Formal Firms, Informal Workers and Household Labor Supply in Mexico

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Abstract

I analyze the consequences of informal employment at formal firms in Mexico using a new employer-employee-household matched panel dataset. I find that 25% of all employees at formal firms are informal workers. Using data from the Ministry of Labor’s randomly applied inspections between 2005 and 2016, I analyze the effects of enforcement on formalization, turnover, and wages. I find that inspections increase the quarterly probability that a worker will transition from an informal to a formal job within the same establishment from 14% to 20%, but the quarterly probability of job separation also increases. There is no evidence of a change in after-tax wages for informal workers that remain employed after an inspection. This suggests the cost of registration is not levied on the newly formalized workers. Instead, after an inspection, the average after-tax wage for other, previously formal workers at inspected firms is lower, indicating that coworkers of informal employees bear part of the increase in firms’ labor costs. I then use the exogenous shock to workers’ informality status to analyze how households respond to changes in access to a formal job. I find that after an inspection spouses of informal workers who became formal decrease labor market participation in formal jobs and increase after-tax reservation wages, consistent with assigning a high value to the shared benefits of a formal job.

Keywords: Informal employment, regulation enforcement, household labor supply

JEL Codes: H13, J46, J63

Disclaimer: This paper uses confidential data from Mexico’s National System of Statistical and Geographical Information (Sistema Nacional de Informacion Estadistica y Geografia), accessed through the National Institute of Statistics and Geography (INEGI) Microdata Laboratory and from the Ministry of Labor and Social Welfare’s (STPS) Inspection and Sanctions System (Sistema de Seguimiento Inspectivo Sancionador). All results reported herein, however, are my own and are not part of INEGI’s or STPS’s official statistics. All statements and opinions are my own and do not reflect the official stance of INEGI or STPS.

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1 Introduction

Lack of compliance with tax and labor regulations is a common affliction across countries. In developing economies, it gives rise to large and persistent informal labor markets. In this paper, using a new employer-employee-household matched panel dataset that includes both formal and informal workers, I analyze informal employment within formal firms, a dimension of the informal sector that has not received much attention in the prior literature.

Informality within the formal sector is important for several reasons. First, through informal jobs, firms can bypass minimum wage laws and avoid contributing to financing government mandated benefits. If the ability to shirk these regulations is negatively correlated with firm productivity, this allows less productive firms to compete with more productive ones, while maintaining the benefits of participating in the formal economy, such as access to credit and foreign markets. At the aggregate level, this can lead to resource misallocation and productivity losses. Second, informal jobs reduce hiring and firing costs for firms, providing them with an additional adjustment margin and more flexible labor markets during downturns. Third, from a household perspective, informal employment can offer tax-arbitrage opportunities. Access to the benefits of a formal job for one household member can affect other family members’ labor market participation and the type of jobs that they are willing to accept.

In this paper, I present new facts regarding the characteristics, consequences, and dynamic behavior of informal employment at formal firms. Using inspections at randomly selected formal establishments in Mexico by the Ministry of Labor (STPS), I analyze the effect of labor regulation enforcement on informal and formal employment, turn-over, and wages. I exploit STPS inspections to identify exogenous transitions out of informal employment and study the effect of access to the shared benefits of a formal job on household labor supply.

First, I find that 25% of all employees at formal firms are informal workers who do not receive government mandated benefits. These informal workers represent 31% of all informal employment (56% excluding self-employment) in Mexico. Previous literature has estimated labor market flows across the formal and informal sectors for Argentina, Brazil and Mexico. I contribute to this prior work, first, by directly identifying formal firms using registration with STPS and, second,
by distinguishing changes in formality status that occur with and without the worker changing jobs. Taking advantage of my new data, I estimate a 16.5% baseline quarterly transition rate from informal to formal, salaried jobs, with 86% of them occurring within the same establishment. The baseline quarterly transition rate from formal to informal jobs is 8.2%, and 13% of these transitions occur within the same establishment. The likelihood of transitioning to a formal job increases during the first 6 months of employment; then after a year, it decreases with tenure.

Next, using confidential data on inspections by STPS at randomly selected establishments, I analyze the effects of labor regulation enforcement on formalization rates, turn-over, and wages. I find that inspections increase the average probability of quarterly transitions from informal to formal jobs within the same establishment from 14% to 20% within the first 3 months after the inspection. Moreover, conditional on staying employed at the same establishment, average after-tax wages for informal workers at inspected establishments do not decrease. Therefore, informal workers who become formalized after an inspection do not appear to bear the cost of becoming registered. Instead, the average after-tax wage for formal workers is 1.1% lower after an inspection than for similar workers at non-inspected firms. These results are consistent with workers who were already formal before an inspection absorbing part of the increase in the establishment’s labor costs.

Overall, the quarterly probability of remaining informally employed at the same establishment decreases after an inspection from 39% to 28%. However, not all of these transitions are towards formality. Informal workers at inspected establishments are also more likely to separate from their current job. Quarterly transition rates to unemployment for informal workers increase to 4% within 3 months of the inspection, 1.1 p.p. higher than the separation rate for similar workers at non-inspected firms (2.9%). I find that unmarried women with children, who arguably assign more value to health care, day-care centers and maternity leave benefits, are more likely to become formal after an inspection. Young men (under 25 years old) with less than a high-school degree or older women (45 years old or more) are more likely to become unemployed.

Finally, I use the exogenous shock to a worker’s informal employment status generated by STPS’s inspections to measure the response of spousal labor supply with respect to the benefits of a formal job. I find that the spouses of informal workers that become formal after an inspection are more likely to remain unemployed, less likely to start a new formal job and, conditional on employment, are more likely to transition to a higher paying job. These results are consistent with
a decrease in the willingness to accept a lower wage in exchange for a formal job, since these workers are already receiving the benefits through someone else in their household.

This paper contributes to the literature on informality in three relevant ways. First, I present new facts about the Mexican labor market from the first employer-employee-household matched panel dataset that includes both formal and informal workers as well as establishment characteristics. This data allows me to directly identify formal firms using STPS records and calculate labor market flows to different formality states within and across establishments. Second, I use random inspections by authorities as a source of exogenous variation to analyze various aspects of firms’ hiring practices and workers’ responses to them. I show that enforcement leads to heterogeneous outcomes that benefit some workers, while hurting others. Third, I analyze how spouses respond to receiving the shared benefits of a formal job. Determining the effects of benefits on spouses’ labor supply requires addressing endogeneity concerns caused by assortative matching in the marriage market and unobserved heterogeneity in the value households assign to these benefits. Since the probability of an inspection is uncorrelated with worker and firm characteristics, inspections provide a more reliable identification strategy for estimating the effects of benefits on household labor supply.

The paper is organized in 7 sections. Section 2 reviews the literature on informal employment, wage compensation theory and households’ joint labor supply decisions. The third section discusses payroll taxes and government mandated benefits in Mexico, describes STPS inspection mandate and its implementation. Section 4 presents the datasets used and includes descriptive statistics for the Mexican labor market highlighting the characteristics of workers in formal and informal jobs. Section 5 documents the characteristics and labor market dynamics of informal workers at formal firms in Mexico. Section 6 analyzes the effects of inspections on formalization rates, labor turn-over, and wages for formal and informal workers. It also presents the effects of exogenous transitions out of informal employment by one spouse on the other’s labor supply and starting wages. Section 7 concludes.
2 Literature Review

2.1 Informality and Labor Regulation Enforcement

Perry et al. (2007) describe informality as the result of two phenomena: exclusion and exit. The "exclusion" literature views informal jobs and firms as an inferior type of employment. Under this view, informality exists due to barriers (taxes, burdensome regulation, search costs, etc.) that prevent all workers from accessing a formal job with higher pay and benefits, creating a segmented market. Workers would prefer to be formal but market frictions prevent wages from adjusting to reflect this preference (Lewis, 1954; de Soto, 1989; Rauch, 1991). The "exit" perspective instead argues that individuals and firms choose their optimal level of regulatory compliance. Some individuals do not find enough net benefit from compliance and therefore choose informality instead (Hirschman, 1970; Farrell, 2004; Levy, 2008).

Several authors argue that empirical evidence favors the "exit" view of informality. Maloney (1999, 2004), Bosch and Maloney (2010), Levy (2008) and Anton et al. (2012) argue that the high transition rates across formal and informal employment in Mexico are inconsistent with individuals being excluded from the formal sector. Pratap and Quintin (2006) do not find any evidence of a wage premium in the formal sector after controlling for individual and firm characteristics and conclude that the labor market is not segmented. However, this evidence does not account for the heterogeneity within the informal sector, in particular, it does not distinguish between self-employed individuals, employees at formal firms or employees at informal firms.

Since workers can only have a formal job if their employer is registered with tax authorities, previous theoretical literature analyzing informality has focused on what drives employers' registration. The assumption is that a formal firm follows all regulations, including the requirement to register employees. Hence, which workers have the benefits of a formal job depends on where they work. Few papers analyze the factors that influence whether a specific worker is hired as a formal employee or not at a formal firm.

Pratap and Quintin (2006) and Amaral and Quintin (2006) argue that the informal sector arises from firms' trade-off between paying taxes and access to funding. Satchi and Temple's (2006), Zenou's (2008) and Alcaraz et al. (2015) models argue that search frictions are one of the main differences across both sectors. There is a barrier to entry in the formal sector while in the informal
sector the job finding rate is equal to one. Albrecht et al. (2009) and Meghir et al. (2015) consider economies where both the formal and the informal sector are subject to matching frictions. However, Albrecht et al. (2009) assume that workers are homogenous in their productivity in the formal sector and the arrival rate of offers for these jobs is exogenous. Meghir et al. (2015) assume arrival rate of offers is exogenous in both sectors. While these papers are useful to model the effects of labor market policies on informality at the firm level or for self-employed individuals, they are not well suited for analyzing informality within formal firms.

Ulyssea (2015) is one of few papers, to my knowledge, to explicitly study the existence of informal workers within formal firms, a phenomenon he refers to as the “intensive margin” of informality. Heterogeneous firms can choose whether to register their business and, if registered, they can choose whether to register their workers or not. The model assumes firms face an increasing and convex expected cost to hire informal workers without which firms would hire all workers informally. The number of informal workers is determined exclusively by this cost function. Therefore, even though Ulyssea’s paper explicitly models the existence of informal workers at formal firms, it has little to say about which workers receive a formal or an informal job within a firm.

This paper contributes to the literature in two valuable ways. First, it studies the effects of informal employment at formal firms on workers, firms, and households in Mexico. In doing so, I provide insights into the factors that influence which workers receive a formal vs. an informal job, the dynamics of this type of work arrangement, and how households respond when they receive the benefits of a formal job through another family member. Second, I use new data on random inspections by the Ministry of Labor (STPS) to analyze the effects of labor regulation enforcement and transitions out of informal employment. Moreover, unlike prior papers that had to rely on firm size or industry to proxy for formality status, this data allows me to identify formal establishments by directly observing whether they are registered with STPS.

2.2 Wage Compensation Theory

Wage compensation theory predicts that workers sort themselves into jobs that offer their preferred mix of wages and benefits. If the benefits received as a result of being registered with IMSS have a non-negative value for workers, then this theoretical framework implies that the after tax wage for registered workers should be lower than that of informal workers who are not covered by the
mandated benefits, after controlling for other variables influencing pay. Currie and Madrian (1999) note that the literature analyzing the existence of a trade-off between wages and employer provided health insurance has typically found estimates that either contradict wage compensation theory or are not statistically significant. They attribute this lack of consistency between theory and data to bias generated by unobserved variables that influence both labor market outcomes and the likelihood of having health insurance.

Olson (2002) uses male head of household’s firm size and union status as an instrument for wives’ access to health insurance with their own employers. He estimates wives with own employer health insurance take a 20% cut to their wages relative to what they would have earned if they chose to give up this benefit. Royalty (2008) exploits variation across employees required contributions for different health plans offered at the same firm to estimate marginal willingness to pay for different services. She finds that while workers have low valuation for lower health premiums, they instead value insurance generosity (such as covered services) highly. Gallen (2014) focuses in Tennessee’s Medicaid program and uses the variation in prices and participation requirements across income groups and a forced disenrollment policy to estimate an average cash value of $0.26 cents per dollar spent on Medicaid.

Currie and Madrian (1999) highlight the endogeneity concern that arises when trying to estimate the trade-off between benefits on wages. Workers sort themselves into firms and jobs based on the wage/benefits bundle that best suits their preferences. Moreover, access to a formal job and wages are positively correlated with worker’s productivity. Therefore, a credible source of exogenous variation is needed to estimate the willingness to pay for benefits. STPS’s random visits produce plausibly exogenous transitions out of informal employment. I use this as my identification strategy to measure the effects of benefits on labor supply and wages.

2.3 Collective Labor Supply Decisions

Recently, a growing literature analyzes the effects of employer or government provided benefits to household labor supply decisions. This is a relevant distinction because the benefits received can often be extended beyond the individual, making them a public good at the household level. Using a joint labor supply decision model, Dey and Flinn (2008) show that ignoring the possibility of extending coverage to other household members can lead to biased estimates of the marginal
willingness to pay for health insurance. Similarly, focusing on the Old-Age and Survivors Insurance program of the U.S. Social Security system, Nishiyama (2010) demonstrates that models that do not take into account the existence of spouses or dependents underestimate the program’s effects on labor supply.

Blundell et al. (2015) characterize the individual and household level impacts of disability insurance (DI) receipt in Norway. Using random assignment of judges across DI appeal cases, they find evidence that while being denied DI leads to large significant decreases in income for unmarried applicants, married households alter their labor supply to entirely offset the loss of DI benefits. This literature highlights the importance of looking at both spouses’ response to changes in formality status in order to develop the welfare implications, especially considering that the benefits from a formal job extend to the worker’s partner and dependents. In this paper, I contribute to this literature by analyzing the effects of spousal labor supply and starting wages after a worker transitions out of an informal job.

3 Government Mandated Benefits and Payroll Taxes in Mexico

3.1 Mandatory Benefits and Taxes

In Mexico, employers must register all employees with the Mexican Social Security Institute (IMSS) within 5 business days of hiring. Mandated registration applies to all remunerated, subordinate employees including temporary, part-time, and outsourced workers. Registration with IMSS gives workers access to a set of benefits including health care for themselves and their family members, day care services and maternity leave for female workers, sick leave, disability insurance, and a retirement fund, among other goods and services. Registered workers are also covered by minimum wage laws and severance payment regulations.

These benefits for formal workers and their family members are financed using payroll taxes levied on employers and employees. Once a worker is registered with IMSS, the employer must calculate the total contributions, make the corresponding deductions to workers’ earnings and forward the payments to IMSS each time the employee is paid. Employers and workers must contribute to financing all of the benefits, regardless of whether workers use or want them.

As shown in Table ??, the tax on employers has a fixed and a variable component. The fixed
cost is equal to 20.4% of the daily minimum wage (MW), times the number of days the employee worked in the period. There is an upper bound on employers’ contributions at a daily wage of MXN$1,826 pesos (USD$101.45) or 25 daily MW. For employers, the cost of registering a worker with IMSS ranges from 17% of the wage for an employee that earns 25 minimum wages to 35% for a minimum wage earner.

Table 1: Contributions to Government Mandated Benefits (per worker/day)

<table>
<thead>
<tr>
<th>Employer Contribution</th>
<th>Worker Contribution</th>
<th>Total w/o Government</th>
<th>Government Contribution</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.4% × MW</td>
<td>0%</td>
<td>20.4% × MW</td>
<td>13.9% × MW</td>
<td>34.3% × MW</td>
</tr>
</tbody>
</table>

Proportional to wage

- If wage < 3 MW: 15.15% × MW 2.375% 17.525% 0.475% 18%
- Added % on wage >= 3 MW: 1.10% 0.40% 1.50% 0% 1.50%


Source: Own calculations based on payroll tax rates established in the Social Security Law. MW refers to the daily minimum wage, equal to MXN$73.04 since January 2016.

Figure 1: Average and Marginal Tax Rate by Pre-Tax Daily Wage

Source: Own calculations based on payroll tax rates established in the Social Security Law. Wage data comes from the National Employment and Occupation Survey (ENOE) for all employees at formal firms in the 2nd quarter of 2016. See section ?? for a description of the data and sample.
Figure ?? shows the total and marginal tax rates that employers and formal workers must pay. The graph also displays an equal probability density plot of daily wages before taxes for workers at formal firms. Each bar on the graph shows a decile in the wage distribution. The median employee at a formal firm earns MXN$220 per day (USD$12) and pays a 2.375% tax if enrolled with IMSS. The total cost for the firm is MXN$268 per day, after paying the 22% tax.

3.2 Enforcement

IMSS and STPS visit establishments to check whether they are compliant with various labor market regulations. STPS has 3 type of inspections: ordinary, extraordinary, and follow-ups. Ordinary inspections are the main focus of this paper and are explained in section ???. Extraordinary inspections are performed after a complaint by a worker, an accident at an establishment, or a concern for public or worker safety. Follow-up inspections are scheduled after ordinary and extraordinary inspections to verify compliance with previously detected violations. Meanwhile, IMSS inspections focus on identifying informal employment and thus target establishments that are more likely to have informal workers.³

STPS’s self-proclaimed objective is to foster compliance, not through sanctions but by helping firms understand and comply with the law. After each visit, STPS inspectors file a report and give a copy to the establishment. The report details the results from the inspection, specifically, whether the establishment was found to be in violation of any regulation. Except for cases that are deemed to be dangerous or extreme (such as improper management of hazardous waste or use of child labor), violations are pointed out, and firms are given a timeframe to resolve any problems. Firms are also given the chance to request an extension. STPS then schedules a follow-up visit to verify that the corrective measures agreed upon were implemented. STPS fines the establishment only if any of the originally detected violations are still occurring.

STPS inspectors make note of how many workers are employed at the establishment and whether the establishment was able to provide proof of payroll tax payments to IMSS.⁴ Even though informal employment is one of the items on STPS’s inspection checklist, sanctioning firms for this

³The exact parameters that IMSS uses to determine which establishments to inspect are confidential. However, according to IMSS officers in charge of inspections, when deciding which firms to inspect they take into account firm size, industry, history of previous violations and notifications made to IMSS by STPS.

⁴See Figure 7 in Appendix D.
violation falls outside of its jurisdiction. Therefore, when informal workers are detected during a STPS visit, the inspector includes it in the report and sends a notice to IMSS.

STPS notifications are one of the inputs used by IMSS to determine which establishments to inspect. Therefore, an inspection by STPS increases the probability of an inspection by IMSS. However, not all notifications result in a follow-up visit by IMSS. If IMSS does perform an inspection and finds evidence of informal employment, the employer is fined for each unregistered worker and must pay back-due payroll taxes. However, employers that register (or terminate) informal workers in the time between a STPS inspection and an IMSS follow-up can reduce the likelihood of being fined. Employers can also be charged with fraud against IMSS, which is punishable with up to nine years in jail.

Informal employment violates several mandates in the Social Security Law. Beside the obligation to register all employees, the law also requires that employers provide information to IMSS about their workers’ wages and timely payment of payroll taxes. Table ?? show the range of fines, in daily minimum wages, that an employer is subject to if caught having unregistered workers.

Table 2: IMSS Fines Related to Informal Employment (2016)

<table>
<thead>
<tr>
<th>Violation</th>
<th>Fine (Daily MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not registering workers</td>
<td>20 - 350 (per worker)</td>
</tr>
<tr>
<td>Not notifying changes in wages</td>
<td>20 - 150</td>
</tr>
<tr>
<td>Late payment of social security fees</td>
<td>20 - 75</td>
</tr>
<tr>
<td>Providing false information</td>
<td>20 - 250</td>
</tr>
</tbody>
</table>

Source: Social Security Law 11/12/2015 (Ley del Seguro Social. Diario Oficial de la Federacion.)

IMSS is lenient towards employers with informal workers that decide to register them before an IMSS inspection. If an employer admits having informal workers before prompted by IMSS enforcement actions, fines are partially, and sometimes entirely, waived. Moreover, employers who come forward with IMSS about their informal employment can request extensions and installment payment plans for their back-due payroll taxes. Therefore, since receiving an inspection by STPS increases the probability of an inspection by IMSS, employers have incentives to formalize (or terminate) their workers promptly after receiving a visit by STPS to either take advantage of IMSS’s leniency or potentially avoid detection altogether.
4 Data and Descriptive Statistics

This paper offers, to my knowledge, the first effort to create a dataset that includes formal and informal workers while also identifying the establishments where they are employed. Using the National Employment and Occupation Survey (ENOE), I construct a quarterly employer-employee-household matched dataset for Mexico, spanning from 2005 to 2015. Constructing this dataset requires matching confidential data on firm names as reported by workers in ENOE’s household surveys with STPS’s National Firms Directory (DNE). This section gives a brief description of the data. Appendix A describes the matching process used to join them.

4.1 National Employment and Occupation Survey (ENOE)

ENOE is a rotating panel that gathers information regarding households’ composition and dwelling characteristics, as well as extensive data on each household member such as age, education, gender, labor market participation, and job characteristics. The National Institute of Statistics and Geography (INEGI) started data collection through ENOE in the first quarter of 2005 and the latest available information is for the second quarter of 2016. Due to its panel dimension, ENOE allows for direct calculation of labor market flows.

The dwelling or household is the sampling unit in ENOE. The survey keeps track of different families within a dwelling. Families are classified as individuals who share income and consumption. Each quarterly sample includes 120,260 households and 420,000 individuals on average. Data is gathered daily and the samples are chosen so that the information gathered every month is representative of the national labor market. Households that are selected into the sample are interviewed for five consecutive quarters and then replaced, maintaining sample representativeness.

Using the information that employed individuals provide regarding the establishment they work at and the benefits associated with the job, ENOE also allows distinguishing between formal and informal jobs. I drop observations for individuals who are under 15 years of age and for household members that aren’t currently living in the household’s residence. I focus on remunerated

\footnote{If all the members of a household move to a different location, they cannot be followed and are replaced. However, the attrition rate is only 3% for the first quarter in the sample. I observe 85% of households for a full year and 77% of all households stay in the sample for the full 5 quarters.}

\footnote{The definition of informality in this paper follows the latest resolution adopted during the 17th International Conference of Labor Statisticians which sets international standards for measuring informality. See Appendix B for details on this definition and its implementation in the data.}
workers hired as employees\footnote{Focusing on employees means excluding individuals hired through non-subordinated contractual relationships.} since these are the workers that fall under IMSS mandated registration regime. I also drop individuals employed in agriculture or as domestic employees. I further restrict the sample to workers who are employees at firms included in the DNE since these are the establishments that have the option of registering workers with IMSS and are potentially subject to STPS inspections. This leads to an average sample size of 38,610 workers at formal firms per quarter.

A worker’s formality status is determined by his registration with IMSS: a worker who is registered is a formal worker. Since administrative data only tracks individuals’ labor market status while they are employed in a formal job, I instead use self-reported access to IMSS’s benefits through a job (rather than through another family member) to identify formal and informal workers in ENOE’s sample. In order to account for misclassification across ENOE’s waves, I consider consecutive back and forth transitions across formal and informal jobs within the same establishments to be false transitions. Any worker that goes from formal to informal back to formal within a 9 month period \footnote{This correction has a negligible effect on the stocks of informal and formal jobs within formal firms. However, it reduces the rate of transitions from formal to informal jobs and vice-versa by 2.5 p.p. and 2.0 p.p., respectively.} that is, within 3 consecutive quarters) while staying employed at the same establishment is considered to be formal throughout the whole 9 month period. Analogously, an informal-formal-informal transition path at the same establishment is considered to be a continuously informal case.\footnote{If establishments register their workers after an inspection to avoid being detected in a follow-up visit by IMSS but then un-register them after the verification takes place, observed informal-formal-informal transitions would not be misclassifications but rather real transitions. However, employers have incentives to avoid this “hiding” practice. Registering and unregistering workers within short periods of time can raise flags with authorities making establishments targets of directed inspection visits.}

4.2 The National Directory of Firms (DNE) and Ministry of Labor’s (STPS’s) Inspection Visit Report Log

It is STPS’s responsibility to schedule and perform inspection visits at work centers to verify that they abide with labor regulations.\footnote{Reglamento Interior de la Secretaria de Trabajo y Prevision Social, Article 18-VI http://www.stps.gob.mx/bp/secciones/conoce/Reglamento%20Interior%20STPS.pdf} For ordinary inspections, STPS chooses establishments randomly from a list known as the National Firms’ Directory (DNE)\footnote{Reglamento General para la Inspeccion y Aplicacion de Sanciones por Violaciones a la Legislacion Laboral http://www.stps.gob.mx/02_sub_trabajo/01_dgaj/r_inspeccion.pdf}. The DNE includes information on establishments’ name, unique tax identifier, unique IMSS registration identifier, address, number
of employees, 6-digit NAICS code, among other relevant establishment-level characteristics. In June 2016, there were 394,651 firms in the DNE. Since firms do not have a legal obligation to register, the DNE is not an exhaustive list of all establishments operating in Mexico. The main channel through which firms get included in the DNE is through participation in any of STPS’s programs\textsuperscript{12}. Firms can also be added to the DNE after a complaint is filed against them\textsuperscript{13}.

After STPS visits an establishment, the inspector files a report which details the type of inspection conducted\textsuperscript{14}, the establishment’s name and address, the inspector’s name, the date(s) on which the inspection was carried out, and the detailed results from the visit\textsuperscript{15}.

My data includes all firms in the DNE, their addresses, industry and the date in which they were added to this list. For each establishment, I can also see the dates on which an inspection occurred, a broad description of the inspections’ results, and whether there were any sanctions and fines imposed due to the violation. When a fine is imposed, I can also see the amount of the fine.

Table ?? shows the distribution of inspections by results. These statistics refer only to violations that are part of STPS’s jurisdiction and hence do not include any detection or notifications sent to IMSS regarding informal employment. 43\% of inspections are closed without further action by STPS. In 48\% of all inspections, establishments are able to provide proof of compliance with irregularities detected after the inspection. Only 10\% of all inspections result in a sanction by STPS. Between 2005 and 2016, the average fine was MXN$32,194 (USD$1,740) with a maximum fine of MXN$82,569,000 (USD$4,463,189)\textsuperscript{16} and a minimum of MXN$20.57 (USD$1.11).

\begin{itemize}
\item \textsuperscript{12}These programs offer firms training that helps them understand and comply with regulation, participate in government contracts, and even provide various free courses and training for the firm’s workers.
\item \textsuperscript{13}In recent years, STPS has made additional efforts to exchange information with other government authorities and private sector institutions that have data on establishments operating in Mexico. STPS is seeking to increase communication with, for example, IMSS, the Ministry of Economy (SE), the Ministry of Finance and Public Credit (SHCP), the National Chamber of Commerce, the Industrial Chamber Confederation (CONCAMIN), and the Mexican Business Sector Information System (SIEM).
\item \textsuperscript{14}Inspection visits can be ordinary, extraordinary, initial, follow-ups or part of a specific program to verify a particular type of violation (e.g. child labor prevention).
\item \textsuperscript{15}See Appendix D for a template of an inspections report (in Spanish).
\item \textsuperscript{16}This fine was imposed due to health and hygiene violations in 2013.
\end{itemize}
Table 3: Distribution of STPS’s Inspections by Result*  
(2005-2016)

<table>
<thead>
<tr>
<th>Result</th>
<th>No. of Inspections</th>
<th>% of All Inspections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed without report of violations</td>
<td>266,517</td>
<td>43%</td>
</tr>
<tr>
<td>Provided proof of compliance</td>
<td>296,367</td>
<td>48%</td>
</tr>
<tr>
<td>Violation detected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Request for time extension granted</td>
<td>184</td>
<td>0%</td>
</tr>
<tr>
<td>Sanction process started</td>
<td>Sanction imposed</td>
<td>23,154</td>
</tr>
<tr>
<td></td>
<td>Sanction no yet imposed</td>
<td>34,620</td>
</tr>
</tbody>
</table>

*Excludes violations of labor regulations beyond STPS’s direct jurisdiction, including, informal employment.


The probability of being inspected in a given year shows an increasing trend starting in 2012. Between 2005 to 2011, establishments’ annual inspection probability was 9%. In 2013 the likelihood of being inspected in a given year increased to 17% and by 2015 this probability was 29%. This is due to an increase in the number of inspections performed per year rather than to an increase in the number of establishments subject to random selection for inspection. As a result, Figure ?? shows that the probability of receiving more than two inspections in a given year has also increased.

Figure 2: Yearly Inspection Probability and Distribution of Establishments by Number of Inspections Received in a Year (Conditional on being Inspected)

A few caveats regarding STPS inspections and their effects on informal employment are worth highlighting. First, since establishments receive notice of the inspection, they can potentially hide any evidence of informal employment. Therefore, STPS inspectors may not detect all (or even any) informal employees at an establishment. Moreover, an establishment’s ability to avoid detection could be correlated with its share of informal workers. Second, even if informal employment is detected, I do not have access to data on notifications sent to IMSS by STPS. I also do not observe whether IMSS performs a follow-up inspection, nor do I know the average length of time between STPS inspection and IMSS follow-ups. In spite of these limitations, STPS inspections can promote compliance with regulation even without detecting violations by making firms aware of the presence of authorities.

Detection rates and firms’ ability to avoid detection matter for the effect of inspections on informal employment. The probability that an informal employee at an inspected establishment remains informally employed at the same establishment decreases after an inspection. However, it is not equal to zero. Furthermore, some workers may be formalized while others might instead separate from their current job. The likelihood of each of these outcomes is plausibly correlated with the share of detected informal workers. Even though this information is included in the reports, I unfortunately do not currently have access to it. Instead, I use inspections as an instrument for any transition out of informal employment.

5 Informal Workers at Formal Firms: Characteristics and Labor Market Flows

Accounting for informality within the formal sector allows distinguishing between 5 different employment states, based on the type of job (formal vs. informal), the position within the firm (employee vs. self-employed or employer) and the type of firm in which the job is performed (formal vs. informal). Figure ?? below decomposes the Mexican labor market on the 2nd quarter of 2016 into these 5 types of employment.

During the 2nd quarter of 2016, there were 45.9 million employed individuals in Mexico. 26.4

\footnote{This classification of workers is known in the informality literature as a Hussmanns Matrix and is based on the 17th International Conference of Labour Statisticians’ Resolution concerning statistics on the informal sector and informal employment.}
were employees at a formal firm but 28% of them did not receive the benefits mandated by law, that is, they were informal employees at formal establishments. This type of informal employment represented 31% of all the informal sector in Mexico.

**Figure 3: Employed Population by Job and Firm Type**

II qtr. 2016 (millions)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.7</td>
<td>5.8</td>
<td>19.0</td>
<td>3.0</td>
<td>7.4</td>
</tr>
</tbody>
</table>

Source: Own calculations based on data from the National Employment and Occupation Survey (ENOE) and the National Directory of Firms (DNE)

Table ?? presents descriptive statistics for informal and formal employees at formal firms included in the DNE. Informal workers at formal establishments are younger and less likely to have completed schooling beyond the mandatory 9th grade. Employees with informal jobs at formal firms work a similar number of hours per week and with similar patterns throughout the day as formal employees.
<table>
<thead>
<tr>
<th></th>
<th>Informal Employees at Formal Establishments</th>
<th>Formal Employees at Formal Establishments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median After-Tax Wage (2014 Pesos p/Hr.)</td>
<td>$18</td>
<td>$26</td>
</tr>
<tr>
<td>Median No. Hours (Weekly)</td>
<td>46</td>
<td>47</td>
</tr>
<tr>
<td>Median Tenure (Months)</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>% aged 15-25</td>
<td>31</td>
<td>15</td>
</tr>
<tr>
<td>% Female</td>
<td>40</td>
<td>39</td>
</tr>
<tr>
<td>% Completed 9th grade</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>No. Obs:</td>
<td>406,003</td>
<td>1,307,054</td>
</tr>
</tbody>
</table>

Source: Own calculations based on data from the National Employment and Occupation Survey (ENOE) and the National Directory of Firms (DNE)

Informal workers at formal firms have lower tenures than formal employees. Table ?? documents quarterly transition rates between formal and informal jobs within and across establishments. To my knowledge, this is the first paper to distinguish transitions to formal jobs that occur within the same place of employment from those that involve a firm change. On average, 14% of all informal employees at formal firms on a given quarter transition to a formal job within the same establishment the following quarter. Conditional on remaining informally employed, the quarterly transition probability to a formal job within the same establishment decreases with tenure. Formal employees have much higher probabilities of being employed the following quarter (95%), particularly at the same establishment (83%). By contrast, only 53% of all informal employees remain employed at the same establishment the next quarter and 18% transition to non-employment.
Table 5: Predicted Quarterly Transition Probabilities

<table>
<thead>
<tr>
<th>Labor Market Status Next Quarter</th>
<th>Initial Labor Market Status</th>
<th>Informal at Formal Establishment</th>
<th>Formal at Formal Establishment</th>
<th>Unemployed</th>
<th>OLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same Formal Firm</td>
<td>Informal</td>
<td>38.5%</td>
<td>1.1%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Formal</td>
<td>14.2%</td>
<td>81.8%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>New Formal Firm</td>
<td>Informal</td>
<td>5.0%</td>
<td>2.3%</td>
<td>11.9%</td>
<td>3.4%</td>
</tr>
<tr>
<td></td>
<td>Formal</td>
<td>5.2%</td>
<td>2.7%</td>
<td>17.2%</td>
<td>3.5%</td>
</tr>
<tr>
<td>New Informal Firm</td>
<td>Informal</td>
<td>13.0%</td>
<td>1.9%</td>
<td>10.2%</td>
<td>3.1%</td>
</tr>
<tr>
<td></td>
<td>Formal</td>
<td>5.8%</td>
<td>1.3%</td>
<td>8.1%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Self-Employed or Employer</td>
<td>Informal</td>
<td>2.9%</td>
<td>0.8%</td>
<td>1.6%</td>
<td>0.1%</td>
</tr>
<tr>
<td></td>
<td>Formal</td>
<td>4.4%</td>
<td>0.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>Informal</td>
<td>2.9%</td>
<td>1.5%</td>
<td>19.3%</td>
<td>1.8%</td>
</tr>
<tr>
<td></td>
<td>Formal</td>
<td>15.4%</td>
<td>3.6%</td>
<td>31.7%</td>
<td>83.2%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Own calculations based on data from the National Employment and Occupation Survey (ENOE) and the National Directory of Firms (DNE).

It is important to point out that quarterly transition probabilities do not behave like a first-order Markov process. The likelihood of formalization within the same establishment increases with tenure during the first 6 months of employment and decreases after the first year. Specially for establishments with 6 to 10 employees, the probability of informal to formal transitions decreases sharply after 2 years of tenure. Figure ?? in Appendix A shows within-establishment informal to formal transition rates by tenure. Table ?? shows the 4-quarter transition probabilities.

ENOE’s household-level data allows characterizing spouses based on their joint labor market status. Table ?? in Appendix A shows the conditional distribution of spouses’ labor market participation and formality status. The likelihood that a head of household’s spouse is a formal employee is higher if the head of household is also formally employed. Spouses are more likely to be out of the labor force if the head of household is an employee at an informal firm.

---

18 See Shibata (2015), for a discussion and model of history-dependent transition probabilities.

19 From here on forth, I use the term spouses or partners interchangeably to refer to a couple that includes the head of household and her partner regardless of marital status.
6 Effects of Enforcement on Formalization, Turn-Over and Wages

In this section, I first show that the probability of being inspected, conditional on being employed in an establishment included in the DNE, is not correlated with workers’ or establishments’ characteristics. Then, I use STPS inspections to analyze how firms respond to enforcement. I focus on the effects of inspections on the rate of formalization, wages for informal and formal workers, and turn-over rates. Afterwards, I use inspections to identify exogenous transitions out of informal employment and analyze the effects of access to a formal job on household labor supply.

Let $IF_{i,j,t}$ be a dummy variable equal to 1 if individual $i$ was informally employed in establishment $j$ in quarter $t$ and became formally employed at the same establishment in period $t + 1$ and zero if he remained informally employed. Let $IU_{i,j,t}$ be equal to 1 if $i$ was informally employed at $j$ in period $t$ and became unemployed in period $t + 1$, and 0 if he remained informally employed at $j$. Finally, let $Z_{i,t}$ indicate whether individual $i$ was employed at an establishment that received an inspection within the past 3 quarters $[t - 3, t]$ and zero otherwise. Finally, let $X_{i,j,t}$ be a vector of worker and establishment characteristics.

Columns (1), (2) and (3) in Table ?? present the estimates from the following linear probability models:

$$E(IF_{i,j,t}|X_{i,j,t}, t) = \phi(\alpha_0 + \alpha_1 X_{i,j,t} + t + \epsilon_{i,j,t})$$

$$E(IU_{i,j,t}|X_{i,j,t}, t) = \phi(\beta_0 + \beta_1 X_{i,j,t} + t + \eta_{i,j,t})$$

$$E(Z_{i,t}|X_{i,j,t}, t) = \phi(\gamma_0 + \gamma_1 X_{i,j,t} + t + \zeta_{i,j,t})$$

(1)

Column (1) uses a linear probability model to test whether worker and firm characteristics are predictive of within-establishment quarterly transitions from informal to formal status. As expected, demographic and skill-related characteristics are highly predictive of whether an informal worker will transition to a formal job at his current place of employment. Workers with higher education are more likely to transition to a formal job. Establishment size is also significantly and positively correlated with this transition probability.

---

20I refer to within-establishment or within-job transitions in formality status as the cases in which a worker experiences a change in access to government mandated benefits without transitioning to a job at a different establishment.
<table>
<thead>
<tr>
<th></th>
<th>Coeff.</th>
<th>s.e.</th>
<th>Coeff.</th>
<th>s.e.</th>
<th>Coeff.</th>
<th>s.e.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>0.002</td>
<td>(0.002)</td>
<td>-0.005**</td>
<td>(0.002)</td>
<td>-0.001**</td>
<td>(0.001)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>0.068*</td>
<td>(0.041)</td>
<td>-0.229***</td>
<td>(0.057)</td>
<td>0.005</td>
<td>(0.013)</td>
</tr>
<tr>
<td><strong>Tenure</strong></td>
<td>0.008**</td>
<td>(0.003)</td>
<td>-0.014***</td>
<td>(0.002)</td>
<td>0.001</td>
<td>(0.001)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than High School</td>
<td>0.261*</td>
<td>(0.149)</td>
<td>0.287</td>
<td>(0.241)</td>
<td>0.068</td>
<td>(0.066)</td>
</tr>
<tr>
<td>Completed High School</td>
<td>0.522***</td>
<td>(0.154)</td>
<td>0.559**</td>
<td>(0.247)</td>
<td>0.043</td>
<td>(0.067)</td>
</tr>
<tr>
<td>Some College</td>
<td>0.619***</td>
<td>(0.167)</td>
<td>0.650**</td>
<td>(0.264)</td>
<td>0.075</td>
<td>(0.069)</td>
</tr>
<tr>
<td>College +</td>
<td>0.642***</td>
<td>(0.156)</td>
<td>0.554**</td>
<td>(0.250)</td>
<td>0.074</td>
<td>(0.068)</td>
</tr>
<tr>
<td>Children in daycare</td>
<td>0.050***</td>
<td>(0.015)</td>
<td>-0.784***</td>
<td>(0.270)</td>
<td>0.000</td>
<td>(0.005)</td>
</tr>
<tr>
<td>No. of household members</td>
<td>0.018</td>
<td>(0.017)</td>
<td>0.008</td>
<td>(0.014)</td>
<td>0.003</td>
<td>(0.006)</td>
</tr>
<tr>
<td><strong>Establishment size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-10</td>
<td>0.372***</td>
<td>(0.0154)</td>
<td>0.259***</td>
<td>(0.087)</td>
<td>-0.046</td>
<td>(0.025)</td>
</tr>
<tr>
<td>11-15</td>
<td>0.516***</td>
<td>(0.073)</td>
<td>0.554**</td>
<td>(0.113)</td>
<td>0.014</td>
<td>(0.029)</td>
</tr>
<tr>
<td>16-50</td>
<td>0.727***</td>
<td>(0.055)</td>
<td>0.801***</td>
<td>(0.084)</td>
<td>0.002</td>
<td>(0.021)</td>
</tr>
<tr>
<td>51+</td>
<td>0.892***</td>
<td>(0.052)</td>
<td>1.354***</td>
<td>(0.075)</td>
<td>-0.003</td>
<td>(0.019)</td>
</tr>
<tr>
<td><strong>LR</strong></td>
<td>1,194.36</td>
<td></td>
<td>649.23</td>
<td></td>
<td>30.44</td>
<td></td>
</tr>
<tr>
<td><strong>p-value</strong></td>
<td>0.000</td>
<td></td>
<td>0.000</td>
<td></td>
<td>0.595</td>
<td></td>
</tr>
</tbody>
</table>

No. of Observations: 406,003

This table displays the test of whether inspections by STPS are in fact randomly distributed across workers and establishments. The baseline estimation sample is individuals who are informally employed at an establishment that is included in the DNE between 2005 to 2015. The dependent variables in columns 1, 2 and 3 are, respectively, $IF_{i,j,t}$ a dummy equal to 1 if individual $i$ was informally employed at establishment $j$ in quarter $t$ and transitioned to being formally employed at the same establishment in $t + 1$ and 0 if he remained informally employed at the same establishment; $\text{Sep}_{i,j,t}$ a dummy equal to 1 if individual $i$ was informally employed at establishment $j$ in quarter $t$ and became unemployed between quarters $t$ and $t + 1$ and 0 if he remain informally employed at the same establishment; and $Z_{i,t}$ a dummy equal to 1 if individual $i$ was informally employed at an establishment inspected within period $t - 3$ and $t$, and 0 if the establishment is included in the DNE but was not subject to an inspection within this timeframe. Workers and establishments’ characteristics are measured before transition or inspection. Tenure is measured in months employed at the current establishment. Children in day-care is the number of children within the ages of 0 to 4 in the household. Gender is equal to 1 for men and 0 for women.
Column (2) shows that tenure, age and education are negatively correlated with the probability of separating from an informal job into unemployment. Column (3) assesses whether the probability of being subject to an ordinary inspection is correlated with firm or worker variables. Jointly, workers and establishments' characteristics explain less than 0.1 percent of the variation in inspection probability across establishments within the DNE (joint p-value of 0.595). Therefore, I conclude that STPS Inspection and Sanction System generates a distribution of inspections that is consistent with random selection across establishments included in the DNE.21

Being subject to an inspection by STPS gives employers incentives to correct their informality situation before IMSS verifies their compliance and levies a fine. Therefore, inspections should lead to changes in the probability that employers register their currently informal workers with IMSS or in the probability that the match is terminated. Since registering workers implies contributing to funding the benefits associated with a formal job, it is also possible that inspections affect wages of newly registered employees and even of already formalized co-workers. In the next sections, I separately analyze the effect of enforcement on informal and formal workers’ turnover rates and wages.

For each worker employed at an establishment that received an inspection between 2005 and 2015, I can calculate the number of quarters since the inspection took place. I use an event-time comparison between treatment and control groups to analyze the effect and persistence of inspections on labor market flows. For each time period \( t \) and each number of quarters \( q \in [-3, 3] \), the treatment group is composed of all the individuals who in period \( t \) are employed at an establishment that received an inspection in period \( t - q \).22 Meanwhile, for each time period \( t \) and each number of quarters \( q \in [-3, 3] \), the control group includes all the individuals who in period \( t \) are employed at establishments that have not received an inspection in the past 3 quarters and will not be subject to one within the next 9 months.

6.1 Effects on Informal Employees

I consider 6 different transitions out of informal employment at a formal establishment: to a formal job at the same establishment, to an informal job at a different formal establishment, to a formal job

21 The similarities between the distribution of establishments in the DNE and inspected establishments by industry and size presented in Appendix A is also consistent with a random assignment of inspections.
22 \( t - q < 0 \) refers to an establishment that will receive an inspection in the future, \( q \) quarters after period \( t \).
at a different formal establishment\textsuperscript{23}, to a job at an informal establishment\textsuperscript{24}, to unemployment and leaving the labor force. This section analyzes whether the probability of each of these transitions changes after an inspection for workers that are informally employed at the time of inspection.

Let $TI_{i,j,t}$ be a multinomial categorical variable indicating the different transitions out of informal jobs at a formal establishment. For every worker $i$ that is informally employed at formal establishment $j$ in period $t$, $TI_{i,j,t}$ is equal to:

a) 0 if individual $i$ remains informally employed at establishment $j$ ($INF_{jF,t} \rightarrow INF_{jF,t+1}$);

b) 1 if individual $i$ transitions from being informally employed at establishment $j$ in quarter $t$ into unemployment in quarter $t + 1$ ($INF_{jF,t} \rightarrow U_{t+1}$);

c) 2 if he becomes formally employed at the same establishment $j$ ($INF_{jF,t} \rightarrow F_{jF,t+1}$);

d) 3 if he becomes formally employed at a formal establishment $k$ different from $j$ ($INF_{jF,t} \rightarrow F_{kF,t+1}$);

e) 4 if he transitions to an informal job at a formal establishment $k$ different from $j$ ($INF_{jF,t} \rightarrow INF_{kF,t+1}$);

f) 5 if he transitions to an informal job at an informal establishment $l$ ($INF_{jF,t} \rightarrow INF_{lINF,t+1}$);

g) 6 if he leaves the labor force ($INF_{jF,t} \rightarrow OLF_{t+1}$)

Let $s_{i,t,q}$ be an indicator variable equal to 1 if in period $t$ individual $i$ was employed at an establishment that received an inspection on period $t - q$, $q \in [-3, 3]$ and 0 otherwise. Let $Inspected_i$ be an indicator variable equal to 1 if individual $i$ was employed at an establishment that received an inspection within the 3 previous quarters or will receive one within the next 3 quarters, and 0 otherwise.

I model the probability of transitions out of informal employment using a multinomial logit model as specified in equation ?? below. The set of coefficients $\beta^x_q$ capture the time-varying effects of inspections over transition probabilities out of an informal job. $X_{i,j,t}$ is a vector of relevant worker

\textsuperscript{23}This category includes formal self-employment and formal employers.

\textsuperscript{24}This category includes informal employees at informal establishments, informal self-employment and informal employers.
and establishment characteristics including age, gender, tenure, education, occupation, industry, establishment size, number of family members, and number of children in day-care age. Result_{j,t} is a set of dummy variables indicating whether STPS detected a potential violation of labor regulations and the type of violation, and whether the detection resulted in a sanction and fine. \( t \) is a set of quarter-year fixed effects.

\[
Pr(TI_{i,j,t} = x|i,t,j) = \phi \left( \sum_{q=-3}^{3} (\beta_q^s s_{i,t,q} \times Inspected_i + \gamma_q^s s_{i,t,q}) + X_{i,j,t}^{t} \eta^{r} + Result_{j,t}^{t} \alpha + t + \epsilon_{i,j,t} \right)
\]

\( \forall x \in \{0, 6\} \)

Panels (a) to (g) in Figure ?? below show the effects of inspections on transition probabilities before and after the inspection occurs, estimated using equation ??%. Each panel plots the average transition probabilities out of informal employment into different labor market states for the treated (informal workers employed at establishments that received an inspection) by number of quarters until/since the inspection takes/took place. The blue line shows the baseline average transition probability for the control (informal workers at establishments included in the DNE that did not receive an inspection within a [-3,3] quarters window).
Figure 4: Transition Probabilities by No. of Quarters to/since Inspection

(a) Probability of Staying in an Informal Job at the Same Establishment

(b) Transition Rate from Informal Job at Formal Establishment to Unemployment
(c) Transition Rate from Informal to Formal Job Within the Same Formal Establishment

(d) Transition Rate from Informal to Formal Job* at a Different Formal Establishment

*Includes transitions into formal self-employment and becoming a formal employer.
(e) Transition Rate from Informal Job at Formal Establishment to Informal Job at New Formal Establishment

(f) Transition Rate from Informal Job at Formal Establishment to Informal Job* at New Informal Establishment

*Includes transitions into informal self-employment and becoming an informal employer.
Notes: These figures display the effect of inspections on transitions out of informal employment on the treated (inspected) and control groups (not inspected) by number of quarters until and since an inspection occurs. $q = 0$ indicates the quarter of inspection. The sample includes informal workers employed at establishments included in the DNE between 2005-2015. For each value of $q$, the treatment group includes all informal workers employed at an establishment inspected $q$ quarters ago. The control group includes informal workers at establishments in the DNE that were not inspected within a [-3,3] quarter window. Dotted lines show $\pm 2$ standard errors for the inspection effect coefficients. The effect on the treated is calculated as the sum of $\beta_q + \gamma_q$ and the transition rate dependent mean. The effect on the control group is calculated as the predicted rate of transition out of informal employment towards each of the labor market states considered with establishment and worker’s characteristics fixed at their mean values.

These results show that:

1. Informal employees at inspected and non-inspected establishment exhibit similar average quarterly transitions rates out of informality before an inspection occurs (consistent with random selection of establishments for inspection).

2. The quarterly probability of remaining informally employed at the same establishment decreases from 38% to 27% after an inspection (Panel (a)).

3. This is due mainly to an increase in the within-establishment formalization rate from 14% to 21% on the quarter of inspection (Panel (b)) and an increase in the probability of quarterly flow rates into unemployment from 2.9% to 4.0% (Panel (c)).
4. Although the likelihood of formalization at the same establishment increases, the quarterly probability of starting a formal job at a different establishment decreases from 5% to 4% for informal workers at the time of inspection (Panel (d)).

5. Quarterly transitions to another informal job at a different formal establishment also increase, although the change is not statistically significant (Panel (e)).

6. After an inspection, the probability of job-to-job transitions to an informal establishment from one quarter to the next increase from 17% to 19% (panel (f)).

7. Informal workers at inspected establishments do not exhibit a different likelihood of exiting the labor force relative to informal workers at non-inspected establishments (panel (g)).

Figure ?? shows that inspections lead to different outcomes for different workers. While in some cases inspections result in transitions to a formal job within the same establishment, they also increase the likelihood of separation towards informal employment at a new establishment or to unemployment.

Since registering workers with IMSS implies paying taxes to fund the benefits received, inspections can either increase the cost of labor for the employer, change the after-tax wage of the workers at inspected establishments, or both. In order to check whether inspections affect wages for informal workers, I compare average wages before and after an inspection occurs for informal workers who remain employed at the same establishment. Formality status for worker $i$ is defined by his self-reported access to social benefits through his job before the inspection occurs ($q = -1$). The post-treatment group includes informal workers that transitioned to a formal job at the same place of work as well as those that remained informally employed.

Let $q$ be the number of quarters until/after an inspection, $q \in \{-4, 4\}$, and $\text{stay}_{i, j, q}$ be a dummy equal to 1 if individual $i$ stays employed in the same establishment $j$, $q$ quarters before/after the inspection occurs. Let $w_{i, q}$ be the hourly wage earned by worker $i$, $q$ quarters before/after an inspection. For each worker $i$, I define the average wage per hour earned while employed at establishment $j$ before and after inspection, $\bar{w}_{i,j,p}$ and $p \in \{\text{Pre, Post}\}$, as follows:
\[ w_{i,j;p} = \begin{cases} \sum_{q<0} w_{i,q} \times stay_{i,q} / \sum_{q<0} stay_{i,j,q} & p = Pre \\ \sum_{q \geq 0} w_{i,q} \times stay_{i,q} / \sum_{q \geq 0} stay_{i,j,q} & p = Post \end{cases} \] (3)

Table ?? below compares the average after-tax wage for informal workers at inspected establishments against their counterparts at non-inspected establishments, conditional on staying at the same place of work, before and after an inspection, as described in equation ?? below.

\[
\ln \left( \frac{w_{i,j;p}}{w_{i,j;p}} \right) = \zeta_1 Post_{i,p} + \zeta_2 Post_{i,p} \times Inspected_i + \zeta_3 X_{j,p} + i + \epsilon_{i,j;p} \] (4)

Table 7: Informal Workers at the Time of Inspection Ln Daily Wage
(Conditional on Employment at the Same Establishment)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient (Std. Err.)</th>
<th>Dependent Mean Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>-0.016 (0.021)</td>
<td>MXN$ 162</td>
</tr>
<tr>
<td>PostXInspected</td>
<td>0.025 (0.019)</td>
<td></td>
</tr>
<tr>
<td>No. of Individuals</td>
<td>55,164</td>
<td></td>
</tr>
</tbody>
</table>

Notes: This table shows the \( \zeta_1 \), and \( \zeta_2 \) coefficients defined in equation ???. The baseline sample are all informal workers employed at establishments in the DNE who remained employed at the same establishment at least one quarter after the inspection. The control group includes all informal workers employed in an establishment included in DNE that was not chosen for a random inspection and who remain employed at the same establishment. The treatment group are workers who were informally employed a quarter before an STPS inspection and remain employed at the same establishment for at least one quarter after the inspection. Formality status is defined as the self-reported access to government mandated social benefits one quarter before the inspection takes place. The mean dependent wage is calculated with all other control variables at their mean values. Standard errors are clustered at the establishment level.

Table ?? indicates, perhaps surprisingly, that the average after-tax wage for informal workers does not change significantly after an inspection relative to workers who were not inspected. Although inspections increase the probability of transitioning to a formal job, which represents a 24% increase in labor costs for a formal worker earning the average wage, informal workers do not have lower wages after an inspection. Instead, table ?? shows that being employed at an inspected establishment after an inspection is associated with a wage 2.5% above that of non-inspected in-

\(^{31}\)These analyses limit the sample to those workers who remain employed at the same establishment before and after the inspection.
formal workers, conditional on employment at the same establishment, although the coefficient is not statistically significant. This could be explained by a composition effect. If after an inspection employers keep only higher skilled, informal workers and terminate matches for lower skilled workers, the average wage conditional on staying employed would be higher at inspected establishments, consistent with the results presented in table ??.

6.2 Effects on Formal Employees

Despite increasing the likelihood of within-establishment informal to formal job transitions, Table ?? above presented some evidence consistent with informal workers not experiencing a negative shock to wages after an inspection. This could indicate that some of the costs of registering workers after an inspection are paid by other employees at the same firm. Table ?? below compares average wages before and after an inspection for formal workers who remain employed at the same establishment after the inspection occurs as detailed in equation ???. Formality status for worker \( i \) is defined by his self-reported access to social benefits before the inspection occurs (\( q = -1 \)). Therefore, the post-treatment group does not include informal workers that transitioned to a formal job at the same place of work on or after the quarter of inspection.

\[
\ln (\overline{w_{i,j,p}}) = \zeta_1 Post_{i,p} + \zeta_2 Post_{i,p} \times Inspected_i + \zeta_3 X_{j,p} + i + \epsilon_{i,j,p} \tag{5}
\]

where \( \overline{w_{i,j,p}} \) is defined as in equation ?? above.

Table 8: Formal Workers at the Time of Inspection Ln Daily Wage
(Conditional on Employment at the Same Establishment)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>(Std. Err.)</th>
<th>Dependent Mean Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>postdummy</td>
<td>0.019</td>
<td>(0.009)</td>
<td>MXN$239</td>
</tr>
<tr>
<td>postXtreated</td>
<td>-0.013</td>
<td>(0.006)</td>
<td></td>
</tr>
<tr>
<td>No. of Individuals</td>
<td>315,548</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table ?? shows that, after an inspection, formal workers have lower wages relative to similar workers at non-inspected establishments. After an inspection the average wage for formal workers at inspected firms who remain at the same establishment is 1.3 p.p. lower than that of their counterparts at non-inspected firms. It is important to mention that since the sample is restricted to
workers who remain employed at the same establishment, the results could be driven by composition effects.

In Appendix C, I analyze the effect of inspections on already formalized workers. Formal workers are more likely to remain employed at the same establishment and maintain their formality status than informal workers. Inspections have a small negative effect on the probability of staying formally employed at the same establishment, mostly driven by transitions to a different formal job. Figure ?? presents evidence of higher job-to-job transitions for formal workers after an inspection. If workers that leave after an inspection are those with higher wages, this could explain the negative coefficient in the wage equation for formal workers who remain employed at the same establishment after an inspection.

6.3 Effects on Households’ Labor Supply

A transition from an informal to formal job has two potential effects on workers’ labor supply decisions. On the one hand, since registration to a formal job implies contributing to funding the benefits offered through IMSS, a formal job is accompanied by negative wage effect equal to the worker’s share of the payroll taxes. On the other hand, formality also has an income effect because of the benefits that workers receive from IMSS. The magnitude of the income effect depends on how much value households’ place on these benefits. Therefore, labor market responses to changes in formality status can provide information regarding the value of a formal job.

The results presented in the previous section indicate that inspections increase the likelihood of informal workers transitioning to a formal job or becoming unemployed. Moreover, for those informal workers that remain employed at the same firm after an inspection, there is no significant change in wage indicating that the cost of registration is not borne directly by the worker, at least in the short-term. In this section, I analyze how these transitions out of informal employment by one household member affect other members’ labor supply decisions.

Since some of the main benefits received from IMSS (health care and day care services) are fully shared with family members, the incentives to become a formal employee decrease once another household member receives coverage. Therefore, an individual whose spouse transitions from an

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\[^{33}\text{Again, throughout the paper I use the term “spouses” to refer to the head of household and his/her adult partner, regardless of marital status.}\]
informal to a formal job after an inspection would be more likely to accept an informal job. If after an 
inspection the worker instead becomes unemployed, the spouse’s likelihood of accepting an informal 
job might also increase. Given the lack of unemployment insurance in Mexico and the absence of 
severance payments in informal jobs, spouse’s 1 transition from an informal job to unemployment 
after an inspection lowers spouse’s 2 reservation wage. If informal jobs are more readily available, 
as the job finding rate indicates, then the likelihood of a transition into an informal job by spouse 
2 could increase after an inspection.

I focus on households where the head of household is married or has a partner that he or 
she co-habitates with, regardless of marital status. I refer to the partner who did not receive an 
inspection shock as spouse 2.

6.3.1 Inspections’ Effects on Unemployed Spouses

Consider the joint labor supply decision of a household where one spouse is unemployed (spouse 2) 
and the other is informally employed (spouse 1). The probability that spouse 2 transitions from 
unemployment into a formal or an informal job depends on the worker’s characteristics, frictions 
in the formal and informal jobs markets, and the value of the benefits that are offered through a 
formal job relative to the cost of contributions for these benefits. Additionally, since some of the 
benefits are shared between household members, the value of a formal job will vary depending on 
the employment and formality status of his partner (spouse 1). I use the exogenous variation in the 
probability that spouse 1 transitions out of an informal job generated by STPS inspections as an 
instrument to estimate the effects of access to formal jobs on households’ labor supply.

Let $S_{n,h,t}^k$ be an indicator variable that characterizes the labor market status for spouse 
n $\in [1, 2]$ in household $h$ and time period $t$, $\forall k \in [INF, F, U]$.

$$S_{n,h,t}^F = \begin{cases} 
1 & \text{if spouse } n \text{ is formally employed} \\
0 & \text{otherwise} 
\end{cases}$$

$$S_{n,h,t}^{INF} = \begin{cases} 
1 & \text{if spouse } n \text{ is informally employed} \\
0 & \text{otherwise} 
\end{cases}$$
\[ S_{n,h,t}^U = \begin{cases} 
1 & \text{if spouse } n \text{ is unemployed} \\
0 & \text{otherwise} 
\end{cases} \]

The correlation between spouse’s 2 labor supply and spouse’s 1 formality status is summarized in equation (5). The probability that spouse 2 is formally (or informally) employed in period \( t + 1 \) conditional on being unemployed in period \( t \) depends on the probability that spouse 1 remains informally employed in period \( t + 1 \) given that he is informally employed in period \( t \). The effect of spouse’s 1 informal job on spouse’s 2 labor supply is summarized by the set of coefficients \( \alpha^k_1 \)

\[
\mathbb{E} \left( S_{2,h,t+1}^k | S_{2,h,t}^U = 1 \& S_{1,h,t}^{INF} = 1 \right) = \phi \left( \alpha^k_0 + \alpha^k_1 \mathbb{E} \left( S_{1,h,t+1}^{INF} | S_{1,h,t}^{INF} = 1 \right) + i_{2,h} + t + \eta_{2,h,t} \right)
\]
\[ \forall k \in \{U, F, INF\} \] (6)

Assortative matching in the marriage market coupled with unobserved heterogeneity in the value households place on the benefits from a formal job lead to biased estimates of the \( \alpha^k_1 \) coefficients. Those individuals that transition from informal to formal jobs are likely to be those that value a formal job the most. Moreover, as shown in table (8), formal workers are more likely to have a formal spouse. Therefore, it is unlikely that \( \eta_{2,h,t} \) and \( \mathbb{E} \left( S_{1,h,t+1}^{INF} | S_{1,h,t}^{INF} = 1 \right) \) are uncorrelated. In order to surpass this endogeneity problem, I use STPS inspections to instrument for the probability that spouse 1 remains informally employed in period \( t + 1 \) conditional on informal employment in \( t \).

Let \( Post_{1,t} \) be an indicator value equal to 1 for all time periods \( t \) after spouse’s 1 establishment is inspected. Let \( Inspected_1 \) be a dummy variable equal to 1 if spouse 1 is employed at an inspected establishment and 0 if employed at an establishment included in the DNE that did not receive an inspection. The \( \beta^F_2 \), \( \beta^{INF}_2 \), and \( \beta^U_2 \) coefficients in equation (5) below can be interpreted as the average effect of a change in spouse’s 1 transition probability out of informal employment on spouse’s 2 probability of transitioning from unemployment to a formal job, an informal job, or remaining non-employed, respectively.
\[
E\left(S_{2,h,t+1}^{FS} | S_{2,h,t}^{FS} = 1 \land S_{1,h,t}^{INF} = 1\right) = \phi \left( \beta_1^{FS} Post_{1,t} + \beta_2^{FS} Post_{1,t} \times Inspected_1 + i_2 + t + \eta_{2,h,t} \right)
\]
\[\forall k \in [F, INF, U] \tag{7}\]

Columns (1), (2) and (3) in Table ?? show the effects of inspections on spouse’s 2 probability of non-employment, starting an informal job, and starting a formal job conditional on being non-employed at the time spouse’s 1 establishment is inspected.

Table 9: Inspection Effects on Transition Probabilities for Non-Employed Spouses of Informal Inspected Workers

<table>
<thead>
<tr>
<th>New Labor Market Status</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-employment</td>
<td>68.9%</td>
<td>18.3%</td>
<td>12.7%</td>
</tr>
<tr>
<td>New Informal Job</td>
<td>1.005*</td>
<td>1.085***</td>
<td>0.901*</td>
</tr>
<tr>
<td>New Formal Job</td>
<td></td>
<td>(0.003)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>Odds Ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Observations</td>
<td>69,765</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: This table shows the effect of inspections on transition probabilities for spouse 2 (i.e. the spouse who was not directly affected by an inspection). The baseline sample is non-employed individuals with an informal spouse employed at an establishment in the DNE. The treatment group are individuals whose spouse was informally employed at an establishment at the time of inspection. All regressions include individual and time fixed effects. The dependent mean transition probability is calculated as the average probability of each transition out of non-employment with individual characteristics fixed at their mean values. The displayed odds ratios are the exponential of the \( \beta_k^2 \) coefficients shown in equation ??.

The first row in Table ?? shows the average probability of staying non-employed, transitioning to informal employment and transitioning to formal employment for non-employed spouses of informal workers. The second row shows the estimated effects of spouse 1 receiving an inspection on each of these transition probabilities. Spouses of inspected individuals are more likely to start an informal job and less likely to start a formal one, conditional on non-employment, compared to spouses of non-inspected workers. After an inspection, the quarterly transition rate from non-employment to a formal job decreases by 9.9% (from 8.7% to 7.7%). Transitions into an informal job instead increase by 8.5%. The probability of remaining non-employed increases slightly by 0.5%.
These results are consistent with flows out of informal employment by spouse 1 affecting the type of jobs that spouse 2 accepts, but not significantly changing the overall probability of working.

Section ?? showed that inspections cause two different types of transitions out of informal employment: flows into formal jobs within the same firm and flows into unemployment. Each of these transitions is likely to have different effects on other household members’ labor supply. In order to analyze the effect that within-establishment informal to formal transitions have on household labor supply, I use a three-stage instrumental variables approach. This methodology uses inspections as an exogenous shock to the probability that an informal worker with a non-employed spouse transitions from informal to formal employment within the same establishment. It then uses the predicted transition probability, \( E(S_{F_1,h,j,t+1}^{|S_{INF_1,h,j,t}=1}) \), to estimate the effect of access to a formal job’s shared benefits on other household member’s flows out of non-employment, \( E(S_{U_2,h,t+1}^{|S_{INF_1,h,j,t}=1}) \).

In the first stage, I estimate a logit of the determinants of spouse’s 1 probability of transitioning from informal to formal employment, \( E(S_{F_1,h,j,t+1}^{|S_{INF_1,h,j,t}=1}) \).

\[
E(S_{F_1,h,j,t+1}^{|S_{INF_1,h,j,t}=1}) = \phi(\gamma_0 + \gamma_2Post_1,t + \gamma_3Post_1,t \times Inspected_1 + X_{j,t}'\gamma_3 + i_{1,h} + t + \eta_{1,h,t}) \quad (8)
\]

where \( S_{F_1,h,j,t} \) is an indicator variable equal to 1 if spouse 1 in household \( h \) has a formal job at establishment \( j \) in period \( t+1 \) and 0 otherwise.

In the second stage, I regress spouse 1 informal to formal transition probability on the fitted probability from the first-stage \( E(S_{F_1,h,j,t+1}^{|S_{INF_1,h,j,t}=1}) \) and a set of spouse’s 2 characteristics \( (X_{2,t}) \) and individual fixed-effects \( (i_{2}) \).

\[
E(S_{F_1,h,j,t+1}^{|S_{INF_1,h,j,t}=1}) = \Phi(\delta_0^k + \delta_2^k E(S_{F_1,h,j,t+1}^{|S_{INF_1,h,j,t}=1}) + i_{2,h} + t + \eta_{2,h,t}) \quad (9)
\]

\( \forall k \in [U, F, INF] \)

In the third stage, I regress spouse’s 2 labor market transition probability on a set of time varying characteristics, individual fixed-effects, and the fitted values of the second stage \( E(S_{F_1,h,j,t+1}^{|S_{INF_1,h,j,t}=1}) \). The estimated effect of transitions from informal to formal jobs by spouse...
1 on spouse’s 2 decisions, $\gamma_2^k$ provides an estimate of secondary earners’ elasticity of labor supply with respect to the shared benefits from a formal job. As discussed in Angrist and Krueger (2001) and Greene (2012), standard 2SLS leads to biased estimates with non-linear probability models. This approach takes the binary and non-linear nature of the first-stage regression into account. Moreover, as discussed in Wooldridge (2002) the standard IV standard errors are still asymptotically valid.

$$E\left( S_{2,h,j,t+1}^k | S_{1,h,j,t+1}^U \& S_{1,h,j,t}^{INF} = 1 \right) = \Phi \left( \gamma_0^k + \gamma_2^k E\left( S_{1,h,j,t+1}^F | S_{1,h,j,t}^{INF} = 1 \right) + i_2, h + t + \eta_2, h, t \right)$$

\( \forall k \in [U, F, INF] \)

Table ?? presents the results. Based on these results, I conclude that the probability of remaining non-employed increases by 6.6% (from 68.9% to 73.5%) for secondary earners. This result is driven by declines in the transition rates into formal jobs which decrease by 5.9% (from 12.7% to 11.9%).

Table 10: Unemployed Spouses’ Labor Supply Response to the Shared Benefits of a Formal Job

<table>
<thead>
<tr>
<th>Panel A: First Stage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable: Spouse’s 1 Pr(Transitions Out of an Informal Job)</td>
<td></td>
</tr>
<tr>
<td>PostXInspected</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>1.489***</td>
<td>0.137</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Second Stage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable: Spouse’s 1 Fitted Probability of Transitions from Informal to Formal within the Same Establishment</td>
<td></td>
</tr>
<tr>
<td>PostXInspected</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>1.412***</td>
<td>0.145</td>
</tr>
</tbody>
</table>

For individual household members, Azuara and Marinescu (2011) find that increase in access to health care benefits through Seguro Popular did not increase the propensity to participate in the informal market. My results indicate that, for secondary earners, the likelihood of being informal does not significantly increase. However, the probability of being formally employed is negatively affected.
Panel C: Third Stage

Dependent Variable: Spouse’s 2 Labor Market Transition Probabilities (Conditional on Non-Employment)

<table>
<thead>
<tr>
<th>New Labor Market Status</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Employed</td>
<td>68.9%</td>
<td>18.3%</td>
<td>12.7%</td>
</tr>
<tr>
<td>New Informal Job</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Formal Job</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pr (Spouse becomes formal)

<table>
<thead>
<tr>
<th>Odds Ratio</th>
<th>1.066**</th>
<th>1.011</th>
<th>0.941***</th>
</tr>
</thead>
<tbody>
<tr>
<td>s.e.</td>
<td>(0.031)</td>
<td>(0.021)</td>
<td>(0.019)</td>
</tr>
</tbody>
</table>

No. of Observations 69,765

Notes: This table shows the effect transitions from informal to formal employment by spouse 1 on transition probabilities for spouse 2 (i.e. the spouse who was not directly affected by an inspection). The baseline sample is non-employed individuals with an informal spouse employed at an establishment in the DNE. The treatment group are individuals whose spouse was informally employed at an establishment at the time of inspection. The dependent mean transition probability is calculated as the average probability of each transition out of non-employment with individual characteristics, for both spouses, fixed at their mean values. The displayed odds ratios are the exponential of the $\gamma_k^2$ estimated as shown in equation ??.

6.3.2 Inspections’ Effects on Employed Spouses

The previous section showed the effect of transitions out of informal employment in households where one spouse is not employed. This section analyzes household labor supply decisions when both spouses are employed at the time of inspection for each of the following cases:

(1) Both spouses are informal at the time of inspection

$$E \left( S_{2,h,t+1}^{INF} | S_{2,h,t}^{INF} = 1 \& S_{1,h,t}^{INF} = 1 \right) = \phi \left( \gamma_1^{Post_{1,t}} + \gamma_2^{Post_{1,t}} \times Inspected_{1} + i_2 + t + \eta_{2,h,t} \right)$$

\( \forall k \in [F, INF, U] \)

(2) Inspected spouse is informal and non-inspected spouse is formal

37
\[
\mathbb{E}\left(S_{2,h,t+1}^k|S_{2,h,t}^F = 1 \& S_{1,h,t}^{INF} = 1 \right) = \phi\left(\delta_1^k Post_{1,t} + \delta_2^k Post_{1,t} \times Inspected_1 + i_2 + t + \mu_{2,h,t}\right)
\forall k \in [F, INF, U]
\]

(3) Both spouses are formal

\[
\mathbb{E}\left(S_{2,h,t+1}^k|S_{2,h,t}^F = 1 \& S_{1,h,t}^F = 1 \right) = \phi\left(\xi_1^k Post_{1,t} + \xi_2^k Post_{1,t} \times Inspected_1 + i_2 + t + \epsilon_{2,h,t}\right)
\forall k \in [F, INF, U]
\]

(4) Inspected spouse is formal and non-inspected spouse is informal

\[
\mathbb{E}\left(S_{2,h,t+1}^k|S_{2,h,t}^{INF} = 1 \& S_{1,h,t}^F = 1 \right) = \phi\left(\rho_1^k Post_{1,t} + \rho_2^k Post_{1,t} \times Inspected_1 + i_2 + t + \xi_{2,h,t}\right)
\forall k \in [F, INF, U]
\]

Columns (1), (2) and (3) in Table ?? show the effects of inspections on spouse’s 2 probability of non-employment, starting an informal job, and starting a formal job conditional on both spouses being employed at the time of inspection for each of the cases outlined above.

Table 11: Inspection Effects on Transition Probabilities
for Employed Spouses of Inspected Informal Workers

Panel A: Both Spouses are Informal at the Time of Inspection

<table>
<thead>
<tr>
<th>Spouse’s 2 (Not Inspected) New Labor Market Status</th>
<th>Unemployment or OLF</th>
<th>New Informal Job</th>
<th>New Formal Job</th>
<th>Same Job (Stayers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Mean Transition Probability</td>
<td>36.8%</td>
<td>13.2%</td>
<td>8.6%</td>
<td>41.0%</td>
</tr>
<tr>
<td>PostXInspection Odds Ratio</td>
<td>0.990***</td>
<td>1.031</td>
<td>0.934**</td>
<td></td>
</tr>
<tr>
<td>s.e.</td>
<td>(0.003)</td>
<td>(0.041)</td>
<td>(0.027)</td>
<td></td>
</tr>
<tr>
<td>No. of Observations</td>
<td>25,764</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Panel B: Inspected Spouse is Informal and Spouse 2 is Formal at the Time of Inspection

<table>
<thead>
<tr>
<th>Spouse’s 2 (Not Inspected) New Labor Market Status (from Formal Job)</th>
<th>Unemployment or OLF</th>
<th>New Informal Job</th>
<th>New Formal Job</th>
<th>Same Job (Stayers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Mean Transition Probability</td>
<td>17.8%</td>
<td>2.3%</td>
<td>5.1%</td>
<td>74.7%</td>
</tr>
<tr>
<td>PostXInspection Odds Ratio</td>
<td>0.981</td>
<td>0.979</td>
<td>0.953**</td>
<td></td>
</tr>
<tr>
<td>s.e.</td>
<td>(0.075)</td>
<td>(0.016)</td>
<td>(0.021)</td>
<td></td>
</tr>
<tr>
<td>No. of Observations</td>
<td>18,255</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: This table shows the effect of inspections on transition probabilities for spouse 2 (i.e. the spouse who was not directly affected by an inspection). The baseline sample is employed individuals with a spouse employed at an establishment in the DNE. The treatment group are individuals whose spouse was employed at an establishment at the time of inspection. The dependent mean transition probability is calculated as the average probability of each transition with individual characteristics, for both spouses, fixed at their mean values. The displayed odds ratios are the exponential of $\gamma_k^2$ and $\delta_k^2$, $k \in \{U, INF, F\}$ estimated as shown in equations (1) and (2) in section ?? above.

Panels A and B in Table ?? show the average treatment effect of spouse 1 transitions out of an informal job, instrumented using STPS inspections, on spouse’s 2 labor market status conditional on both spouses’ formality status at the time of inspection. Panel A shows that if both spouses are informal, inspections on spouse’s 1 establishment make transitions into a formal job by spouse 2 less likely. The probability that spouse 2 transitions into non-employment also declines.

Panel B shows the effect if spouse 2 is formal. In this case, transitions out of informal employment by spouse 1 have no significant effect on separations to unemployment by spouse 2. However, job-to-job transitions within the formal sector decrease. Spouse 2 is more likely to keep his current job in the formal sector. This result may appear to contradict the idea that spouses should avoid paying for benefits on both of their jobs. However, it is important to note that:

a) Transitions out of informality by spouse 1 need not be towards formal employment; they can also lead to unemployment;

b) Not all the benefits from formality are perfectly shared across household members (e.g. retirement funds and housing loans), therefore, additional members with formal jobs can have added value for the household;
c) Separation rates to unemployment are much lower in formal jobs (22.6% vs. 10%). If households value this stability they might choose to have two spouses with formal jobs regardless of paying for the shared benefits twice.

These results indicate that spouse’s 2 response to spouse’s 1 transitions out of informal employment depend on her own formality status. If spouse 2 is informal, job-to-job transitions to a formal job become less likely. If instead she has a formal job, job-to-job transitions within the formal sector also decrease. If spouse 1 is informal, inspections on spouse’s 1 establishment increase the probability that spouse 2 stays in the same job.

Panels A and B in Table ?? show the effect of inspections on spouse’s 2 transitions probability conditional on the inspected spouse being formal. In these cases, inspections do not have a significant effect on household turnover rates. This is consistent with the findings from section ??: inspections do not have a significant effect on formal workers’ turnover rates and hence their spouses are similarly unaffected.

Table 12: Inspection Effects on Transition Probabilities for Employed Spouses of Inspected Formal Workers

Panel A: Both Spouses are Formal at the Time of Inspection

<table>
<thead>
<tr>
<th>Spouse’s 2 New Labor Market Status</th>
<th>Unemployment or OLF</th>
<th>New Informal Job</th>
<th>New Formal Job</th>
<th>Same Job (Stayers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Mean Transition Probability</td>
<td>15.9%</td>
<td>1.5%</td>
<td>4.7%</td>
<td>77.8%</td>
</tr>
<tr>
<td>PostXInspection Odds Ratio</td>
<td>0.959</td>
<td>0.851</td>
<td>0.983</td>
<td></td>
</tr>
<tr>
<td>s.e.</td>
<td>(0.049)</td>
<td>(0.142)</td>
<td>(0.060)</td>
<td></td>
</tr>
<tr>
<td>No. of Observations</td>
<td>108,533</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Panel B: Inspected Spouse is Formal and Spouse 2 is Informal at the Time of Inspection

<table>
<thead>
<tr>
<th>Spouse’s 2 (Not Inspected) New Labor Market Status (from Informal Job)</th>
<th>Unemployment or OLF</th>
<th>New Informal Job</th>
<th>New Formal Job</th>
<th>Same Job (Stayers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Mean Transition Probability</td>
<td>34.5%</td>
<td>11.8%</td>
<td>11.2%</td>
<td>42.3%</td>
</tr>
<tr>
<td>PostXInspection Odds Ratio</td>
<td>0.951**</td>
<td>1.050</td>
<td>0.962</td>
<td></td>
</tr>
<tr>
<td>s.e.</td>
<td>(0.021)</td>
<td>(0.096)</td>
<td>(0.108)</td>
<td></td>
</tr>
<tr>
<td>No. of Observations</td>
<td>43,898</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: This table shows the effect of inspections on transition probabilities for spouse 2 (i.e. the spouse who was not directly affected by an inspection). The baseline sample is employed individuals with a spouse employed at an establishment in the DNE. The treatment group are individuals whose spouse was employed at an establishment at the time of inspection. All regressions include individual and time fixed effects. The dependent mean transition probability is calculated as the average probability of each transition with individual characteristics fixed at their mean values. The displayed odds ratios are the exponential of \( \zeta_k^2 \), and \( \rho_k^2 \), \( k \in \{U, INF, F\} \) estimated as shown in equations (3) and (4) in section ?? above.

Next, I analyze whether starting wages for spouses of inspected workers differ from those of non-inspected workers. If household members take into account the joint access to benefits offered in a formal job, transitions out of informal employment by spouse 1 will affect spouse’s 2 reservation wage. This change in reservation wage provides information regarding how much households value a formal job.

As before, let \( S^{F}_{1,h,j,t+1} \) be an indicator equal to 1 if spouse 1 in household \( h \) is employed in formal job in establishment \( j \) in period \( t+1 \). Let \( Inspected_1 \) indicate whether the establishment where spouse 1 is employed received an inspection. Let \( w^s_{2,h,k,t+1} \) be spouse’s 2 starting wage in establishment \( k \) in period \( t+1 \). I use the following specification to analyze the effect that transitions out of an informal job by spouse 1 have on spouse’s 2 starting wages, conditional on starting a new job:

\[
\begin{align*}
E \left( S^F_{1,h,j,t+1} | S^{INF}_{1,h,j,t} = 1 \right) &= \phi \left( \alpha_0 + \alpha_1 Post1, t + \alpha_1 Post1, t \times Inspected_1 + X'_{j,t} \alpha_2 + i_1 + t + \epsilon_{1,h,t} \right) \\
ln \left( w^s_{2,h,k,t+1} \right) &= \beta_0 + \beta_1 E \left( S^F_{1,h,j,t+1} | S^{INF}_{1,h,j,t} = 1 \right) + X'_{k,t} \beta_3 + i_2 + t + \eta_{2,h,t}
\end{align*}
\] (11)
Table 13: Ln Daily Starting Wage
(Conditional on Spouse 1 Having an Informal Job and Spouse 2 Starting a New Job)

First Stage: Spouse’s 1 Pr(Transitions Out of an Informal Job)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>s.e.</th>
<th>Dependent Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>PostXInspected</td>
<td>1.489***</td>
<td>0.137</td>
<td>14.3%</td>
</tr>
</tbody>
</table>

Second Stage: Spouse’s 1 Fitted Probability of Transitioning out of an Informal Job

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>s.e.</th>
<th>Dependent Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>PostXInspected</td>
<td>1.412***</td>
<td>0.145</td>
<td></td>
</tr>
</tbody>
</table>

Third Stage: Spouse’s 2 Ln(Starting Daily Wage)
Conditional on having an informal partner and starting a new job

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff.</th>
<th>s.e.</th>
<th>Daily Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr (Spouse becomes formal)</td>
<td>0.034**</td>
<td>(0.012)</td>
<td>MXN$106</td>
</tr>
<tr>
<td>No. of Observations</td>
<td>12,487</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table ?? indicates that even though spouse 2 is less likely to transition to a formal job after an inspection on his partner’s establishment, his starting wage is 3.4% higher.

7 Conclusions

In principle, all Mexican workers enjoy health, retirement and saving funds, and other social benefits in return for tax contributions paid by workers and their employers. In practice, enforcement is lax and many workers have informal jobs: they neither pay taxes to support programs that target registered workers nor receive the corresponding government mandated benefits. Moreover, informality is not exclusively a firm-level phenomenon. Formal firms also hire many informal employees. In fact, informal workers account for 25% of all employees at formal firms.

I presented new facts regarding the characteristics and dynamic behavior of informal employment at formal firms. In the case of workers at formal firms registered with the Ministry of Labor in Mexico, informality does not provide a more flexible or lighter work schedule. Moreover,

\[^{25}\text{See Table ?? Panel B and Table ?? Panel A}\]
for most workers, informality is not a stepping stone for a formal job either. Although during the first year of employment the average quarterly probability of transitioning from informal to formal status without changing jobs increases from 12% to 16%, afterwards, this probability stabilizes and even decreases with tenure. Informal workers are likely to remain informally employed a year later, either at the same establishment or with a different employer. Only 18% of all workers that are informally employed become formal employees and this transition is most likely to occur within the same establishment.

Using inspections at randomly selected formal establishments by the Ministry of Labor (STPS), I showed this type of enforcement mechanism leads to heterogenous outcomes that benefit some workers and households, while hurting others. Informal workers are more likely to transition to a formal job at the same establishment on the quarter of inspection, but the probability that they separate from their current job also increases. Larger firms and employers in the Utilities, Energy and Government-related sectors are more likely to respond to enforcement by formalizing their workers. Workers who already had a formal job before the inspection are among the negatively affected group. Formal workers at inspected establishments face a negative effect on after-tax wages, indicating that they absorb part of the firm’s compliance costs. Meanwhile, after-tax wages for informal workers that remain employed at the same establishment do not decrease after an inspection. This is consistent with an increase in the bargaining power of inspected informal workers who remain employed at the same establishment.

At the household level, when one member receives a formal job, spouses change labor supply decisions in a manner consistent with a positive income effect that increases reservation wages, specially for formal jobs. Non-employed spouses of informal workers who transition to formality because of an inspection are more likely to remain non-employed. Conditional on a new job, they are less likely to be formal but receive higher starting wages than spouses of informal non-inspected workers. The magnitude of the effects varies depending on household composition and, interestingly, on the gender of the inspected spouse. Despite the fact that formal female workers receive more benefits than their male counterparts (in the form of maternity leave, free day care centers, baby formula, among other child-bearing related goods), women’s labor market participation decreases by more than men’s when their respective spouses receive the benefits of a formal job after an inspection. These findings can be used in a revealed preference approach to measure the value that
Mexican families assign to having a formal job. The results are indicative of a high valuation of these benefits at the household level.
References


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Sistema INFOMEX. Instituto Nacional de Transparencia, Acceso a la Información y Protección de Datos Personales. 2015. Data access request numbers: 0001400017416, 0001400017316, 0064100620916, 0064100621116, 0064100621216.


Appendix A: Dataset Matching and Description

The National Employment and Occupation Survey (ENOE) includes comprehensive data for 120,260 households every quarter starting in 2005. Among other questions regarding labor market participation, it asks every household member who is employed or involved in any income generating activity the name of the firm, business or institution of employment. ENOE also includes a battery of questions regarding the type of activities performed and goods or services provided by the firm. The Mexican National Institute of Statistics and Geography (INEGI) then uses the answers provided to these questions to classify the firm into one of 178 NAICS industry codes.

Constructing the employer-employee-household dataset requires matching the firm’s name, as provided by the worker in the household survey, and industry code, as determined by INEGI based on responses from ENOE, with the firm’s name and industry code included in the Ministry of Labor’s (STPS) National Firm Directory (DNE). Due to spelling mistakes and incomplete name reporting by the workers surveyed in ENOE, the name provided by the worker is not always an exact match to the official name registered by the firm with STPS. Therefore, to match ENOE with STPS’ list of firms I use the inexact character variables matching algorithm proposed by Rai (2012).

ENOE’s questionnaire includes the households’ exact address but due to confidentiality concerns I currently only have access to the "Basic Geostatistical Area" (AGEB) where the household dwelling is located. Since workers are not asked about the location of the place of work, for multi-establishments firms, I match workers to the establishment located in the same AGEB where they live. In the cases where there is more than one establishment with the same name and industry code in the same AGEB, I randomly assign workers to each of the establishments. There are also cases where I find more than one match in establishment’s name and industry code but none of the establishments are in the same AGEB as the worker’s home address. I consider these matches only if the worker and the establishment are in the same municipality, even if not in the same AGEB.

---

26 This algorithm calculates the number of letters that match in the two variables of interest from right-to-left and left-to-right, then it divides the sum of these by the total number of letters in the two strings. This ratio gives a measure of the proportion of common letters between the two strings. According to Rai’s (2012) results, "when the proportion of common letters is more than 0.80 the two names, almost certainly, belong to the same company". I use a more conservative threshold of 0.85 to determine a positive match. Using a fuzzy match algorithm such as a generalization of the Levenshtein edit distance produces more false-positives than this method.

27 An AGEB is a subdivision for municipalities in Mexico. AGEB’s contain between 1 to 50 blocks of a municipality.
this still leaves more than one match, I randomly assign workers to one of the establishments with
the same firm name, industry code and municipality as the worker’s home address.\footnote{The random assignment of workers to establishments when there is more than one match (either within the same
AGEB or the same municipality) could lead to incorrectly assigning a worker to the control or treatment groups. This would only bias down my estimate of the effects of inspections at the firm and household levels. Going forward, I plan on mapping the distance between a worker’s AGEB and the nearest establishment and assign matches based on distance rather than randomly.}

On average I match 38,610 workers per quarter (out of an average of 115,993 employees per
quarter in the sample). Table ?? shows the results of the matched inspected and non-inspected
workers by formality status.

Table 14: Matching by Workers’ Inspection and Formality Status

<table>
<thead>
<tr>
<th>Formal Firms Employees in ENOE’s sample (Jan. 2005-Jun. 2016)</th>
<th>Matched to DNE</th>
<th>Not Matched to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inspected</td>
<td>Not Inspected</td>
</tr>
<tr>
<td>Informal</td>
<td>88,732</td>
<td>317,271</td>
</tr>
<tr>
<td>Formal</td>
<td>336,157</td>
<td>1,033,898</td>
</tr>
</tbody>
</table>

Table ?? compares the share of establishments by industry code in ENOE, the DNE and by
inspection status. Consistent with random selection of establishments to inspect, conditional on
being part of the DNE list, inspections are equally distributed across establishments in different
industries.
Table 15: Establishments in ENOE and DNE by Industry

<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>% of establishments in ENOE</th>
<th>% of establishments in DNE</th>
<th>% of inspections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining &amp; oil</td>
<td>0.9%</td>
<td>2.7%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.6%</td>
<td>5.1%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Construction</td>
<td>4.0%</td>
<td>8.8%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>18.3%</td>
<td>8.6%</td>
<td>8.0%</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>4.5%</td>
<td>6.1%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Retail trade</td>
<td>18.1%</td>
<td>10.3%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Transport and warehousing</td>
<td>4.2%</td>
<td>8.5%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Finance and insurance</td>
<td>1.9%</td>
<td>9.2%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Prof. and technical services</td>
<td>3.0%</td>
<td>1.0%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Administrative services</td>
<td>4.1%</td>
<td>1.4%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Educational services</td>
<td>10.4%</td>
<td>1.8%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Health care and social assis.</td>
<td>5.3%</td>
<td>1.6%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Entertainment and rec.</td>
<td>1.5%</td>
<td>1.4%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Accomm. and food services</td>
<td>8.6%</td>
<td>9.9%</td>
<td>7.4%</td>
</tr>
<tr>
<td>Other services</td>
<td>6.2%</td>
<td>18.8%</td>
<td>19.2%</td>
</tr>
<tr>
<td>Public administration</td>
<td>8.5%</td>
<td>4.7%</td>
<td>4.9%</td>
</tr>
</tbody>
</table>

Table ?? documents annual transition rates between formal and informal jobs within and across establishments. Although during the first year of employment the average quarterly probability of transitioning from informal to formal status without changing jobs increases, afterwards, this probability stabilizes and even decreases with tenure. Informal workers are likely to remain informally employed a year later, either at the same establishment or with a different employer.
Table 16: Predicted 4-Qtr. Transition Probabilities

<table>
<thead>
<tr>
<th>Labor Market Status Next Quarter</th>
<th>Informal at Formal Establishment</th>
<th>Formal at Formal Establishment</th>
<th>Unemployed</th>
<th>OLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same Formal Firm</td>
<td>Informal</td>
<td>20.0%</td>
<td>2.1%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Formal</td>
<td>17.3%</td>
<td>50.5%</td>
<td>-</td>
</tr>
<tr>
<td>New Formal Firm</td>
<td>Informal</td>
<td>4.5%</td>
<td>2.4%</td>
<td>10.2% xx%</td>
</tr>
<tr>
<td></td>
<td>Formal</td>
<td>0.6%</td>
<td>10.2%</td>
<td>24.5% xx%</td>
</tr>
<tr>
<td>New Informal Firm</td>
<td>Informal</td>
<td>9.2%</td>
<td>2.2%</td>
<td>8.1% xx%</td>
</tr>
<tr>
<td>Self-Employed or Employer</td>
<td>Informal</td>
<td>10.0%</td>
<td>3.0%</td>
<td>9.8% xx%</td>
</tr>
<tr>
<td></td>
<td>Formal</td>
<td>4.5%</td>
<td>3.5%</td>
<td>2.7% xx%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>Informal</td>
<td>3.7%</td>
<td>2.6%</td>
<td>7.5% xx%</td>
</tr>
<tr>
<td></td>
<td>OLF</td>
<td>31.6%</td>
<td>23.4%</td>
<td>37.2% xx%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Own calculations based on data from the National Employment and Occupation Survey (ENOE) and the National Directory of Firms (DNE)

Figure ?? shows within-establishment informal to formal transition rates by tenure and firm size.

Figure 5: Average Quarterly Transition Rate from Informal to Formal Job within the Same Establishment by Tenure and Establishment Size

Source: Own calculations using data from the 2005-2015 National Employment and Occupation Surveys (ENOE) and the National Directory of Firms (DNE). Workers’ are classified as formal or informal based on their self-reported access to social security services. Tenure is self-reported. Excludes individuals employed in agriculture or as domestic
employees.

Table ?? shows spouses' joint labor force participation.

Table 17: Head of Household and Spouses' Joint Labor Market Status

(% of Head of Households 2005-2015)

<table>
<thead>
<tr>
<th></th>
<th>Informal Employee at Formal Firm</th>
<th>Formal Employee at Formal Firm</th>
<th>Informal Employee at Informal Firm</th>
<th>Self-Employed</th>
<th>U</th>
<th>OLF</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal Employee at Formal Firm</td>
<td>8.7%</td>
<td>4.4%</td>
<td>3.8%</td>
<td>4.5%</td>
<td>5.6%</td>
<td>3.0%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Formal Employee at Formal Firm</td>
<td>14.6%</td>
<td>26.9%</td>
<td>7.6%</td>
<td>15.0%</td>
<td>18.9%</td>
<td>9.7%</td>
<td>18.5%</td>
</tr>
<tr>
<td>Informal Employee at Informal Firm</td>
<td>1.9%</td>
<td>1.2%</td>
<td>3.9%</td>
<td>1.8%</td>
<td>2.4%</td>
<td>2.3%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Self-employed</td>
<td>13.0%</td>
<td>10.9%</td>
<td>12.8%</td>
<td>17.8%</td>
<td>13.2%</td>
<td>11.5%</td>
<td>12.9%</td>
</tr>
<tr>
<td>U</td>
<td>1.9%</td>
<td>1.6%</td>
<td>1.7%</td>
<td>1.1%</td>
<td>4.3%</td>
<td>0.8%</td>
<td>1.4%</td>
</tr>
<tr>
<td>OLF</td>
<td>59.8%</td>
<td>55.1%</td>
<td>70.3%</td>
<td>59.9%</td>
<td>55.5%</td>
<td>72.7%</td>
<td>60.8%</td>
</tr>
</tbody>
</table>

Source: Own calculations using data from the 2005-2015 National Employment and Occupation Surveys (ENOE) and the National Directory of Firms (DNE). Workers' are classified as formal or informal based on their self-reported access to social security services through their employer. The table excludes individuals employed in agriculture or as domestic employees. Each cell shows the share of head of households by presence of a partner in the household, and self and partner’s labor market status.

Appendix B: Defining and Measuring Informality

I follow the latest resolution adopted during the 17th International Conference of Labor Statisticians which sets international standards for measuring informality. According to this Resolution, informality has two dimensions. The first dimension refers to the characteristics of the economic unit where an individual is employed: a business is categorized as informal when it produces goods and/or services for the market using household resources and lacks basic accounting registries or is not registered with the corresponding tax authorities. The second dimension refers to job characteristics. Informal jobs are those that lack the benefits and institutional protection required by the legal framework in the country, regardless of whether the firm or business where the individual is employed is formally registered with the corresponding authorities or not. Using this definition of informality, an employee can have either a formal or an informal job at a formal firm. At an
informal firm, all jobs are informal.

Previous literature uses data on firms’ size and industry to determine whether a firm is formal or not. This classification strategy relies on the assumption that larger firms are more likely to be detected by authorities and hence have a higher risk to informality. Similarly, it assumes that firms in certain industries have more incentives to register with authorities because they either require a larger scale to operate or are more likely to benefit from participating in production networks that require issuing tax deductible sale receipts which are only available to firms registered with the government.

There are several problems with this strategy. First, since data is gather at the household level it is unclear whether firm size is accurately represented. Second, Hsieh and Olken (2014) find no evidence in the distribution of firms in Mexico to support size-based sorting into formality. Third, more than half of all employers registered at IMSS have between 2 to 5 employees. Using size to classify employers could therefore lead to misclassifying a large share of registered employers as informal firms. Fourth, since formal firms can hire workers off-the-books and tax authorities do not share information with IMSS, it is not clear whether the relevant measure to determine risk of getting caught is related to aggregate labor force size, share of non-registered workers or a combination of both.

Exploiting new data from STPS and ENOE, I depart from previous literature to identify formal firms. If a firm is included in the DNE then it is a formal firm. It is important to point out that not all formal firms are included in the DNE. I can further identify formal firms using formality status of co-workers or firm and industry categories as previous literature has done. However, since only firms in the DNE are subject to STPS’s random inspections, I restrict my analysis to this subset of formal firms.

Appendix C: Inspection Effects on Transitions out of Formal Employment

I consider 3 different transitions out of formal employment at a formal firm: to an informal job at a different establishment (including informal self-employment), to a formal job at a different establishment (including formal self-employment), and to non-employment. This section analyzes whether the probability of each of these transitions changes after an inspection.

Let $T_{F_{i,j,t}}$ be a multinomial categorical variable equal to:
• 1 if individual \( i \) transitions from being formally employed at establishment \( j \) in quarter \( t \) into non-employment in quarter \( t + 1 \);

• 2 if he instead transitions into informal employment at a firm different from \( j \); and

• 3 if he becomes formally employed at a firm different from \( j \).

The baseline outcome, \( TF_{i,j,t} = 0 \), are those workers formally employed in establishment \( j \) in period \( t \) who remain formally employed at the same establishment in period \( t + 1 \).

I model the probability of transitions out of formal employment using a multinomial logit model as specified in equation \ref{eq:multinom} below. The set of coefficients \( \beta_q^x \) capture the time-varying effects of inspections over transition probabilities out of an informal job. \( X_{i,j,t} \) is a vector of relevant worker and establishment characteristics including age, gender, tenure, education, occupation, industry, establishment size, number of family members, and number of children in day-care age. \( Result_{j,t} \) is a set of dummy variables indicating whether STPS detected a potential violation of labor regulations and the type of violation, and whether the detection resulted in a sanction and fine. \( t \) is a set of quarter-year fixed effects.

\[
Pr(TF_{i,j,t} = x| i, t, j) = \phi \left( \sum_{q=-3}^{3} (\beta_q^x s_{i,t,q} x Inspected_i + \gamma_q^x s_{i,t,q}) + X_{i,j,t}^{t} \eta^F + Result_{j,t}^{t} \alpha + t + \epsilon_{i,j,t} \right)
\]

\( \forall x \in \{0, 3\} \)

(12)

Panels (a) to (d) in Figure \ref{fig:transitions} below show the the effects of inspections on transition probabilities before and after the inspection occurs, estimated using equation \ref{eq:multinom}. Each panel plots the average transition probabilities out of formal employment into different labor market states for the treated (formal workers employed at establishments that received an inspection) and the mean average transition probability for non-inspected workers.
Figure 6: Transition Probabilities by No. of Quarters to/since Inspection

(a) Transition Rate from Formal Job to Formal Job* at a Different Establishment

(b) Transition Rate from Formal Job to Non-employment

*Includes transitions into formal self-employment.
(c) Transition Rate from Formal to Informal Job* at a Different Establishment

![Transition Rate Graph](chart)

*Includes transitions into informal self-employment.

(d) Probability of Staying in a Formal Job at the Same Establishment

![Staying Probability Graph](chart)

Notes: These figures display the effect of inspections on transitions out of formal employment on the treated (inspected) and control groups (not inspected) by number of quarters until and since an inspection occurs. $q = 0$ indicates the quarter of inspection. The sample includes formal workers employed at establishments included in the
DNE between 2005 to 2016. For each value of \( q \), the treatment group includes all formal workers employed at an establishment inspected \( q \) quarters ago. The control group includes formal workers at establishment in the DNE that were not inspected within a [-3,3] quarters window. Dotted lines show \( \pm 2 \) standard errors for the inspection effect coefficients. The transition rate dependent mean is calculated as the rate of transition out of formal employment towards each of the labor market states considered with establishment and worker’s characteristics fixed at their mean values.

These results show that:

1. For workers who are already formal, the average quarterly probability of a formal to formal job transition to a different establishment increases from 3.5% to 3.7% on the quarter of inspection (Panel (a)).

2. Flows from formal jobs to non-employment increase during the quarter of inspection. However, the change is not statistically significant (Panel (b)).

3. Formal employees at inspected establishments are no more likely to transition to an informal job after an inspection (Panel (c)).

4. Formal workers are more likely to remain employed at the same establishment and maintain their formality status than informal workers. Inspections have a small negative effect on the probability of staying formally employed at the same establishment (Panel (d)). The decrease is caused by an increase in transitions to a formal job at a different establishment.
Appendix D: Inspection Documentation

Figure 7: Inspection Visit Notice
Figure 8: Notification of Rights, Obligations and List of Required Documentation
Figure 9: Survey for Employees at Inspected Establishments
ACTA DE INSPECCIÓN
DE NORMAS LABORALES

En Baja California, siendo las horas del día, el (os)
suscripto(s) Inspector(es) Local(es) para Trabajo, con fundamento en lo dispuesto por los artículos 640, 641 y 642 de la Ley Federal del Trabajo, se constituyó en el domicilio de la empresa ubicado en de esta Ciudad, en base a las disposiciones de la Directiva de fecha , la Secretaria del Trabajo y Previsión Social, de conformidad con lo dispuesto en dicha ley, se realiza la inspección de las normas laborales que se encuentran en el domicilio antes citado, a fin de constatar el cumplimiento de las disposiciones de la ley de trabajo, y que en particular se describen en lo dispuesto en el art. 523, fracción "A", de la Constitución Política de los Estados Unidos Mexicanos, y en los Reglamentos de la citada ley. Los autores de la inspección son los siguientes: (los), quienes se identifican con a quien se le requiere realizar su personalidad, que desde el momento con y aparecidos en el acta en las infraestructuras, interacciones distintas a las Judiciales, manifestando que, en el caso de declarar con falsedad, les toca el cargo de la presente Acta. Posteriormente se requiere al representante de la empresa que comparezca en esta diligencia. Representante de los trabajadores (Secretario General del Sindicato de su representante legal), para comparecer el efecto y, asimismo se le requiere al representante de la empresa designa a dos testigos de asistencia, en el entendido de que se negar a designarlos, el Inspector los designara, por lo que el representante de la empresa designa a los quienes se identifican con respectivamente. Se hace constar que las identificaciones
ACTA DE INSPECCIÓN

DE

NORMAS LABORALES

mostradas previo requerimiento del inspector por las personas que intervienen en esta diligencia, contienen fotografía y firma de los interesados, misma que concuerda con los rasgos físicos de sus portadores, lo que los identifica plenamente además de estar vigente durante el presente año. El inspector de Trabajo que actuó se identificó plenamente ante quienes intervenían en la visita, mostrando el efecto la Credencial número ________ expedida por Oficial Mayor del Gobierno del Estado de Baja California, documento en que aparece la firma autógrafa del inspector, además y fotografía misma que concuerda con los rasgos físicos de su portador. dicha identificación tiene vigencia hasta el ________.

El siguiente documento, y correspondiente oficio de comisión, del cual se deja original el duplicado de dicho documento, como constancia, fue entregado al inspector legalmente. Se han confirmado plenamente enterados las comparendas del motivo y alcance de la inspección. Alcance se reconociera plenamente la personalidad que cada uno ostenta y requeridas que fueron las facilitaciones necesarias para su desarrollo. El Representante Legal de la empresa se manifestó en el sentido de otorgar todos los avales necesarios para el desarrollo de la inspección, solicitando a continuación la documentación referente al cumplimiento de la normatividad laboral, obteniendo como resultado los siguientes:

AGTA CONSTITUTIVA: El acta constitutiva de la escuela Número ________

Volumen ________

Propiedad ante la Firma Público Número ________

Ciudad de ________

OBJETO SOCIAL

ACTIVIDAD REAL DE LA EMPRESA

REGISTRO FEDERAL DE CONTRIBUYENTES

CÁMARA

REGISTRO PATRONAL DEL SEGURO SOCIAL

RIESGO

A

En encontrándose a trabajadores en el mismo el Instituto Mexicano del Seguro Social, excepto a los trabajadores ________ manifestando la empresa

B

PAGOS AL SEGURO SOCIAL: se tuvo a la vista la inscripción de montos correspondientes al ________

C

INFONAVIT y S.A.R.: se tuvo a la vista los pagos correspondientes al 5% de INFONAVIT con Número de Folio ________ y 2% del SAR, mismos que se encuentran cubiertos hasta el ________

CÁPITAL CONTABLE ACTUAL: ________
SALARIOS: El suscrito Inspector de Trabajo requirió las nóminas de pago las cuales se mostraron, así como los recibos de pago de los últimos meses, mismas que se revisaron de manera selectiva y se observó que se maneja un tipo de remuneración para el personal, se paga ______.

De la revisión de las nóminas se pudo comprobar que todos los trabajadores (operativo y administrativo) perciben una remuneración mínima general o profesional, encontrando violaciones al salario ______.

REPARTO DE UTILIDADES: Se obtiene la Declaración Anual del ejercicio correspondiente al año ______, cuyo resultado se detalló en ______, y la utilidad reparable fue de $ ______, que se aplicó entre ______ trabajadores, como se acreditará en ______, firmado por los trabajadores de turno ______.

VACACIONES Y PRIMA VACACIONAL: La prestación de vacaciones así como el 25% de Prima Vacacional fueron paga por la empresa como se acredita en ______, firmado por los trabajadores de turno ______.

AGUINALDO: La empresa ______ no realizó ningún tipo de pago, ______ fueron inescritos firmados por los trabajadores de turno ______.

LA EMPRESA: Fomenta actividades recreativas entre sus trabajadores ______.

Se requirió a la empresa que remita el Cuadro General de Antigüedades de la empresa a ______, se encuentra publicado en la instalación de la empresa ______, se exhibió el acta constitutiva de la comisión formuladora del cuadro general de antigüedades ______.

PROCESO DE TRABAJO DE LA EMPRESA: Una vez aplicados los interrogatorios a los trabajadores y revisada la documentación exhibida, se realizaron las siguientes observaciones a la empresa ______.
SALARIOS: El suscrito Inspector de Trabajo requirió las nóminas de pago las cuales se mostraron, así como los recibos de pago de los últimos meses, mismas que se revisaron de manera selectiva y se observó que se manejaba un tipo de nómina, para el personal, se paga ___________________

De la revisión de las nóminas se pudo comprobar que todos los trabajadores (operativo y administrativo) perciben fuera menos un salario mínimo general o profesional, encontrando violaciones al salario de $ ____________________________.

REPARTO DE UTILIDADES: Se encontró la liquidación anual del ejercicio correspondiente al año __________________________, la utilidad repartible fue de $ ____________________________, y la utilidad repartible fue de $ ____________________________, que se aplicó entre _______ trabajadores, como se acredita con ________________ formados por __________ trabajadores de __________, y fue mostrada el Acta Constitutiva de la Comisión para el Reparto de Utilidades.

VACACIONES Y PRIMA VACACIONAL: La prestación de vacacionales así como el 20% de Prima Vacacional fueron puestas por la empresa como se acredita con ________________ firmados por los trabajadores de __________, y los trabajadores de __________.

AGUINALDO: La empresa __________________________, para aplicar en todo caso que fueran mostrados ________________ firmados por los trabajadores de __________.

LA EMPRESA: Fomenta asociaciones sociales y culturales entre sus trabajadores.

Se requiere presentar el Cuadro General de Antigüedades de la empresa mismo que se encuentra actualizado en las instalaciones de la empresa. Se exhibió el acta constitutiva de la comisión formadora del cuadro general de antigüedades.

PROCESO DE TRABAJO DE LA EMPRESA: Una vez aplicados los interrogatorios a los trabajadores y revisada la documentación exhibida, se realizaron las siguientes observaciones a la empresa: ____________________________.
EN EL USO DE LA VOZ EL REPRESENTANTE DE LA EMPRESA, MANIFIESTA LO SIGUIENTE:


Siendo la(s) ____________ hora(s) de ____________ minutos a.m. y ____________ minutos p.m. que fue, se hace entrega de una copia a los que se refiere, en representación del ____________, de los documentos representativos obreros-patronales, así como los testimonios de asistencia. Dicho documento fue objeto de la inspección de las normas laborales del Trabajo, que actual y de fe - DOY FE -

E. C. INSPECTOR DE TRABAJO

REPRESENTANTE DE LA EMPRESA

REPRESENTANTE DE LOS TRABAJADORES

TESTIGOS DE ASISTENCIA

SECRETARIA DEL TRABAJO Y PREVISIÓN SOCIAL
DELEGACIÓN ENSENADA
EDIFICIO DE GOBIERNO
ENSENADA, B. C. TEL. 17-330-18

SECRETARÍA DEL TRABAJO Y PREVISIÓN SOCIAL
DELEGACIÓN ENSENADA
EDIFICIO DE GOBIERNO
ENSENADA, B. C. TEL. 17-330-18

SECRETARÍA DEL TRABAJO Y PREVISIÓN SOCIAL
DELEGACIÓN ENSENADA
EDIFICIO DE GOBIERNO
ENSENADA, B. C. TEL. 17-330-18

OFICINA DE LA S.T.P.S. EN SAN QUINTÍN
CARRETERA TRANSBORDOS
EDIFICIO DE GOBIERNO
SAN QUINTÍN, B. C. 165-25-60
<table>
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<th>No. DE ACTA</th>
<th>FECHA</th>
<th>Nº DE LA EMPRESA</th>
<th>DOMICILIO</th>
<th>TIPO DE INSPECCIÓN</th>
<th>No. TRAB.</th>
<th>IESS</th>
<th>AÑOS AFOROS</th>
<th>INFONAVIT</th>
<th>VIOLACIONES A LA LEY FEDERAL TRABAJO</th>
</tr>
</thead>
</table>

**FIRMA**

**E.I.C. INSPECTOR DEL TRABAJO**