

The Impact of E-Government on Child Support Enforcement Policy Outcomes

Jeongsoo Kim
University of California, Berkeley
2607 Hearst Avenue
Berkeley, CA
jk37@berkeley.edu

ABSTRACT

This study explores the effect of E-government application, the Automated Information Systems (AIS), of child support enforcement on child support collection outcomes. Using Current Population Survey (CPS) data from 2000 to 2005, I employ Heckman's two step method to deal with selection bias. The result in the first step shows a positive association between AIS and the probability of single mothers receiving child support from delinquent fathers. In the second step, AIS is statistically significant, indicating that among single mothers who received support, those living in a state that adopted AIS received \$192 more per year, on average, than single mothers living in a state without AIS, holding other factors being constant.

Categories and Subject Descriptors

H.4.2 [Information System Application]: E-government application

General Terms

Management, Measurement, Performance

Keywords

E-government, child support enforcement, automated information system, policy outcome measurement

1. INTRODUCTION

In this paper, I intend to show the effect of the automated information systems of child support enforcement on child support collection outcome: whether and how the Automated Information Systems, abbreviated AIS, increase the probability of single mothers receiving child support from delinquent fathers. The reason for the analysis is three fold: first, AIS is an excellent example of an E-government initiative as a government managerial innovation. E-government, broadly defined, refers to the use of all information technology and communication technologies to facilitate the daily administration of government; second, child support enforcement is one of the most rapidly evolving areas of policy legislation over the past three decades and one of the most fundamental social problems facing our society; lastly and most importantly, by examining the relationship between the two, I expect to present counter evidence to the prevalent conception that the information technology (IT) productivity paradox exists in the public sector. The IT *productivity paradox* is a claim, or hypothesis, that IT has not contributed to real productivity even as it has been widely implemented. Productivity growth in the public sector as well as the private sector has slowed in every decade since the 1960s,

while IT investment in the expectation of productivity improvement has grown tremendously, a puzzle captured in Robert Solow's famous aphorism "We can see computers everywhere but in the productivity statistics." A large literature explores the IT *productivity paradox*, both as to its existence and as to possible reasons for it.

2. RESEARCH PROBLEM SPECIFICATION

More than half of all U.S. children, and over three-quarters of African American children in the U.S., live apart from at least one biological parent, usually the father, before they reach age 18 [6,12]. Children with a non-resident parent are nearly four times more likely to be poor and five times more likely to receive food stamps than children who live with both parents [24]. The proportion of children living in poverty has grown steadily over the past three decades, except for the late 1990's, and it parallels the growth of the single parent families, which has continued until recently. In 2004, 42 percent of children living in single-mother families were poor, compared with 9 percent of children living in married-couple families [9]. Child support is an important source of income for the single parent family recipient. In 1996, children in single parent families who received child support relied upon an average of 16 percent of their family income coming from child support. Child support is an even more important source of income to children in single parent families living in poverty. According to the Urban Institute's report, the average child living in poverty with a nonresident parent and whose family receives child support, received \$1,979 in 1996, which represented over one-quarter (26%) of their family income [24]. A recent study of the Wisconsin child support cases showed that 20 percent of families relied on child support for more than half of their income, but only 51 percent of families whose incomes were below the poverty level received partial child support for 10 months out of the year [7].

Accordingly, the importance of child support has increased dramatically during the past three decades and Federal and state governments have spent a considerable amount of money and time on child support enforcement. In Fiscal Year (FY) 2005, nearly 60,000 full-time equivalent staff worked in child support programs in the United States and administrative expenditures alone totaled \$5.4 billion [27]. Specifically the federal government viewed AIS as being "a critical tool in addressing the rapidly growing caseloads and increasing costs" in the child support enforcement program [29]. Thus, Congress mandated that every state build child support enforcement programs utilizing AIS to help locate non custodial parents, to establish paternity, and to collect and disburse support payments. The Federal Parent Locator Service (FPLS), one of main components of AIS, is a

nationally computerized system operated by the Office of Child Support Enforcement (OCSE), “to assist states in locating non-custodial parents, putative fathers, and custodial parties for the establishment of paternity and child support obligations, as well as the enforcement and modification of orders for child support, custody and visitation. It also identifies support orders or support cases involving the same parties in different states.” Since its implementation in 1998, it is estimated that the FPLS has helped to collect more than \$20 billion in child support payments and contributed to the efforts of the Education Department in collecting more than \$1.4 billion in defaulted education loans and grant payments in 2003 [22]. It was selected as one of the best E-government projects and received the top Excellence.Gov award in 2003.

From a governmental managerial perspective, total expenditures for the child support program, total child support collections, and nationwide cost-effectiveness ratios have increased (Table 1).

Table 1. The Trend of Total Expenditures, Number of Caseloads, Collections, and Cost-effectiveness Ratio

Fiscal Year	Total Expenditure (in 2004 dollars)	Total cases	Cost per case (in 2004 dollars)	Total collections (in 2004 dollars)	Cost-effectiveness ratio
2000	4,964,681,593	17,374,041	286	19,585,783,335	\$4.23
2001	5,157,401,130	17,060,501	302	20,220,723,285	\$4.21
2002	5,442,626,147	16,065,728	339	21,144,270,093	\$4.13
2003	5,354,604,952	15,923,353	336	21,740,326,352	\$4.32
2004	5,322,260,723	15,854,475	336	21,861,258,876	\$4.38

Source: OCSE data

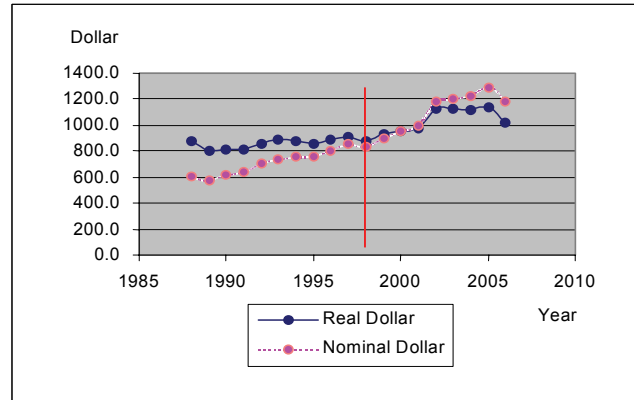
Though total expenditures are decreasing slightly since 2002 due to governmental effort to curtail federal expenditure, overall from fiscal year 2000 to fiscal year 2004, total expenditures for administrative costs increased about 6% (from \$5 billion to \$5.3 billion, in 2004 constant dollar). According to HHS officials interviewed by the Government Accountability Office (GAO), most of the increase was attributable to costs associated with developing and implementing each state’s statewide automated information system [1].

On the other hand, total caseload from 2000 through 2004 has decreased. In 2000 and 2001 the total caseload was 17 million and in 2004 it dropped to 16 million. Federal cost per case, thus, increased from \$286 in 2000 to \$336 in 2004.

As for total child support collection, during fiscal year 2000 through 2004, total collections increased about 10 percent from \$20 billion to \$22 billion (in 2004 constant dollars) and the cost effectiveness ratio (the ratio of collections divided by total federal and state administrative expenditures) increased about 4 percent from \$4.23 to \$4.38 in the same period. Table 1 summarizes total expenditures, total number of caseloads, cost per case, total collections, and the cost-effectiveness ratio from fiscal year 2000 through 2004.

It is puzzling, however, that actual child support received by custodial mothers and the rate of child support payments do not reveal a significant increase, despite the achievements by AIS, including FPLS, as well as the considerable amount of time and money the federal and state governments have spent on child support policy during the past decades. Figure 1 illustrates the

trend of child support payments received by custodial single mothers, contrasting real dollars with nominal dollars. The vertical line in figure indicates the year that AIS was initially implemented (1998). Though the trend of real dollar shows the increase in the amount of child support received during 2001-2002, the rate of increase is not as high as expected. Further, since 2002, the level of payments did not change and then actually dropped in 2006.



Source: March CPS, 1988-2006

Figure 1. The Trend of Child Support Payment (Nominal vs. Real Dollar(2000 constant dollar))

In addition, the analysis of actual amount of payment of child support shows the amount of child support payment decreasing or, at best, remains the same level of the amount, especially since 1999. In addition, according to annual report by Office of Child Support Enforcement (OCSE), the federal share of expenditures for the OCSE programs is increasing and the programs’ critical measure of cost-effectiveness did not change significantly [1]. Further, total child support debt continues to grow, having increased by more than 300 percent nationwide over the last decade.

What is the reason for IT *productivity paradox*?: the slow paced improvement of overall child support payment collections despite governmental efforts using technologically advanced tools. What is the real impact of automated information systems, like FPLS, on child support payment collections? This paper assesses whether and how much AIS, in particular the 1996 expanded AIS, actually improves child support policy outcome.

Child support studies mushroomed during the 1990’s, however they are rarely found in the 2000’s. In addition, although AIS was believed to be effective, it has not yet been empirically evaluated. This paper is meaningful in that it uniquely examines the effect of AIS. It adds to the existing literature by using more recent data to assess the impact of a specific policy, AIS, a part of E-government initiatives as a tool for government innovation to improve policy outcomes. This first analysis of the true effect of AIS will convey insightful information not only for academia but also for policy practitioners.

The paper proceeds as follows. Section 3 presents two literature reviews: the first part, background information on child support enforcement policy during the past several decades; and the

second part, a review of the findings and limitations of previous empirical studies on the impact of child support legislation on child support payments as well as the theoretical background on which this research is based. Section 4 describes the research question and hypotheses, section 5 details the data used and specifies the econometric model employed. Section 6 presents the empirical result and final conclusions are discussed in section 7.

3. LITERATURE REVIEW

3.1 Overview of Child Support Study

3.1.1 Child Support Policy Reforms

Prior to 1975, child support was strictly a state (mainly local, judicial) responsibility governed by family law. It was judicially based and complaint-driven: any single mother who wanted to claim child support had to hire an attorney and go to court. Currently, child support enforcement has two systems: the public system and the private system both of which are administered by the states. The public system, widely known as an IV-D program, is much more pro-active in the collection of child support in order to get federal funding and utilizes many administrative and quasi-judicial procedures to expedite child-support collection. The public system is available to anyone who requests it, however Congress has mandated that families who are on welfare must participate in the IV-D program. When participating in the IV-D program, families on welfare assistance must assign their right to child support to the government as a condition of receiving assistance. Then any child support collected on behalf of welfare families goes to the government. Thus child support payments collected for welfare families were mainly used to offset the cost of providing welfare to the family. However, as the non-welfare family cases comprised large amounts of the total IV-D cases, Congress has repeatedly amended child support law over the last 25 years, and the goal of the child support system has been changed from recouping welfare costs to assuring that all children with a nonresident parent receive child support.

The initial Congressional action in child support legislation took place in 1975. In response to the explosion of the welfare caseloads in the 1960s, Congress added Title IV-D to the Social Security Act. Title IV-D established both the Office of Child Support Enforcement (OCSE) to administer the nationwide Child Support Enforcement (CSE) Program and a federal Parent Locator Service. In addition, each state was required to establish or designate a single separate IV-D agency (State Child Support Enforcement Offices) and a state Parent Locator Service. Under this law, each state must operate a child support enforcement program that meets Federal requirements in order to be eligible for certain block grants. Further major legislation followed in 1984 and 1988. In 1984 states were required to withhold child support payments from the wages of non custodial parents who were more than one month delinquent with award payments. In an effort to increase child support payments, government legislated ‘\$50 pass-through’ which passed through the first \$50 of collections to the family who are on welfare.

The 1988 Family Support Act (FSA) legislated immediate withholding of child support from wages of delinquent fathers whose children were receiving AFDC as of 1990 and for all OCSE child support cases by 1994 [11,12].

The Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 further reformed child support enforcement provision. The most salient reforms involved legislating a signed voluntary acknowledgement of paternity as a legal finding; enhancing access to new information; automating caseload processing; and expanding AIS [19]. It abolished pass-through and left it to each state’s discretion. As of 2004, 28 states abolished the pass through while 23 states kept it.

The Child Support Performance and Incentive Act (CSPIA) of 1998 established new incentive performance measures on which the federal incentive payments are awarded. The Deficit Reduction Act of 2005 reduced the matching fund rate for paternity tests; eliminated the federal match for incentive payments effective October, 2007 [1].

One further issue associated with welfare policy needs to be addressed for this analysis. The state retains child support collection to recoup welfare costs if a single mother family is on-welfare assistance. Accordingly, whether the single mother family is on welfare or not is another important factor that affects the amount which actually goes to a single mother. Thus, this study separates the single mothers on welfare assistance from the single mothers who are not on welfare because they are totally different population in terms of child support receipt.

Figure 2 depicts the major services that the OCSE provides.

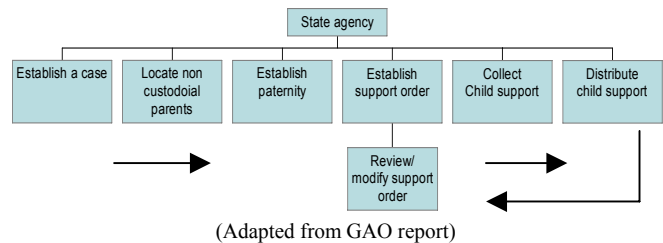


Figure 2. Major Services of the Child Support Enforcement Programs

3.1.2 E-government Innovation in Child Support

With the advent of E-government, information technology has been pivotal in improving the effectiveness and efficiency of the performance of government at various levels. E-government is manifested in child support enforcement policy as well. For example, income withholding is regarded as the most effective application of E-government in child support collection. It automatically withholds child support from delinquent, non custodial parents’ wages, accounting for 65% of the total child support collection in 2002 [27]. Many states have established automated state directories of new hires which also automatically interact with federal new hire directories. This system identifies if non custodial parents are employed or change employment and, in turn, withholds payroll immediately [10].

The intergovernmental linking of databases has been another critical process to improve child support collections. It encompasses all the levels of government: within and between states, and between states and the federal government. For example, the National Directory of New Hires allows states to search for the Social Security Numbers of non custodial parents

through a national data base of new hires. Some further examples are:

- The state of Illinois linked its child support database with the US Postal Service, which allows the CSE to update client addresses to solve the problem of lost or returned checks.
- Washington state linked its child support database with the Department of Motor Vehicles database, which automatically suspends delinquent fathers' drivers' licenses. This is estimated to increase child support collections by \$50 million per year.

Many states have developed websites and online services for the public.

- New Mexico linked its database to its website which enables clients to apply for support service, check the status of payments, view payment history, update addresses, request the locating of non custodial parents, set up direct deposit, and submit electronic payments.
- Electronic distribution of funds is considered to lower administrative costs and increase child support distribution and this technology is becoming more broadly adopted. According to a GAO report, 37 state Child Support Enforcement (CSE) programs had begun offering direct deposit and 9 states deposit funds onto state issued debit cards [1].
- The FPLS helped to collect more than \$20 billion in child support payment in 2003 and contributed to the efforts of the Education Department in collecting more than \$1.4 billion in defaulted education loans and grant payments in 2003 [22].

These are good examples of how E-government has innovated in child support case management, in identifying non custodial parents, collecting child support, and serving a growing number of clients more efficiently. The majority of CSE agencies are incorporating many technological advances into their operations, greatly enhancing their services to clients. However, whether E-government innovation has enhanced the intended policy outcomes has not been examined econometrically. This study intends to evaluate the impact of E-government on child support collection. Among the broad range of E-government innovation cases, this study focuses on the automation features discussed in the following section.

3.1.3 Automated Information Systems (AIS)

Initially developed in 1975, AIS was largely expanded by the PRWORA. AIS is a combination of the Federal Parent Locator Service (FPLS), Child Support Enforcement Net (CSENet), National Directory of New Hires (NDNH), Federal Case Registry (FCR), income withholding, federal tax offsets, liens and bonds, credit reporting agencies, license suspension, passport denials, administrative offsets, and Electronic Fund Transfer (EFT). These systems are intertwined and operate together rather than separately. For example, the FPLS is a computer matching system that locates delinquent non custodial parents. Nationally operated by the OCSE, it assists states in locating non custodial parents, putative fathers, and the establishment of paternity, as well as the

enforcement and modification of orders for child support, custody and visitation. The main components of the expanded FPLS following the 1996 PRWORA are:

- The National Directory of New Hires (NDNH): a central repository of employment, unemployment insurance, and wage data from State Directories of New Hires, State Employment Security Agencies, and Federal Agencies.
- The Federal Case Registry (FCR): a national database that contains information on individuals in child support cases and child support orders.
- Child Support Enforcement Network (CSENet): a computerized communication tool that enables states and territories to transmit interstate child support information electronically in a standardized format.
- External Locator Sources: external sources to which the expanded FPLS is allowed to access. The sources include external Federal agencies such as the Internal Revenue Service (IRS), the Social Security Administration (SSA), Veterans Affairs (VA), the Department of Defense (DOD), and the Federal Bureau of Investigation (FBI).

Incorporating these resources, the expanded FPLS operates in two ways: first, the FPLS automatically matches data from the NDNH with data in the FCR (so called, proactive matching). As soon as the FPLS finds the information on a non-custodial parent or custodial party in the FCR such as a new job, claim for unemployment insurance benefits, or quarterly wages, it automatically notifies any state with a related child support case, so the state child support agency can take immediate action to establish, modify, or enforce a child support order; second, upon request of a state child support agency, the FPLS searches various other federal agency databases (external locate sources) such as the IRS or the SSA to locate non custodial parents and their assets and establish/enforce a child support order.

The old FPLS of 1975 took from one to six weeks to respond to a request and was limited in the number of requests that could be sent to State Employment Security Agencies (SESAs). The expanded FPLS of 1996, by incorporating the four new features described above, electronically and automatically receives and updates location information and the process is completed overnight. With CSENet, EFT is another essential tool for AIS.

3.1.4 Theory and Empirical Evidences

Studies of the effect of child support enforcement mushroomed during the 1990's. Initial studies examined the impact of child support enforcement on child support compliance rather than child support receipt [4,14]. The dependent variables in these studies were typically award rates, award amount, and compliance with awards. These studies pooled cross-sectional data from the March/April Current Population Survey-Child Support Supplement with various econometric models and found some evidence that child support laws and the child support enforcement programs at state levels had a positive effect on child support compliance. However, neither study controlled for the state's fixed effects. Freeman and Waldfogel [28] constructed a child-support legislation index and interacted the index with child

support expenditures, allowing year and state fixed effects. They examined the child support receipt rate with the data from the March CPS rather than the March/April CPS-CSS. They found that expenditures and tougher legislation increased the receipt of child support for never-married mothers. Several recent studies examined the effects of child support enforcement policies on child support collections and custodial mothers' income. Garfinkel et al [13] found that strong child support enforcement and medium to high expenditures on this enforcement increased the income of single mothers by approximately two dollars for each dollar of child support received. Other studies have estimated the impact of specific policies on child support payments which revealed a statistically significant and positive effect [14,23]. None of the above considered the effect of technology on the dependent variable. Sorensen and Oliver assessed the impact of PRWORA reform in child support enforcement on child support outcomes during the initial years [25]. Using the 3D approach (difference-in-difference-in-difference) with data from the 1997 and 1999 National Surveys of America's Families, they found new hire directories (one of AIS features) and improved paternity establishment procedures have had positive impacts on never-married mothers. This study, however, covers only the initial period of PRWORA which might differ from the effect of fully executed PRWORA reform over a longer span of time.

3.2 Theory

The theoretical background for the model specification upon which my analysis is based is from the recursive system study constructed by Beller [3,5] which is widely used in child support studies. A brief sketch of the theory follows.

Beller postulated the recursive system, rather than contemporaneous or simultaneous relationship, among equations (1) through (4): she posited that the child support award takes place initially and that consequently it affects the child support amount received.

$$CSDUE = f^1(H^1, W^1, L^1) \quad (1)$$

Equation (1) refers to the fact that child support due (CSDUE) is a function of a vector of characteristics of the delinquent father's ability and willingness to pay (H^1), the financial need of the single mother and children (W^1), and the legal environment at divorce (L^1).

$$CSREC = f^2(H^2, W^2, L^2, CSDUE) \quad (2)$$

Equation (2), in turn, assumes that child support actually received (CSREC) is determined by three vectors of variables (H^2 , W^2 , and L^2) in addition to the child support due (CSDUE). L^2 pertains to child support enforcement laws which vary across states. The different superscripts on three vectors (H^2 , W^2 , L^2) refer to the different elements of characteristics. For example, according to Beller, W^1 may contain the judge's perception of single mother's needs at the time of divorce while W^2 may measure the delinquent father's perception of her needs. However, this difference does not matter in my analysis because the child support award system at the time of this study (which was judicially based and complaint-oriented) is different from the current public system (which complies with the federal laws and is state administrated).

$$RM = g[Y_d(CSREC_d, \dots), Y_r(CSREC_r, \dots) | C] \quad (3)$$

The third equation depicts the relationship between the probability a divorced woman remarries (RM) and several other determinants: her real income (monetary as well as nonmonetary) while divorced (Y_d), her expected real income if remarried (Y_r), and the costs of marital search.

$$LF_d = k[W_h(CSREC_d, \dots), W_m, V_d(CSREC_d, \dots)] \quad (4)$$

The fourth equation states that the probability a divorced woman in the labor force (LF_d) is negatively associated with the value of her time at home (W_h), positively with the value of her time in the market (W_m), and negatively with nonlabor income (V_d), which itself depends upon child support payments ($CSREC_d$).

This study borrows the basic concept from equations (1) and (2). Equation (3) and (4) will not be considered because these are beyond the scope of this study. Also, rather than analyzing equations (1) and (2) separately, I combined the two into one equation for two reasons. First, due to limited data source and data confidentiality issues, the data on child support due amounts are not available at an individual level. Second, more importantly, the focus group of this study is never-married single mothers. This segment of the population is less likely to have child support due (or child support award) than formerly married mothers, and the amount of their award is likely lower than that of their counterparts [4]. Accordingly, in probing into what role technology plays in increasing the probability of child support receipt, child support due is neither an important nor relevant determinant because most of never married mothers do not have child support due. The important variables to be examined in this study are described in the following section.

4. RESEARCH QUESTION AND HYPOTHESES

The universe for my analysis is single mothers. Following Sorensen [24], I define a single mother as "any adult woman who is divorced, separated, or never married and who lives with her own children, at least one of whom is under 18 years of age". I discard widows from the sample pool because they are not eligible for child support. Another important factor that affects the amount of child support is whether a single mother is on welfare or not due to the pass through policy. Thus, I divide the sample into two groups (whether on welfare or not) and run a separate regression for each group.

This paper focuses primarily on whether and how much technology (AIS) improves child support enforcement outcomes. The core research question is: "Do automated information systems (AIS) have a positive impact on child support enforcement outcomes?"

Child support enforcement outcomes are measured in two ways: 1) the likelihood of receiving child support for custodial parents; and 2) the amount of child support received by custodial parents. This study assumes that the two different measures of outcome capture policy impacts on two different segments of single mother populations: never-married single mothers and previously married single mothers.

Hypothesis 1: Automated information systems (AIS) have a positive impact on the probabilities of receiving child support as well as the amount of payments received by single mothers.

The demographic composition has changed over the past decades. One of the distinct changes is that a growing portion of the population is never married single mothers. In the past, the vast majority of single mothers were divorced or separated women. In 1976, eighty three percent of single mothers were divorced or separated. By 1997, the proportion was 54%, just over half [8,23]. The never-married single mothers are more disadvantaged in terms of child support enforcement, relative to divorced or separated single mothers because, for example, a never-married single mother must identify who fathered her child(ren) and needs to legally establish paternity before a child support award can be determined. This means a never-married single mother faces longer and harder processes to receive child support payments. In contrast, paternity establishment is rarely an issue for previously married single mothers because it is more likely that the paternity was established by the time she divorced/separated.

This study expects that never married single mothers are more affected by AIS, relative to previously married single mothers because AIS is more effective in locating a missing father and establishing paternity than enforcing identified fathers to pay child support.

Hypothesis 2: Automated information systems (AIS) affect never-married mothers and previously married single mothers differently.

Hypothesis 2a: Never-married single mothers are more likely to be affected by the implementation of AIS than previously married single mothers are.

5. DATA AND METHOD

5.1 Data Description

This analysis is primarily based on two data sources: the U.S. Census Bureau, Current Population Survey (CPS) from 2000 to 2005, and the archives of the Child Support Enforcement Office, which is administered by Administration for Children & Families under the U.S. Department of Health & Human Services in corresponding years.

Data on the dependent variable (child support payment amounts received by custodial parents) and most of the independent variables (individual socioeconomic characteristics) were collected from the March CPS of the U.S. Census Bureau. I use the March CPS rather than the March/April CPS-CSS which is also widely used in the child support studies, because it is available on an annual basis. The CPS data has a number of advantages for this study. First, the survey provides a large national data set representative of the entire eligible population. Second, the survey was repeated subsequently since its initial survey in 1979 (1978 child support receipt). This enables me to access not only cross sectional information at a particular point in time, but also time-series data covering a period of time. The limitation of these data is that they do not include information on the non custodial fathers (i.e., absent father's income, ability or willingness to pay support). I handle this limitation, however, following the methods from many previous studies of the determinants of child support through the use of proxy variables obtained from information on the mother's characteristics [3,5]. For example, education, age, and age squared variables of women may serve as proxies for the absent father's ability to pay [5,24]. This is based upon the assumption that men and women tend to

mate in accordance with similar background or characteristics; women are more likely to marry men who belong to the similar range of age as well as the level of educational attainment.

Likewise, the number of children can be a proxy for custodial mother's needs for money from a non custodial father. To proxy a father's willingness to pay, I include the age of eldest own child in household under the assumption that elder children and a father are more likely to have strong bonds because they lived together longer than younger children, which lead a father to be more willing to pay a child support.

The data for the main independent variable (automated information systems) are drawn from the archives of the office of Child Support Enforcement, Administration of Children and Families, the U.S. Department of Health and Human Services. It reports to information on the PRWORA certification status of State Child Support Enforcement Information Systems. HHS conducts an evaluation of each state's automated information systems annually and reports an approval status which indicates whether a state's system was certified based on the federal standard or not. The certification date varies greatly between states, with the earliest adopters being Nevada, Maryland, New Mexico, and Virginia (May-June, 2001) and later adopters New York, New Jersey, and Alabama (June 2005). As of 2007, only two states were not certified: California and South Carolina (see appendix). The AIS variable is constructed as a dummy variable that equals zero until AIS in each state is fully certified and one thereafter.

I augment the data set by adding data on the child support expenditures per single mother in each state and each year to control for state environment. Expenditure data are from various issues of the Federal Office of Child Support Enforcement's Annual Report to Congress and unemployment rate data are extracted from published estimates from the Bureau of Labor Statistics. The percentage of paternity establishment in each state from 2000 to 2005 is obtained from the OCSE annual report as well. The role of the percentage of paternity establishment will be explained in detail in the following section.

I estimate the effect of these determinates on a sample of 51,106 custodial single mothers, 16 years of age or over, who live with their own children (under 21 years of age).

5.2 Method and Model Specification

Whether or not child support is received and how much is received by custodial parents can be treated as two separate outcomes or can be combined together into a single model with a Tobit structure. I choose the former approach for two reasons: first, as I hypothesized above, AIS may affect differently whether child support is received and how much is received. Thus, separating the two outcome measures is more appropriate for the purpose of this study; and second, to deal with a selection bias, I employ Heckman's two step method which utilizes two separate outcome equations. The conceptual model is deployed below:

$$R_{ist}^* = \beta_{10} + \beta_{11}X_{ist} + \beta_{12}Pat_{ist} + \beta_{13}A_{st} + \beta_{14}NM_{ist} + \beta_{15}A_{st} * NM_{ist} + \beta_{16}E_{st} + \beta_{17}TIME_t + \beta_{18} STATE_s + u_{ist}, \quad (5)$$

$$\text{Where, } R_{ist} = 1, \text{ if } R^* > 0 \quad (5a)$$

$$R_{ist} = 0, \text{ if } R^* \leq 0, \text{ and} \quad (5b)$$

$$P_{ist} = \beta_{20} + \beta_{21}X_{ist} + \beta_{22}E_{st} + \beta_{23}A_{st} + \beta_{24}NM_{ist} + \beta_{25}A_{st}*NM_{ist} + \beta_{26}\lambda_i + \beta_{27}TIME_t + \beta_{28}STATE_s + v_{ist} \quad (6)$$

,where R_{ist}^* = an index function determining the likelihood of receiving child support for individual (custodial parent) i , where $R_i=1$ if some is received, and 0 otherwise

P_{ist} = amount of child support received by individual i

X_{ist} = a column vector of individual socioeconomic characteristics

E_{st} = a column vector of state environmental characteristics

Pat_{st} = a column vector of percentage of paternity establishment at the state level

A_{st} = a column vector of automation information system status (AIS) by state s

NM_{ist} = never married single mother

$A_{st}*NM_{ist}$ = interaction term between AIS and never married single mother

$Time_t$ = a set of year dummies ($t=2000, 2001 \dots 2005$)

$STATE_s$ = a set of state dummies ($s=50$ states and DC)

u_{ist}, v_{ist} = independently distributed error terms assumed to be normal with zero mean and constant variance σ^2 and

$i, s,$ and t = person, state, and year, respectively.

In practice we cannot observe R^* in equation (5) directly. What we observe is a dummy variable R defined by (5a) and (5b), that is, whether or not support is received (i.e., $R=1$ or $R=0$). In this case the observed values of R are the realization of a binomial process with probabilities, $\text{Prob}(R_{ist}=1)^1$, varying from case to case (depending on X and A) [20]. Thus, ordinary least squares (OLS) cannot be used to estimate the probability of receiving child support. I employ multivariate probit which is a widely used statistical procedure when the dependent variable is dichotomous. The probit function below is estimated by maximum likelihood methods, where p is the probability that some child support is received, X is a vector of independent variables, and β is a vector of coefficients to be estimated.

$$p=F(X\beta) = 1/\sqrt{2\pi} \int_{-\infty}^{p\beta} \exp(-t^2/2) dt \quad (7)$$

Using a standard normal cumulative distribution function as the regression function, if properly interpreted, the estimated probit coefficients show the estimated effects of a one-unit increase in a given independent variable on the probability required to estimate equations (5a) and (5b) [26].

Equation (6) is estimated only for those who received child support in the year prior to a survey. Since I estimate P_{ist} using the subset of the population who actually receive child support (i.e., for whom $R=1$), the parameter estimates in equation (6) may be biased unless the probability of sample inclusion is taken into account. This causes the problem of sample selection bias. To eliminate the bias, I follow Heckman's (1979) two step method.

¹ $\text{Prob}(R_{ist}=1) = \text{Prob}(u_{ist} > -\beta' x_i) = 1 - F(-\beta' x_i)$

According to Heckman's suggestion, at the first step, I derive the inverse Mill's ratio (λ) for each sample observation from probit estimates of equation (5) and in turn at the second step, I add as an additional regressor, λ , in equation (6) and estimate this augmented equation using OLS [16,17,21].

The inverse Mill's ratio, λ_i , derived from the first procedure is constructed as below:

$$\lambda_i = f(X_i \hat{\beta}) / F(X_i \hat{\beta}) \quad (8)$$

where β -hat is the vector of estimated probit coefficients from equation (5), $f(\cdot)$ is the standard normal density function, and $F(\cdot)$ is the standard normal cumulative distribution function. The inverse Mill's ratio is sometimes called a "control function" because it literally controls for selection bias. The first step should satisfy an exclusion restriction: the exclusion restriction is a variable that belongs in equation (5) but not in equation (6). In other words, it is an instrument. In order to satisfy two conditions, I include the percentage of paternity establishment in each state as an exclusion restriction. It is a proper instrument because whether paternity is established or not affects whether a single mother receives a child support or not while the paternity establishment does not directly affect the amount of child support received by a single mother. The coefficient on λ in the augmented equation appears to be proportional to the covariance between the disturbance in equation (5) and the disturbance in the augmented version of equation (6).

The vector of mother's characteristics (X_{ist}) includes several individual-level demographic characteristics of single mothers such as marital status, race, education, age, age squared, number of children, number of children squared, and residential location. These demographic characteristics also function as proxy variables for differences in a mother's need for child support and a father's ability and willingness to pay child support. For example, the mother's education and age are indicators not only of the needs of her family but also of the long-term ability to pay of the absent father [3]. The race and ethnicity of single mothers are coded as dummy variables-one if the single mother is black (non-Hispanic) and one if the single mother is Hispanic. The baseline is white non-Hispanic.

State environment (E_{st}), the child support expenditure per single mother, total caseloads, and the number of children in the child support system in each state, is considered as well. Further, the state and time dummies are included in all estimated equations to control for the fixed effects of many of the local factors that could lead child support outcome measures to be correlated with the error term. Lastly, the standard errors are adjusted for clustering at the state level using Huber-White methods. The interaction term between AIS and never-married single mothers is a key variable to examine hypotheses 2 and hypothesis 2a.

Before moving on to the data section, I briefly address a few econometric issues. First, the exogeneity of the AIS variable might be questionable here, since child support policy outcome might be a function of AIS as well as vice versa. For example, it may be the case that states with lower levels of child support policy outcome are more likely to adopt AIS (with a stricter enforcement policy) sooner or more actively, in an effort to catch up with other states. In this case, the estimate of the AIS variable

would understate the effect of AIS. On the other hand, states with higher levels of child support collection (or rates) might be more likely to enforce AIS more aggressively because they are already motivated and have more resources or money to invest for new technology. If this is the case, then the AIS estimate would be biased upward. To show that the endogeneity does not bias the model in this study, I conduct the Hausman test to see if the AIS variable is exogenous in these equations. I use a potential instrument variable to generate the test: food stamp Electronic Benefit Transfer (EBT). EBT is an electronic system that food stamp recipients use to transfer their government benefits from a Federal account to a retailer account to pay for products received. EBT has been implemented in all states since June of 1997 to issue food stamp and other benefits. The EBT variable is constructed as a dummy variable that equals zero until EFT is operational statewide and one thereafter. The source of data is an EBT status report by Food and Nutrition Service, United States Department of Agriculture. Further, the inclusion of state and time dummies in all estimated equations, as well as time-varying measures of relevant state environment characteristics at the state level strengthens my confidence that I have controlled for many of the local factors that could lead AIS to be correlated with error term.

A second concern might involve unobserved heterogeneity across states. While the state dummies will capture state fixed effects that are fixed over time, I am also concerned about time-varying characteristics that might be correlated with AIS at the state level. Difference-in-difference (DD) estimates capture these effects and in most cases DD estimates are based on interactions between the variables of interest and dummy variables for a different category of population of interest (never married single mothers and previously married single mothers). This issue was taken care of by adding an interaction term between the AIS variable and the never married single mother variable, which estimates the effects of AIS on the child support payments received by never-married single mothers relative to those of these other groups. I attribute all observed effects of these variables on previously married single mothers to unobserved heterogeneity, and infer the effects on never-married mothers only from any additional effects that these variables have on that group. Before I estimate DD methods, however, I conducted a Chow test to decide whether to pool the samples and then use an interaction term, or not to pool and then calculate the difference between each estimate to see if an interaction term functions for this purpose as well. A Chow test result indicated that to pool was a better option.

6. RESULTS

The probit estimates of the probability of child support receipt and the augmented OLS estimates of the amount of child support payment are depicted in Table 2. For easier interpretation, I present the probit and augmented OLS results separately rather than Heckman's selection model results in which the former and the latter are integrated as a form of the selection equation and the outcome equation, respectively. The results are, however, exactly the same. Also due to limited pages, I show the analysis result from the non welfare population.² In this section, I initially

discuss the results of the effect of AIS on child support outcome and then I discuss the effect of individual socioeconomic factors.

In the probit regression, the coefficients on most variables are individually statistically significantly different from zero at the 5% level. Because this model is nonlinear, specific values of all the regressors must be chosen to compute the difference in predicted probabilities of child support receipt pre AIS and post AIS. Following a convention, I consider an 'average' single mother who has the sample average values of all the regressors other than AIS status. The first row reports that the effect of AIS on child support receipt probability, holding other characteristics constant, is statistically significant at the 5% level. The estimated difference in child support receipt probabilities of pre AIS and post AIS is 2.1 percentage points, of which value is acquired from the cumulative standard normal distribution function, $\Phi(z)=\Pr(Z\leq z)$.³

The coefficient for AIS from the augmented OLS reinforces the results from the probit regression. The policy variable, AIS, is statistically significant, which indicates that among single mothers who received support, those living in a state that adopted AIS received \$192 more per year, on average, than single mothers living in a state without AIS, *ceteris paribus*. The coefficient on λ , the correction for sample selection bias in the equation on the amount of child support received, is positive, very large, and highly significant. It indicates that unobservable factors affect both the amount received and the probability of receipt in the same direction and it controls a selection bias. Overall, all of these results support hypothesis 1.

To test hypothesis 2, the interaction term between the never married mother variable and the AIS variable is employed. The interaction term is statistically significant in the probit regression as well as in the augmented OLS, indicating that the difference in AIS effects on the child support receipt rate for never married mothers and previously married mothers exists. However the sign of the interaction term is counter intuitive. For the interaction term, I hypothesized that AIS benefits never married mothers more than previously married mothers because I believe that AIS is more effective in locating missing fathers and establishing paternity than enforcing identified fathers to pay. The negative sign of the interaction term does not support my hypothesis. Possible reasons are: omitted variable; high variance; selection bias; measurement error; outliers; lack of identification; *ceteris paribus* confusion; and a regression to mean. One of possible reasons in this case is the so-called 'dynamic confusion' [18]. As Baltagi and Pinnoi [2] noted, this could be because the long-run impact of AIS is smaller than its short-run impact. Or it may simply be the case that AIS affects single mothers regardless of marital status.

Turning to individual level characteristics, Table2 illustrates that the estimated coefficients are nearly always statistically significant and of the anticipated signs. As discussed earlier,

4,714). The full result table is available from the author upon request.

³ $\Phi[Z(\text{AIS}=1)] - \Phi[Z(\text{AIS}=0)] = 0.8849 - 0.8643 = 0.0206$ (2.1 percentage point)

² The total sample size is 51,106 and it is comprised of non-welfare single mothers (46,392) and welfare single mothers

Table 2. The Probability and the Amount of Payment of Child Support

Independent variables	Dependent variables			
	Probability of child support receipt		Amount of child support payment	
	Coefficient	Robust S.E.	Coefficient	Robust S.E.
AIS	0.97 **	0.06	192.42 **	92.81
AIS*NeverMar	0.01 **	0.03	-464.17 **	89.36
Metro1	-0.07	0.1	-614.61 **	246.78
Metro2	-0.21 **	0.1	-857.51 **	251.13
Metro3	-0.11	0.1	-346.44	254.48
Metro4	-0.01	0.1	-139.42	245.89
NumberChild	0.18 **	0.02	1441.81 **	95.99
NumberChild^2	-0.02 **	0.004	-189.16 **	15.06
ElderChild	0.03 **	0.0005	85.07 **	5.78
Age	0.12 **	0.02	21.05 **	44.5
Age^2	0.00 **	0.0006	6.29 **	1.01
Age^3	0.00	5.5	-0.13 **	0.01
Educ2	0.28 **	0.11	1050.74 **	84.7
Educ3	0.53 **	0.1	2097.99 **	158.69
Educ4	0.81 **	0.1	3675.53 **	240.68
NeverMar	-0.22 **	0.02	-1243.08 **	-1243.08
Black	-0.47 **	0.02	-2277.19 **	-2277.09
Aisan	-0.53 **	0.05	-2376.76 **	-2376.76
Other	-0.21 **	0.05	-944.20 **	-944.2
Hspanic	-0.47 **	0.02	-2182.07 **	-2182.07
Paternity	0.00	6.10E-06		
RealExpenditure	0.00	1.99E-09	0.00	2.37E-06
CaseLoad	0.00	2.61E-06	0.01	349.22
TotChildren	0.00	2.57E-07	-0.01	0.003
Year 2001	0.02	0.03	15.97	43.99
Year 2002	0.04	0.03	56.02	56.11
Year 2003	0.03	0.03	59.29	55.67
Year 2004	-0.01	0.02	1.20	53.09
λ (inverseMill)			3986.83 **	349.22
constant	-13.58	24.66	-1337.12 **	30329.82
Obs	46392.00		46392.00	
LR chi^2	8234.62			
Wald Chi^2			4169.55	
Prob>chi^2	0.14		0.00	

** Significant at the 5% level

1. The sample who is white, non-Hispanic, with less than elementary school education, not living in metro area and year 2000 are used as a baseline. 2. The state fixed effect variables are suppressed.

several socioeconomic variables in the model function as proxies for unavailable information. The number of children variable indicates that mothers with more children are significantly more likely to receive child support than those with a lesser number of children. According to the sample-selection-bias-corrected OLS in Table 2, holding other factors constant, each additional child increases, on average, \$85 of child support payments per year received by single mothers who are not on welfare, regardless of marital status. The age of the eldest child proxies the willingness of father to pay and it is statistically significant, indicating that a child just a year older in age can affect the father to pay \$85 more, on average, *ceteris paribus*.

Never married mothers receive less child support than their counterparts, on average, by \$1,243 per year, holding other factors constant. This demonstrates that marital status is an important factor affecting the payments received. This also verifies the prevalent theory that never married mothers are the most disadvantaged group in terms of child support payment. They need to take further action to locate and establish paternity before the child support payments are awarded and paid. Another reason for less support is that never married mothers (and their partners) are less likely to be educated, which is associated with the ability of payment by fathers, and thus payment received by mothers. Hispanic single mothers receive less by \$2,183, on average, than non-Hispanic mothers do. Likewise black women receive \$2,277 less per year, on average, than white women do, holding other factors constant. Both education and age variables,

which are assumed to be positively correlated with the father's education and age, are statistically significant at the conventional level. Age variables (age, age squared, age cubed) show an inverted U-shaped relationship with child support payments as it does in the shape of age-earning profiles. These relationships can be interpreted to mean that payment increases with the absent father's ability to pay to some maximum level and then decreases.

The time dummies are not statistically significant while state dummies are, which illustrates a weak time trend in this analysis. I presume that it is partly due to a short time period. State environmental characteristics variables are not statistically significant either.

Lastly, I performed the Hausman test to address the potential endogeneity issue. In the test, I estimated the significance of the difference between OLS and IV (Instrument Variable) estimates, which is accomplished by including the residual from the first-stage IV estimates as an additional independent variable in the second-stage structural equation. I employed the Electronic Benefit Transfer (EBT) for the food stamp program as an IV. The detailed description on IV is discussed earlier. The test result indicates that I cannot reject the hypothesis that AIS is exogenous with respect to child support policy outcome. It is worth while to note that the IV performed reasonably well in the first stage equation I estimated. It is statistically significant at the .05 level with t-value, 43.50. Accordingly, my IV can be considered a plausible instrument, and it gives me greater confidence in the Hausman test result.

7. POLICY IMPLICATION AND CONCLUSION

In this paper I estimated the effect of AIS on the probability and the payment amount of child support received by single mothers. I found that AIS has a statistically significant and positive association with child support enforcement outcomes by which I provided counter evidence to the IT *productivity paradox*: IT has contributed to real productivity, child support enforcement outcomes. This research is meaningful in that it controlled the state and time fixed effect. Also the Hausman test suggests that the results are not driven by potential endogeneity in the AIS variable. Two points need to be underscored: first, time lags should be considered. Once a policy is implemented, we need to wait some time until the policy in effect reveals the actual impact, at least two to three years. Especially in the case of AIS, the system is required to be integrated not only at the county level within a state, but also at the state level, across the states, in order to fully function. The available data to fully analyze the impact is somewhat limited at this point. Secondly, AIS affects the time it takes to both process the case as well as increase the child support payment. However, expedited cases are not measurable and are rarely reflected in figure 1, the trend of child support payments. This can be analyzed only by using administrative data however it is difficult to obtain these data due to confidentiality issues. Further research is needed to confirm AIS' impact on case timing.

8. ACKNOWLEDGMENTS

I am indebted to Professor Eugene Smolensky, Professor Mike O'Hare, Professor Rucker Johnson, and Professor Steven Raphael for useful suggestions. All errors are my own.

9. REFERENCES

- [1] Ashby, C. (2004). Better Data and More Information on Undistributed Collection Are Needed. In Government Accountability Office. GAO-04-377.
- [2] Baltagi, B. H., & Pionni, N. (1995). Public Capital Stock and State Productivity Growth: Further Evidence from an Error Components Model. *Empirical Economics*, 20(35), 351-359.
- [3] Beller, A. H. (1986). The Determinants of Child Support Income. *Social Science Quarterly*, 67(2), 353-364.
- [4] Beller, A. H., & Garfinkel, I. (1993). *Small Change: The Economics of Child Support*. New Haven, CT: Yale University Press.
- [5] Beller, A. H., & Graham, J. W. (1991). The Effect of Child Support Enforcement on Child Support Payment. *Population Research and Policy Review*, 10, 91-116.
- [6] Bumpass, L., & Lu, H. (2000). Trends in Cohabitation and Implications for Children's Family Contexts in the United States. *Population Studies*, 54, 24-41.
- [7] Cancian, M., & Meyer, D. R. (2005). *Child Support in the United States: An Uncertain and Irregular Income Source?* (Discussion Paper 1298-05): Institute for Research on Poverty.
- [8] Case, A., Lin, I.-F., & McLanahan, S. (2003). Explaining Trends in Child Support: Economic, Demographic, and Policy Effects. *Demography*, 40(1), 171-189.
- [9] ChildTrends. (2006). Children in Poverty: Child Trend Data Bank.
- [10] Crowley, J. (2003). *The Politics of Child Support in America*. Cambridge: Cambridge University Press.
- [11] Garfinkel, I. (1992). *Assuring Child Support: An Extension of the Social Security System*. New York: Russell Sage Foundation.
- [12] Garfinkel, I. (1994). The Child Support Revolution. *The American Economic Review*, 84(2), 81-85.
- [13] Garfinkel, I., Huang, C.-C., & Heintze, T. (2001). *Child Support Enforcement: Incentives and Well-being*: JCPR working paper.
- [14] Garfinkel, I., Robins, P. P., & McLanahan, S. (Eds.). (1994). *Child Support and Child Well-Being*. Washington D.C.: Urban Institute.
- [15] Graham, J. W., & Beller, A. H. (1989). The Effect of Child Support Payments on the Labor Supply of Female Family Heads. *The Journal of Human Resources*, 24(4), 664-688.
- [16] Greene, W. (2003). *Econometric Analysis*. Upper Saddle River, N.J.: Prentice Hall.
- [17] Heckman, J. J. (1979). Sample Selection Bias as a Specification Error. *Econometrica*, 47(1), 153-162.
- [18] Kennedy, P. (2005). Oh No! I Got the Wrong Sign! What Should I Do? *Journal of Economic Education*, 36(1), 3-28.
- [19] Legler, P. (2000). *Low Income Fathers and Child Support: Starting Off On the Right Track*. Washington D.C.: Policy Studies, Inc.
- [20] Maddala, G. S. (1983). *Limited-Dependent And Quantitative Variables in Econometrics*. Cambridge, New York: Cambridge University Press.
- [21] Ruud, P. (2000). *An Introduction To Classical Econometric Theory*. New York: Oxford University Press.
- [22] Sinha, V. (2003). Child Support Gets A Support System. *Government Computer News*.
- [23] Sorensen, E., & Halpern, A. (1999). *Child Support Enforcement: How Well Is It Doing?* Washington D.C.: Urban Institute.
- [24] Sorensen, E., & Hill, A. (2004). Single Mothers and Their Child Support Receipt: How Well Is Child Support Enforcement Doing? *The Journal of Human Resource*, 39(1), 135-154.
- [25] Sorensen, E., & Oliver, H. (2002). *Child Support Reforms in PRWORA*. Washington DC: Urban Institute.
- [26] Stock, J., & Watson, M. (2003). *Introduction to Econometrics*. Boston, MA: Addison Wesley.
- [27] United States House of Representative. (2004). 2004 Green Book, Child Support Enforcement Program. In C. o. W. a. Means (Ed.) (Vol. Section 8, pp. 8-51).
- [28] Waldfogel, J., & Freeman, R. (2001). Dunning Delinquent Dads: The Effect of Child Support Enforcement Policy on Child Support Receipt by Never Married Women. *The Journal of Human Resources*, 36(2), 207-225.
- [29] Willemssen, J. C. (1997). *Child Support Enforcement: Leadership Essential to Implementing Effective Automated Systems* (No. GAO/T-AIMD-97-162): Committee on Ways and Means, House of Representatives.