. Consequently, many ex inmates find work in casual or illegitimate employment in the secondary labor market (Sullivan, 1989)" (p. 414, Ibid). Moreover, the effect that the increase in prison population has on social networks, norms, and employment opportunities outside of prison must also be considered. If offenders are coming from specific neighborhoods, then they will change the social dynamics of these areas. For example, a community with a high concentration of former offenders "could affect firms' locational decisions and so reduce labor demands" (p. 415, Ibid).

The research analyzed shows that incarceration has little effect on employment, but has a significant negative effect on earnings. Over the life course, it appears that the impact on

earnings tend to increase with age, especially for those who held white-collar occupations prior to imprisonment. There is also evidence to suggest that program effects differ with age.

Grogger (1995) investigates how arrests affect employment and earnings of a random sample of young men born in 1956, 1958, 1960, and 1962. Longitudinal arrest records from the California Department of Justice are merged with earnings records from 1980-1986 from the California Employment and Development Department. A distributed lag fixed-effects model is used to exploit the longitudinal structure of the data and to allow arrests and prosecutions to influence current and future labor market effects. In addition, a counterfactual is constructed from the data by exploiting the fact that each individual is arrested at different times. In particular, the earnings of individuals arrested in 1984 or earlier are compared to those arrested in 1985 or later, the latter forming the comparison sample. The dependent variables are earnings per quarter and employment (a binary variable equal to one if the individual had positive earnings in the quarter). The covariates used are arrests (a binary variable equal to 1 in the quarter in which the individual was arrested), arrested more than once (a binary variable equal to 1 if the person was arrested more than once in a quarter), a binary variable for whether or not the arrest was "…for a property offense (robbery, burglary, larceny/theft, or autotheft)," binary variables for the judicial outcome of the arrest and sentence (convicted, unknown disposition, disposition in progress, probation, jail and probation, jail, prison, and sentence missing), age (in quarters), a variable indicating whether or not the individual was black, a binary variable indicating if the person was Hispanic, and three binary variables indicating if the individual was born in 1958, 1960, or 1962 (p.56, Ibid).

Results indicate that arrests have a small short-lived effect on employment and earnings. Moreover, the correlation between arrests and labor market outcomes seems to be due to

unobserved heterogeneity (e.g., education), and not a causal relationship. Nonetheless, property offenses have a modestly larger and a more lasting effect on earnings and employment. This may help to support economic theories of crime in the face of strong empirical evidence that suggests that arrests have strong negative effects on crime and evidence that the probability of arrest is actually fairly high (Ibid). If the effect of crime on labor market outcomes is fleeting, then "…widespread crime may well be consistent with optimizing behavior" (p. 70, Ibid). It is also found that the variables measuring convictions, while for the most part positive, do not significantly affect earnings. In addition, among the sentencing variables probation had no significant effect on earnings, while the incarceration variables had strong negative effects on earnings. For the most part, the effects of conviction and sentencing on employment are comparable to those found in earnings. However, not surprisingly, probation sentences increase post-sentence employment considerably.

Needels (1996) examines "…how human capital characteristics such as race, education, age, and criminal history affect employment rates and earnings levels for prison releases" (p. 474). There are several theories that connect crime, human capital, labor market outcomes, and recidivism rates. Rational choice models posit that offenders are rational actors maximize their net expected payoffs to committing a crime. In this framework, individuals with little human capital may continue to commit crimes because they receive a greater return in doing so. Dual labor market theories conjecture that offenders are caught in low paying jobs that require few skills and little commitment. Therefore, criminals have little reason to acquire additional skills. It is also possible that criminals are not rationally acting individuals at all. According to this train of thought, offenders are "are radically present-oriented and do not think about the future (DiIulio 1996; Wilson and Abrahamse, 1992). The relationship between crime, human capital,

and employment arises because criminals only pursue activities that provide immediate gratification. They therefore do not invest in human capital–the legal-sector earnings gains are slow to materialize, whereas gains from crime are often immediate (and punishment is slow to materialize)" (p. 472-473, Ibid).

Needels uses data from the Transitional Aid Research Project (TARP) collected over "…17 years of criminal activity and 9 years of earnings for a large sample of men released from the Georgia prison system in 1976…" (p. 474, Ibid). TARP was a randomly assigned social experiment providing income to newly released inmates in order to reduce recidivism rates and increase employment outcomes. Research conducted by Needels (1994) found the program to have no significant long-term effects on recidivism or earnings (Ibid). The results indicate that race and education had no effect on employment but did have an effect on earnings in the traditional manner. Moreover, age and its square has no impact on earnings, but they do significantly affect whether any earnings were observed in the time period analyzed. Other variables having significant negative effects on employment are not being born in Georgia and whether or not the offender was released from a medium/high security facility. Percentage of time incarcerated and percentage of time on probation from 1983-1991 had significant positive effects on employment. However, these variables may be identifying if the individual was in Georgia during the time unemployment data were collected. Nonetheless, "…time spent incarcerated did not significantly affect life cycle earnings levels during nonincarcerated time" (p. 491, Ibid). First-offender status had a positive impact on earnings, while number of arrest prior to 1983 had a negative effect.

Kling (2002) looks at the effects of prison sentence length on short-term and long-term labor market outcomes (i.e., effects on employment and earnings) of people convicted of

committing serious crimes in California. He created the dataset "…by linking information about criminal defendants in California federal district court felony cases from 1983-1994 with quarterly earnings data collected through the California Unemployment Insurance system from 1987-1997" (abstract, Ibid). He uses three linear econometric techniques, which he refers to as "OLS methods," and instrumental variables (IV) estimation to analyze prison sentence length on employment and earnings.

The first model looks at the labor market outcomes of individuals serving prison terms of different lengths controlling for differences in observable characteristics. The second technique uses differences-in-differences to compare labor market outcomes of post-conviction convicts to individuals with similar characteristics who have not yet been convicted (pre-case filing). The third strategy, while similar to the difference-in-difference method, is a linear model that controls directly for differences in individual earnings history prior to case filing. The IV model uses judge assigned to hear the case as an instrument for sentence length. Kling argues that judges are randomly assigned cases within their district and office, and is therefore a valid instrument when their only impact on labor market outcomes is through prison sentence length. The control group for the time served in prison indicators is those who were convicted of committing a crime but did not serve time in prison.

Kling finds that incarceration has a small impact on employment compared to those who are not incarcerated, and that this effect is increasing in prison sentence length. However, those with longer sentences return to pre-incarceration employment levels just as quickly as those with shorter sentences. Moreover, incarceration has a greater negative effect on earnings than on imprisonment, but this effect is primarily concentrated among white collar criminals. There is no difference in earnings by length of sentence among violent and drug offenders.

Grubb (2001) attempts to measure how the market responds to criminality through analyzing auction prices for British convicts sentenced to servitude in America from 1767-1775 within a human capital framework. The results indicate that convicts had a 21 percent lower per-year price than voluntary indentured servants, and that further discounts were made for type and severity of crime in the expected directions.

Piehl (2003) looks at the mechanisms through which work has played a factor in criminal acts and crime prevention. Several conclusions about the relationship between work and crime are made from her analysis of the literature. For example, work programs should reduce crime and increase legitimate earnings. However, there is no trade off between work and crime (i.e., they are not necessarily substitutes). Offenders may not be in a position to consider the long-run if the short-term need for cash is immediate and if they have no access to credit markets. In theories of social control and anomie, positive work connections can lead to reduced criminal activity.

However, "[t]o the extent that offenders are embedded in a full lifestyle of a variety of anti-social behaviors (Hagan, 1993), it is unlikely that making one aspect of life more pro-social (work) will be sufficient to overcome long-held behavioral patterns and pressures to persist" (p.6, Ibid). Thus, it will take a good job to attract criminals out of a lifestyle of crime; however, these jobs will be hard to find for individuals with low skill levels such as offenders. Moreover, many jobs that may be good in the long-run do not look as attractive in the short-term. In addition, those offenders released from prison typically need jobs with immediate start dates and frequent pay periods, characteristics not held by good jobs. It is also possible that emphasizing

work only can get in the way of human capital investment which may be more beneficial in the long-run (Ibid).[15]

Nonetheless, legitimate work does help offenders to restore trust and make up for the stigma of their unlawful actions. Moreover, work could play a key role in prisoner reentry but it is uncertain exactly what form it should take (e.g., should it take the role of job search, work experience, vocational education, etc.) (Ibid). In addition, because offenders are a fairly heterogeneous group in "…the degree to which they are 'embedded' in deviant lifestyle, and their relationships with people and institutions that would support rather than retard change," it may be more effective for programs to target those individuals most likely to be rehabilitated (p.10, Ibid). Due to many inmates having serious mental health, intelligence, and/or substance abuse issues, vocational programs may be most successful for the upper end of the inmate distribution.

Tyler and Kling (2007) use Florida department of corrections data to test whether or not inmates who obtain a General Education Development (GED) credential while in prison receive a premium in the mainstream labor market compared to dropout offenders who did not participate in a GED program. They also analyze whether the labor market places any additional value to having obtained the credential verses just participating in the curriculum. Using fixed effects, they find that the earnings of white GED holders are no different than those of white dropout offenders. Non-whites who obtain a GED have higher earnings than non-white dropouts (roughly a 20 percent increase in earnings); however, these benefits dissipate over time. Finally, there doesn't appear to be an extra benefit to obtaining the credential over simply participating in the program.

[15] Many offenders have to secure work as conditions for parole.

Rehabilitation through Private and Public Prison Work Programs.

Finally, this section presents various research on the effects of private and public prison work programs on recidivism. Private industry prison work programs can only be operated through PIE. Smith et al. (2006) is the only study to research the PIE program in this section, all the other studies investigate public prison programs known as traditional industries. Smith et al. (2006) used a "quasi-experimental design by using matched samples with a test group of PIECP participants and two control groups of those who work in traditional industries (TI) and those involved in other than work (OTW) activities using quantitative analysis of data collected from agency records" (p.7). These inmates were matched on six criteria: exact matches on race, gender, and crime type; and category matches on age, time served, and number of disciplinary approach. The purpose of matching the inmates was to obtain a sample of observations that would qualify for participation in PIECP. A cluster sampling strategy, which resulted in the selection of five states, was used for site selection. All in all, the data contain three matched samples each of approximately 2200 inmates, released from 46 prisons across 5 PIECP states (certified prior to 1996) between January 1996 and June 2001. They sought to answer two questions with their research: "1. Does PIECP participation increase post release employment as compared to traditional industries (TI) work or other than work (OTW) activities? 2. Does PIECP participation reduce recidivism as compared to traditional industries work or other than work?" (p.8, Ibid).

The variables used to measure employment effects are measured by time to obtain employment (the amount of time that passes between the inmates release from prison and the reporting of earnings in a given quarter), and time from employment to job loss (how much time elapses before no earnings are reported in a given quarter). Recidivism is measured by the time

it takes from release to the first act of recidivism (measured as arrest, conviction, and incarceration). Smith et al. (1996) analyze these questions by using survival analysis. In doing so they are able to "...measure failure rates between groups receiving different treatments by measuring the time between release and employment or recidivism and comparing the groups" (pp.51-52). The authors argue that survival analysis is a better tool to measure employment outcomes and recidivism rates between the three groups of interest than the traditionally used fixed period analysis because it tracks failure at any given point instead of at the end point. Moreover, unlike the fixed point analysis, the month and the year that the event occurs is not important.

The main findings are that inmates who work in PIECP at least one day obtain employment quicker, obtain higher wages, and maintain their employment status for longer periods than TI and OTW releasees. Moreover, more PIECP participants remained arrest-, conviction-, and incarceration- free than TI and OTW participants. Results for TI and OTW did not significantly differ from one another except in the category of obtaining employment where TI releasees obtained employment much quicker than OTW releasees.

Saylor and Gaes (1997) seek to analyze the effect of public inmate work programs "…and skills training on institutional adjustment, licit wages after release, and post release recidivism" (p.6). They proclaim to be the first study to attempt to control for selection bias when evaluating prison training programs. They argue that selection bias coupled with small sample sizes has resulted in insignificant results for prison work/vocational programs on recidivism. They control for selection bias through using propensity score matching techniques to identify a valid counterfactual group. Moreover, they use data from the Post-Release Employment Project (PREP) to obtain a larger sample size.

The project "…was designed to evaluate the impact of prison work experience, and vocational and apprenticeship training on an offender's behavior following his or her release to the community. The evaluation began in 1983 and data were collected through October 1987 on over 7000 offenders" (p.1, Ibid). The benefit of using this dataset is that it was designed to be a longitudinal evaluation. The treatment group was comprised of inmates who had worked in industrial prison programs or who had participated in prison vocational or apprenticeship training. The comparison group was chosen from inmates who had not taken part in prison work or vocational programs, but were released during the same calendar quarter as those in the treatment group.

The results from the logistic regression that produces the propensity score suggests that individuals in the treatment group were more likely to: enter into a halfway house upon release, to be younger during the incarceration period, to have served a longer sentence in prison, to have committed a violent offense, to be non-hispanic and white, to have been held in a higher security level facility, and to have had no history, or very little history, of violence in their past.

Their main findings are that offenders in the treatment group were more likely to be employed in "…machine trades, structural work, and miscellaneous occupations" compared to the distribution of the general U.S. labor force in 1983 (p.13, Ibid). Those in the comparison group had similar results except they were also more likely to work in service jobs. Both groups were least likely to work in professional and clerical/sales positions. While incarcerated, individuals in the treatment group were 15% less likely to receive an incident report than the counterfactuals. Upon release, for those individuals sent to a halfway house, although they found no difference in recidivism between the comparison and treatment groups, those individuals in the treatment group were more likely to obtain full-time employment or day labor

while in the half-way house than the control group. Finally, they found that those individuals who participated in work or vocational/apprenticeship programs while incarcerated were 35% less likely to recidivate and 14% more likely to be employed within the first twelve months of release.

Saylor and Gaes (1997) also looked at a measure of long-term recidivism by testing the impact of prison industries on the time it takes to recommit a federal offense. Subjects in this sample were followed 8-12 years from their initial release date. Their measure of recidivism was being recommitted to a federal facility for a new offense. Their analysis finds that "…hispanics, blacks, younger inmates (ages 18-24), inmates with longer periods of time served, and inmates released in 1985…" were significant and more likely to recidivate (p.21, Ibid). Of most relevance to this study they find that inmates who worked in prison industries were 24% less likely to recidivate, while those who participated in vocational/apprenticeship programs were 33% less likely to recidivate. Those individuals who took part in prison work programs, vocational courses, and apprenticeship training were 23% less likely to recidivate. Nonetheless, only the two variables indicating participation in prison industry programs and vocational/apprenticeship programs were significant.

Using survival analysis, Saylor and Gaes (2001) extended their research from Saylor and Gaes (1997) in order to investigate whether prison industry and vocational training had a differing effect on recidivism for different racial and ethnic groups. They found that "[r]egardless of whether a minority was defined on the basis of race or ethnicity and despite their being at a higher risk of recidivism, minority groups benefitted more from vocational training and industries participation than their lower risk non-minority participants" (p.23, Ibid). Moreover, vocational training inmates were the least likely to recidivate over time, followed by

inmates who participated in prison industries, regardless of race or ethnicity. In addition, vocational training and prison industry programs have a greater effect on groups that are more likely to recidivate over time.

Maguire, Flanagan, and Thornberry (1988) investigate the impact public prison work programs have on recidivism. They used data collected by the Prison Industry Research Project. They identified participants in the project at seven maximum-security state correctional facilities in New York. They selected inmates who were employed for at least 6 continuous months in a prison industry during the 1981-1982 calendar years. They compiled a sample of inmates confined in the same correctional institutions over the same time period who did not participate in the program during their confinement as a comparison group. Their final dataset was comprised of 1434 inmates. Using standard tests of statistical independence, they compared industry nonparticipants and participants on a variety of variables. They found that industry participants were older at the time of incarceration, served longer sentences, and had lower annual rates of prison violations during incarceration. Inmates who participated in prison industries were also more likely to be employed the month prior to arrest and were less likely to have records of drug abuse prior to imprisonment. The samples were similar "…in terms of race, commitment offense, prior felony arrest, preprison educational achievement, occupation, military experience, or marital status" (Ibid, p. 9)

To estimate the effects prison industry participation has on recidivism they use a Cox proportional hazards model. Their measure of recidivism was any felony arrest following release from incarceration. The hazard rate gives the probability of an event occurring at a particular point in time provided the individual is at risk during that time period. Participation in prison industries is in part due the decision of prison officials and in part a decision of the inmate (Ibid).

The authors attempt to control for this selection by including variables to control for this decision. They find that industry participation was not significant and had the smallest effect out of all of the independent variables analyzed in the model. Moreover, participation in prison industries actually increased the hazard of rearrest (Ibid).

Wilson, Gallagher, and MacKenzie (2000) conduct a meta-analysis on education, vocational, and work programs available to inmates while incarcerated. Research on these topics has been inconclusive as to whether these programs are effective in lowering recidivism due to three factors.[16] They analyze 33 studies reporting 53 program-comparisons in order to determine "whether participation in these programs produces reductions in the future offending behavior of adult criminals, …[and] whether there are differential effects across the program types and method features of the studies" (Ibid, p. 349). Of the studies investigated, analysis of vocational programs was the most common, while correctional work and correctional industries were the least observed. The comparison group was usually a sample of inmates who had not participated in the program of interest, who were matched to participants post-hoc or covariate-adjusted analysis (Ibid). Except for the study by Saylor and Gaes (1997), most other studies failed to control for important causes of selection bias, with the typical control variables limited to age, race, and gender. Two-thirds of the studies measured recidivism as reincarceration rates, while the remaining research defined recidivism as either arrest rates, conviction rates, or parole revocation.

The results indicate that participants in these programs are employed more than nonparticipants and recidivate at a lower rate. When comparing across programs, it appears as

[16] Meta-analysis is a statistical technique used to combine and synthesize results from different studies that focus on related topics.

though education programs are the most effective, while the evidence on work programs was unsatisfactory to conclude that work programs reduce recidivism. However, there is evidence to support correlation between employment and crime. Most of the studies used a quasi-experimental design. Nonetheless, because 89 percent of the research methods were of poor quality, "[i]t cannot be concluded from this empirical evidence…that the activities of the programs led to increased employment or reduced reoffending" (Ibid, p.361). In particular, many of the studies suffered from selection bias and failed to adequately control for it their research. There are several mechanisms through which selection bias works. For example, "Gottfredson and Hirschi's (1990) self-control theory views offending as an expression of stable individual differences in impulsivity (i.e., self-control). Voluntary participation in a corrections based program may also be an expression of this enduring personality trait" (p. 363, Ibid). In addition, "…program participants may have a higher average level of social bond to conventional society (e.g., Sampson and Laub 1993; Thornberry and Christenson 1984)[,]" and being sentenced to prison may act as motivation to some individuals to change their lives (p. 363, Ibid).

However, although these studies were of poor research design, they did not upwardly bias the outcomes to be positive. The results do suggest that attrition caused an upward bias in the outcomes: "…the program group is more likely to lose those participants that will recidivate than the comparison group" (p. 359, Ibid). The authors suggest "…incorporating theoretical expectations with regard to both the self-selection process into the program and the linkages between the causal agent, that is, the education, vocation, or work program, and the anticipated distal effect of a reduction in criminal behavior" (p.362, Ibid). Moreover, future studies should

emphasize isolating the effects of these programs and adequately controlling for selection bias so that causality can be determined.

This chapter presented the findings of previous research on the relationship between crime, recidivism, and labor market outcomes. The next section, Chapter III, will develop a theoretical model that incorporates prison labor into the criminal's decision to commit an offense. The results from this chapter and the theoretical analysis to follow will be used to guide the empirical examination of Chapter V.

Chapter III
Theory

Introduction

In the previous section, different theories that establish the connection between crime and labor, as well as previous research on this relationship, were presented. In this section, the economic choice framework will be used to explicitly incorporate the effects that working while in prison will have on the decision to commit a crime. In this way, previous theories on criminal behavior will be extended. Moreover, the results will provide a theoretical foundation for the empirical work to follow.

The theory of criminal behavior as rational choice was first presented by Beccaria and Bentham (Eide, 2000). However, Becker (1968) is the first economist to formalize and modernize Bentham's main idea that an individual will commit a crime if the benefit outweighs its cost (Ibid).[17] Following closely behind further developing the theory of criminal rational choice are Allingham and Sandmo (1972), Erlich (1973), Sjoquist (1973), Kolm (1973), and Singh (1973). Becker (1968) states

> [s]ome persons become "criminals," therefore, not because their basic motivation differs from that of other persons, but because their benefits and costs differ. I cannot pause to discuss the many general implications of this approach, except to remark that criminal behavior becomes part of a much more general theory and does not require ad hoc concepts of differential association, anomie, and the like, nor does it assume perfect knowledge, lightening-fast calculation, or any of the other caricatures of economic theory (p.176).

[17] Eide (2000) notes that Bentham ([1788] 1843, p. 399) wrote that 'the profit of the crime is the force which urges man to delinquency: the pain of the punishment is the force employed to restrain him from it. If the first of these forces be the greater, the crime will be committed; if the second, the crime will not be committed'" (p.346).

Erlich (1973) also explains how:

> Much of the search in the criminological literature for a theory explaining participation in illegitimate activities seems to have been guided by the predisposition that since crime is a deviant behavior, its causes must be sought in deviant factors and circumstances determining behavior. Criminal behavior has traditionally been linked to the offenders presumed unique motivation which, in turn, has been traced to his presumed unique inner structure, to the impact of exceptional social or family circumstances, or to both (for an overview of the literature see, e.g., Taft and England [1964]).
>
> A reliance on a motivation unique to the offender as a major explanation of actual crime does not, in general, render possible predictions regarding the outcome of objective circumstances…Our alternative point of reference, although not necessarily incompatible, is that even if those who violate certain laws differ systematically in various respects from those who abide by the same laws, the former, like the latter, do respond to incentives. Rather than resort to hypotheses regarding unique personal characteristics and social conditions in general affecting preference for crime, one may separate the latter from measurable opportunities and see to what extent illegal behavior can be explained by opportunities given preferences. (pp. 521-522)

While Becker's 1968 essay focused primarily on optimal policies, Ehrlich (1973) and Sjoquist (1973) developed formal models of the criminal choice problem that were extended by other economists such as Block and Heineke (1975), Heineke (1978), Schmidt and Witte (1984), etc. These first models were static models of criminal behavior analyzed in a Von-Neumann-Morgenstern expected utility framework. Some economists have more recently modeled crime

in a dynamic model, such as Leung (1995), who looked at recidivism of a risk-neutral individual and Mocan, Billups, and Overland (2005) who considered criminal behavior in a human capital framework.

Critics to the rational framework approach to crime state that this method is inconsistent with the reality of crime (McCarthy, 2002). They argue that "the rational choice approach describes offenders who collect all relevant information, and weight it carefully, systematically, and effectively before acting. According to these scholars the rational choice approach envisions offenders who regard crime as the illegitimate equivalent of labor-force participation, whereby they can consistently obtain financial returns that surpass those of legal work; they then use this income prudently rather than "irrationally" (e.g., gambling, partying, purchasing expensive clothes)" (Ibid). Nonetheless, this is not the intent of the rational choice approach, as demonstrated above in Ehrlich's (1973) comments.

The main differences among theories of crime[18] and the rational choice approach are that the latter seek to determine how preferences affect choices, while the former looks to explain the source of preferences (McCarthy, 2002). Other critics argue that the rational choice approach is only applicable to certain crimes. In other words, "…it is better at explaining 'instrumental' rather than 'expressive' offenses; the former are assumed to be premeditated and are a means to an end (e.g. material gain), whereas the later occur in the 'heat of the moment' and are ends unto themselves" (Ibid). Nevertheless, this argument assumes that these crimes are mutually exclusive and "…applies labels to outcomes (i.e., crimes) that more accurately refer to motives: anger, jealousy, rage, hatred, and a host of other emotional states commonly used to describe expressive crimes refer to forces that influence outcomes. In addition, emotional states have

[18] These theories assert "that crime is a result of low self-control, differential association, strain, labeling, or other social experiences and forcers" (McCarthy, 2002).

intentional objects and are not independent of preferences (Damasio 1994, Elster 1998)" (Ibid). In summary, "[t]he rational choice approach is not a theory of cognition. It does not argue that people think in ways typically associated with rationality as used in common discourse (e.g., reasoned, thoughtful, reflective), nor does it assume people undertake literal calculations. The rational choice approach refers to the consistency between people's preferences and choices…It does not assume that people are always conscious of their attempts to maximize their interests but simply argues that many of their actions can be understood as rational. In other words, it contends that we can make useful predictions of human behavior by assuming that most people act "as if" they had made cost-benefit calculations" (Ibid).

Nonetheless, supporters of the intersection between economics and the study of crime argue that economic models can provide guidance and predictions that help to better explain and forecast the empirical results on criminal behavior, making them less ad-hoc. Wilson et al. (2000) argue "[a]bsent from much of the literature in this area is a theoretical explication of the connection between activities of education and work programs and the postrelease offending behavior of prison inmates. 'Black-box' empirical evaluations of the effects of these programs may resolve the questions of effectiveness but will fail to illuminate the mechanics of why and how programs work." Moreover, "[t]heoretical perspectives establish the plausibility of finding reductions in future offending that are associated with program participation and point to mediating factors worthy of investigation." In particular, they contend that "economic models of crime…are a natural fit with these programs..."

This thesis investigates how the PIE program affects recidivism and labor market outcomes of the offender. Inherent in the application of this program is the belief that enhancing work skills of the inmate will better their chances of reentry and reduce levels of recidivism. Put

differently, because policy makers view one of the benefits of these programs as helping to reduce crime they are implicitly assuming that criminals are rational. This is exactly what the rational framework purports. Thus, the theoretical model will be developed within the rational framework.

Literature Review

Becker (1968) modeled the decision to commit a crime in a rational framework. In this model, the criminal undertakes the offense if the expected utility from illegal activity exceeds the expected utility from legal activity. The total number of offenses, or the supply of offenses, depends on the probability of detection and conviction, the severity of punishment, and a host of other variables such as income. Because crime can be thought of as an externality and law enforcement, or security, is for the most part a public good, the government decides on the probability of detection and conviction as well as the severity of punishment through minimizing the social loss in income crime imposes on society.

Becker finds that the criminals supply of offenses are negatively related to the severity of punishment and the probability of detection and conviction. The criminal will be more responsive to the probability of detection and conviction than to the severity of punishment if the criminal is risk loving. The reverse would be true if the criminal is risk averse; and, finally, the criminal would be equally responsive to both if the criminal is risk neutral. Through analyzing the government's problem, he finds that the government will minimize the loss function where the elasticities of supply with respect to the probability of detection and conviction, and the severity of punishment are both less than one. Moreover, the elasticity of supply with respect to the probability of detection and conviction is greater than the elasticity of supply with respect to

the severity of punishment, and therefore, criminals have preference for risk and the loss function should be minimized over the regions where crime does not pay.

Stigler (1970) looks at the optimum enforcement of laws. However, in doing so he also makes conclusions about the supply of offenses. The supply of offenses will either be to attain income or for consumption. Because the expert villain pursues income, the tenets of occupational choice will hold: the offender "…must choose the locality of maximum income expectation (and perhaps, like a salesman, move from area to area). [The criminal] must choose between large, relatively infrequent crimes and smaller, more frequent crimes. [The lawbreaker] must reckon in periods of (involuntary) unemployment due to imprisonment. Earnings can be expected to rise for a time with experience" (p. 530, Ibid). It is also assumed that the probability of apprehension is an increasing function of the number of crimes committed. Thus the following can be concluded about the properties of the equilibrium supply of offenses: "1. [n]et returns are equalized, allowance being made for risk and costs of special equipment required for various activities; 2. [t]he determinants of supply which are subject to the control of society are: (a) the structure of penalties by offense[,] (b) the probability of detection for each offense[,] (c) certain costs of the conduct of the offending activity…; The penalties and chances of detection and punishment must be increasing functions of the enormity of offense" (p.530, Ibid)

Ehrlich (1973) extends Becker's analysis in several ways. He incorporates rewards into the notion of opportunities. In particular, "…it predicts and verifies empirically a systematic association between the rate of specific crimes on the one hand, and income inequality as well as law enforcement activity on the other" (p. 522). Moreover, he creates a model of offender behavior that connects illegitimate activity with the theory of occupational choices model so that "…the offender's decision problem [is] one of an optimal allocation of resources under

uncertainty to competing activities both inside and outside the market sector, rather than as a choice between mutually exclusive activities" (p.522). In addition, his model distinguishes between the deterrent and preventive effects of imprisonment; and finally, he empirically investigates the relationship between crime and law enforcement activity using a simultaneous equation model. The decision of offenders "…to specialize in illegitimate activity…becomes an aspect of their attitudes toward risk, as well as their relative opportunities in alternative legitimate and illegitimate activity. Also, whether in equilibrium, crime pays or does not pay in terms of expected (real) marginal returns is simply a derivative of an offender's attitude towards risk…" (p. 528, Ehrlich, 1973). This is because the expected marginal returns from illegal activity are greater than, less than, or equal to the expected marginal returns of illegal activity when the offender is a risk avoider, risk neutral, or risk preferrer, respectively. Ehrlich argues that the results of his model explain why many offenders, even after being convicted and punish, will still continue in the same behavior if their opportunities have not changed given that preferences have remained unaltered. Therefore, "[r]ecidivism is...not necessarily the result of an offender's myopia, erratic behavior, or lack of self control, but may rather be the result of choice dictated by opportunities" (p.529, Ibid).

Comparative statics of his model show that a change in the probability of apprehension and punishment and the penalty will both reduce the incentive to participate in illegal endeavors. However, the magnitude of the deterrent effect will depend on the offender's attitude towards risk. An increase in the marginal or average differential return from illegitimate activity will cause an increase in the impetus to partake in illegal activity. An increase in the probability of unemployment will cause an ambiguous effect on motivation to participate in illegal activity for offenders that are risk avoiders. The response of offenders to a pure wealth effect will depend on

how risk behavior varies with wealth: if the offender has increasing relative risk aversion then less time will be allocated to illegal activity punishable by imprisonment as wealth increases. Finally, if the amount of time apportioned to nonmarket activities decreases (i.e., a rise in the time allotted to market activities), holding everything else constant, then time spent in both legitimate and illegitimate interest would increase if nonmarket endeavors do not change an individual's penchant for wealth in different conditions of the world. Two important results follow from this model: "…the effect of compensated and even uncompensated changes in legitimate market wages on the extent of participation in i may be lower than that of changes in illegitimate payoffs;…[and] the extent of (initial) participation in illegitimate activity may be an important determinant of the magnitude of the response of specific offenders to changes in various market opportunities" (p. 531-532, Ibid).

Sjoquist (1973) also models the individual's behavior as a time allocation model with a Von Neumann-Morgenstern expected utility approach. The assumptions are as follows: the gain from legal and illegal activity include any psychic benefits and costs. Psychic and financial costs resulting from arrest and conviction are quasi-fixed, thus the cost is the same regardless of the time spent in illegal activity.[19] The costs of incarceration vary with the individuals legal wage rate and the time spent in illegitimate pursuits. Individuals have subjective probabilities of incarceration, apprehension, and conviction and are assumed to be independent of the time spent in illegal activities. Finally, the individual will either be arrested, convicted, and punished or will go undetected. Given risk aversion, the model predicts: a rise in the probability of detection and conviction, a rise in the cost of illegal activity, and a rise in the legal wage rate will decrease

[19] A corner solution may result within this model because of these quasi-fixed costs (Sjoquist, 1973).

illegal activity; and an increase in the illegal "wage rate" will increase time spent in illegal activity.

Brown and Reynolds (1973) show that the unambiguous results of Becker's model concerning offenders' attitudes towards risk hinges on his definition of punishment or loss. Specifically, "Becker concluded that if offenders are more deterred by the probability of conviction than the "punishment" for an offense, then they prefer risk; and if they are more deterred by punishment than probability of conviction, they are risk averse" (p.508, Ibid). Nonetheless, this result is due to Becker defining punishment as the "…the difference between what happened and what might have happened," versus the more "conventional" definition of loss "…as the decrement in income from his certain present income if convicted and the "gain" as the increase in income from a successful crime" (p.509, Ibid). Once losses are redefined, it can no longer be concluded that offenders have risk loving behavior when they are more deterred by the probability of detection and conviction than by the severity of punishment.

Although preference for risk implies that offenders are more responsive to the probability of detection and conviction, and being more responsive to the severity of punishment implies risk averse behavior, it cannot be concluded that being more responsive to the probability of detection and conviction than to the severity of punishment implies risk loving behavior because this scenario is now possible for risk avoiders and those who prefer risk (Ibid). This definition of losses amounts to "tak[ing] the individual's initial income position as a point of reference[,]" "[w]hereas Becker considers the income and punishment equivalents of an offense separated from other income…" (p.347, Eide, 2000). The former is the definition of income used in the present model.

Block and Lind (1975) scrutinize Becker's (1968) model of crime and punishment. Unlike in Becker's 1968 model where the arguments of the utility function was the individual's income (monetary plus psychic) from an offense, minus any monetary equivalent of the sanction, Block and Lind (1975) assert that the arguments of the utility function should actually be the individual's wealth excluding the possible effects of crime and punishment, a set of attributes of the crime, and a set of attributes of the penalty. They argue that separating the "direct wealth effects of crime and punishment from the wealth variable…simplifies the analysis because, with wealth defined in this way, the arguments [of the utility function] are not functionally related as they would be if the direct wealth component of [the attributes of the crime and the penalty of the crime] were incorporated into" the wealth variable (p. 243).

While Becker's results hinge on the existence of a monetary equivalence for the penalty of committing a crime, Block and Lind (1975) show that the subsistence wage creates a lower bound on the value of the penalty. As a result, depending on the initial wealth of the offender and the severity of punishment, there may not exist a monetary equivalent of the sentence. They also argue that there is no reason to believe that a monetary equivalent to a particular crime and punishment, nor a particular crime exists. Nonetheless, even though these monetary equivalents do not exist, there still may be a penalty that is capable of deterring the individual from committing the crime.

However, assuming that there is a wealth equivalent to the fine, they also point out that Becker's analysis overlooks the fact that it is much harder to evade imprisonment than it is to avoid paying a fine. Thus, fines may not be a more inexpensive punishment compared with imprisonment, and that it is because of the threat of imprisonment that helps reduce the collection costs of fines. Finally, they dispute Becker's assertion that the optimal policy for risk

neutral and risk averse offenders "…would be to reduce the probability of punishment arbitrarily close to zero while making the punishment infinite" (p. 245, Ibid). They show that assumptions about risk preference are not needed "to explain the limits on the effectiveness of threatened punishment" (p. 245, Ibid). In particular, they demonstrate that there is no punishment severe enough that would completely prevent any crime; however, there probably "…exists a probability of punishment less than one that will completely deter any crime. Moreover, for any crime, beyond some point in terms of the severity of punishment, it is not possible to keep deterrence constant by trading off harsher punishments against a lower probability of punishment" (p.246, Ibid).

Block and Heineke (1975) show that the unambiguous results obtained from Becker (1968), Ehrlich (1973), and Sjoquist (1973) are due to rather strong assumptions about psychic costs. In particular, they show that these time allocation models treat psychic costs and wealth as independent and thus allow for them to obtain unambiguous results in making assumptions about attitudes towards risk and how risk behaviors vary with income. When psychic costs are fully taken into consideration; i.e., "…when the psychic costs of effort is afforded its traditional labor theoretic role, the agent's simple behavior toward risk (sign U_{ww}) has no allocative implication" (p. 316, Block & Heineke, 1975). In their model, the effect of changes in initial wealth on criminal activity is ambiguous; the effect of changes in the payoffs of illegal activities will depend on the direction of the wealth effect (the substitution effect is positive), however, if the activity is inferior the effect cannot be signed; the effect of changes in enforcement (e.g., probability of arrest) can only be signed if illegal activity is independent of wealth; the effects of changes in penalties has a substitution and wealth effect, while the substitution effect is negative, the wealth effect cannot be signed without additional information on preference leading to an

ambiguous sign. Moreover, they do not assume a Bernoulli distribution for the probability of detection and conviction, but simply assume the offender has a subjective probability distribution function (Ibid). Thus, it is not just the assumption that "…ethical costs are independent of wealth…" that lead a risk averse offender to increase illegal activity when the dispersion of returns to illegal activity decreases, but the additional restriction that the probability density is Bernoulli is also required (p. 325, Ibid). In doing so they illustrate that "…if the density is Bernoulli and/or ethical costs are not independent of wealth, simple behavior towards risk is not sufficient to establish the effect of mean preserving dispersion changes" (p. 325, Ibid).

Heineke (1978) investigates economic models of crime in general. He shows that the models presented by Becker, Ehrlich, and Sjoquist are nothing more than simple portfolio models. That is, "…the term 'portfolio model' is used…to denote that class of models in which all returns and costs are monetary. So 'a portfolio model of time allocation' is a non-sequitor to the extent that 'work,' be it legal or illegal, is disagreeable, i.e., involves psychic costs" (pp.10-11, Ibid). As a result, authors of this approach have included in their gains and loss functions monetary returns as well as the "monetary or wealth equivalent" of psychic gains or losses (p.11, Ibid). This monetary equivalence places strong assumptions on the behavior of offenders that allowed for unambiguous results within the models of these authors as noted above. He formulates a general model of the Becker-Ehrlich-Sjoquist models and shows that the unambiguous results obtained depend "…the independence of the markets for legal and illegal activities which is implied by the special nature of the monetary equivalences…used" (pp.18-19, Ibid). Moreover, Ehrlich and Sjoquist obtain the results that legal and illegal activity are substitutes which is shown to stem directly from assuming leisure is fixed. When time allocated to leisure is free to vary then leisure and illegal activities are substitutes.

Fairly unambiguous results can be derived from the general form of the Becker-Ehrlich-Sjoquist model. Time allocated to legal activity is positively affected by increases in the returns to legitimate endeavors but is unaffected by the remaining parameters (probability of detection and conviction, Initial wealth, changes in the returns to illegal activity, changes in the penalty, and mean preserving changes in the dispersion of returns to illegal actions). Time dedicated to illegal activity is negatively affected by increases in the probability of apprehension and the severity of punishment. Time allocated to illegitimate pursuits is positively affected by increases in wealth levels "…if the individual is risk averse and displays decreasing absolute risk aversion or prefers risk and displays increasing absolute risk preference…" (p.17, Ibid). Time allotted to illegal activity increases with increases in the return to legal activities (legal and illegal activity are gross compliments). Finally, when the penalty function is separable, mean preserving increases in the dispersion of returns to illegal activity "…decrease, leave unchanged or increase participation in illegitimate activities if and only if the agent is risk averse, risk neutral or prefers risk, respectively" (p.18, Ibid).

However, when the decision problem directly includes nonmonetary costs comparative static results cannot be signed without very strong assumptions about the preferences of offenders. In addition, attitudes towards risk are no longer necessary or sufficient "…for determining the allocative effects of changes in the dispersion of returns" (p. 26, Ibid). Thus, no conclusions can be made about risk behavior of offenders by analyzing compensating changes in the probability of detection and conviction and the severity of punishment.

Finally, Heineke addresses the evaluation of the decision problem using a Bernoulli distribution. Modeling choices in this way forces only two possible outcomes for the offender: complete success or complete failure. Although, a more general distribution would remedy this

problem (as noted in Heineke, 1975), static models fail to take into consideration the fact that the offender is not able to supply the desired number of offenses if imprisoned. This could be remedied in analyzing the decision model in a dynamic framework or by "…view[ing] the individual's decision problem as either (i) that of choosing whether or not to commit any one offense or (ii) that of choosing the time allocation to any one offense" (p.28, Ibid).

Schmidt and Witte (1984) extend Heineke's (1978) model by including 6 additional possible states of the world and making employment in legal activity uncertain (as done in Ehrlich, 1973). These states are "…: (1) not apprehended, (2) arrested but not convicted, (3) convicted and fined, and (4) convicted and freedom restricted (e.g., incarcerated or placed on probation)" (p.157, Schmidt & Witte, 1984). They also separate the probabilities of these states into the probability of arrest, the probability of conviction if arrested, and the probability of having one's freedom restricted if convicted. Because for each state the individual will either be employed or unemployed, there are 8 possible states.

The Model

Following Heineke (1978) and Schmidt and Witte (1984) this study will model the decision to commit a crime in a simple static model similar to a simple portfolio problem where the individual has to make a decision as to how much of his wealth to put at risk in criminal activity (Heineke,1978). The model follows from theories previously presented by Becker (1968), Ehrlich (1973), and Sjoquist (1973) and formalized by Heineke (1978) and Schmidt and Witte (1984). The model presented borrows heavily from Schmidt and Witte (1984) and Heineke (1978). However, it differs from previous models in that it explicitly introduces prison labor into the model.

While Schmidt and Witte (1984) acknowledge prison labor, it is implicitly modeled as a variable that increases nonwage income upon release, and therefore would simply fall under an increase in nonwage income.[20] The simplicity of the model allows for unambiguous predictions regarding the effects of the parameters on criminal activity. However, assumptions about attitudes towards risk must still be made. The model hinges on the "monetary equivalence" of psychic gains and losses (Heineke, 1978). This approach "…implies that 'return' and 'cost' functions into which both monetary and non-monetary returns have been aggregated (via monetary equivalents) will be functions of … each argument entering the utility function…" (p.13, Heineke, 1978).[21]

[20] While they do not explicitly mention prison labor in developing their theoretical model, in their empirical analysis, Schmidt and Witte (1984) measure non labor income as accumulated work release funds.

[21] Block and Lind (1975) show that a monetary equivalent for prison terms may not exist because wealth is bounded from below by a subsistence level of wealth. Therefore, there is "… a limit on the monetary penalty that can be effectively imposed on any given individual…" (p. 242). Thus, whether or not a monetary equivalent exist, will depend on the severity of the penalty and the individual's initial wealth.

Table 2: Definition of Variables

Variable	Definition
t_L	Time spent in the labor market
t_I	Time spent in illegal activity
T	Total time endowment
I_i	Total income or wealth in state i
A	Nonwage income or wealth
U(I)	Utility Function of Income
E[U(I)]	Expected Utility
$F(t_i,\beta)$	Penalty for t_i hours of illegal activity
$G(t_i,\alpha)$	Gains from t_i hours of illegal activity (net of the monetary equivalent psychic gains)
$L^f(t_L, \delta)$	Value of t_L hours in free labor market activities (net of the monetary equivalent psychic costs)
$L^i(t_L,\gamma)$	Value of t_L hours in labor market activities while incarcerated (net of the monetary equivalent psychic costs)
p	subjective (or expected) probability of detection and conviction
e	expected unemployment rate
h	subjective probability of legal work while in prison
$\beta,\alpha,\delta,\gamma$	exogenous shift parameters for the penalty, illegal gains, free labor market gains, and incarcerated labor market gains respectively

Table 3: States and Respective Probabilities

State	Probability	Income Level
Employed and not apprehended	$p_1=(1-e)(1-p)$	$I_1=A+L^f(t_L, \delta)+G(t_i,\alpha)$
Unemployed and not apprehended	$p_2=e(1-p)$	$I_2=A+G(t_i,\alpha)$
Employed apprehended, convicted and incarcerated, no employment in prison	$p_3=(1-e)(1-h)p$	$I_3=A+L^f(t_L,\delta)+G(t_i,\alpha)-F(t_i,\beta)$
Unemployed apprehended, convicted and incarcerated, no employment in prison	$p_4=ep(1-h)$	$I_4=A+G(t_i,\alpha)-F(t_i,\beta)$
Employed apprehended, convicted and incarcerated, employed while incarcerated	$p_5=(1-e)hp$	$I_5=A+L^f(t_L,\delta)+G(t_i,\alpha)-F(t_i,\beta)+L^i(t_L,\gamma)$
Unemployed apprehended, convicted and incarcerated, employed while incarcerated	$p_6=eph$	$I_6=A+G(t_i,\alpha)-F(t_i,\beta)+L^i(t_L,\gamma)$

The behavior of offenders is consistent with the rules of optimizing behavior. Expectations can be formed about legitimate and illegitimate opportunities.[22] A criminal will commit an offense only if the expected utility of committing a crime is greater than the expected utility of using his time and other resources towards other activities.[23] Expected Utility is defined as:

$$E[U(I_i)] = \sum_{i=1}^{6} p_i U(I_i).$$

Where p_i, I_i, and the variables that make up I_i are as defined in Tables 2 and 3. It is assumed that time allocated to legal labor market activity and time allocated to illegal activity are independent (Heineke, 1978; Schmidt & Witte, 1984). The gains and costs included in the model include psychic gains and psychic costs. The functions representing the gains to legal activity, $L^f(t_L, \delta)$ and $L^i(t_L,\gamma)$, gains to illegal activity, $G(t_i,\alpha)$, and penalties for illegal activity, $F(t_i,\beta)$, increase with time and with the shift parameter. For example, for $L^f(t_L, \delta)$ assume the following:

$$L_t \equiv \frac{\partial L}{\partial t_L} > 0,$$

$$L_\delta \equiv \frac{\partial L}{\partial \delta} > 0, and$$

$$L_{t\delta} \equiv \frac{\partial^2 L}{\partial t_L \partial \delta} > 0,$$

[22] Legitimate opportunities would be employment in the legal market, such as construction work, working at a fast-food restaurant, etc.; while illegitimate activities would be black market activities, such as selling drugs, supplying stolen goods for purchase at lower prices, etc.

[23] As Witte and Tauchen (1994) and DiIulio (1996) point out, this type of labor model of crime that uses time to commit an offense may not characterize criminal behavior because many offenses may not be planned and don't take much time to commit. Witte and Tauchen (1994) call these "crime as work" models (p.2). They also argue that these models do not include the psychic gains within the model. As a result, they use a model similar to the one suggested by Block and Lind (1975) and use the level of criminal activity in their theoretical model instead of time devoted to illegal behavior. However, these "crime work models" lead to the conclusion that improving legal work opportunities will help deter criminal activity. Since this thesis is a study of improving how legal work opportunities affect offender's criminal behavior, this model seems to be appropriate.

and the same is true for L^i, G, and F. Due to the monetary equivalence mentioned above, these functions are net of the psychic costs involved. It is also assumed that, on the margin, the cost of partaking in criminal ventures outweighs the gain. This is formalized as $(G_t - F_t) < 0$. In addition, employment and criminal justice outcomes are independent.

The criminal's maximization problem is formalized as follows:

$$\underset{t_L, t_I}{Max} \quad \sum_{i=1}^{6} p_i U(I_i)$$

$$s.t. t_L, t_I \geq 0 \; and \; t_L + t_I \leq T.$$

Assuming an interior solution, or that the constraints are not binding, then this becomes an unconstrained maximization problem. This assumption means that the individual will choose to partake in legal, illegal, and leisure activities. In addition, inherent in this model is the rather unrealistic assumption that the value of leisure is zero.[24]

The first order conditions for the maximization problem are:

$$(1)\; C_1: \frac{\partial E[U(I_i)]}{\partial t_L} = \; p_1 U' L_t^f + p_3 U' L_t^f + p_5 U'\left(L_t^f + L_t^i\right) + p_6 U'\left(L_t^f + L_t^i\right) = 0 \; and$$

$$(2)\; C_2: \frac{\partial E[U(I_i)]}{\partial t_I} = \; \sum_{i=1}^{2} p_i U'_i G_t + \sum_{i=3}^{6} p_i \, U_i'(G_t - F_t) = 0.$$

In order to have C_1=0, then L_t^f, L_t^I =0 at the optimum level of t_L. This implies that the model is recursive: time spent in legal activities is determined independently of income and illegal gains and attributes (Schmidt & Witte, 1984). As a result, the "…system…is not a system of simultaneous equations, but rather a recursive system in which legal activity decisions are made and then, given [these decisions], the allocation to illegal activities is determined" (pp.18-19, Heineke, 1978). Nonetheless, time spent in illegal activity is dependent on L_t^f and L_t^I. Thus, the

[24] This is probably a very unrealistic assumption. However, this model is similar to that used in Schmidt and Witte (1984) and Heineke (1978). However, Schmidt and Witte (1984) show that when leisure is taken into consideration, one needs even stronger assumptions than that of the present model in order to obtain unambiguous results.

criminal first determines time allocation to the labor market and then decides how much time to allocate to illegal activity. [25] In order to have $C_2 = 0$, it is required that $G_t - F_t < 0$ or $U_i^i = 0$. Thus, it is necessary that the expected marginal penalty of committing the crime to be greater than the expected marginal benefit. When $G_t - F_t < 0$, the sum of the first term must equal the absolute value of the sum of the second term. This means that the expected marginal benefit of the crime of getting caught and convicted should just offset the expected marginal benefit of committing the crime without apprehension and conviction.

Define the following derivatives as:

$$C_{11} = \frac{\partial C_1}{\partial t_L},$$

$$C_{12} = C_{21} = \frac{\partial C_1}{\partial t_I} = \frac{\partial C_2}{\partial t_L},$$

$$C_{22} = \frac{\partial C_2}{\partial t_I}, and$$

$$|C| = C_{11}C_{22} - C_{12}^2 .$$

In order to have a local maximum it must be that $C_{11} < 0$, $C_{22} < 0$, and $|C| > 0$, which are assumed to hold. The exogenous parameters that affect the criminal's maximization decision are A, p, e, β, α, γ, & δ (see Table 2 for definitions). Comparative statics are calculated in order to obtain the effects of these parameters on t_L and t_I. Define θ to be any parameter, then $\partial t_L / \partial \theta$ and $\partial t_I / \partial \theta$ can be obtained by differentiating (1) and (2) by each parameter, solving for $\partial t_L / \partial \theta$ and $\partial t_I / \partial \theta$, and then determining their respective signs. This gives us:

[25] If this analysis represents the decision to recommit a crime, then this may not be an invalid assumption. Freeman (1996) finds that crime and employment may be mutually exclusive for youths who end up incarcerated.

$$(3)\frac{\partial C_1}{\partial \theta} + C_{11}\frac{dt_L}{d\theta} + C_{12}\frac{dt_I}{d\theta} = 0, and$$

$$(4)\frac{\partial C_2}{\partial \theta} + C_{12}\frac{dt_L}{d\theta} + C_{22}\frac{dt_I}{d\theta} = 0.$$

Note that C_{12} is :

$C_{12} = p_1 U"(L_t^f(G_t - F_t) + p_3 U"L_t^f(G_t - F_t) + p_5 U"(L_t^f + L_t^i)(G_t - F_t) + p_6 U"L_t^i(G_t - F_t) = 0$

because L_t^f, L_t^i =0 at the maximum. This means (3) and (4) can be restated as:

$$(5)\frac{dt_L}{d\theta} = -\frac{1}{C_{11}}\frac{\partial C_1}{\partial \theta}, and$$

$$(6)\frac{dt_I}{d\theta} = -\frac{1}{C_{22}}\frac{\partial C_2}{\partial \theta}.$$

Since it is already known that $C_{11}, C_{22} < 0$, then the signs of (5) and (6) will depend on the sign of $\frac{\partial C_1}{\partial \theta}$ and $\frac{\partial C_2}{\partial \theta}$ respectively.

Analyzing the effect of the change in the probability of detection and conviction, p, on t_L and t_I gives the following:

$$(7)\frac{\partial C_1}{\partial p} = 0 \; and$$

$$(8)\frac{\partial C_2}{\partial p} = -(1-e)U_1'G_t - eU_2'G_t + (1-e)(1-h)U_3'(G_t - F_t) + e(1-h)U_4'(G_t - F_t)$$
$$+ (1-e)hU_5'(G_t - F_t) + ehU_6'(G_t - F_t) < 0.$$

These results unambiguously imply that $\frac{\partial t_L}{\partial p} = 0$ and $\frac{\partial t_I}{\partial p} < 0$. Thus an increase in the subjective probability of detection and conviction has no effect on the time allocated to legal activity but does decrease the time allocated to illegal activity.

A change in the subjective unemployment rate, e, gives the following results:

$$(9)\frac{\partial C_1}{\partial e} = 0 \; and$$

$$(10)\frac{\partial C_2}{\partial e} = (1-p)G_t\left(U_2^{'} - U_1^{'}\right) + p(1-h)(G_t - F_t)\left(U_4^{'} - U_3^{'}\right) + ph(G_t - F_t)(U_6^{'} - U_5^{'}).$$

From the above results $\frac{\partial t_L}{\partial e} = 0$ and the subjective probability of unemployment have no effect on the time designated to legal activities. However, assumptions have to be made about risk behavior in order to sign $\frac{\partial t_I}{\partial p}$. Under risk neutrality $\frac{\partial t_I}{\partial e} = 0$ and e will have no effect on the time allocated to illegal activities. Under risk aversion and risk loving behavior the sign is still ambiguous. In order to have the expected positive sign the following must hold:

$$(10_a^{'})\ risk\ averse: (1-p)G_t\left(U_2^{'} - U_1^{'}\right) > p\ (G_t - F_t)(1-h)\left(U_4^{'} - U_3^{'}\right) + h\left(U_6^{'} - U_5^{'}\right)\ and$$

$$\left(10_b^{'}\right)\ risk\ loving: (1-p)G_t\left(U_2^{'} - U_1^{'}\right) < p\ (G_t - F_t)(1-h)\left(U_4^{'} - U_3^{'}\right) + h\left(U_6^{'} - U_5^{'}\right).$$

Thus, for a risk averse person the change in the marginal utility of income due to an increase in the subjective unemployment rate from committing an offense and getting caught has to be less than the change in the marginal utility of committing an offense and not getting caught. The reverse is true for risk loving individuals. Nonetheless, if for the risk averse individual decreasing absolute risk aversion is also assumed, and $I_6 < I_2$ and $I_5 < I_1$,[26] then the mean value theorem could be used to argue, but not prove, the unexpected result that $\frac{\partial t_I}{\partial e} < 0$.[27]

According to the mean value theorem:

$$(11)U_2^{'} - U_1^{'} = (I_2 - I_1)U_{1,2}^{"}\ .$$

Where $U_{1,2}^{"}$ is $U^{"}$ evaluated somewhere between I_1 and I_2. Note that $I_2 - I_1 = I_4 - I_3 = I_6 - I_5 = -L^f(t_L, \delta)$. Thus (11) can be rewritten as:

$$(11^{'})U_2^{'} - U_1^{'} = -L^f(t_L, \delta)U_{1,2}^{"}\ .$$

Substituting this into (10) gives:

[26] These conditions do not necessarily hold because of the introduction of prison labor

[27] This analysis follows from Schmidt and Witte (1984). As they point out, the exact income in which $U_{i,j}^{"}$ is calculated would be needed in order to prove this result.

$$(12)\ \frac{\partial C_2}{\partial e} = (1-p)G_t\left(-L^f(t_L,\delta)U_{1,2}^{"}\right) + p(1-h)(G_t - F_t)\left(-L^f(t_L,\delta)U_{3,4}^{"}\right) + ph(G_t - F_t)(-L^f(t_L,\delta)U_{5,6}^{"}).$$

Under the assumption of decreasing absolute risk aversion the negative terms receive a heavier weight than the positive terms; therefore, it can be argued that $\frac{\partial t_I}{\partial e} < 0$. Therefore, as the unemployment rate increases time allocated to illegal activity will decrease. Nonetheless, for the risk loving individual that displays decreasing absolute risk aversion, the expected positive sign will be obtained and crime will move in the same direction as the unemployment rate.

Changing the probability of being employed while in prison, h, has the following effects on t_L and t_I:

$$(13)\frac{\partial C_1}{\partial h} = 0\ and$$

$$(14)\frac{\partial C_2}{\partial h} = p(1-e)(G_t - F_t)\left(U_5^{'} - U_3^{'}\right) + pe(G_t - F_t)\left(U_6^{'} - U_4^{'}\right).$$

A change in the probability of employment while in prison has no effect on legal labor market activity. However, the sign of $\frac{\partial C_2}{\partial h}$ is ambiguous and depends on the assumptions made about risk. Under the assumption of risk neutrality neither t_L or t_I would be affected by the subjective probability of legal employment while incarcerated. If risk averse behavior is assumed then $\frac{\partial C_2}{\partial h} > 0$ and under risk loving behavior $\frac{\partial C_2}{\partial h} < 0$.

The effect of a change in nonwage income, A, depends on assumptions made about risk. Comparative static results give us:

$$(17)\frac{\partial C_1}{\partial A} = 0\ and$$

$$(18)\frac{\partial C_2}{\partial A} = \sum_{i=1}^{6} p_i U_i^{"}\frac{\partial I}{\partial t_i}.$$

Define $U_i^{"} = -U_i^{'}R(I_i)$, where $R(I_i)$ is the Arrow-Pratt absolute measure of risk. This leads to the following:

$$(18^{'})\frac{\partial C_2}{\partial A} = -\sum_{i=1}^{6} p_i U_i^{'} R(I_i)\frac{\partial I}{\partial t_i}.$$

The comparative statics results show that a change in nonwage income has no effect on the amount of time allocated to legal labor market activity. Nonetheless, the sign of (18') is ambiguous and additional assumptions are needed to obtain a definite sign. Under risk neutrality, or constant absolute risk aversion, nonwage income will have no effect on time allocated to crime. If risk averse behavior is assumed, decreasing absolute risk aversion, $I_1 > I_5 > I_3$, and $I_2 > I_6 > I_4$, then the more negative terms will receive a greater weight (because $R(I_i)$ will be larger for the smaller values) and (18') will be unambiguously positive. Therefore, the time allocated to crime will increase with increases in nonwage income.[28]

Changing the shift parameter δ will give the effect of a change in the return to legal labor market activities. This results in the following:

$$(19)\frac{\partial C_1}{\partial \delta} = \sum_{i=1,3,5} p_i U_i^{'} L_{t\delta}^{f} > 0 \; and$$

$$(20)\frac{\partial C_2}{\partial \delta} = L_{\delta}^{f}\sum_{i=1,3,5} p_i U_i^{"}\frac{\partial I}{\partial t_i}.$$

Time allocated to legal labor market activity unambiguously increases with an increase in the return to legal activity. Notice the summation part of (20) looks similar to that of (18) except it only contains the terms where the individual was employed in legal activity while free. Thus, it should be expected that the effect of an increase in the return to legal activity on illegal activity should be similar to the results obtained for nonwage income. Specifically, if risk aversion,

[28] This result may not hold if $I_1 < I_5$ and $I_2 < I_6$. If this were true, then assuming decreasing absolute risk aversion would not be enough to obtain an unambiguous sign.

decreasing absolute risk aversion, $I_1 > I_5 > I_3$, and $I_2 > I_6 > I_4$ is assumed, then (20) will be unambiguously positive and the time allocated to crime will increase with an increase in the return to legal labor.

An increase in the returns to illegal activity, represented by the shift parameter α, has the following outcomes:

$$(21)\ \frac{\partial C_1}{\partial \alpha} = 0 \ \ and$$

$$(22)\ \frac{\partial C_2}{\partial \alpha} = \sum_{i=1}^{6} [p_i U_i^{'} G_{t\alpha} + p_i U_i^{"} G_{\alpha} \frac{\partial I_i}{\partial t_i}].$$

(22) Can be rewritten as:

$$(22')\ \frac{\partial C_2}{\partial \alpha} = G_{t\alpha} \frac{\partial E[U(I)]}{\partial A} + G_{\alpha} \frac{\partial C_2}{\partial A}.$$

Once again, time allocated to legal labor market activity is not affected by an increase in the returns to illegal activity. The first term on the right of equation (22') is unambiguously positive. However, the second term will depend on the sign of $\frac{\partial C_2}{\partial A}$, and as in previous results, additional conjectures about risk must be made in order to sign this term. Thus, in order to have $\frac{\partial t_i}{\partial \alpha} > 0$, the second term must equal zero (i.e., risk neutrality or constant absolute risk aversion), or be positive (i.e., risk aversion, decreasing absolute risk aversion, $I_1 > I_5 > I_3$, and $I_2 > I_6 > I_4$).

A change in the returns to prison labor results in the following:

$$(23)\ \frac{\partial C_1}{\partial \gamma} = \sum_{i=5,6} p_i U_i^{'} L_{t\gamma}^{i} > 0 \ and$$

$$(24)\ \frac{\partial C_2}{\partial \gamma} = \sum_{i=5,6} p_i U_i^{"} L_{\gamma}^{i} \ (G_t - F_t).$$

An increase in the returns to prison labor unambiguously increases the time allocated to legal activity. However, it has an ambiguous effect on the time allocated to illegal activity. Assumptions about risk behavior must be made to find the effect. If the individual is risk averse, then an increase in γ will cause an increase in illegal activity. However, if the individual is risk loving, then an increase in γ will lead to a decrease in time allocated towards illegal activity.

A change in the penalty of incarceration, represented by β, has the following effect:

$$(25)\ \frac{\partial C_1}{\partial \beta} = 0 \ \ and$$

$$(26)\ \frac{\partial C_2}{\partial \beta} = \sum_{i=3}^{6} [p_i U_i^{'} \frac{\partial^2 I_i}{\partial t_i \partial \beta} + p_i U_i^{"} G_\alpha \frac{\partial I_i}{\partial t_i} \frac{\partial I_i}{\partial \beta}].$$

An increase in the penalty of committing an offense has no effect on time allocated to legal activity. However, the outcome is indeterminate for time allocated to illegal activity. The first term in (26) is unambiguously negative because $\frac{\partial^2 I_i}{\partial t_i \partial \beta} = -F_{t\beta}$ for all i.[29] Because $\frac{\partial I_i}{\partial t_i} \frac{\partial I_i}{\partial \beta} = -(G_t - F_t)F_{t\beta} > 0$, the sign of $\frac{\partial C_2}{\partial \beta}$,and thus $\frac{\partial t_i}{\partial \beta}$, will depend on assumptions about risk. If risk aversion is assumed, or risk neutrality, then (26) will be unambiguously negative and an increase in the penalty for committing a crime will result in a decrease in the time allocated to illegal endeavors.[30] If risk loving behavior is presumed, then the result is ambiguous because the second term will be positive.

Summary

The above is a simple model of criminal behavior based off of the work of Becker (1968), Ehrlich (1973), Sjoquist (1973), Heineke (1978), and Schmidt and Witte (1984). Due to the assumptions made in this model, time allocated to legal labor market activity is independent

[29] It is assumed that $F_{t\beta} > 0$

[30] This is also true if the second term in (26) is equal to zero

of every parameter except for δ, the shift parameter for legal gains earned while free, and γ, the shift parameter for legal gains made while incarcerated. The criminal's time allocation to legal market activity varies positively with both parameters.

The only parameter that unambiguously affects time allocated to illegal activity is p, the probability of detection and conviction. An increase in the probability of detection and conviction unambiguously decreases time allocated to illegal activity. Most of the other parameters require additional assumptions about the offender's attitude towards risk, how risk behavior varies with income, and restrictions on the different states of the world.

There are three parameters that do not require assumptions about how risk varies with income: the shift parameter representing a change in the penalty for incarceration, β, the probability of employment while in prison, h, and the shift parameter for changes in the returns to prison labor, γ. For h and γ, if the individual is risk averse, then an increase in these parameters will cause an increase in the time allocated to illegal behavior. The opposite holds true if the individual is risk loving. For β, if risk averse behavior (or risk neutrality) is assumed, then an increase in the penalty of incarceration will lead to a decline in criminal activity. If risk loving behavior is presumed the result will be ambiguous.

For the parameters representing a change in the subjective probability of unemployment, e, a change in nonwage income, A, a change in the returns to legal labor market activity, δ, and a change in the returns to illegal activity, risk averse and decrease absolute risk aversion is not only assumed, but restrictions must also be placed on the different states of the world. In other words, it is speculated that $I_6 < I_2$ and $I_5 < I_1$. Given these constraints, an increase in e will cause a decrease in the time allocated to illegal activity (this effect will be positive if the individual displays risk loving behavior and decreasing absolute risk aversion); and an increase

in A, δ, and α will cause an increase in criminal behavior. Thus, t_L and t_I are gross complements as found in Heineke (1978).[31]

There are several limitations to be noted regarding this model. First, the model developed gives half of the picture because it only analyzes the criminal's behavior. In reality, criminals interact with government and society and a more complete model would incorporate the two. In this case a game theoretic approach would be optimal as argued by Sebelis (1989). In addition, the probability of detection and conviction is exogenous. This means, that the criminal's behavior is not allowed to affect his/her probability of detection and conviction. Moreover, static models do not allow us to incorporate the problem of prison sentences. This is a "..problem not usually addressed in labor supply models: The individual may be apprehended and hence be unable to supply the planned number of offenses" (Heineke, 1978). A dynamic model would be able to circumvent this issue. However, another possibility around this dilemma would be to interpret the model on an offense by offense basis (Ibid). In addition, use of a Bernouli distribution also implies that either the criminal will succeed or fail on every criminal activity, which may not be a valid assumption. Wages are also modeled as exogenous to the model so offenders' behavior does not affect the offender's payoff stream. Moreover, time versus number of offenses is used in the model which may be less realistic if criminal activities do not take up significant amounts of time (Witte & Tauchen, 1994; DiIulio, 1996). Furthermore, it could be that prison labor supply is best analyzed in a rationing framework (Marks & Vining, 1986). Finally, it may be that work is a good, not a bad in the prison setting. However, this is not taken into consideration in this model and therefore is considered as a bad it is not taken into consideration and is represented as a bad.

[31] These results are comparable to Heineke and Schmidt and Witte (1984) for every parameter except for the ones not included in their model: h and γ.

This thesis seeks to explore the effects of prison work programs, in particular the PIE program, on recidivism and employment outcomes. This section develops a simple theoretical model that directly incorporates prison labor in order to discover what effect this type of program will have on the criminal's optimization problem. The above model suggests that the criminal's problem is recursive. Therefore, the criminal will first decide how much time to allocate to legal activities, and then he will choose the optimal time allotment to illegal endeavors. The decision to commit a crime will be a function of the expected unemployment rate, the subjective probability of detection and conviction, legal labor market activity, the penalty for illegal activity, gains from illegal activity, nonwage income or wealth, the subjective probability of legal work while in prison, severity of punishment, and tastes. The theory formed in this section will provide a guide to the empirical analysis as to how these programs, as well as the other parameters explored should affect the decision to partake in legal (employment) as well as illegal (criminal) activities.

Chapter IV
Empirical Methods and Data

In Chapter II the connection between work and crime is explored through the research of previous literature. In Chapter III theoretical model incorporating prison labor is developed in order to see how prison work programs approximating real world experience, e.g. PIE, would affect the criminal's decision to (re)commit a crime. This section will present the methods used to empirically test the PIE program's effects on the decision to recommit a crime and employment outcomes of inmates released from state prisons across 5 states between January 1996 and June 2001. In addition, this chapter will discuss the data used, and the variables included in the analysis. The findings in Chapter II and Chapter III will guide the variable selection and the expected outcomes of including these variables in the analyses.

Methods

Recidivism and Employment Outcomes.

The analysis on recidivism and employment outcomes will be executed with survival analysis using the commonly applied Cox Proportional Hazard (PH) model, Weibull model, and an Accelerated Failure Time (AFT) model with a lognormal distribution. Survival models incorporate the timing of recidivism into their methods, not just the outcome of whether or not an ex-offender has recommitted a crime as is typically done when using a logit or probit model.[32] In using a binary outcome model to measure recidivism, information would be lost about the actual timing of recidivism because the only outcome that could one could speak on would be the probability of recommitting a crime. Given that such a high rate of offenders recidivate, more

[32] Note that when duration data are grouped, failure times recorded at aggregated time intervals, this can be handled using a stacked logit or probit model. Moreover, the Han and Hausman (1990) approach to handling grouped duration data can be estimated using an ordered probit form or an ordered logit form depending on the assumptions made about the error term (Cameron & Trivedi, 2005).

than two-thirds recidivate within 3 years after release, there seems to be merit in not only looking at how certain variables affect the probability of recidivating, but also the effects that these covariates have on an ex-offenders crime-free spells (Langan & Levin, 2002). Thus, in using the time to recidivism as the dependent variable one could actually analyze not only the factors that influence recidivism, but how these factors affect the duration of time until recidivism.

Nonetheless, there are problems that arise by using the follow up periods as the dependent variable in regression analysis. In particular, the spells in transition datasets are often incompletely observed (or censored) causing length-biased sampling (Kiefer, 1988). As a result, many studies model transitions instead of the mean duration time since doing so require weaker distributional assumptions (Cameron & Trivedi, 2005). Moreover, since this study is interested in the conditional probability of a crime free spell ending given participation in the PIE program (as well as other control variables), survival analysis will be more efficient than a binomial regression (Cameron & Trivedi, 2005). Therefore, since the data analyzed has information on the timing of recidivism, as well as the timing of employment upon release and job loss once employed, survival models seem to be most appropriate for this investigation of recidivism and employment outcomes.

The Cox PH model is popular in duration data due to its semi-parametric approach. Unlike other models, such as the log-normal, log-logistic, gamma, weibull, and gompertz, the Cox proportional hazard model does not assume a functional form for the baseline hazard model. This gets around the issue of inconsistent estimators that plagues fully parametric models if the underlying model is misspecified (Cameron & Trivedi, 2005). The coefficients on the covariates are estimated using the partial-likelihood function. This allows estimation of the parameters without requiring knowledge about the baseline hazard function. Thus, this partial likelihood

function is considered a limited information likelihood. Moreover, the estimates are consistent; and even though the estimator is inefficient, the loss in efficiency is small when compared to maximum likelihood estimators for fully parametric PH models (Ibid). This estimator also controls for censored and tied data.[33]

The proportional hazard rate for this model is of the form:

$$\lambda(t \mid x, \beta) = \lambda_0(t)\phi(x, \beta).$$

If $\phi(x, \beta) = \exp(x'\beta)$ [34] is selected then:

$$\lambda(t \mid x, \beta) = \lambda_0(t)\exp(x'\beta).$$

β is then estimated by minimizing the log partial-likelihood function:

$$\ln L_p(\beta) = \sum_{i=1}^{N} \delta_i \left[\ln \phi(x_i, \beta) - \ln(\sum_{l \in R(t_i)} \phi(x_l, \beta) \right].$$

where δ_i is an indicator variable equal to 1 for uncensored observations and zero for censored subjects, x_i are time-constant regressors that vary by individual, $R(t_j)$ is the set of periods at risk at t_j (Ibid).

The Weibull and lognormal models are parametric models. As such, they require the baseline hazard to follow the weibull distribution or lognormal distribution respectively. The Weibull model is a popular model in the survival literature because it can have an increasing, decreasing, or constant hazard rate. However, because it has a monotonic hazard rate, it restricts the hazard function so that it can only increase, decrease, or remain constant (Chung et al.,

[33] Tied data occurs when multiple failures happen at the same point in time (Cameron & Trivedi, 2005)
[34] This assumes $\varphi(x,\beta) > 0$

1991). If the underlying hazard function is nonmonotonic then this model will not be appropriate. The lognormal distribution is nonmonotonic and has been shown to be appropriate in previous analysis of recidivism data so it is also applied here (e.g., Chung et al., 1991). It has an inverted bathtub shaped hazard function that first increases and then decreases (Cameron and Trivedi, 2005).

The following likelihood function is maximized for the weibull and lognormal models:

$$\ln L(\theta) = \sum_{i=1}^{N}[\delta_i \ln f(t_i|x_i,\theta) + (1-\delta_i)\ln S(t_i|x_i,\theta)].$$

Where $f(\cdot)$ is the density function, $S(\cdot)$ is the survivor function, δ_i and x_i are as defined above, t_i "…is the length of a possibly incomplete spell," and θ is a q x 1 parameter vector (p.587, Ibid).

The Weibull hazard function is defined as:

$$\lambda(t) = \gamma\alpha t^{\alpha-1} \; where \; \alpha > 0 \; and \; \gamma > 0.$$

Regressors are introduced by letting $\gamma = \exp(x'\beta)$. Therefore,

$$\begin{aligned} \text{Ln}\, f(t|x,\beta,\alpha) &= \ln[\exp(x'\beta)\,\alpha t^{\alpha-1}\exp(-\exp(x'\beta)t^{\alpha})] \\ &= x'\beta + \ln\alpha + (\alpha-1)\ln t - \exp(x'\beta)\,t^{\alpha} \end{aligned}$$

and

$$\begin{aligned} \text{Ln}\, S(t|x,\beta,\alpha) &= \ln[\exp(-\exp(x'\beta)\,t^{\alpha})] \\ &= -\exp(x'\beta)\,t^{\alpha}. \end{aligned}$$

Thus, the likelihood function is:

$$\text{Ln}\, L = \sum_i \delta_i\,[\{x_i'\beta + \ln\alpha + (\alpha-1)\ln t_i - \exp(x_i'\beta)\,t_i^{\alpha}\} - (1-\delta)\exp(x_i'\beta)\,t_i^{\alpha}].$$

maximized with respect to α and β (p. 589, Ibid).

Following Chung et al. (p. 74, 1991) the lognormal MLE will be defined by the following:

If z is distributed as N(μ,σ^2), then y= e^z has a lognormal distribution with mean

$$\phi = \exp(\mu + \frac{1}{2}\,\sigma^2)$$

and variance

$$\tau^2 = \exp(2\mu + \sigma^2)\,[\exp(\sigma^2) - 1] = \phi^2\psi^2,$$

where

$$\psi^2 = \exp(\sigma^2) - 1,$$

clearly, the density of z = ln y is the density of N(μ,σ^2):

$$f(\ln y) = \left(1/\sqrt{2\pi}\,\sigma\right)\exp[-(1/2\sigma^2)(\ln y - \mu)^2].$$

There is generally no advantage to working with the density of y itself rather than ln y. Thus simply assuming that the logarithm of the survival time is distributed as N(μ,σ^2), the likelihood function [is]:

$$L = -\frac{n}{2}\ln(2\pi) - \frac{n}{2}\ln(\sigma^2) - \frac{1}{2\sigma^2}\sum_{i-1}^{n}(\ln t_i - \mu)^2 + \sum_{i=n+1}^{N}\ln F[\frac{\mu - \ln T_i}{\sigma}].$$

Where F is the cumulative distribution function ofr the N(0,1) distribution.

Wage Outcomes.

The wage analysis will be performed using a two-step Heckman selection model to control for selection bias. Failure to control for this selection bias may lead to inconsistent estimators. Although this specification produces consistent estimates of the βs, the "…efficiency loss compared to the MLE under joint normality of the errors…can be quite large" (p.550, Cameron & Trivedi, 2005). Nonetheless, "…the estimator is very popular for the following reasons: (1) It is simple to implement; (2) the approach is applicable to a range of selection models…; (3) the estimator requires distributional assumptions weaker than joint normality of [the error terms from the equations estimating the latent variable and the outcome variable]; and (4) these distributional assumptions can be weakened even further to permit semiparametric estimation…" (pp.550-551, Ibid). Thus, the following two-step procedure is employed:

$$w_i = x_{2i}^{'}\beta_2 + \sigma_{12}\lambda(x_{1i}^{'}\hat{\beta}_1 + \upsilon_i).$$

Where w_i is the log of the post release weekly earnings, x_2 are covariates included in the wage equation with at least one regressor different from that in x_1 (for identification purposes), and υ_i is the error term. $\hat{\beta}_1$ is estimated by first regressing non-prison labor force participation (lfp), defined as having worked at least one quarter post-incarceration, on x_2 with the following equation:

$$\Pr[lfp_i = 1 \mid x_{1i}] = \Phi(x_1^{'}\beta_1).$$

Where $\Phi(\cdot)$ is the standard normal cdf. The inverse mills ratio, $\lambda(\cdot)$, is then estimated by the following equation:

$$\lambda(x_1' \hat{\beta}_1) = \frac{\phi(x_1' \hat{\beta}_1)}{\Phi(x_1' \hat{\beta}_1)}.$$

Where $\phi(\cdot)$ is the standard normal pdf (Cameron & Trivedi, 2005). It is assumed that the error in the wage equation is a multiple of the error term in the labor force participation equation plus some noise that is independent of the error in the labor force participation.

Data

The data were collected using grants from the Bureau of Justice Assistance and analyzed under the National Institute of Justice in order to investigate the effects correctional industries have on inmate re-entry. The data were compiled from agency records across 5 states and includes inmates incarcerated in 46 prisons, at different security levels, released between January of 1996 and June of 2001. The follow up period ended in February of 2003 so inmates could be followed from 2 to 7.5 years. The states were selected using a cluster sampling strategy in order to guarantee an adequate sample size. Using this method, states, certified prior to 1996, were ranked according to the number of PIECP participants.[35] This method led to the selection of 5 states (Smith et al.).

From those states, all inmates who worked in PIE that were released between January 1996 and June of 2001 were selected. Qualification for PIE differs "…by state institution, and industry. While there are general criteria that seem to fit most of the sites and industries, it is not consistent" (Ibid). In general, Department of Corrections prerequisites are: "[1)] disciplinary report free for 6 months[;] [2)] minimum and medium security levels[;] [3)] enrolled in a high

[35] The ranking resulted in states from "…all major U.S. geographic regions, rural and urban populations, gender representation to ensure results can be determined based on gender, and each of the models of PIECP…" (p.7, Smith et al., 2006).

school or GED program or completion[;] [4)] sentence of at least 6 months remaining[;] [5)] no major medical problems prohibiting work" (Ibid).

Common industry requirements are: "[1)]submit an application[;] prior work experience, but some employers prefer to hire those who have never worked before[;] [3)] ['f']it with the current work force" (Ibid). Inmates were then matched using a variable by variable approach to inmates who worked in traditional industries (TI) or participated in activities other than industrial work (OTW). Exact matches were made on race (white and minority), gender, and crime type (person and all other)**.** Category matches were made on age at intake (5 criteria), timed served (7 criteria), and the number of disciplinary reports (10 criteria). From this process, a sample of 2268 OTW, 1863 TI, and 2333 PIE participants was created for a total of 6464 inmates. Information on control variables was not collected for all inmates in this sample. Therefore, this study analyzes a subset of these data containing 890 observations that have complete information on all of the control variables of interest.[36]

One of the criteria for participation in the PIE program is that it must be voluntary. As a result, there may be considerable selection bias when analyzing this program for it could be that a significant effect of the program is due to unobservable inmate characteristics, such as motivation, and not the program itself. Therefore, matched samples were used to control for selection bias. However, because of the use of matched samples, the results should only be generalized to those inmates who participated in PIE or are similar to PIE workers. A related

[36] In doing so it is assumed that the data are Missing Completely at Random. In other words, it is assumed that this subsample is a random sample of all data that could possibly be examined. In other words, "…suppose x_i is an observation on a variable in the data set... Then the data on x_i is said to be MCAR if the probability of missing data on x_i depends neither on its own values nor on the values of other variables in the data set" (p. 927, Cameron & Trivedi, 2005). Thus, no bias will result and the parameter estimates will be consistent. Nonetheless, standard errors will be larger due to loss of information (Cameron & Trivedi, 2005). As mentioned above, the data are collected from agency records that are recorded by employees of these agencies. Since all of the variables used in this analysis are not self-reported as in surveys, it seems reasonable there is no additional information in the data set that would aid in predicting these missing values.

idea that affects the ability to generalize the results from this data is the notion of creaming. Creaming is when the program chooses the best inmates from the pool of incarcerated individuals who would have been more successful upon release regardless of whether they participated in PIE. In addition, the data does not allow determination of those individuals who are housed in a PIE facility but are included in the TI or OTW cohorts. Moreover, spillover effects of being placed in a cost accounting center cannot be isolated nor controlled. Furthermore, there is no variable to control for the particular task of the inmate while incarcerated. Because of overlap among the duties performed by TI and OTW and TI and PIE, there must be a large outcome between the groups before a significant difference will be detected. Finally, the data does not have enough information to control for the effect of educational or vocational that may be required for participation in the PIE program (Smith et al., 2006). Due to this research design, the results of the following analysis can only be generalized to the 5 states and the participants in the sample (Ibid).

Variables

The literature and the theoretical findings in Chapter II and Chapter III is used to guide the selection of covariates that should be included in the empirical models presented in the previous section. As argued in these chapters, the decision to commit a crime and employment outcomes are intricately connected. As a result, the effects of the PIE program on both recidivism and work outcomes will be analyzed. The following section presents the variables that will be included in the recidivism and labor market equations.

Recidivism.

The theoretical model developed suggests that the decision to engage in illegal activity will be a function of the expected unemployment rate, the subjective probability of detection and

conviction, gains from legal labor market activity, the penalty for illegal activity, gains from illegal activity, nonwage income or wealth, the subjective probability of legal work while in prison, and tastes. Taste can be placed into three categories: 1) family and community background; 2) personal characteristics; 3) and activities during juvenile or young adult years (Witte & Tauchen, 1994). This definition of tastes is consistent with the two risk factors of recidivism, static predictors and dynamic predictors, identified by Gendreau et al. (1996) in their meta-analysis discussed in the literature review.

The penalty for illegal activity will be measured as time served for original offense and total monetary penalties. While gains from legal labor market activity could be represented directly by the post incarceration hourly wage and the incarceration hourly wage, these variables are left out since this research is primarily interested in the effects of the PIE program on recidivism and work outcomes. That is, if the effects of PIE may work through these covariates, including them will hamper the impact of this program. There are no direct measures for the unemployment rate,[37] the subjective probability of detection and conviction, gains from illegal activity, the subjective probability of legal work while incarcerated, the subjective probability of being employed while incarcerated, and nonwage income.[38]

Variables measuring age, gender, race, criminal history, and history of antisocial behavior are static predictors of recidivism. In these data these variables are as follows:

1. Age: Age at release
2. Gender
3. Race: Defined as Black, White, and Other
4. Criminal History: Number of incarcerations

[37] This is due to confidentiality reasons
[38] Although, nonwage income will also be correlated with participation in PIE.

5. History of antisocial behavior: Contact with the juvenile justice system as a minor and history of substance abuse.

On behalf of dynamic predictors, there are variables for antisocial personality/sociopathy/ psychopathy scales, criminogenic needs, personal distress, and social achievement. These variables are as follows:

6. Antisocial personality/sociopathy/psychopathy: A variable indicating whether there was an indication of a mental health issue
7. Criminogenic needs: Number of quarters worked pre-incarceration
8. Social achievement: An indicator variable indicating marital status and highest level of education completed

Additionally, a facility dummy will be included in order to control for unobserved heterogeneity.[39] Moreover, a dummy for the year of release will also be included in order to control for any exogenous factors that may affect the individual's decision to recidivate due to the timing of when he/she was released. Finally, the variable of interest, the indicator variable for participation in PIE/TIE/OTW will be included to assess the impact of PIE on recidivism. This will give us a difference in difference analysis commonly used in program evaluation.

When choosing a measure of recidivism it is important to choose one that best indicates the offender's behavior: "[t]he further a measure is from the individuals behavior, the more it is measuring the influence of organizational behavior and decision-making rather than commission of delinquency acts" (Office of Juvenile Justice & Delinquency Prevention, 1989). There are three measures of recidivism frequently used in research: time frim release to arrest, time from release to conviction, and time from release to incarceration. Analyzing recidivism as length of time until recidivism is more beneficial than using traditional binary measures. This is so

[39] Because of confidentiality state dummies were not allowed in the analysis.

because in using time until recidivism additional information held in the timing of recidivism can be used in the analysis (Schmidt & Witte, 1984). In addition, "…estimation of the distribution of length of time allows one to predict rates of recidivism for any desired period after release, whereas analysis of the common binary measure of recidivism only allows one to predict the rate of recidivism for the particular follow-up period in the data used to estimate the model" (p. 101, Ibid).

There are disadvantages to using all three measures. Wilson et al. (2000) found reincarceration to be the most popular measure of recidivism, followed by arrest, and then reconviction. Moreover, "[s]tudies that measured recidivism as reincarceration observed a larger reduction in recidivism. This is consistent with the argument that reincarceration is a more reliable measure of recidivism than arrest rates. According to this argument, arrest rates are more heavily influenced by factors other than offending pattern (i.e. police behavior) than is incarceration" (Ibid). Langan and Levin (2002) compared rearrest rates and reconviction rates in 1994 to those in 1984 and they found that rearrests changed over that time period while reconviction rates remained the same for all offenders except drug offenders. Thus, reconviction rates appear to be more stable than rearrest rates over time. Furthermore, the criteria for conviction is more stringent than that of arrest because to make an arrest probable cause is adequate, while in order to condemn an individual of a crime one needs to have proof beyond a reasonable doubt (Maltz, [1984] 2001). Moreover, "[a]rrests are used for purposes other than detaining suspects or those known to have committed crimes" (p.52, Ibid). For example, police could use arrests to harass former criminals to persuade them to leave the area, or they could arrests exoffenders more often when looking for suspects. Finally, pressure placed on police

officers to clear their cases with arrests may lead them to arrests ex-criminals without ample justification.

Nonetheless, reincarceration rates are comprised of the time from release to arrest, the time from arrest to the hearing, the time from hearing to trial, the time from trial to sentencing, and the time from sentencing to recommitment (Maltz, [1984],2001). Thus, rearrest may be a more appropriate measure because it is the only component of the time from release to reincarceration that has to do with the offender's behavior (Ibid). Finally, in using the variable only measuring reconviction, true recidivism may be understated (Beck & Shipley, 1997). For example, people who do not violate parole may not go through prosecution; therefore, they will be left out of this measure. However, the same can be said for reincarceration because those individuals who were convicted but not resentenced to prison will not be included. All three measures are subject to Type I (individuals that are included as recidivist that should not be counted) and Type II (individuals that are not included as a repeat offender that should be incorporated) errors. This analysis will use time from release to arrest and time from release to conviction to measure recidivism.

Labor Market Outcomes.

Employment.

The dependent variable used to measure the likelihood of employment is time from release to employment measured in quarters. The choice to supply labor will depend on wages, nonwage-income, and observable personal characteristics believed to influence tastes (Pencavel, 1986). As in the recidivism analysis, total wages during incarceration will be used to proxy for nonwage income. Personal characteristics include:

1. Type of Crime: employers may find activity in certain crimes more apprehensible (Grogger, 1995; Grubb, 2001; Waldfogel, 1994).
2. Race: human capital theory suggest this variable should be used to control for discrimination and differences in taste (Schmidt & Witte, 1984). Moreover, among exoffenders, it may be that race plays a more important role in labor market outcomes among the population of exoffenders (Saylor & Gaes 2001)
3. Age at release: conventionally, age is a variable used in labor market analysis to denote experience. However, among the inmate population, negative impacts of incarceration on labor market outcomes seems to increase with age (Western et al. 2001).
4. Age at release squared
5. Time served: traditionally this variable is thought to indicate depreciation of human capital because offenders lose experience and skills while incarcerated (Schmidt & Witte 1984; Needels, 1994; Western et al., 2001).
6. Education: according to human capital theory, as this variable increases, it should indicate more skills and should signal to the employer worker productivity. However, segmented labor market theorist argue that employers see education as a signal of traits and characteristics attractive to employers (Cain, 1976). However, there is evidence that this may not be the case for the inmate population (Needels, 1994; Western et al., 2001; Schmidt & Witte 1984)
7. Number of disciplinary reports: Western et al. (2001) notes that those skills needed for survival in prison may be opposite of those needed to obtain and maintain employment. This variable represents the extent of continued criminality behind bars (Schmidt & Witte, 1984;Tyler & Kling, 2006).
8. Marital Status: This variable is also a measure of taste and like and theories of social control and anomie can represent social achievement and social attachment. Moreover, it may lead to increased social stability and may lead to reductions in adult crime (Sampson & Laub, 1992).
9. Substance abuse history: these variables may signal to the employer lower worker productivity. Moreover, there may be a stigma attached to substance abuse and therefore, such individuals may suffer from discrimination (Schmidt & Witte, 1984; Borus, Hardin, & Terry, 1976).
10. Quarters worked prior to incarceration: this variable measures attachment to the labor market prior to incarceration and job stability. Job stability may lead to decreases in adult crime (Sampson & Laub, 1992).
11. Previous Occupation: Individuals who worked in white collar jobs or positions of trust may find it harder to obtain employment upon release (Waldfogel, 1994; Kling, 1999).
12. Number of children: individuals with more dependents may be more compelled to seek employment. This is a common variable used in labor market analysis.
13. Mental health: Individuals with mental health disorders may have a hard time finding and maintaining employment due to disability or discrimination. It has also been found that inmates disproportionately suffer from mental health disabilities (Freeman, 2003; Piehl, 2003)

14. Dummy variables for year of release: these variables will pick up labor market and general economic conditions at the time of release.
15. Gender: It is well documented that labor market outcomes for men and women are different.
16. Health Status: individuals who are sick or disabled will have a harder time finding employment. This may be due to health reasons or discrimination.
17. Quarters worked during incarceration: this variable will represent the extent to which human capital does not depreciate while incarcerated.
18. Criminal History variables: This variable represents a type of lifestyle employers may find offensive and antithetical to a good worker (Schmidt & Witte, 1984). Those with more extensive criminal histories will be more involved in criminal lifestyles (Piehl, 2003; Sampson & Laub, 1992). Also, those with more extensive criminal records may be more stigmatized, or suffer from greater discrimination on the labor market (Western et al., 2001; Western & Pettit, 2000).

The above are control variables. The main variable of interest will be the variable indicating participation in PIE, TIE, or OTW. As in the recidivism analysis, this will provide a difference in difference estimator for the effects of PIE participation on employment.

The dependent variable used to measure the exoffender's ability desire for employment will be employment to job loss. Research "[i]ndicates that … labor market instability [among prison releases] is chosen, as most job terminations are voluntary" (p. 233, Schmidt & Witte 1984). Therefore, this variable could be thought of as a measure of job satisfaction or job stability. In theories of segmented labor markets (or dual economies), it is believed that "…low wage, low quality jobs cause work instability" (p. 219, Schmidt & Witte 1984). These low wage, low quality, unstable jobs are a result of "…the workers' habits and attitudes ("tastes for work") that are inimical to steady employment, to the firm's output goals, and to upgrading onself" (Cain, 1976). To the extent that this is true, time from employment to job loss will also measure exoffenders' attitudes towards work. The control variables used in this analysis will be much the same as those in the recidivism and employment analysis discussed above. These are:

1. Type of crime

2. Race
3. Age
4. Age squared
5. Time Served
6. Education
7. Number of disciplinary reports
8. Marital Status
9. Substance abuse history
10. Quarters worked prior to incarceration
11. Number of children
12. Mental Health
13. Health status
14. Quarters worked during incarceration
15. Dummies for year of release
16. Gender
17. Criminal history variables

In addition, the variable measuring participation in PIE/TI/OTW will also be included to measure the program effect.

Wages.

Following Schmidt and Witte (1984), the above variables measuring work stability and job satisfaction will be used in the analysis of wages earned post-release for men. However, a Heckman selection model will be employed to control for selection bias.

Chapter V
Empirical Analysis

Summary Statistics

The sample is a cross-section of 890 offenders. As can be seen in the summary stastistics presented in Table 4, there is a fairly even distribution of OTW, TI, and PIE workers each comprising 34%, 32%, and 34% of the sample respectively. Naturally, because of the nature of this study, the concentration of TI and PIE workers is extremely high compared to the overall state inmate population. In 2000, 39.4% of state inmates worked in General Work, 3.0% did farm work, 5.3% worked in Traditional Industries, and 0.3% worked in PIE (Solomon, Johnson, Travis, & Mcbride, 2003).

Langan and Levin (2001) report that of the offenders released from prison in 1994, 50.4% of inmates were white and 48.5% were black, and 2.1% were other. In this sample 49% are white, 45% are black, and other minorities are 6% of the sample. Moreover, while women are only 8.7% of prisoners released, they are roughly 31% of these data. In addition, 44.1% of prisoners released in 1994 were under age 30 compared to only 21.2% of this sample. Forty-seven percent of the sample is single and the average number of children for an inmate is 2.

There is a high percentage of inmates with a history of substance abuse with 85% having had a history of alcohol or drug use. Solomon et al. (2003) report 70% of state prison inmates having ever used drugs, 57% using drugs the month before arrest, 33% using drugs at the time of offense, and 37% using alcohol at the time of offense. Moreover, 25% of the sample has a mental health problem and 8% of the sample has a medical problem with a special need. Those with a mental health condition or physical medical problem comprise 28.5% of the sample. However, Solomon et al. (2003) states this number to be 31%.

The average education level for the inmates in this sample is 11 years. Moreover, only 5.2% of the sample had less than eight years of education; Freeman (2003) reports this number to be at 8%. Thus, this sample seems to be more educated. Average weekly earnings prior to incarceration are $41.34, average weekly earnings during incarceration are $39.31, and average weekly earnings post-incarceration are $192.60.[40] Ex-offenders worked an average of 11 hours per week prior to incarceration, 9 hours per week during while in prison, and 32 hours after release. Prior to incarceration 24% of the sample worked in food, retail, or an office; 33% worked as unskilled laborers, in assembly, in a warehouse, or trucking; 3% were self-employed; 28% worked in skill labor, in construction trades, or in welding; and 12% are unemployed, a student, or disabled (SSI).

Of the sample, property offenders, personal offenders, and drug offenders comprised 26%, 43%, and 29% respectively. Of offenders released in 1994, 22.5% were violent offenders (e.g., murder, sexual assault, and robbery), 33.5% were property offenders, and 32.6% were released from Drug offenses. It appears as though this sample has a fairly high percentage of individuals who committed crimes against a person compared to the 1994 sample of prison releases (Langan & Levin, 2001). The mean number of incarcerations for these data is 2, with 85.6% of the sample having had a prior incarceration. This is much higher than the 56% found by Langan and Levin (2001) in 1994. Moreover, the average time served in prison in this sample is 54 months (1,620 days) compared to 20.3 months in 1994 (Ibid). The average monetary penalty is $90,803.57. Thirty-five percent of the sample had involvement in delinquent acts as a juvenile. In comparing these statistics with those of the sample used in Langan and Levin (2001)

[40] Averages for weekly earnings are not adjusted for inflation.

it seems as though this data does not suffer from a creaming effect (i.e., it does not appear that the data include only the “best” of the criminal offenders).

This sample has a much lower rate of recidivism than prisoners released in 1994. For the 3 years they were followed in 1994, 67.5% of inmates were rearrested, 46.9% were reconvicted, and 51.8% were reincarcerated. However, in this sample 43% were rearrested, 30% were reconvicted and 13% were reincarcerated. Moreover, 80% of the sample obtained employment after release; however, 91% lost their jobs during the follow up period.

Table 4. Summary Statistics

Variable	Obs	Mean	Min	Max
Other Than Work Participants (OTW)	890	34		
Traditional Industries Participants (TI)	890	32		
Prison Industry Enhancemant Participants (PIE)	890	34		
Age at Release (Years)	890	36	20	60
White	890	49		
Black	890	45		
Other	890	6		
Female	890	31		
Education (Highest Grade Completed Pre-incarceration)	890	11	0	20
Single (Binary Variable indicating if Inmate is Single)	890	47		
Number of Children	890	2	0	10
Number of Hours Worked Per Week Pre- Incarceration	890	11	0	40
Number of Hours Worked Per Week During Incarceration	890	9	0	40
Number of Hours Worked Per Week Post Incarceration	890	32	0	40
Hourly Wage-Pre Incarceration (Dollars)	890	1.03	0	30.00
Hourly Wage-During Incarceration (Dollars)	890	0.98	0	70.00
Hourly Wage-Post Incarceration (Dollars)	890	4.82	0	50.00
Previous Occupation: Food/Retail/Office	887	24		
Previous Occupation: Unskilled labor/Assembly/Warehouse /Trucking	887	33		
Previous Occupation: Self-Employed	887	3		
Previous Occupation: Skilled Labor/construction Trades/Welding	887	28		
Previous Occupation: Unemployed Disabled (SSI)/Student/Unemployed	887	12		
Mental Health Issue (Prison Records Indicated a Mental Health Problem)	890	25		
Medical Special Need (Prison Records Indicated Inmate Has a Physical Medical Special Need)	890	8		
History of Substance Abuse	890	85		
Number of Previous Incarcerations	890	2	0	24
Involvement in Crime as a Juvenile	890	35		
Offense Type: Personal	890	43		
Offense Type: Property	890	26		
Offense Type: Drug	890	29		
Offense Type: Other	890	2		
Time Served (years)	890	4.44	0.20	30
Number of Disciplinary Reports	890	3	0	64
Total Monetary Penalties (Dollars)	890	90,803.57	0.00	7,999,990.00
Time from Release to First Arrest (Days)	885	1011	0	2630
Censored Arrest (Ex-Offenders that Were not Arrested During Follow up Period)	889	57		
Time from Release to Conviction (Days)	885	1164	10	2660
Censored Conviction (Ex-Offenders that Were not Convicted During Follow up Period)	889	70		
Release to Employment (Quarters)	890	4	0	30
Censored Employment (Ex-Offenders that did not Obtain Employment During Follow up Period)	890	20		
Employmet to Job Loss (Quarters)	890	5	0	30
Censored Job Loss (Ex-Offenders that Obtained Employment who did not Experience Job Loss During Follow up Period)	890	9		
Release Year 1[1]	890	21		
Release Year 2	890	17		
Release Year 3	890	15		
Release Year 4	890	9		
Release Year 5	890	27		
Release Year 6	890	11		

[1] Actual Release Years Are Unknown Due to Confidentiality

Results

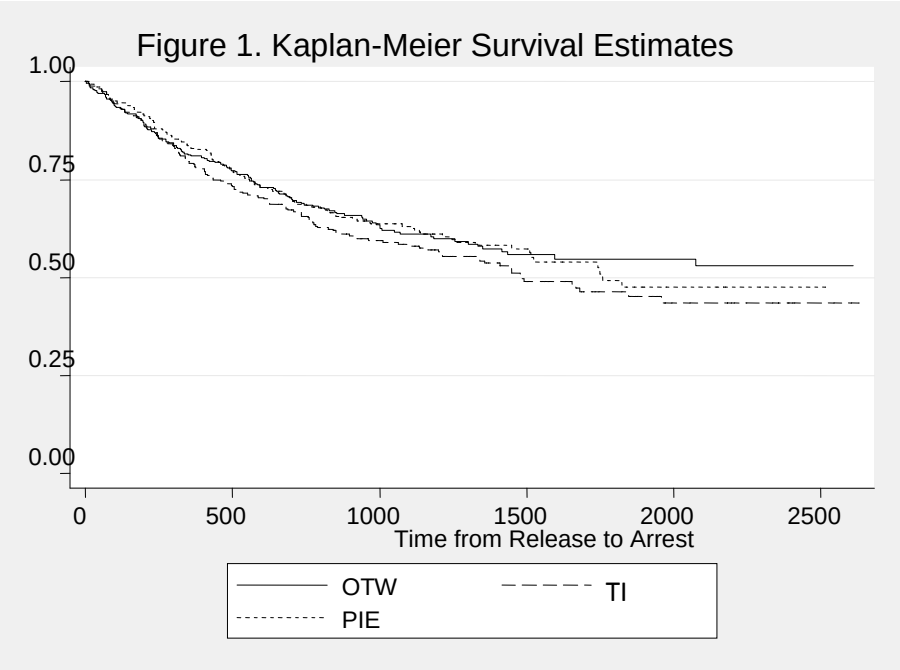
How Does PIE Participation Affect Recidivism as Measured by Time from Release to Arrest, Time from Release to Conviction, and Time from Release to Incarceration?

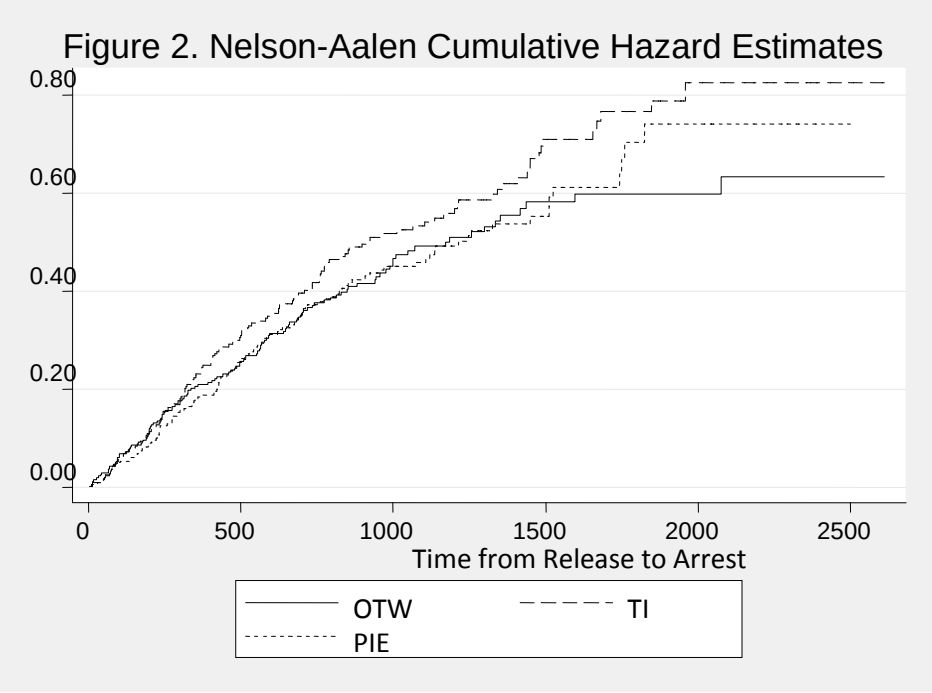
In this section survival analysis will be used to analyze how the PIE program affects recidivism. Time from release to arrest and time from release to conviction will be used to measure recidivism. The merits of these covariates are discussed in Chapter IV. In addition, this analysis will also test some of the results suggested by the theoretical model of Chapter III. The next section of the results will focus on PIE's effect on legal labor market outcomes. Given that the theoretical framework developed in Chapter III suggested a recursive model (i.e., the criminal will choose the time allocated to legal labor market activity and then determine the time allocated to illegal endeavors), separate inquiries can be carried out analyzing illegal labor market activity, as measured by recidivism, and legal labor market activity, evaluated by unemployment duration, employment duration, and wage outcomes. Therefore, this section will only investigate how the PIE program has reduced the criminality of the former inmate.

Time from Release to Arrest.

Kaplan-Meier survival estimates and the Nelson Aalen cumulative hazard estimates give a nonparametric estimate of the survival curve and cumulative hazard curve without taking into consideration any covariates. When these functions are graphed by work category while incarcerated (i.e., PIE, TI, or OTW) Figures 1 and 2 graphically illustrates that all three curves are indistinguishable until around 330 days. At this point, the TI survival curve drops below that of OTW and PIE. The survival rates for OTW, TI, and PIE at 330 days from discharge are 82%, 81%, and 85% respectively. OTW and PIE survival curves continue to follow the same pattern until around 1,642 days after which the PIE survival rate drops below OTW (also see Tables A2

and A3 of the Appendix). The survival rates for OTW, TI, and PIE by 1,970 days from release are 55%, 44%, and 48% respectively. Nonetheless, The log-rank test of equality among the OTW,TI, and PIE survival curves fails to reject a difference among these groups. TI not OTW, seems to perform the worst out of the three groups.





Next, additional covariates are included in the model suggested by the literature and theory (as discussed in Chapter II and Chapter III) in order to see how inclusion of these variables will impact PIE's effect on the decision to recommit a crime as measured by the number of days from release to arrest. The models common in the literature, and used in this analysis, are the Cox proportional hazard model, the Lognormal model, and the Weibull model.[41]

The results can be found in Table 5.[42] For the most part the results seem to be robust to model specification. For the majority of the variables, the models are similar in significance and sign. The signs for the Cox and Weibull model are opposite those of the lognormal model because the lognormal has an AFT framework and the Cox and Weibull model are estimated as

[41] See the methods section for an in depth analysis

[42] Likelihood ratio tests were performed with each of the models to test whether there was a difference between the model containing release year, release year and facilities dummies, facility dummies, and the model with none of these variables (restricted). For all models, the best specification was the one including only facility dummies.

PH models (Chung et al., 1991).[43] For all three models, age at release, time served, gender, number of previous incarcerations, history of substance abuse, having committed a property crime compared to a personal offense, having committed a crime in the other category compared to a personal offense, and having a history of involvement with the juvenile justice system as a minor significantly affect recidivism of the ex-offender. In addition, having a history of a mental health disorder is a significant covariate in the Weibull and Cox models, and race is a significant covariate in the Weibull specification. The last year of schooling completed, having committed a drug offense compared to a personal offense, being single, the number of quarters worked pre-incarceration, and total penalties have no effect on recidivism rates in any of the models analyzed. Quarters worked pre-incarceration has an unexpected sign in the Cox and Weibull models, however, its effect on the baseline hazard is small and not significant.

[43] AFT models "…specif[y] that the effect of the covariable is multiplicative on t rather than on the hazard function. That is [it is] assume[d] [that] a base-line hazard function…exist and that the effect of the regression variables is to alter the rate at which an individual proceeds along the time axis. Equivalently, it is supposed that the role of [the covariate] is to accelerate (or decelerate) the time to failure" (p.34, Kalbfleisch & Prentice, 1980). However, with proportional hazards models "…the covariates act multiplicatively on the hazard function," which is a function of the time variable, but not on the time variable itself (p.32, Ibid). However, it is important to note that the Weibull model can be estimated as either a PH or an AFT model (Kalbfleisch & Prentice, 1980; Cameron & Trivedi, 2005). In this analysis the PH framework of the Weibull model is used instead of the AFT construction due to the benefits of PH models provided in the Empirical Methods section of Chapter IV.

Table 5. Dependent Variable: Time from Release to Arrest

	Cox Model		Weibull Model		Lognormal	
Variable	**Change in Baseline Hazard**	**Standard Error**	**Change in Baseline Hazard**	**Standard Error**	**Change in Time to Failure**	**Standard Error**
OTW	0.122	0.203	0.120	0.203	-0.250	0.153
TI	0.344	0.251	0.360*	0.255	-0.302*	0.151
Education	-0.024	0.029	-0.027	0.029	0.022	0.035
Age at Release	-0.041***	0.009	-0.040***	0.009	0.046***	0.011
Time Served	-0.087***	0.024	-0.081***	0.024	0.086***	0.027
White	-0.173	0.104	-0.196*	0.101	0.257	0.177
Female	-0.926**	0.088	-0.928**	0.087	15.683**	19.603
Number of Previous Incarcerations	0.070***	0.022	0.075***	0.022	-0.078***	0.024
History of Substance Abuse	1.135***	0.403	1.133***	0.400	-0.578***	0.088
Property	0.749***	0.266	0.763***	0.268	-0.514***	0.086
Drug	0.180	0.191	0.195	0.194	-0.232	0.137
Other	1.926***	0.942	2.053***	0.981	-0.731***	0.110
History as a Juvenile	0.268*	0.162	0.280**	0.164	-0.284**	0.103
Mental Health Issue	0.254*	0.171	0.256*	0.172	-0.142	0.138
Single	0.073	0.135	0.090	0.138	-0.037	0.135
Quarters Worked Pre-Incarceration	0.001	0.025	0.012	0.025	0.006	0.027
Total Penalties	0.000	0.000	0.000	0.000	0.000	0.000
α			0.984			
Facility Dummies	x		x		x	
Log-Likelihood			-938.187		-940.747	
N	885		885		885	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

The Cox and Weibull models show that OTW and TI proportionately increase the baseline hazard above that of PIE workers indicating higher rates of recidivism. Although, the magnitudes for these two models are roughly the same, there is no statistically significant difference among PIE participants and non-PIE participants in the Cox model. However, the Weibull model indicates that TI participants will proportionately increase the baseline hazard rate above that of PIE participants by a significant 36%. Thus, TI participants have a higher baseline hazard rate, or failure rate, compared to PIE participants. While the effects are different

in magnitudes, this same result is seen in the lognormal specification. TI participation results in a decrease in time to failure by 30.2% compared to PIE participants.

It appears as though PIE participants have longer crime free spells than both TI and OTW releasees. However, this difference is only significant between TI and PIE participants. At first, this may seem to be an odd result because it seems as though the larger difference should be between PIE and OTW not PIE and TI becuse PIE and TI workers are both working for pay and can often work in the same job. However, depending on the state of confinement, there can be a fine line between OTW and TI, and PIE and TI. Thus,

> [s]ome of the task performed by TI and OTW employees may be exactly the same (i.e., laundry). The only difference being that the TI group completes their task in an industry setting where making a profit is emphasized. In the same respect, those in PIECP and TI may be completing similar tasks…, the difference being that PIECP people are earning the prevailing wage during the time they are working in PIECP (p.32, Smith et al., 2006).

Moreover, an OTW worker could have worked in PIE in a previous incarceration and be assigned to OTW for this incarceration. In addition, spill-over effects, or the desire of an OTW or TI participant to participate in the PIE program (i.e.,OTW and TI participants that are in PIE facilities and those that are not are indistinguishable) cannot be controlled for in the model. Some industries may require additional training, and as a result all prisoners interested in working in PIE may attain this training even if they are never employed in PIE while in prison (Ibid). All of these limitations require an even larger difference between PIE, TI, and OTW in order to achieve a statistically significant effect of the PIE program. Therefore, what may be

concluded from the results is that the difference between TI and PIE was large enough to attain a statistically significant result, while that between OTW and PIE was not. After controlling for sample selection and unobserved heterogeneity (through the inclusion of additional covariates) there remains a statistically significant effect between PIE and TI participants but no difference between PIE and OTW in the Weibull and lognormal specifications.

Although all of the models give very similar results, they differ in significance for three variables: TI participation, race, and having a history of a mental health issue. All three of these variables are significant in the Weibull model. However, only TI participation is significant in the lognormal model, and having a history of a mental health issue is significant in the Cox PH model.

The difference in these models may be due to goodness of fit, i.e. the different assumptions made by each of the models about the baseline hazard function. Therefore, in order to test the appropriateness of the different models "…an empirical estimate of the cumulative hazard function based…on the Kaplan Meier survival estimates [is calculated] …taking the Cox-Snell residuals as the time variable and the censoring variable as before, and plotting it against [the Cox-Snell residuals]. If the model fits the data, then the plot should be a straight line with slope of 1" (p. 230, Stata, 2003). These graphs are displayed in Figures 3-5. They show that the Weibull and lognormal model are descent fits of the data. It is hard to detect which model provides a better fit of the data. However, the Weibull specification has a slightly larger log-likelihood statistic than the lognormal specification. Nonetheless, there is only a difference of roughly 3 between the log-likelihood ratios of the two models. In addition, all of the signs of the variables seem to be as expected in the lognormal model, while the variable for quarters worked

pre-incarceration is of the opposite sign expected. Thus, the lognormal model is analyzed further.

Figure 3. Cox Model

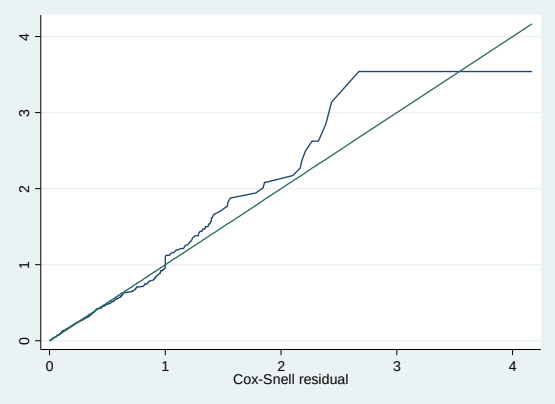


Figure 4. Lognormal Model

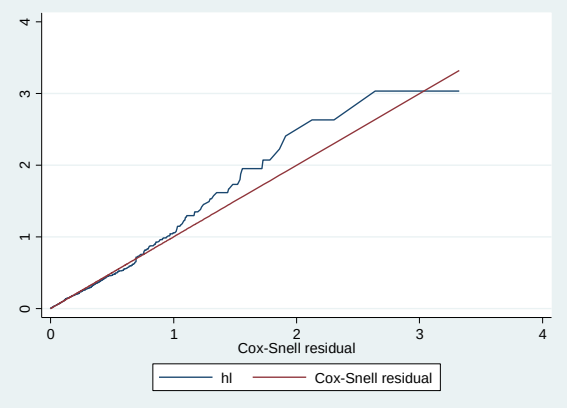
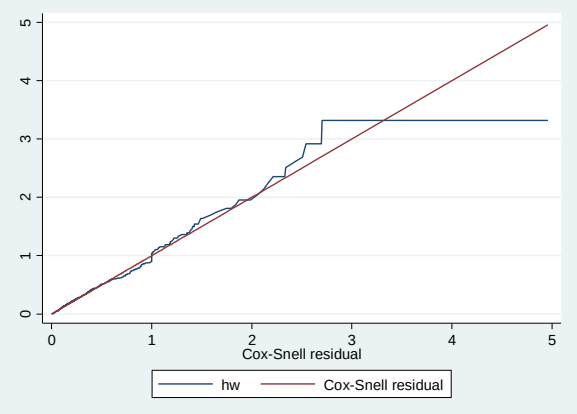


Figure 5. Weibull



A likelihood ratio test failed to reject the hypothesis that the unrestricted model is nested in the restricted model. Thus, Table 6 presents only the results of the restricted lognormal model. This model tells us that a young male who has a shorter sentence for the current offense, has a history with the juvenile justice system as a youth, who has previous incarcerations, who has a history of substance abuse, who has a current offense of a property crime or a crime in the other category, and who participated in the TI program while incarcerated is more likely to recidivate. TI participation causes a 31.2% decrease in time to failure compared to a PIE worker. The only variable included in this model from the economic model of crime that has an impact on recidivism is time served. The variables post-release hourly wage and incarceration hourly wage were not included in the model because participation in PIE probably works through these variables. However, in order to analyze the results of the theoretical model, these variables are also included in the analysis with and without the covariates representing PIE participation.

Table 6. Restricted Lognormal: Time from Release to Arrest

Variable	Coefficient	Standard Error	Change in Time to Failure	Standard Error
OTW	-0.321	0.202	-0.274	0.147
TI	-0.373*	0.215	-0.312*	0.148
Age at Release	0.047***	0.009	0.048***	0.010
Time Served	0.079***	0.024	0.082***	0.026
Female	2.858***	1.167	16.435***	20.346
Number of Previous Incarcerations	-0.086***	0.026	-0.082***	0.024
History of Substance Abuse	-0.880***	0.204	-0.585***	0.084
Property	-0.723***	0.177	-0.515***	0.086
Drug	-0.263	0.177	-0.231	0.136
Other	-1.330***	0.405	-0.735***	0.107
History as a Juvenile	-0.373***	0.140	-0.311***	0.096
Facility Dummies	x		x	
Constant	6.315***	0.801		
Log Likelihood	-942.518		-942.518	
N	885		885	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

Tables 7 and 8 show the Cox, Weibull, and lognormal specifications including the post-incarceration hourly wage and the incarceration hourly wage with and without the variables indicating PIE participation. In all three models excluding the variables for PIE, OTW, and TI participation the signs and significance levels of the covariates are the same. However, it is still the case that a young male having a history of substance abuse, having committed either a property crime or a crime in the other category compared to having committed a personal crime, and having a history with the juvenile justice system as an adolescent has a higher failure rate. The incarceration hourly wage is significant in the lognormal model but not in the Cox or Weibull analysis. Moreover, except for having a history of a mental health issue and race, these

variables are the same variables that are significant in the model excluding incarceration hourly wage and post-release hourly wage, but including the covariates for participation in PIE, TI, and OTW. In addition, the signs remain unchanged between the two specifications. While the post-incarceration hourly wage significantly decreases the baseline hazard in the Cox and Weibull models and increases the time from release to arrest in the lognormal model, the incarceration-hourly wage has the opposite effect. It actually increases recidivism. However, this variable is not significant in the Cox and Weibull specifications, but it is significant in the lognormal model. Even with it being significant in the lognormal model, its coefficient is smaller in magnitude than the post-incarceration hourly wage by .014. Therefore, if the post-incarceration hourly wage is greater than or equal to about 74% of the incarceration hourly wage then the payoff to legal activity will increase the time to arrest, and decrease recidivism.

Table 7. Economic Model of Crime: Time from Release to Arrest

	Cox Model		Weibull Model		Lognormal Model	
Variable	**Change in Baseline Hazard**	**Standard Error**	**Change in Baseline Hazard**	**Standard Error**	**Change in Time to Failure**	**Standard Error**
Education	-0.011	0.030	-0.013	0.030	0.009	0.034
Age at Release	-0.041***	0.009	-0.040***	0.009	0.044***	0.011
Time Served (years)	-0.087***	0.023	-0.082***	0.024	0.086***	0.027
White	-0.141	0.106	-0.161	0.104	0.233	0.172
Female	-0.919**	0.095	-0.922**	0.094	14.921**	18.610
Number of Previous Incarcerations	0.062	0.021	0.067***	0.021	-0.064***	0.024
History of Substance Abuse	1.100***	0.396	1.103***	0.394	-0.565***	0.089
Property	0.755***	0.268	0.769***	0.270	-0.514***	0.085
Drug	0.191	0.192	0.209	0.195	-0.228	0.137
Other	1.870***	0.919	1.994***	0.956	-0.705***	0.120
History as a Juvenile	0.291**	0.164	0.305**	0.165	-0.276**	0.103
Mental Health Issue	0.222	0.166	0.223	0.167	-0.109	0.143
Single	0.049	0.132	0.066	0.134	-0.021	0.136
Quarters Worked Pre-Incarceration	0.007	0.025	0.019	0.025	-0.005	0.027
Total Penalties	0.000	0.000	0.000	0.000	0.000	0.000
Post-Incarceration Hourly Wage	-0.041***	0.014	-0.043***	0.014	0.051***	0.017
Incarceration Hourly Wage	0.010	0.020	0.012	0.020	-0.020	0.018
Release Year						
Facility	x		x		x	
α			0.989			
Log-Likelihood			-934.763		-937.297	
N	885		885		885	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

Adding the dummy variables representing PIE participation to the model does not change the sign or the significance of the variables for the Cox model: participation in OTW and TI compared to PIE has no effect on the baseline hazard. Nonetheless, TI is no longer significant in the Weibull framework. However, the lognormal model still has a significant negative effect for participants in TI compared to PIE participants, i.e., TI participants recidivate faster than PIE participants. Moreover, once prison work program participation is controlled for there is no longer a significant effect of the incarceration hourly wage in the lognormal model. Nonetheless, this variable still acts to accelerate the time from release to arrest in the lognormal model and increase the baseline hazard in the Cox and Weibull models.

Table 8. Economic Model of Crime: Time from Release to Arrest with PIE

	Cox Model		Weibull Model		Lognormal Model	
Variable	**Change in Baseline Hazard**	**Standard Error**	**Change in Baseline Hazard**	**Standard Error**	**Change in Time to Failure**	**Standard Error**
OTW	0.074	0.198	0.063	0.196	-0.227	0.158
TI	0.333	0.253	0.352	0.257	-0.300***	0.152
Education	-0.017	0.030	-0.018	0.030	0.012	0.035
Age at Release	-0.040***	0.009	-0.041***	0.009	0.043***	0.011
Time Served (years)	-0.079***	0.025	-0.079***	0.025	0.076***	0.027
White	-0.144	0.108	-0.163	0.106	0.221	0.172
Female	-0.935**	0.077	-0.934**	0.079	18.123***	22.595
Number of Previous Incarcerations	0.070***	0.022	0.071***	0.022	-0.072***	0.025
History of Substance Abuse	1.13***	0.405	1.167***	0.411	-0.582***	0.087
Property	0.755***	0.269	0.773***	0.272	-0.515***	0.086
Drug	0.173	0.192	0.183	0.194	-0.224	0.138
Other	1.815***	0.905	1.921***	0.937	-0.709***	0.118
History as a Juvenile	0.261*	0.161	0.268*	0.162	-0.278**	0.104
Mental Health Issue	0.225	0.167	0.223	0.167	-0.103	0.144
Single	0.070	0.137	0.074	0.137	-0.032	0.135
Quarters Worked Pre-Incarceration	0.025	0.027	0.028	0.027	-0.015	0.028
Total Penalties	0.000	0.000	0.000	0.000	0.000	0.000
Post-Incarceration Hourly Wage	-0.044***	0.014	-0.045***	0.014	0.053***	0.017
Incarceration Hourly Wage	0.016	0.020	0.017	0.019	-0.023	0.018
Release Year	x		x		x	
Facility	x		x		x	
α			0.990			
Log-Likelihood			-932.226		-934.674	
N	885		885		885	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

Results from the specification analysis shown in Figures 6-11 suggest that the lognormal model provides the best fit of the data when PIE participation is excluded from the model and when it is included back in the model with the additional variables suggested by the theory. Moreover, likelihood ratio tests confirm that there is no difference between the restricted lognormal specifications and the unrestricted model. Due to the fact that PIE participation is still significant in the chosen specification and that the likelihood ratio test failed to detect a difference between the restricted and unrestricted lognormal models, the results from the restricted model including the PIE participation variables and the post-hourly incarceration wage and the incarceration wage are presented in Table 9.

Figure 6. Cox Model without PIE Participation

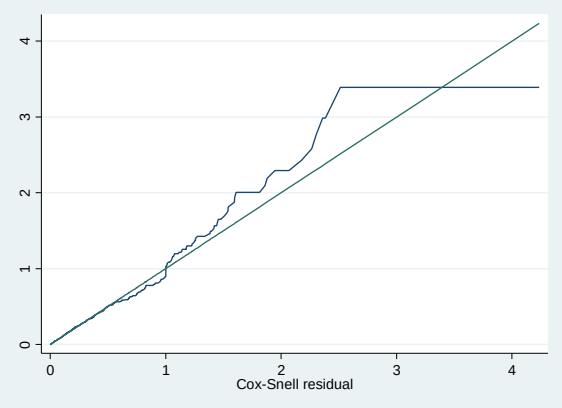


Figure 7. Lognormal Model without PIE Participation

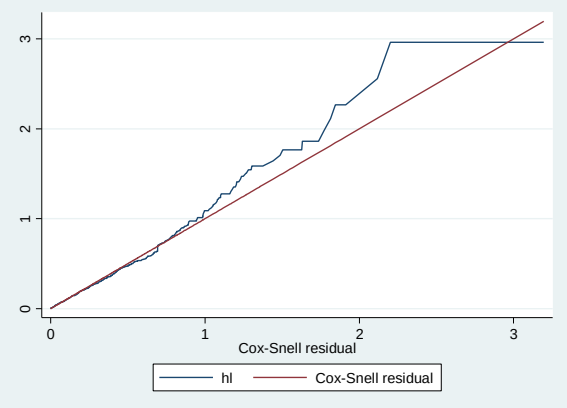


Figure 8. Weibull Model without PIE Participation

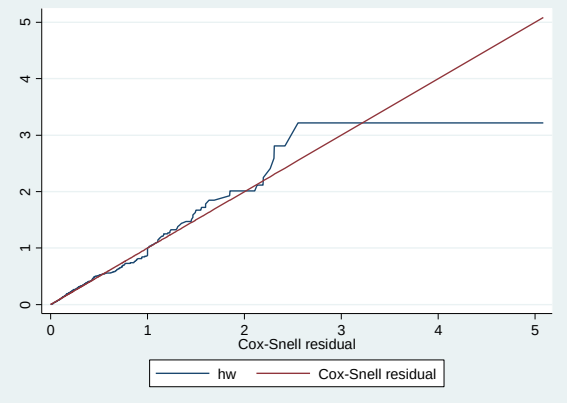


Figure 9. Cox Model with PIE Participation

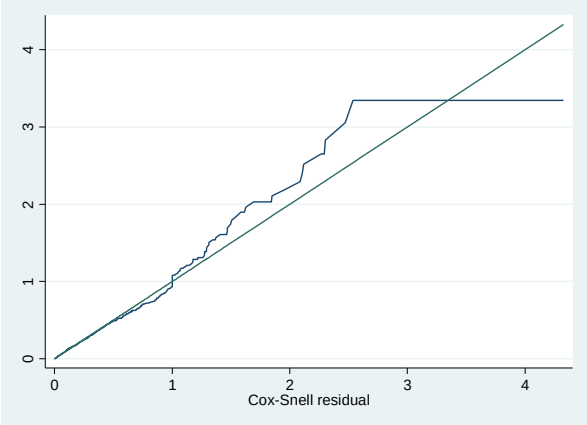


Figure 10. Lognormal Model with PIE Participation

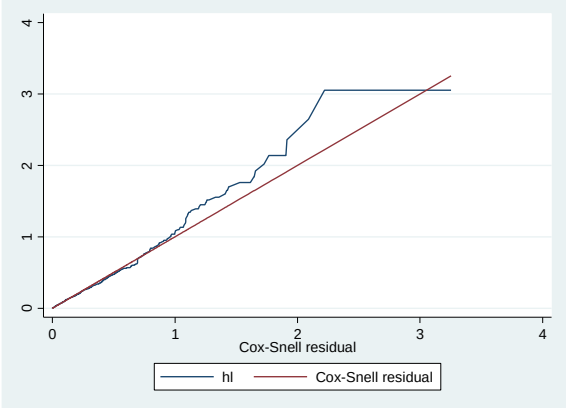
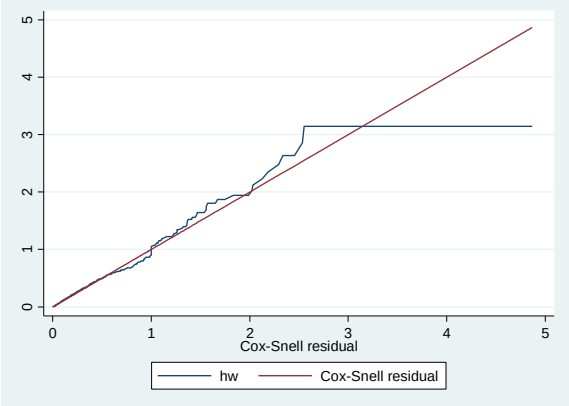


Figure 11. Weibull Model with PIE Participation



All of the variables are highly significant and seem to be of the correct sign. The type of person most likely to more quickly recidivate is a young male who participated in the TI during

incarceration, who had a shorter prison term, who had more previous incarcerations, who has a history of substance abuse, who committed a property crime or a crime in the other category compared to a crime against a person, who has a history with the juvenile justice system as a minor, and who has a lower post-release wage. PIE participation increases the time from release to arrest by 30% over TI participants.

Table 9. Economic Model of Crime: Time from Release to Arrest

	Restricted Lognormal Model	
Variable	**Change in Time to Failure**	**Standard Error**
OTW	-0.232	0.155
TI	-0.300*	0.150
Age at Release	0.045***	0.010
Time Served (years)	0.080***	0.026
Female	18.807***	23.324
Number of Previous Incarcerations	-0.072***	0.024
History of Substance Abuse	-0.577***	0.086
Property	-0.512***	0.086
Drug	-0.220	0.137
Other	-0.713***	0.115
History as a Juvenile	-0.286**	0.099
Post-Incarceration Hourly Wage	0.044***	0.015
Facilities	x	
N	885	
Log-Likelihood	-937.833	

**** Significant at the 1% Level*
*** Significant at the 5% Level*
** Significant at the 10% Level*

The above analysis suggest that the type of person to recidivate is a young male, who served a shorter prison sentence for his current offense, who committed a crime in the property or other category compared to a crime against a person, who has a history with the juvenile justice system as a youth, who has a history of substance abuse, who participated in the TI

program, and who has a greater number of previous incarcerations. With the lognormal model it appears as though PIE participation is robust to the inclusion of the variables representing the payoff to legal behavior.

Release to Conviction.

There are a number of benefits to using time from release to conviction as the measure of recidivism instead of time from release to arrest such as reconviction rates being more stable over time, and requiring a greater burden of proof for conviction than for arrest to name a few (please refer to Chapter IV for a more in depth discussion). In this section the same analysis carried out in the previous section is repeated; nonetheless, time from release to conviction is used as the measure of recidivism. However, the time from release to arrest is factored out of the time from release to conviction in order to handle the sequential nature of this variable. In essence, this section is examining how PIE participation affects the time from arrest to conviction.

As in the analysis of time from release to arrest, the Kaplan-Meier survival estimates and the Nelson-Aalen cumulative hazard estimates, displayed in Figures 12 and 13, show that OTW recidivates at a lower rate than both PIE and TI. Moreover, the log-rank test of equality fails to reject the null that the survivor functions of the OTW, TI, and PIE cohorts are equal (Please also see Tables A4 and A5 of the Appendix).

Figure 12. Kaplan-Meier Survival Estimates

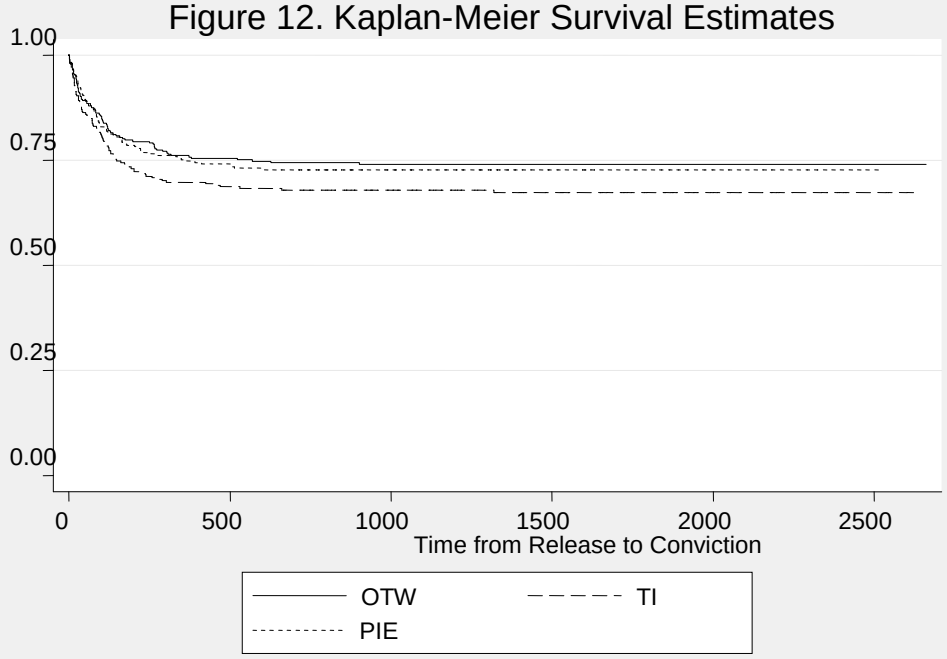
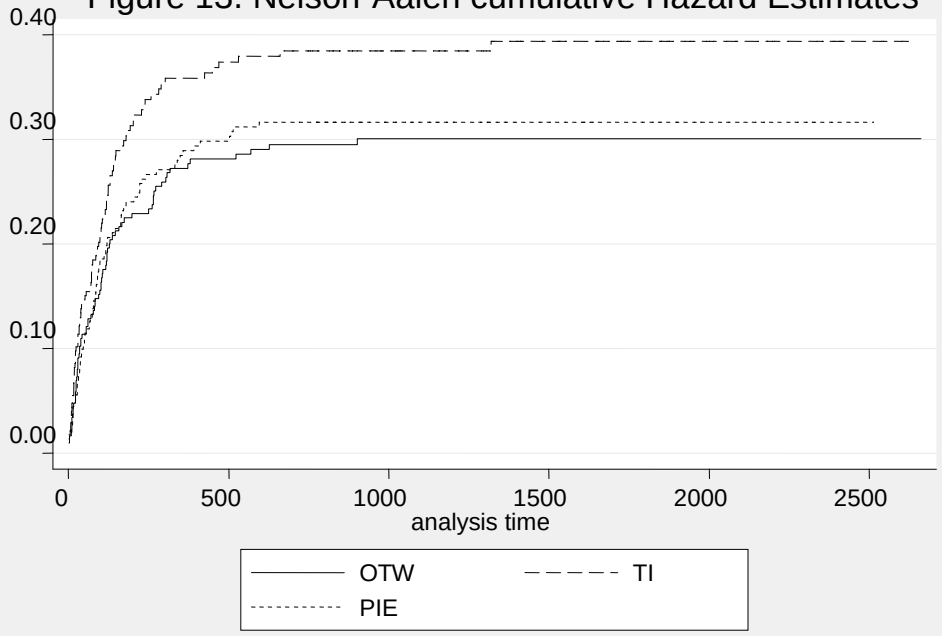


Figure 13. Nelson-Aalen cumulative Hazard Estimates



Once again, survival analysis, including the same controls employed in the previous section, is used to carry out the analysis presented in Table 10. In all three specifications (Cox, Weibull, and lognormal) age at release, time served, history of substance abuse, having committed a crime in the other category, and history of problems as a juvenile are significant covariates. Moreover, the signs of these variables are as expected. In addition, gender is significant in the Cox model, and the number of previous incarcerations is significant in the Cox and lognormal frameworks. Nonetheless, unlike in the analysis using time from release to arrest, PIE participation is not significant in any of the models analyzed when time from release to conviction is used as the measure of recidivism.

Table 10. Dependent Variable: Time from Release to Conviction

	Cox Model 1		Weibull		Lognormal	
Variable	Change in Baseline Hazard	Standard Error	Change in Baseline Hazard	Standard Error	Change in Time to Failure	Standard Error
OTW	0.056	0.232	0.022	0.224	-0.095	0.525
TI	0.258	0.293	0.262	0.289	-0.485	0.320
Education	-0.043	0.035	-0.043	0.034	0.152	0.111
Age at Release	-0.038***	0.011	-0.042***	0.010	0.105***	0.032
Time Served	-0.064**	0.029	-0.078***	0.028	0.226***	0.089
White	-0.208	0.123	-0.204	0.123	0.782	0.706
Female	-1.000***	0.000	-1.000	0.000	6.280E+09	1.100E+13
Number of Previous Incarcerations	0.050*	0.029	0.042	0.028	-0.119*	0.066
History of Substance Abuse	0.989***	0.476	1.032***	0.475	-0.816***	0.110
Property	0.290	0.250	0.322	0.255	-0.542	0.231
Drug	0.134	0.226	0.160	0.228	-0.219	0.393
Other	1.478**	0.995	1.752***	1.106	-0.897**	0.119
History as a Juvenile	0.325*	0.201	0.369**	0.205	-0.598**	0.163
Mental Health Issue	0.272	0.227	0.235	0.216	-0.381	0.284
Single	0.105	0.170	0.117	0.169	-0.296	0.280
Quarters Worked Pre-Incarceration	-0.023	0.032	-0.035	0.030	0.085	0.083
Total Penalties	0.000	0.000	0.000	0.000	0.000	0.000
α			0.386			
Release Year Dummies	x					
Facility Dummies	x		x		x	
Log-Likelihood			-949.025		-934.283	
N	869		869		869	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

However, even though the effect is not significant, OTW and TI both proportionately still increase the baseline hazard in the Cox and Weibull models, and accelerate time to recidivism in the lognormal model, compared to PIE participants. As before, the Kaplan-Meier estimates of the Cox-Snell residuals against the Cox-Snell residuals are used as a measure of goodness of fit. The graphs show that the lognormal distribution seems to fit the data the best; thus, an in depth analysis of this model is carried out next.

Figure 14. Cox Model

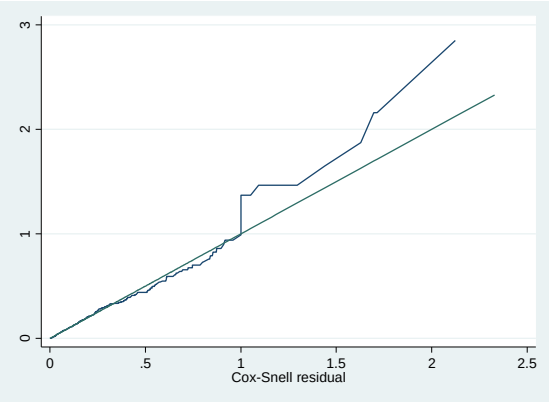


Figure 15. Lognormal Model

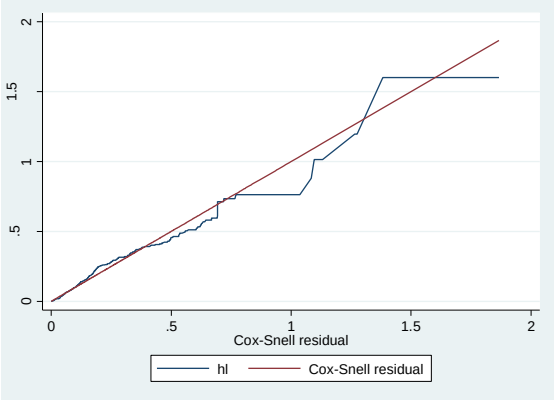


Figure 16. Weibull

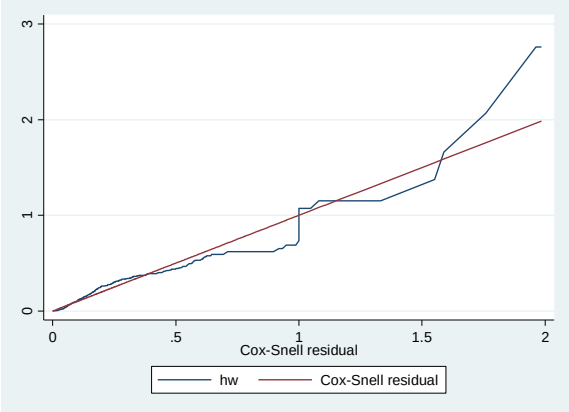


Table 11 presents the results of the sequential and non-sequential analysis of the lognormal model. The signs of the coefficients, and for the most part their significance, do not change when taking into consideration the sequential nature of the time from release to conviction. However, education and committing a property crime are important variables, number of previous incarcerations has a higher significance, and history of delinquency as a juvenile has a lower significance in the non-sequential analysis. Moreover, the magnitudes of the covariates are larger in the sequential model. It appears as though the time from release to conviction is longer for more educated individuals and shorter for those who commit a property crime compared to a crime against a person. However, these variables seem to have their effect on the length of time from release to arrest and not on the time from arrest to conviction because they are no longer significant after controlling for time from release to arrest.

Table 11. Lognormal: Time from Release to Conviction

	Sequential Analysis				Non-Sequential Analysis	
Variable	Coefficient	Standard Error	Change in Time to Failure	Standard Error	Change in Time to Failure	Standard Error
OTW	-0.100	0.580	-0.095	0.525	-0.118	0.193
TI	-0.663	0.620	-0.485	0.320	-0.177	0.193
Education	0.142	0.097	0.152	0.111	0.066*	0.039
Age at Release	0.100***	0.029	0.105***	0.032	0.028***	0.011
Time Served	0.204***	0.073	0.226***	0.089	0.099***	0.030
White	0.578	0.396	0.782	0.706	0.249	0.187
Female	22.561	1750.806	6.280E+09	1.100E+13	5.022E+03	2.519E+06
Number of Previous Incarcerations	-0.127*	0.074	-0.119*	0.066	-0.064**	0.026
History of Substance Abuse	-1.693***	0.598	-0.816***	0.110	-0.525***	0.107
Property	-0.781	0.505	-0.542	0.231	-0.310**	0.130
Drug	-0.247	0.504	-0.219	0.393	-0.135	0.164
Other	-2.275**	1.159	-0.897**	0.119	-0.608**	0.167
History as a Juvenile	-0.911**	0.406	-0.598**	0.163	-0.248*	0.115
Mental Health Issue	-0.480	0.459	-0.381	0.284	-0.015	0.171
Single	-0.351	0.398	-0.296	0.280	-0.150	0.127
Quarters Worked Pre-Incarceration	0.082	0.076	0.085	0.083	0.023	0.030
Total Penalties	0.000	0.000	0.000	0.000	0.000	0.000
Constant	5.749**	2.564				
Facility Dummies	x		x		x	
Log-Likelihood	-934.283		-934.283		-720.640	
N	869		869		886	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

Likelihood ratio tests confirm that there is no difference between the restricted models presented in Table 12 and the unrestricted models. The type of person to be more quickly convicted is younger, has served a shorter sentence length, has a history of substance abuse, has committed a crime in the other category compared to a crime against a person, and has a history of involvement with the juvenile justice system as a minor. As in the analysis of the time from release to arrest, the only variable from the economic model of crime that has a significant effect on recidivism is the number of years served in prison for the current offense. This variable has a positive effect on recidivism.

Table 12. Log-normal Restricted Model:Time from Release to Conviction

			Sequential Analysis		Non-Sequential Analysis	
Variable	**Coefficient**	**Standard Error**	**Change in Time to Failure**	**Standard Error**	**Change in Time to Failure**	**Standard Error**
Age at Release	0.113***	0.027	0.120***	0.030	0.034***	0.010
Time Served	.171***	0.069	0.186***	0.082	.089***	0.029
Number of Previous Incarcerations	-0.149**	0.073	-0.139**	0.063	-0.071***	0.025
History of Substance Abuse	-1.853***	0.589	-0.843***	0.092	-0.554***	0.099
Property	-0.772	0.506	-0.538	0.234	-0.314**	0.129
Drug	-0.166	0.502	-0.153	0.425	-0.118	0.166
Other	-2.211*	1.164	-0.890*	0.128	-0.597**	0.172
Juvenile	-1.148***	0.395	-0.683***	0.125	-0.299**	0.104
Constant	7.011***	2.254				
Facility Dummies	x		x			
Log-Likelihood	-940.758		-940.758			
N	869		869		886	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

Next, PIE participation is removed from the model and the variables for the incarceration hourly wage and the post-release hourly wage suggested as by the economic model of crime are included in the equation. Table 13 illustrates that in all three specifications, age at release, time served, substance abuse, having committed a crime in the other category, having involvement in the juvenile justice system as an adolescent, and post-hourly wages significantly affect recidivism. In addition, in the Cox model gender and the number of previous incarcerations are also important. Although incarceration hourly wages are not significant to the model, it still has the opposite sign of post-hourly wages: post-hourly wages increase the time until conviction and incarceration hourly wages decrease the time until conviction.

Table 13. Economic Model of Crime: Time from Release to Conviction (Sequential)

	Cox Model		Weibull Model		Lognormal Model	
Variable	**Change in Baseline Hazard**	**Standard Error**	**Change in Baseline Hazard**	**Standard Error**	**Change in Time to Failure**	**Standard Error**
Education	-0.035	0.035	-0.034	0.035	0.132	0.110
Age at Release	-0.037***	0.011	-0.040***	0.010	0.103***	0.032
Time Served (years)	-0.064**	0.029	-0.079***	0.028	0.223***	0.088
White	-0.183	0.126	-0.179	0.125	0.668	0.657
Female	-1.000***	0.000	-1.000	0.000	3.130E+09	4.780E+12
Number of Previous Incarcerations	0.047*	0.029	0.038	0.028	-0.106	0.066
History of Substance Abuse	0.975***	0.474	1.018***	0.473	-0.804***	0.116
Property	0.289	0.251	0.308	0.253	-0.518	0.242
Drug	0.133	0.225	0.154	0.226	-0.203	0.400
Other	1.392**	0.961	1.636**	1.059	-0.885*	0.134
History as a Juvenile	0.348**	0.203	0.385**	0.206	-0.615**	0.155
Mental Health Issue	0.248	0.223	0.200	0.210	-0.357	0.295
Single	0.092	0.168	0.099	0.166	-0.271	0.291
Quarters Worked Pre-Incarceration	-0.014	0.033	-0.029	0.030	0.074	0.084
Total Penalties	0.000	0.000	0.000	0.000	0.000	0.000
Post-Incarceration Hourly Wage	-0.030*	0.018	-0.031*	0.017	0.078*	0.049
Incarceration Hourly Wage	0.015	0.019	0.015	0.019	-0.069	0.046
Release Year	x					
Facility	x		x		x	
α			0.387			
Log-Likelihood			-948.170		-937.29707	
N	869		869		869	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

When PIE participation is included back in the framework, with the post-hourly wage and the incarceration hourly wage, the same results are obtained as when they are left out of the model (Please see Table A6 of the Appendix). Thus, focus is placed on the model without the PIE participation covariates.

Performing the model specification diagnostics used in the analysis for time from release to arrest, Figures 17-19 show that the lognormal model appears to fit the data the best.

Figure 17. Cox Model without PIE Participation

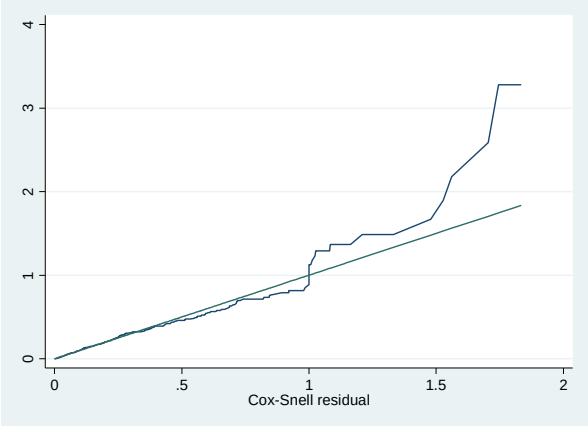


Figure 18. Lognormal Model without PIE Participation

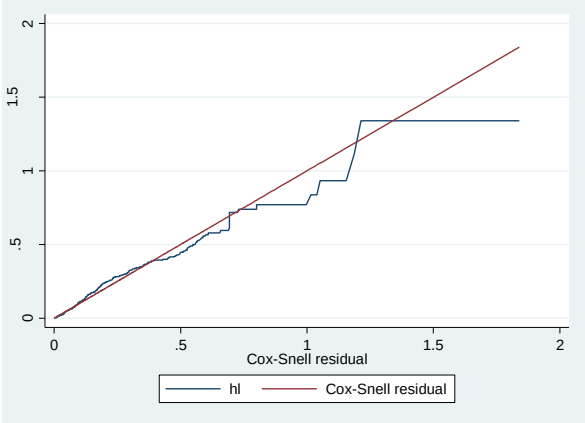
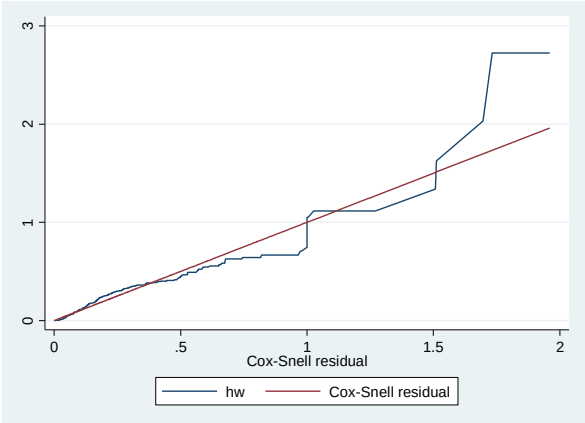


Figure 19. Weibull Model without PIE Participation



Focusing on the lognormal specification, Table 14 illustrates that the type of individual who will recidivate fastest is a young person, who served a shorter sentence for the current offense, who has a history with substance abuse, who committed a property crime or crime in the other category, and who has lower earnings post-release.[44]

Table 14. Economic Model of Crime: Time from Release to Conviction

	Restricted Lognormal Model	
Variable	**Change in Time to Failure**	**Standard Error**
Age at Release	0.106***	0.029
Time Served (years)	0.207***	0.083
Female	1.120E+10	1.720E+13
Substance	-0.843***	0.092
Property	-0.578*	0.213
Drug	-0.206	0.400
Other	-0.879*	0.141
History as a Juvenile	-0.696***	0.119
Post-Incarceration Hourly Wage	0.077*	0.043
Facilities	x	
Log-Likelihood	-938.430	
N	869	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

In summary, PIE participation is not significant when recidivism is measured as time from arrest to conviction. This result is not dependent on whether or not the additional variables suggested by the economic model of crime (i.e., payoff to legal behavior such as the incarceration hourly wage and the post-incarceration hourly wage) are included in the model. In addition, most of the significant variables are robust to the inclusion of these variables in the

[44]Although gender was not significant in the unrestricted model, likelihood ratio test rejected the null that the unrestricted model is nested in the restricted model when it is left out. Therefore, it is included in the restricted model.

model. When, these covariates are excluded from the model, the type of person most likely to recidivate is a young person who served a shorter sentence, who has been previously incarcerated, who has a history of substance abuse, who committed a crime in the other category, and who has a history with the juvenile justice system as a youth.

When post-incarceration hourly wages and incarceration hourly wages are included in the framework, the type of person most likely to commit a crime remains roughly unchanged except now the number of previous incarcerations and having committed a crime in the other category are no longer significant. Moreover, post-hourly incarceration wages have a significant positive effect on the time from release to conviction net of the time from release to arrest. While PIE participation was not significant when recidivism is measured as time from arrest to conviction, it is important to note that due to the overlap between PIE, TI, and OTW a large gap is required in order to obtain significance between these groups. Moreover, to the extent that the PIE program also increases the earnings potential of its participants, then the program may positively influence the time from release to conviction through post-incarceration hourly wages. This will be the final analysis of the section on labor market outcomes.

How Does PIE Participation Affect Labor Market Outcomes?.

In the theoretical model, the time allocated to legal endeavors and the time allocated to illegal activities is recursive; i.e., the decision to work or commit a crime can be analyzed separately. Therefore, the effects of PIE on labor market outcomes are examined separately from the recidivism analysis. If focus was solely on recidivism, this analysis would only investigate if the treatment, i.e. the PIE program, reduced criminality. However, if whether the treatment actually alleviates the targeted criminogenic needs of the criminal is important (e.g., increased

job skills and an increased likelihood of employment upon release), then recidivism should actually be a secondary goal in analyzing the rehabilitative effects of the PIE program on the inmate (Maltz, [1984]2001). Moreover, Maltz ([1984] 2001) argues that "focus[ing] on these more tangible aspects of rehabilitation would have fewer measurement problems" (p. 9). Thus, how the PIE program affects these crimonegenic needs will be evaluated by looking at employment outcomes. Therefore, in addition to looking at how PIE affects the decision to recommit a crime, this thesis will also analyze how the program influences the likelihood of employment through looking at time from release to employment; how the program influences the exoffender's ability to maintain a job once employed; and how the program impacts wages upon release.

Time from Release to Employment.[45]

Analyzing the time from release to employment is essentially investigating unemployment duration from the time an inmate is released from prison. Thus, this section is basically investigating how the PIE program affects the inmates' ability to obtain employment upon release from prison.

The Kaplan-Meier survival estimates and Nelson-Aalen cumulative hazard estimates presented in Figures 20 and 21 illustrate that PIE performs better than both TI and OTW in obtaining employment upon release from prison (also see Tables A7 and A8 of the Appendix). Nonetheless, log-rank tests of equality of the survival curves fail to reject any differences among the graphs of the three cohorts.

[45] Observations dropped from 890 to 509 because there are 381 observations recorded as having a time of zero from release to employment. This means that the time from release to employment was zero, thus these observations had employment immediately upon release from prison. Nonetheless, if the zeros are a result of measurement error, then it could be that these observations were recorded as having falsely obtained employment immediately upon release.

Figure 20. Kaplan-Meier Survival Estimates

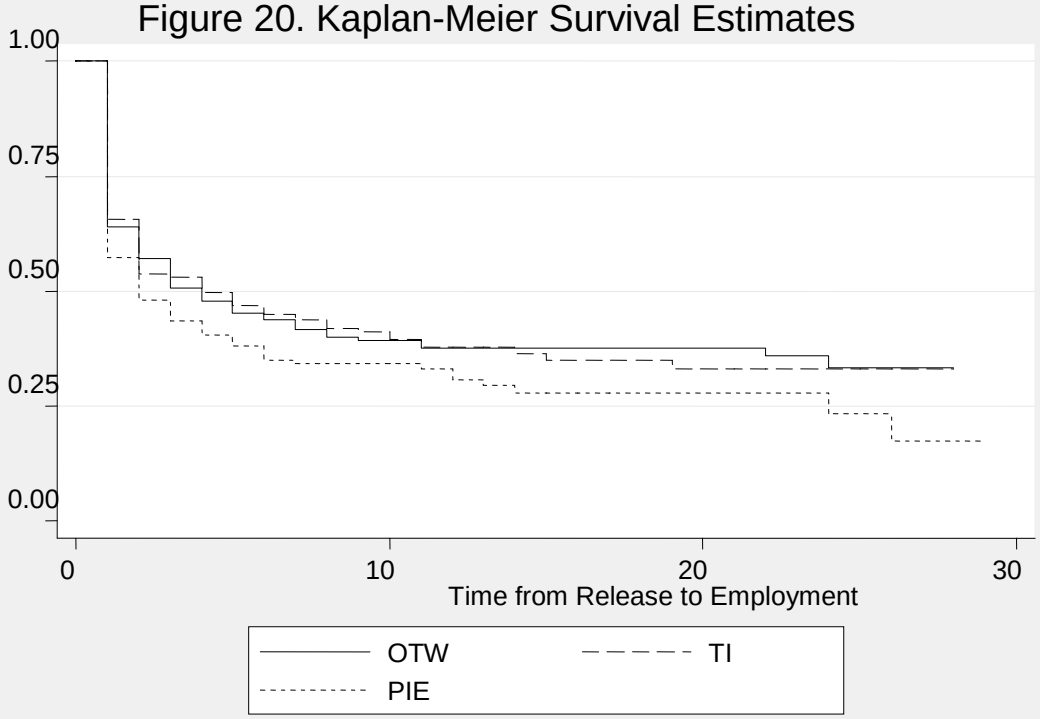


Figure 21. Nelson-Aalen Cumulative Hazard Estimates

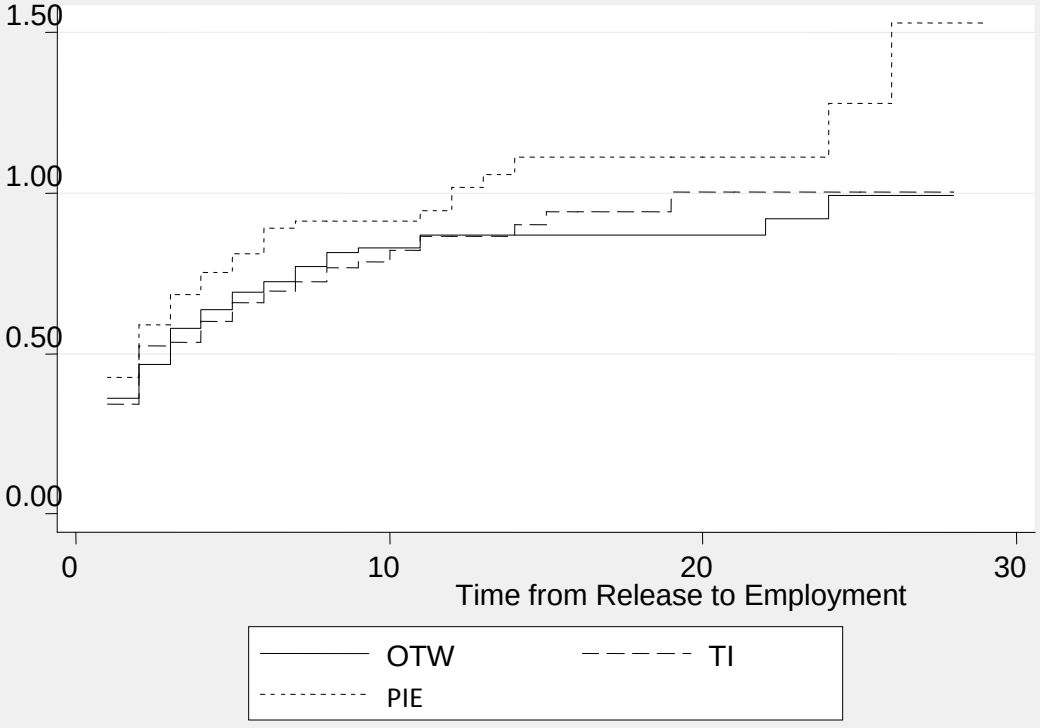


Table 15 presents the Cox, Weibull, and lognormal models which include the additional controls. Figures 22-24 show the results of the specification tests. The graphs demonstrate that none of the models provide a very good fit for measuring the time from release to employment. This is also seen in the fact that very few of the variables are significant to the models and many of the variables in all three specifications have signs contrary to what is expected.

Figure 22. Cox Model

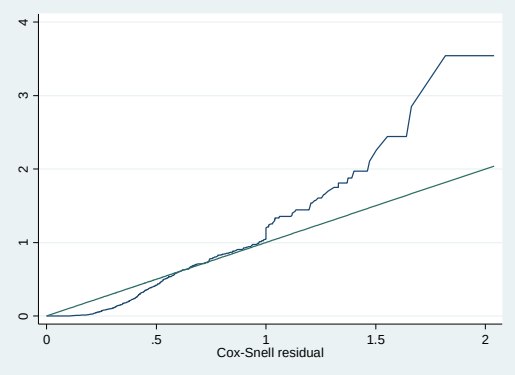


Figure 23. Lognormal Model

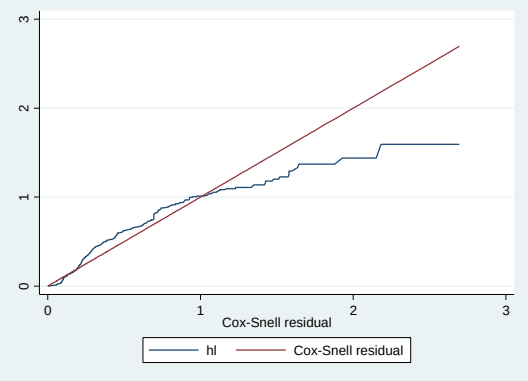
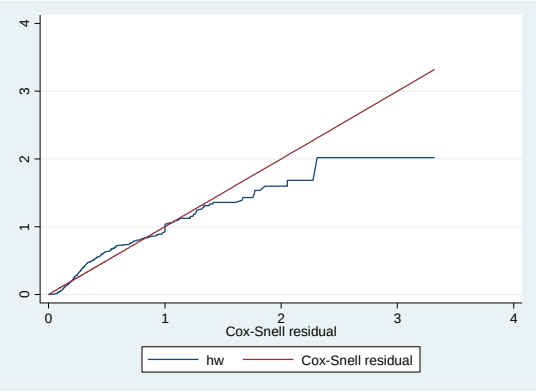


Figure 24. Weibull Model



There are only two variables that significantly affect time from release to employment: number of quarters worked pre-incarceration and having committed a property crime. Number of quarters worked pre-incarceration is significant in all three models, while having committed a property crime is significant only in the Cox and lognormal specifications. The number of quarters worked pre-incarceration increases the baseline hazard in the Cox and Weibull models by 6.6% and 13.9% respectively and decreases the time from release to employment in the lognormal model by 9.8%. Thus, it is a positive indicator of attaining employment. Those who commit property crimes increase the baseline hazard in the Cox model by 29.2% compared to a person who commits a crime against a person, and decreases the time from release to employment by 34.8% compared to those who commit a crime against a person in the lognormal specification. Although it is not significant, PIE participants have a higher hazard rate in the Cox and Weibull models and a more accelerated failure time in the lognormal model than the TI and OTW cohorts indicating that those who participate in PIE gain employment faster than TI and OTW participants.

Table 15. Dependent Variable: Time from Release to Employment

	Cox Model		Weibull		Lognormal	
Variable	Change in Baseline Hazard	Standard Error	Change in Baseline Hazard	Standard Error	Change in Time to Failure	Standard Error
OTW	-0.104	0.128	-0.208	0.170	0.196	0.233
TI	-0.120	0.131	-0.126	0.197	0.161	0.235
Education	0.001	0.030	-0.044	0.031	0.007	0.041
Age at Release	-0.003	0.060	0.049	0.071	-0.018	0.078
Age at Release Squared	0.000	0.001	-0.001	0.001	0.000	0.001
Number of Disciplinary Reports	0.002	0.010	0.010	0.012	0.000	0.013
Time Served (years)	-0.022	0.022	-0.022	0.030	0.018	0.029
White	0.000	0.117	-0.032	0.129	0.077	0.175
Female	-0.048	0.136	-0.699	0.367	0.039	0.199
Number of Previous Incarcerations	0.024	0.020	0.004	0.026	-0.033	0.027
History of Substance Abuse	0.118	0.197	-0.074	0.187	-0.131	0.202
Property	0.292*	0.196	0.178	0.215	-0.348**	0.137
Drug	0.127	0.163	0.054	0.185	-0.220	0.152
Other	0.229	0.490	0.334	0.555	-0.273	0.406
History as a Juvenile	0.011	0.134	-0.006	0.149	-0.055	0.171
Mental Health Issue	0.213	0.170	0.264	0.200	-0.261	0.144
Single	0.059	0.134	0.031	0.146	-0.017	0.168
Quarters Worked Pre-Incarceration	0.066***	0.022	0.139***	0.029	-0.098***	0.028
Number of Children	0.037	0.036	0.038	0.039	-0.047	0.047
Previous Occupation: Food/Retail/Office	0.032	0.341	0.010	0.356	-0.077	0.388
Previous Occupation: Unskilled labor/Assembly/Warehouse /Trucking	0.417	0.444	0.250	0.416	-0.387	0.246
Previous Occupation: Skilled Labor/construction Trades/Welding	0.139	0.361	0.107	0.373	-0.095	0.367
Previous Occupation: Unemployed Disabled (SSI)/Student/Unemployed	-0.138	0.299	-0.207	0.293	0.270	0.557
Medical Special Needs	-0.134	0.195	-0.102	0.216	0.254	0.370
Release Year Dummies	x				x	
Facility Dummies			x			
α			0.763			
Log-Likelihood			-784.692		-774.725	
N	509		509		509	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

Figures 22-24 show little difference in the goodness of fit of the lognormal and Weibull models (the Cox model seems to be the worst fit of the data). Nonetheless, the log-likelihood is larger in the lognormal model indicating that the lognormal model may provide a better fit than the Weibull specification. The restricted lognormal model, displayed in Table 16, is further discussed because the likelihood ratio test indicated no difference between the restricted and the unrestricted specification. Once the insignificant covariates are dropped, having committed a crime in the drug category compared to a crime against a person now significantly decreases the unemployment duration of the inmate. Thus, the type of criminal to most quickly gain

employment upon release from prison will have committed a property or a drug crime compared to a crime against a person, and has greater work experience (as measured by the number of quarters worked) pre-incarceration.

Table 16. Restricted Lognormal Model: Time from Release to Employment

Variable	Coefficient	Standard Error	Change in Time to Failure	Standard Error
Property	-0.513***	0.194	-0.401***	0.1164126
Drug	-0.314*	0.184	-0.270*	0.1342368
Other	-0.383	0.556	-0.318	0.3789062
Quarters Worked Pre-Incarceration	-0.104***	0.029	-0.099***	0.0264147
Constant	1.875	0.232		
Release Year Dummies	X		x	
Log-Likelihood	-784.521		-784.521	
N	509		509	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

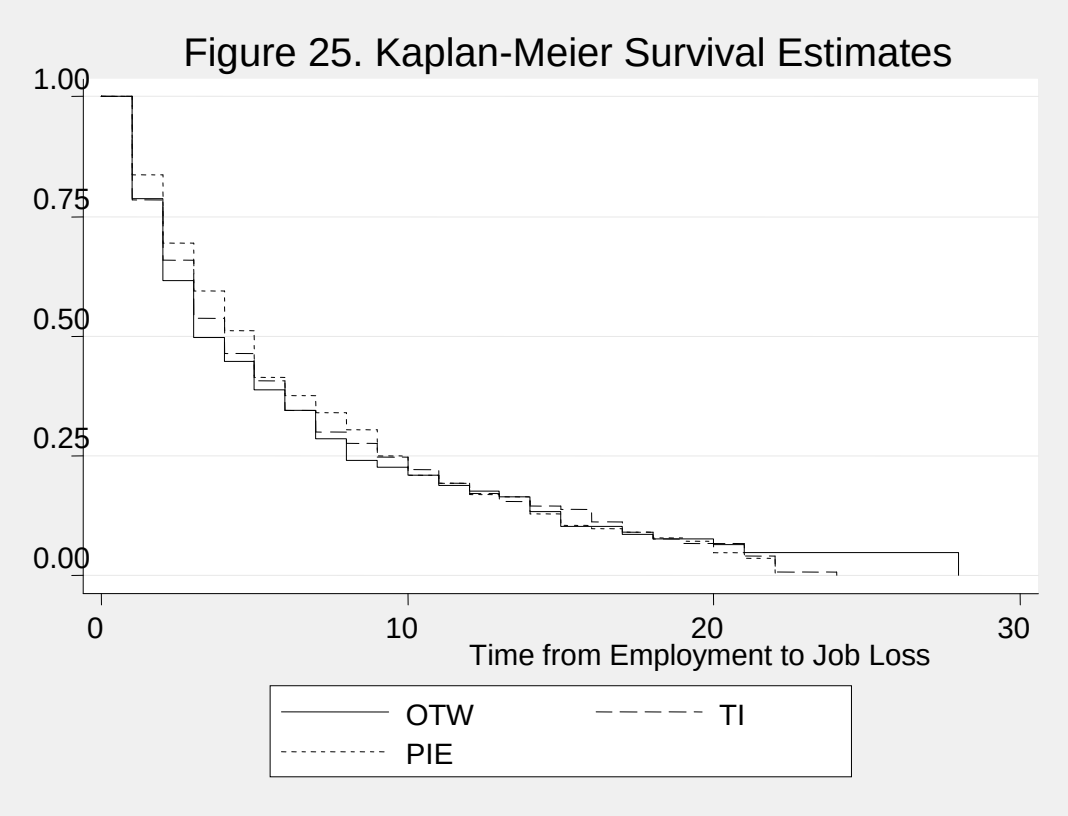
Time from Employment to Job Loss.[46]

If job termination is the decision of the employer, then evaluating time from employment to job loss will be equivalent to assessing the soft-skills of the ex-offender, e.g., the ability to consistently show up at work on time. However, if job termination is the decision of the former inmate, as is believed to be in the literature (see Schmidt & Witte, 1984), then investigating PIE's effect on the time from employment to job loss will be a measure of job satisfaction and stability of the ex-offender. Thus, time from employment to job loss is more than likely measuring how the PIE program affects the ex-offenders ability to attain satisfactory employment. This is important because in theories of dual, or segmented, labor markets unsatisfactory employment is one reason individuals end up in the secondary, or low-paying,

[46] The sample decreases from 890 to 709 observations because 181 observations never obtained employment.

labor pool. Following the logic of segmented labor market theorists, by helping individuals to attain more pleasing jobs, this will change the criminals tastes for work and therefore, taste for crime.

The Kaplan-Meier survival estimates and Nelson-Aalen cumulative hazard estimates of Figures 25 and 26 show no difference between PIE, TI, and OTW (also see Tables A9 and A10 of the Appendix). Moreover, log-rank test of equality fail to reject the null that all three survival curves are equal.



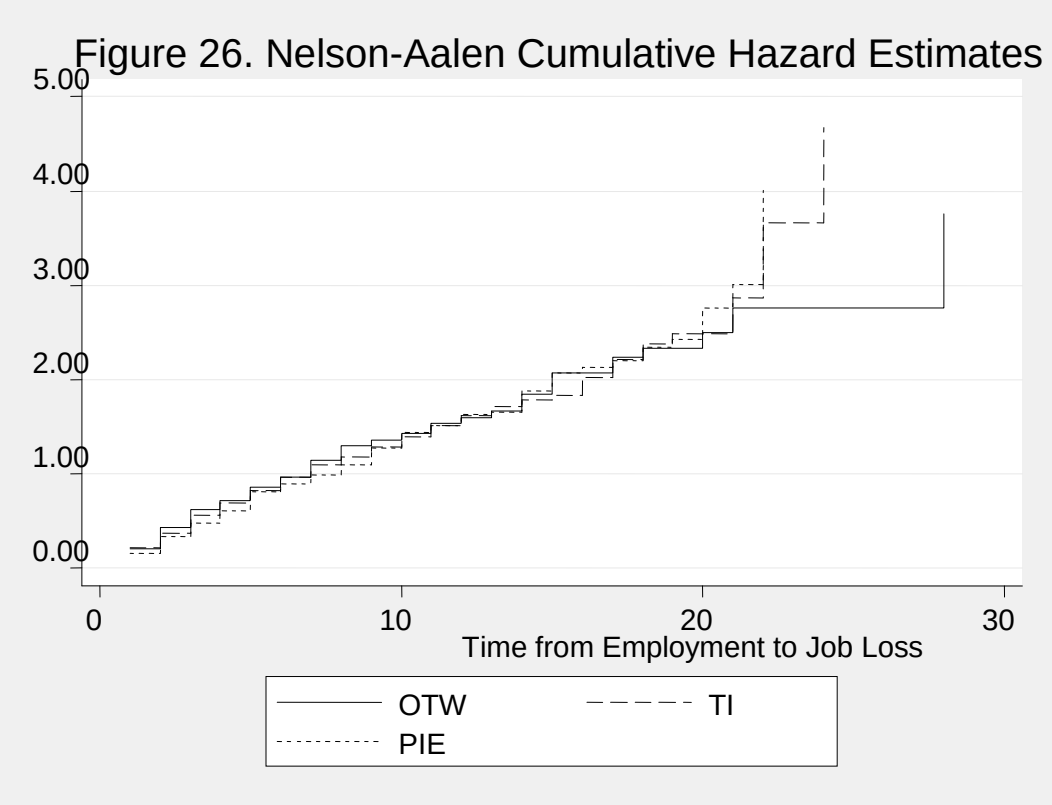


Table 17 shows that the Cox, Weibull, and lognormal models provide similar results in sign and significance. In all three models education, time served, gender, number of previous incarcerations, having committed a crime in the other category as compared to a property crime, and having a history with the juvenile justice system as a minor significantly influences time from employment to job loss. Moreover, there is a significant difference in the time from employment to job loss between the OTW cohort and PIE participants in the lognormal model, having a history of mental health is significant in the Weibull and lognormal specifications, and the number of quarters worked pre-incarceration is significant in the Weibull model.

Table 17. Dependent Variable: Time from Employment to Job Loss

	Cox		Weibull		Lognormal	
Variable	**Change in Baseline Hazard**	**Standard Error**	**Change in Baseline Hazard**	**Standard Error**	**Change in Time to Failure**	**Standard Error**
OTW	0.144	0.169	0.194	0.178	-0.225**	0.092
TI	0.082	0.174	0.117	0.182	-0.169	0.106
Education	-0.053**	0.022	-0.062***	0.022	0.066***	0.021
Age at Release	-0.027	0.046	-0.036	0.046	0.002	0.040
Age at Release Squared	0.000	0.001	0.000	0.001	0.000	0.001
Number of Disciplinary Reports	0.004	0.008	0.006	0.008	-0.006	0.007
Time Served	-0.050**	0.021	-0.064***	0.021	.046***	0.017
White	0.021	0.104	0.028	0.106	-0.053	0.077
Female	-0.798*	0.169	-0.875**	0.108	3.233	2.969
Number of Previous Incarcerations	0.046**	0.020	0.056***	0.020	-0.043***	0.016
History of Sustance Abuse	-0.040	0.131	-0.050	0.131	-0.040	0.107
Property	0.017	0.130	0.040	0.136	-0.060	0.097
Drug	-0.010	0.129	0.000	0.133	-0.013	0.103
Other	1.216***	0.634	1.619***	0.766	-0.488***	0.124
History as a Juvenile	0.352***	0.141	0.460***	0.156	-0.180**	0.070
Mental Health Issue	0.211	0.144	0.230*	0.147	-0.14*	0.083
Single	0.127	0.113	0.153	0.117	-0.073	0.076
Quarters Worked Pre-Incarceration	-0.025	0.016	-0.034**	0.016	0.021	0.014
Number of Children	0.039	0.030	0.039	0.030	-0.037	0.023
Medical Special Needs	0.230	0.228	0.304	0.247	-0.098	0.135
Release Year Dummies	X		X			
Facility Dummies	X		X		X	
α			1.293	0.041		
Log-Likelihood			-910.617		-887.662	
N	709		709		709	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

Comparing Figures 27-29, as in the previous analyses, shows that the lognormal model is a very good fit when measuring time from employment to job loss. In addition, the likelihood ratio test assessing the null that the unrestricted model is nested in the restricted model cannot be rejected. Therefore, the results in Table 18 only present the restricted model.

Figure 27. Cox Model

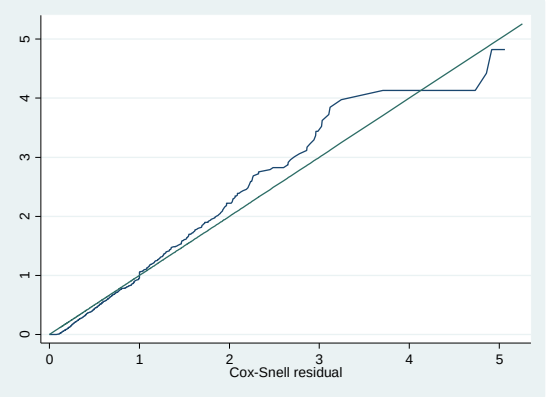


Figure 28. Lognormal Model

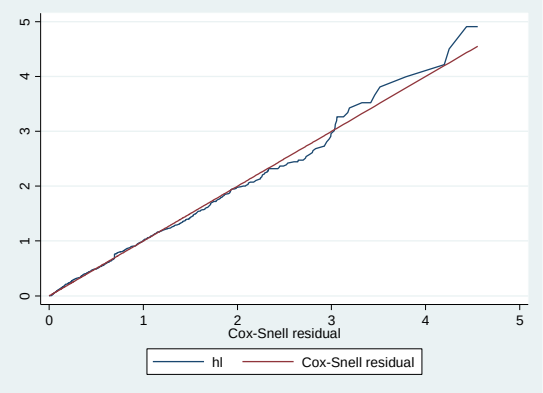
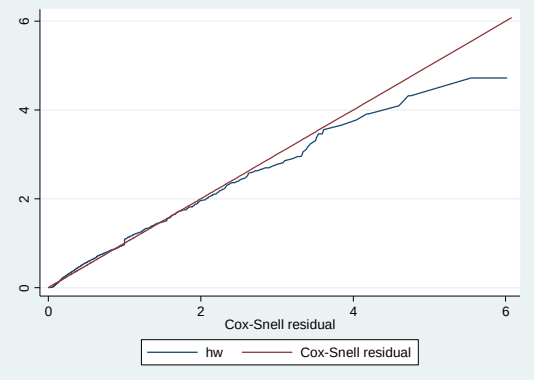


Figure 29. Weibull



The restricted model presented in Table 18 indicates that the type of inmate to maintain employment longer upon release is a woman who worked in PIE while incarcerated, who is more educated upon entering prison, who served a longer sentence, who had fewer previous incarcerations, who committed a crime against a person compared to a crime in the other category, who does not have a history with the juvenile justice system as a youth, and who does not have a history of a mental health issue. These covariates affect the time from employment to job loss as follows: PIE participants have a time to failure that is 23% greater than OTW partakers; each additional year of education upon entry into prison will increase the time from employment to job loss by 7.7%; each additional year of time served will increase the length of employment by 4.1%; female offenders will have longer spells of employment than male offenders upon release by 277.3%; each additional previous incarceration will decrease the employment spell by 4.3%; a person who has committed a crime in the other category will have an employment duration 47.7% shorter than someone who commits a crime against a person; having involvement in delinquent acts as a juvenile will decrease the employment spell by 20.2%; and having a history of a mental health issue will decrease the time from employment to job loss by 15.5%.

Table 18. Restricted Lognormal Model: Time from Employment to Job Loss

Variable	Coefficient	Standard Error	Change in Time to Failure	Standard Error
OTW	-0.261**	0.118	-0.230**	0.091
TI	-0.202	0.127	-0.183	0.104
Education	0.074***	0.019	0.077***	0.021
Time Served	.040***	0.014	.041***	0.014
Female	1.328*	0.699	2.773*	2.638
Number of Previous Incarcerations	-0.044***	0.016	-0.043***	0.015
Property	-0.068	0.103	-0.066	0.096
Drug	-0.018	0.104	-0.018	0.102
Other	-0.649***	0.243	-0.477***	0.127
History as a Juvenile	-0.226***	0.083	-0.202***	0.066
Mental Health Issue	-0.169*	0.094	-0.155*	0.079
Constant	0.700	0.468		
Facility Dummies	X		x	
Log_Likelihood	-892.210		-892.210	
N	709		709	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

An inmate that participated in activities characterized as other than work will have a time from employment to job loss that is 23% lower than a person who worked in PIE while incarcerated. Therefore, if time from employment to job loss is measuring job satisfaction, then those who work in PIE while incarcerated are able to obtain more fulfilling jobs upon release. If time from employment to job loss is measuring soft skills of the inmate (e.g., showing up to work consistently and on time), then it may be that participation in PIE while incarcerated also enhances the soft skills of the inmate so that they are able to maintain employment longer upon release.

How does PIE Participation Affect Wages?

Wages are the payoff to legal labor market activities. Therefore, according to the economic choice theory developed in Chapter III, wages will directly affect the criminal's decision to (re)commit a crime. In the theoretical model an increase in legal wages is ambiguous, and increasing the payoffs to legal labor market activity encourages criminal behavior (crime and legal employment are gross compliments) only given certain assumptions about attitudes towards risk and different states of the world. Moreover, segmented labor market theories and theories of anomie suggest that wages are important in reducing criminality (see Chapter II). The results in the recidivism analysis of this chapter show that once the payoffs to free labor and incarceration labor are accounted for in the model PIE participation no longer has an effect on recidivism. Moreover, time from release to arrest and time from release to conviction are significantly and positively influenced by the post-hourly wage (i.e., increasing post-hourly wages seems to reduce recidivism). Thus, for a complete analysis of labor market outcomes, it seems appropriate to analyze how PIE participation affects free labor market wages. In this section this will be investigated by first modeling labor market participation and then analyzing wages.

Table 19 shows the probit model for labor force participation defined as having worked at least one quarter post-incarceration. It indicates that OTW and TI participants have statistically significant lower probabilities of labor force participation than PIE individuals. Being in the OTW category lowers the probability of labor force participation by .115, and working in TI lowers the probability of labor force participation by .138. In addition, years worked pre-incarceration and race are also significant in the labor force model. Each additional year worked before incarceration increases the probability of employment by .096 and being white increases

the probability of employment by .056. The remaining variables were not significant. However, the number of previous incarcerations, history of substance abuse, history of delinquent acts as a juvenile, having a mental health issue, and being single all have signs opposite to what is expected. In summary, the type of male inmate most likely to be employed upon release worked in the PIE program, has greater legal labor market experience pre-incarceration as measured by the number of years worked prior to the current prison sentence, and is white.

Table 19. Probit: Labor Force Participation

Variable	Coefficient	Standard Error	Marginal Effects
OTW	-0.415***	0.153	-0.115
TI	-0.490***	0.160	-0.138
Education	-0.005	0.033	-0.001
Age at Release	-0.035	0.061	-0.009
Age at Release Squared	0.000	0.001	0.000
Number of Disciplinary Reports	-0.005	0.008	-0.001
Time Served (years)	-0.020	0.020	-0.005
White	0.215*	0.131	0.056
Number of Previous Incarcerations	0.048	0.031	0.012
History of Substance Abuse	0.137	0.175	0.037
Property	0.162	0.164	0.041
Drug	0.192	0.159	0.048
Other	0.729	0.564	0.132
History as a Juvenile	0.084	0.134	0.022
Mental Health Issue	0.101	0.161	0.026
Single	0.117	0.139	0.031
Years Worked Pre-Incarceration	0.367***	0.130	0.096
Number of Children	0.026	0.041	0.007
Medical Special Needs	-0.289	0.195	-0.084
Release Year Dummies	X		
Inverse Mills Ratio			
Constant	1.864	1.175	
Pseudo R-squared	0.099		
N	613		

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

To analyze how PIE participation affects weekly earnings, OLS is ran without controlling for selection bias resulting from the decision to work (see Table 20). The OLS results show that having participated in OTW while in prison lowers weekly earnings by 22.2% compared to those of PIE participants; being white increases weekly earnings by 16%; increasing education by one

year upon intake into prison increases post-release weekly earnings by 9%; serving one more year in prison increases post-release weekly earnings by 5%; increasing the number of previous incarcerations by one term will decrease wages by 6.9%; having a history of substance abuse will increase earnings by 22.3%; having a history of mental illness will decrease earnings by 36.9%; having one more year of experience in the labor market pre-imprisonment will increase earnings by 14.2%; and being unemployed, disabled, or a student pre-confinement will decrease post-release earnings by 49.2% compared to those who are self-employed prior to incarceration. Therefore, white men who participated in PIE while imprisoned, who are more educated at the time of confinement, who served longer prison terms, who had fewer previous incarcerations, who have a history of substance abuse, who do not have a history of a mental illness, who have greater work experience pre-incarceration, and who are self-employed will earn higher wages upon release. All of the signs for the significant covariates are as expected except for the sign on substance abuse. However, this could be due to the large portion of the sample (86.4% of males who obtained employment post-release) having a history of substance abuse.

Table 20. Earnings Equations

Variable	Probit: Labor Force Participation		Wage Equation (Log Weakly Earnings)		Wage Equation(Log Weakly Earnings): No Experience		Wage Equation(Log Weakly Earnings):Heckman Selection	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
OTW	-0.415***	0.153	-0.222**	0.103	-0.253**	0.105	-0.088	0.177
TI	-0.490***	0.160	-0.056	0.112	-0.075	0.113	0.103	0.206
Education	-0.005	0.033	0.090***	0.024	0.088***	0.024	0.092***	0.024
Age at Release	-0.035	0.061	0.024	0.052	0.017	0.052	0.033	0.053
Age at Release Squared	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001
Number of Disciplinary Reports	-0.005	0.008						
Time Served (years)	-0.020	0.020	0.050***	0.013	0.043***	0.012	0.061***	0.017
White	0.215*	0.131	0.160*	0.096	0.130	0.094	0.092	0.122
Number of Previous Incarcerations	0.048	0.031	-0.069***	0.024	-0.070***	0.023	-0.084***	0.030
History of Substance Abuse	0.137	0.175	0.223*	0.134	0.217	0.134	0.167	0.145
Property	0.162	0.164	0.028	0.108	0.022	0.109	-0.030	0.123
Drug	0.192	0.159	0.011	0.115	0.021	0.116	-0.061	0.127
Other	0.729	0.564	-0.428	0.362	-0.407	0.341	-0.614	0.433
History as a Juvenile	0.084	0.134	-0.039	0.102	-0.072	0.103	-0.067	0.106
Mental Health Issue	0.101	0.161	-0.369***	0.130	-0.378***	0.131	-0.406***	0.136
Single	0.117	0.139	-0.050	0.101	-0.076	0.099	-0.083	0.109
Years Worked Pre-Incarceration	0.367***	0.130	0.143***	0.057			0.055	0.107
Number of Children	0.026	0.041	-0.095	0.221	-0.008	0.033	-0.012	0.034
Medical Special Needs	-0.289	0.195	-0.178	0.212	-0.001	0.155	0.080	0.177
Previous Occupation: Food/Retail/Office			-0.071	0.214	-0.041	0.220	-0.087	0.224
Previous Occupation: Unskilled labor/Assembly/Warehouse /Trucking			-0.492*	0.278	-0.153	0.210	-0.167	0.215
Previous Occupation: Skilled Labor/construction Trades/Welding			-0.004	0.033	-0.021	0.212	-0.060	0.217
Previous Occupation: Unemployed Disabled (SSI)/Student/Unemployed			-0.021	0.156	-0.502*	0.276	-0.464*	0.283
Release Year Dummies	X		X		X		X	
Inverse Mills Ratio							-0.899	0.854
Constant	1.864	1.175			3.969***	1.005	3.739***	1.015
R-squared	0.099		0.166	0.155			0.168	
N	613		485		485		485	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

A Heckman two-step selection model is used to control for selection bias. In order to obtain identification, at least one variable must be different between the selection equation and the wage equation. This variable is number of disciplinary reports while in prison. It is believed that this variable represents attitudes and characteristics that are counterproductive to the legal labor market, and will thus affect the decision to commit a crime, however, it should not affect the earnings of the ex-offender once the decision is made to work. The inverse mills ratio in the Heckman-selection model is basically the hazard of obtaining employment. It is included in the

model in order to control for selection bias inherent in the decision to work. In this model it is not significant as can be seen in Table 20.[47] All of the signs are as expected except for the coefficients on TI, having a medical condition with special needs, and having a history of substance abuse. Nonetheless, these variables are not significant to the model. Compared to the OLS model, once selection is controlled for the marginal effects of OTW, race, substance abuse, and years worked pre-incarceration are no longer significant. Moreover, the sign on TI and having a medical problem changes from negative to positive. The marginal effects of education, number of years served, number of previous incarcerations, having a mental health issue, and being unemployed or out of the labor force prior to incarceration all significantly affect post-release weekly earnings. There magnitudes are 9.2%, 6.1%, -8.4%, -40.6%, -46.4% respectively. It appears as though controlling for selection mitigates the effects of participation in PIE compared to OTW and TI, and, not surprisingly, the experience variable. Moreover, it seems as though individuals who are self employed earn higher wages than those who are not (although this difference is only significant between the self-employed and the occupation group representing the unemployed and those who were not in the labor force). Thus, after controlling for selection, male inmates who are more educated, served more time in prison, had fewer previous incarcerations, have no history of a mental health issue, and who were self-employed prior to incarceration earn higher wages.

The wage equation excluding experience seems to have all of the coefficients of the expected sign except for history of substance abuse. Although the sign on that coefficient is positive, it is not significant. Moreover, the coefficient on OTW is negative and statistically

[47] This model is also estimated using the full maximum likelihood estimator (MLE) in order to test for selectivity bias. The full MLE tests for selection bias based on the correlation parameter rho. The rho coefficient is not significant when the model is estimated using full MLE. Thus, selection bias does not seem to be important in the model.

significant indicating that those who were placed in other than work positions earned 25.2% less than PIE participants after release from prison. The remaining significant coefficients mirror those in the Heckman equation in magnitude and level of importance. Thus, after excluding the experience variables, an having an additional year of education at the time of confinement increases post-incarceration weekly earnings by 8.8%; serving an additional year of prison prior to release increases weekly earnings by 4.3%; increasing the number of previous incarcerations by one decreases post-confinement weekly earnings by 7%; having a mental health issue decreases post-release weekly earnings by 37.8%; and being unemployed or out of the labor force prior to incarceration decreases post-imprisonment weekly earnings by 50.2%. Therefore, men who participated in the PIE program, who are more educated upon entry into prison, who served a longer prison sentence, who had fewer previous incarcerations, who do not have a history of a mental health issue, and who are self-employed earn higher wages upon release.

The findings suggest that there is no difference in post-release earnings between PIE participants and the TI cohort. However, PIE participants could earn up to 25.2% more than OTW participants upon release from prison.

Discussion of Results.

The effects of the PIE program on the criminality (recidivism) and the criminogenic needs (labor market outcomes) of the offender were analyzed in the previous sections. Table 21 gives a brief summary of the results from the analyses. The variables that significantly affect recidivism and/or labor market outcomes are PIE participation, age at release, gender, education, number of quarters worked pre-incarceration, post-incarceration hourly wage, occupation prior to incarceration, having a mental health issue, history of substance abuse, number of previous

incarcerations, history of juvenile delinquency, and the offense type. None of the variables have the same effect in all of the equations examined.

Table 21. Table of Results

Variables	Time from Release to Arrest	Time from Release to Conviction	Time from Release to Employment	Time from Employment to Job Loss	Earnings (No Experience)
Other Than Work Participants (OTW)	No Effect	No Effect	No Effect	-	-
Traditional Industries Participants (TI)	-	No Effect	No Effect	No Effect	No Effect
Prison Industry Enhancemant Participants (PIE)	Comparison Group	Comparison Group	Comparison Group	Comparison Group	Comparison Group
Age at Release (Years)	+	+	No Effect	No Effect	No Effect
Age at Release Squared	N/A	N/A	No Effect	No Effect	No Effect
White	No Effect	No Effect	No Effect	No Effect	No Effect
Minority	Comparison Group	Comparison Group	Comparison Group	Comparison Group	Comparison Group
Female	+	No Effect	No Effect	No Effect	N/A
Education (Highest Grade Completed Pre-incarceration)	No Effect	No Effect	No Effect	+	+
Single (Binary Variable indicating if Inmate is Single)	No Effect	No Effect	No Effect	No Effect	No Effect
Number of Children	N/A	N/A	No Effect	No Effect	No Effect
Number of Quarters Worked Pre- Incarceration	No Effect	No Effect	-	No Effect	N/A
Hourly Wage-During Incarceration (Dollars)	No Effect	No Effect	N/A	N/A	N/A
Hourly Wage-Post Incarceration (Dollars)	+	+	N/A	N/A	N/A
Previous Occupation: Food/Retail/Office	N/A	N/A	No Effect	N/A	No Effect
Previous Occupation: Unskilled labor/Assembly/Warehouse /Trucking	N/A	N/A	No Effect	N/A	No Effect
Previous Occupation: Self-Employed	N/A	N/A	Comparison Group	N/A	Comparison Group
Previous Occupation: Skilled Labor/construction Trades/Welding	N/A	N/A	No Effect	N/A	No Effect
Previous Occupation: Unemployed Disabled (SSI)/Student/Unemployed	N/A	N/A	No Effect	N/A	-
Mental Health Issue (Prison Records Indicated a Mental Health Problem)	No Effect	No Effect	No Effect	-	-
Medical Special Need (Prison Records Indicated Inmate Has a Physical Medical Special Need)	N/A	N/A	No Effect	No Effect	No Effect
History of Substance Abuse	-	-	No Effect	No Effect	No Effect
Number of Previous Incarcerations	-	No Effect	No Effect	-	-
History of Delinquency as a Juvenile	-	-	No Effect	-	No Effect
Offense Type: Personal	Comparison Group	Comparison Group	Comparison Group	Comparison Group	Comparison Group
Offense Type: Property	-	-	-	No Effect	No Effect
Offense Type: Drug	No Effect	No Effect	-	No Effect	No Effect
Offense Type: Other	-	-	No Effect	-	No Effect
Time Served (years)	+	+	No Effect	+	+
Number of Disciplinary Reports	N/A	N/A	No Effect	No Effect	N/A
Total Monetary Penalties (Dollars)	No Effect	No Effect	N/A	N/A	N/A

Time from release to arrest and time from arrest to conviction are used to measure recidivism. PIE participation, gender, and the number of previous incarcerations are significant in the equation measuring time from release to arrest but are not significant when recidivism is

measured as time from release to conviction. Participation in Traditional Industries compared to working in PIE while incarcerated, being male, and the number of previous incarcerations all work to decrease the time from release to arrest. In addition, younger individuals who had shorter prison terms, who were incarcerated for a property offense or an offense in the other category compared to a person incarcerated for a crime against a person, who have a history of substance abuse, who have a history of delinquency as a juvenile, and who earn lower wages upon release have shorter crime free spells regardless of the measure of recidivism. These variables are all consistent with what has been found in the literature (please see the literature review of Chapter II).

Smith et al. (2006) also analyzed PIE's impact on recidivism when measured as time from release to arrest and time from release to conviction using a larger sample of the data used in this analysis. They find that more PIE participants remained arrest- and conviction- free than OTW and TI participants. However, in this analysis PIE only significantly differs from those who worked in TI when recidivism is measured as time from release to arrest. Except for the Kaplan-Meier estimates the estimation techniques in this study differed from those in Smith et al. (2006) because covariates were included in the analysis. Nonetheless, the Kaplan-Meier estimates did not find any statistically significant difference between PIE, OTW, and TI. There are a couple of reasons why the results differ across studies. It may be that the there is bias in the smaller sample resulting from loss of efficiency due to the reduction in the sample size. In addition, it could be that the data are not a random sample of the larger dataset.

Labor market outcomes were measured by time from release to employment, time from employment to job loss, and weekly earnings. The only variables that significantly affected time from release to employment are the type of offense (i.e., having committed a property offense or

a drug offense compared to a crime against a person) and the number of quarters worked pre-incarceration. All of these covariates significantly decreased the time from release to employment. The variables significantly affecting the time from employment to job loss are participation in OTW compared to PIE, education, time served, gender, number of previous incarcerations, having committed a crime in the other category as compared to a crime against a person, having a history of juvenile delinquency, and having a mental health issue. All of these variables except for gender, education, and time served decrease the time from employment to job loss. Being female, serving a longer sentence, and having more education increase the time from employment to job loss. Finally, the covariates significantly influencing earnings of the ex-offender are partaking in OTW instead of PIE, education, time served, number of previous incarcerations, having a history of a mental health issue, and having a previous occupation as unemployed/disabled/student compared to being self-employed. All of these variables except for education and time served negatively affect post-incarceration earnings. These results are very similar to those found in Needels (1996) and Schmidt and Witte (1984) in that the majority of the human capital variables (such as race, age at release, age at release squared, education, and number of previous incarcerations) are not significant to employment and earnings outcomes. The only human capital variables that had any impact on employment (job stability) and earnings of prison releasees are education and criminal history (number of previous incarcerations).

Smith et al. (2006) find that PIE participants obtain employment quicker, obtain higher wages, and maintain their employment status for longer periods than TI and OTW releasees. However, in this analysis PIE only significantly affects time from employment to job loss and weekly earnings when compared to OTW but not TI. Moreover, the Kaplan-Meier estimates for time from release to employment and time from employment to job loss, which are more

comparable to the Smith et al. (2006) results, find no statistically significant difference among the three cohorts in this study. As in the recidivism analysis, this may be due to loss in inefficiency due to the smaller sample size or it may be that the data used in this analysis are not a random sample of the larger dataset used in Smith et al.'s (2006) investigation.

Chapter VI
Conclusion

The PIE program is a unique federal initiative that allows private industry to utilize prison labor for the manufacturing of goods and services. The program is thought to benefit the public (e.g., the state, tax payers, victims) and the inmate (e.g., enhanced skills, leading to higher better paying jobs upon release). This thesis sought to investigate how participation in the PIE program affects the inmate through recidivism and labor market outcomes. First, it developed a simple theoretical framework that incorporated employment of the inmate during confinement in order to determine what effect this program will have on the criminal's optimization problem. The model suggests that the criminal's problem is recursive. Therefore, the criminal will first decide how much time to allocate to legal activities, and then he will choose the optimal time allotment to illegal endeavors. The model shows that it is theoretically possible that participation in PIE could increase recidivism through wages if an increase in the wage rate causes the consumption of illegal activity to increase by more than the consumption of legal endeavors. The decision to commit a crime will be a function of the expected unemployment rate, the subjective probability of detection and conviction, legal labor market activity, the penalty for illegal activity, gains from illegal activity, nonwage income or wealth, the subjective probability of legal work while in prison, severity of punishment, and tastes.

Next, the effects of participation in the Prison Industry Enhancement Certificate Program on recidivism and employment outcomes were empirically tested using survival analysis. The effects of the PIE program on post-release earnings were also examined using the two-step Heckman selection estimator. Due to the overlap in task between PIE and TI and TI and OTW, the lack of information on whether or not an individual participated in PIE in a previous

incarceration, and the inability to control for spillover effects from being incarcerated in a PIE facility, this analysis requires a large difference between the three cohorts in order to obtain a significant effect. The results show that such an effect exists between TI and PIE but not between OTW and PIE. PIE participation significantly lowers recidivism compared to those inmates who participated in TI when recidivism is measured as time from release to arrest. Nonetheless, although there was no significant difference between OTW and PIE participants, the sign of the coefficient still suggests that PIE inmates had lower recidivism than those in the OTW cohort. When recidivism is measured as time from arrest to conviction there is no significant difference between PIE, TI, and OTW. Nonetheless, the signs on the coefficients still indicate that PIE participants are reconvicted at lower rates. In addition, when post-incarceration hourly wages are controlled for in the model those who earn higher wages have significantly longer survival times. Moreover, while incarceration wages turned out to be insignificant in the majority of the models tested for recidivism, in all of the models it did seem to reduce the time to recidivate.

In analyzing PIE's impact on employment outcomes, no significant effect was found between PIE and unemployment duration of the inmate once released from confinement. However, specification tests suggest that this model may be poorly specified. The only variables that are significant to the model are the number of quarters worked prior to incarceration and having committed a property crime compared to a crime against a person. Both of these variables decrease the duration of unemployment. Nonetheless, of those who worked after release, PIE participation does seem to significantly increase employment duration (as measured by time from employment to job loss) compared to that of OTW inmates. If job loss is the decision of the ex-offender, then this may suggest that PIE workers find more satisfying jobs

upon release. If job loss is the decision of the employer, then PIE may help inmates develop the soft-skills (e.g., showing up consistently to work and on time) necessary to maintain employment.

The recidivism analysis found that post-incarceration hourly wages significantly affect recidivism when measured as time from release to arrest or time from release to conviction. In addition, according to SLM theory low paying wages cause individuals to develop attitudes antithetical to working. Therefore, the final analysis investigates how the PIE program influences the earnings of its participants compared to TI and OTW. It first looks at labor market participation using a probit model. The analysis shows that PIE significantly increases labor market participation above that of TI and OTW. Moreover, the earnings equations suggest that while PIE workers may not have earnings that are different from TI participants upon release from confinement, they do have significantly higher earnings than OTW releasees. Nonetheless, in all of the earnings equations the coefficients on TI and OTW were negative when compared to PIE.

Although the results suggest that the PIE program may help to lower recidivism and to increase earning potential of the ex-offender, they should be cautioned for several reasons. First, due to the nature of the data, the results cannot be generalized to the prison population as a whole. In an attempt to control for sample selection, the data is compiled of individuals who participated in PIE and those individuals who performed TI or OTW in task while in prison that most look like PIE participants. Therefore, these results can only be generalized to inmates who look like PIE. Moreover, the program is voluntary and the data to control for this decision was not available. Therefore, although there was an attempt to control for selection bias through the inclusion of additional covariates and the sampling strategy, there still may be bias in the results.

Ideally, if this study were conducted as a natural experiment where inmates are randomly assigned to work in PIE, TI, and OTW the results could be generalized to the entire prison population. However, natural experiments are very expensive to conduct and for this reason are rare in research. In addition, the PIE program requires inmates to volunteer to participate, which in and of itself creates issues with selectivity. In an imperfect world, methods such as propensity scoring and matching are used to deal with problems arising from sample selection. However, these methods are often used at the expense of being able to generalize one's results.

In addition, the data were collected from state department of corrections records and from other state entities. As a result, there may be measurement error in the data that may cause biased outcomes.[48] In addition, some of the covariates may be endogenous. Endogeneity could be a result of unobserved heterogeneity in the models or causality. Because these are single spell data, this analysis could not adequately control for unobserved heterogeneity among the observations.[49] However, the use of covariates does allow each individual to have a separate hazard rate which should temper the unobserved heterogeneity, even though the data is only single spell. Moreover, the wage rate may be endogenous to the recidivism equations. It is not clear whether lower wages bring about crime or whether participation in crime lowers the wage rate. In addition, it may be that recidivism and employment are jointly determined; if so, a simultaneous equation approach is necessary to accurately estimate these models. Finally, there were a number of things that could not be controlled for, due to confidentiality agreements, that

[48] For example, incarceration earnings data was coded as zero for some inmates who participated in PIE, even though it is known that PIE participants must earn at least the minimum wage for their labor.

[49] Unobserved heterogeneity poses a problem in duration data when estimating the baseline hazard (Cameron & Trivedi, 2005). However, because this analysis is interested in the effect of PIE participation on the baseline hazard of recidivism and employment outcomes, unobserved heterogeneity in the duration models is ignored. Moreover, incorporating control variables into the analysis allows for the hazard to be different for each individual, which may also help to control for much of the unobserved heterogeneity.

may have also caused bias in the outcomes. For example, the state of incarceration could not be controlled for and the actual unemployment rate could not be included in the models.

Given the caveats above, there are still some interesting policy implications of these results. If these results could be generalized to the broader prison population it would suggest that putting prisoners to work in a real world setting and expanding the scope of the PIE program may help to combat high rates of recidivism among ex-offenders. This analysis suggests a couple of things with regards to participation in crime and recidivism. It suggests that those involved in the criminal justice system as a youth are more likely to commit a crime. Therefore, in order to prevent individuals from entering a life of crime, policy should target young males. Policy should specifically target the areas of substance abuse and programs to enhance the earning potential of these young men. In order to combat the revolving door of incarceration, policy officials should seek to enhance the earning potential of the inmate through programs such as PIE that help to enhance hard and soft skills of the inmate and that may help to place them on a higher income trajectory upon release.

Stephan (2004) estimated that the average inmate cost per year was $22,650 in 2001. In the results of this analysis there is a significant difference between TI and PIE participants when recidivism is measured as time from release to arrest. In the data there are 286 TI participants; and of these 286, 48%, or 136, are rearrested during the follow up period. Of the TI workers that are rearrested, roughly 32.35% are reincarcerated. The findings suggest that participation in PIE may lower the baseline hazard of rearrest by 36%.[50] If 48% is taken as a very rough estimate of the hazard of being rearrested for the TI cohort, then this suggest that had those inmates

[50] The estimate for the Weibull model is used because the Weibull and the Lognormal model give similar results and the Weibull model gives an estimate on the effect of the baseline hazard.

participated in PIE the rearrest rate would be 30.72%, or 88 individuals. Moreover, if the reincarceration rate remains at 32.35%, then 28 TI workers will return to prison. Given the average inmate cost per year of $22,650, had these inmates participated in PIE the state would have saved a total of $634,200 per year that these inmates are incarcerated for the new offense. Seeing that there should be little additional cost to the state to operate the PIE program (most of the costs should be on the private entity looking to employ PIE inmates), this should be an added benefit to the state. Nonetheless, this figure is a lower bound of the savings to the state because it does not incorporate the additional savings from taxes, room and board, and child support payments that PIE inmates make while incarcerated.

Future research will seek to apply recent developments in program evaluation, such as propensity score matching, in order to more adequately control for endogeneity and measure local average treatment effects. In addition, a superior strategy for controlling for the sequential nature of some of the duration times used in this analysis should be developed. Finally, it may be that work and crime are not separable and therefore, should be estimated using seemingly unrelated regression analysis.

Appendix

Table A1: PIECP Certificate Holders

State	Agency	Certificate Start Date	Certificate End Date
	State Agencies:		
CA	California Department of Corrections and Rehabilitation	1985	
MN	Minnesota Department of Corrections	1985	
NV	Nevada Department of Corrections	1985	
UT	Utah Department of Corrections	1985	
ID	Idaho Department of Correction	1986	
KS	Kansas Department of Corrections	1986	
NM	New Mexico Corrections Department	1986	
NE	Nebraska Department of Correctional Services	1987	
OK	Oklahoma Department of Corrections	1987	
SC	South Carolina Department of Corrections	1987	
WA	Washington Department of Corrections	1987	
ME	Maine Department of Corrections	1988	
AK	Alaska Department of Corrections	1989	
CT	Connecticut Department of Corrections	1989	
IA	Iowa Department of Corrections	1989	
MO	Missouri Department of Corrections	1989	1989
OR	Oregon Department of Corrections	1989	
CO	Colorado Department of Corrections	1990	
AZ	Arizona Department of Corrections	1991	
SD	South Dakota Department of Corrections	1991	
TN	Tennessee Rehabilitative Initiative In Corr. Board	1991	
DE	Delaware Department of Corrections	1992	2001
HI	Hawaii Department of Public Safety	1992	
IN	Indiana Department of Correction	1992	
MD	Maryland Division of Correction	1992	
NC	North Carolina Department of Correction	1993	
TX	Texas Oversight Authority Board	1993	
VT	Vermont Department of Corrections	1993	
WI	Wisconsin Department of Corrections	1993	
LA	Louisiana Department of Public Safety and Corrs	1994	
MT	Montana Department of Corrections	1994	
FL	Prison Rehab. Industries & Diversified Enterprises	1995	
OH	Ohio Department of Rehabilitation and Corrections	1995	
VA	Virginia Department of Corrections	1995	
WA	Washington State Jail Industries Board	1998	
MS	Mississipi Prison Industries Corp	1999	
ND	North Dakota Dept of Corrs and Rehabilitation	1999	
WY	Wyoming Department of Corrections	2001	
AR	Arkansas Department of Corrections	2005	
GA	Georgia Department of Corrections	2006	
	Total Currently Certified: 38		

Table A1 Continued: PIECP Certificate Holders

State	Agency	Certificate Start Date	Certificate End Date
	County Agencies:		
NH	New Hampshire, Strafford County Dept of Corrs	1987	
NH	New Hampshire, Belknap County Dept of Corrs	1988	
TX	Texas Red River County Corrections Department	1992	2000
UT	Utah County Sheriff's Office	1999	
MN	Hennepin County Adult Correctional Facility	2004	
	Total Currently Certified: 5		

Table A2. Kaplan Meier Survivor Function: Time to Arrest

Time	OTW	TI	PIE
2	1	0.9965	1
330	0.82	0.8099	0.8472
658	0.7166	0.6866	0.7209
986	0.6405	0.5951	0.6364
1314	0.5865	0.5553	0.5911
1642	0.5484	0.4902	0.541
1970	0.5484	0.4368	0.475
2298	0.5295	0.4368	0.475
2626	.	0.4368	.
2954	.	.	.

Table A3. Nelson-Aalen Cummulative Hazard Function: Time to Arrest

TIME	OTW	TI	PIE
2	0	0.0035	0
330	0.198	0.2104	0.1655
658	0.3325	0.375	0.3265
986	0.4445	0.5177	0.4508
1314	0.5321	0.5866	0.5243
1642	0.5988	0.7103	0.612
1970	0.5988	0.8242	0.74
2298	0.6333	0.8242	0.74
2626	.	0.8242	.
2954	.	.	.

Table A4. Kaplan Meier Survival Function:Time to Conviction

TIME	OTW	TI	PIE
1	0.9899	0.982	0.9864
333	0.7609	0.6978	0.7585
665	0.7441	0.6798	0.7279
997	0.7399	0.6798	0.7279
1329	0.7399	0.6735	0.7279
1661	0.7399	0.6735	0.7279
1993	0.7399	0.6735	0.7279
2325	0.7399	0.6735	0.7279
2657	0.7399	.	.
2989	.	.	.

Table A5. Nelson-Aalen Cummulative Hazard Function: Time to Conviction

TIME	OTW	TI	PIE
1	0.0101	0.018	0.0136
333	0.2724	0.3586	0.2755
665	0.2947	0.3847	0.3166
997	0.3005	0.3847	0.3166
1329	0.3005	0.394	0.3166
1661	0.3005	0.394	0.3166
1993	0.3005	0.394	0.3166
2325	0.3005	0.394	0.3166
2657	0.3005	.	.
2989	.	.	.

Table A6. Economic Model of Crime: Time from Release to Conviction (Sequential)

	Cox Model		Weibull Model		Lognormal Model	
Variable	**Change in Baseline Hazard**	**Standard Error**	**Change in Baseline Hazard**	**Standard Error**	**Change in Time to Failure**	**Standard Error**
OTW	0.024	0.227	-0.021	0.217	-0.067	0.544
TI	0.252	0.293	0.236	0.287	-0.448	0.345
Education	-0.038	0.035	-0.039**	0.035	0.152	0.112
Age at Release	-0.037***	0.011	-0.038***	0.011	0.096***	0.032
Time Served (years)	-0.062**	0.029	-0.069**	0.029	0.187**	0.088
White	-0.190	0.126	-0.210	0.123	0.751	0.696
Female	-1.000***	0.000	-1.000	0.000	2.650E+09	3.600E+12
Number of Previous Incarcerations	0.046	0.029	0.044	0.029	-0.126*	0.066
History of Substance Abuse	0.962***	0.468	1.020***	0.474	-0.815***	0.111
Property	0.285	0.251	0.330	0.259	-0.536	0.235
Drug	0.137	0.227	0.168	0.234	-0.218	0.396
Other	1.367**	0.951	1.675**	1.082	-0.895**	0.122
History as a Juvenile	0.325*	0.200	0.356**	0.204	-0.593**	0.165
Mental Health Issue	0.251	0.223	0.218	0.215	-0.354	0.297
Single	0.100	0.170	0.133	0.174	-0.327	0.270
Quarters Worked Pre-Incarceration	-0.012	0.033	-0.010	0.033	0.028	0.084
Total Penalties	0.000	0.000	0.000	0.000	0.000	0.000
Post-Incarceration Hourly Wage	-0.031*	0.018	-0.033*	0.018	0.079*	0.050
Incarceration Hourly Wage	0.017	0.019	0.016	0.019	-0.077	0.045
Release Year	x		x		x	
Facility	x		x		x	
α			0.386			
Log-Likelihood			-944.534		-929.448	
N	869		869		869	

**** Significant at the 1% Level*

*** Significant at the 5% Level*

** Significant at the 10% Level*

Table A7. Kaplan-Meier Survival Function: Release to Employment

TIME	OTW	TI	PIE
1	0.6404	0.6571	0.5725
4	0.4778	0.4971	0.4046
7	0.4165	0.4386	0.3432
10	0.3931	0.3963	0.3432
13	0.3774	0.3791	0.2955
16	0.3774	0.3509	0.28
19	0.3774	0.3303	0.28
22	0.3585	0.3303	0.28
25	0.3329	0.3303	0.2333
28	0.3329	0.3303	0.175
31	.	.	.

Table A8. Nelson-Aalen Cummulative Hazard Function: Release to Employment

TIME	OTW	TI	PIE
1	0.3596	0.3429	0.4275
4	0.6376	0.6006	0.7529
7	0.7719	0.723	0.9122
10	0.8286	0.8226	0.9122
13	0.8686	0.8661	1.0576
16	0.8686	0.9418	1.1102
19	0.8686	1.0006	1.1102
22	0.9186	1.0006	1.1102
25	0.99	1.0006	1.2769
28	0.99	1.0006	1.5269
31	.	.	.

Table A9. Kaplan-Meier Survival Function: Employment to Job Loss

TIME	OTW	TI	PIE
1	0.7876	0.7844	0.8377
4	0.4476	0.4633	0.5117
7	0.2853	0.3011	0.3408
10	0.2105	0.2214	0.2097
13	0.1642	0.1566	0.166
16	0.1041	0.1123	0.0984
19	0.0781	0.0676	0.0721
22	0.0488	0.0084	0
25	0.0488	.	.
28	0	.	.

Table A10. Nelson_Aalen Cummulative Hazard Function: Employment to Job Loss

TIME	OTW	TI	PIE
1	0.2124	0.2156	0.1623
4	0.7231	0.6979	0.6164
7	1.14	1.0989	0.9926
10	1.4261	1.3908	1.4391
13	1.6634	1.7176	1.6616
16	2.0708	2.0257	2.1332
19	2.3375	2.4909	2.426
22	2.7541	3.6659	4.0093
25	2.7541	.	.
28	3.7541	.	.

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Vita

Robynn Cox left her hometown of Los Angeles, California in 1998 to attend Duke University. After graduating from Duke University in 2002 with a dual A.B. in Economics and "Spanish and Latin American Studies," she entered the Masters program in economics at Georgia State University. She began the Ph.D. program in the fall of 2004. In 2007, she received her Masters of Arts in Economics from Georgia State University and received her Ph.D. in 2009. Her dissertation is titled "An Economic Analysis of Prison Labor."

Prior to entering the Masters and Ph.D. programs at Georgia State, she attended the Foundation (Summer 2002) and Advanced (Summer 2004) levels of the American Economic Association's (AEA) summer program. During the summer of 2007, Robynn returned to the summer program as a Teaching Assistant to Dr. Frank Sloan. Robynn is also a participant in the AEA's Pipeline Project, where Dr. Sally Wallace serves as her mentor. In 2005, she was selected to be a representative for the Impact and Relationship Committee between the AEA summer program and the Pipeline Project.

In the fall of 2006, Robynn interned at Congressional Research Service (CRS) in Washington, D.C., where she wrote a report on noncitizens' eligibility for Medicaid. She returned to CRS in the spring of 2008 in a temporary post as an Economist/Intern where she co-authored a report on the Prison Industry Enhancement Certificate Program.

Robynn recently was invited and became a member of the Golden Key International Honour's Society at Georgia State University. She was also nominated to the 2005-2006 Chancellor's List. She was the 2004-2007 recipient of the Andrew Young Fellowship at Georgia State University and received an honorable mention from the 2004 Ford Foundation Pre-

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