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Health Insurance and the Labor Market with Wage Rigidities: Insights from a Laboratory Experiment*

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Abstract

Most individuals who have health insurance in the U.S. obtain it through their employer. In some states the government mandates employers to provide insurance to certain types of workers. We use experimental laboratory to study how employer mandates affect labor market efficiency and the level and structure of employment in the presence of wage rigidities such as minimum wage laws. We find that a binding minimum wage reduces labor market efficiency and decreases, and may fully eliminate, voluntary provision of health insurance by firms to low wage workers. Mandating health insurance for all workers guarantees insurance coverage for those employed, but reduces firms' demand for workers and thus leads to unemployment.

JEL classification codes: C92, I18, J20, J3.

Key words: Labor market, health insurance, minimum wages.

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1 Introduction

Health care reform has been at the forefront of both public policy debate and academic literature. Widely-discussed issues include the effectiveness of proposed policies on increasing insurance coverage, the effect of increased health insurance on medical spending, how the costs are distributed among the population, and effects of health care policies on the labor market (e.g., Gruber 2011, Aron-Dine et al. 2013, Mulligan 2014).[1] Understanding the effects of specific health insurance policy interventions on insurance coverage and employment level and structure are important in evaluating policy alternatives and informing the public.

In this study we investigate, experimentally, the effects of certain health insurance regulations on labor markets in the presence of wage rigidities such as minimum wage laws or union contracts. Specifically, we focus on the effects of employer health insurance mandates. Most individuals who have health insurance in the U.S. obtain it through their employer. In several states, the government has attempted mandating employers to provide insurance to certain types of workers. In Hawaii, the government requires private-sector employers to provide insurance to all full-time workers (those employed 20 hours a week or more), but not to part-time workers.

The effects of an insurance mandate on the labor market can be modeled through the framework of rising fixed costs (Gruber 2000). Since the mandate on the health insurance increases the fixed costs for the employer, low-hours workers become more costly compared to full-time employees. Employers will therefore desire increased hours by fewer workers, lowering the cost per hour of the health insurance for a given total labor supply. If part-time employees can be readily excluded from the health insurance coverage, there may be countervailing effect on the employer side, as full-time employees are replaced with their uninsured part-time counterparts. Mandate on health insurance will generally lead to a decrease in wage and an ambiguous effect on employment (Summers, 1989; Gruber, 2000). In a fully competitive market with no wage rigidities, if employers are able to lower workers' wages by the lump-sum increase in costs, then neither hours nor employment should change

[1] See also Uwe Reinhardt's New York Times blog, `http://economix.blogs.nytimes.com/author/uwe-e-reinhardt/`

(Summers 1989, Gruber and Kruger 1991, Feldman 1993, Gruber 2000).

In reality, however, worker wages are not always freely adjustable due to minimum wage laws or union contracts. The federal minimum wage for covered nonexempt employees is $7.25 an hour as of July 2009; many states have set minimum wage levels higher than the federal level. The effects of these wage regulations on the labor market are controversial. Supporters of minimum wage laws argue that minimum wages eliminate firm market power and guarantee workers a fair compensation on labor. Opponents argue that the minimum wages disadvantage low-wage workers, thereby distorting the market. The argument against the minimum wages is based on the competitive model of the labor market, which predicts that wage controls above the market equilibrium wage will create unemployment (e.g., Stigler 1946). The arguments for the minimum wage regulations are supported by monopsonistic labor market models, in which firms with market power would set wages and employment below the social optimum. Such models predict that wage regulations may increase both the employment and welfare of workers (e.g., Card and Krueger, 1995; see also Cahuc and Michel, 1996; and Rebitzer and Taylor, 1995).[2]

Empirical evidence on minimum wage impacts on the employment level is mixed. A number of studies that use time-series data and cross-section data conclude that, ceteris paribus, a 10% increase in the minimum wage would result in one to three percent decrease in teenage employment (Brown et al. 1982, Brown 1988, Ehrenberg 1992, Neumark and Wascher 1992). Deere et al. (1995) also report that the 1990-1991 federal minimum wage increase led to decreased employment of low-wage workers. These studies are consistent with the competitive labor market model. On the other hand, several other studies suggest little employment effects due to changes in the minimum wages (Card, 1992a and 1992b; Katz and Krueger, 1992; Card and Krueger, 1994 and 1995). The latter research is consistent either with a monopsony model of the low wage labor market, or with very inelastic demand for low wage labor model.

Possible effects of health insurance mandates in a competitive labor market in the presence of wage rigidities are discussed in Gruber (2000) and Wolaver et al. (2003). To the

[2]Several other models that imply firm monopsony power predict ambiguous employment and welfare effects of minimum wages; e.g., Swinnerton, 1996; Lang and Kahn, 1998; Boadway and Cuff 2001.

extent that workers value health insurance, mandated health insurance benefits result in lowering wages in exchange for the benefits. However, if employers cannot implement proportional wage reduction due to minimum wage law or union contract, the labor costs of certain workers will rise above the market value of their labor and firms will be forced to pay the wage above the marginal product of worker.[3] For example, for workers already at the minimum wage, firms will be unable to balance an increase in the firm's health insurance cost by lowering wage. There are a number of ways how firms can avoid this situation. They may hire less low-wage workers and increase hours of remaining workers, thus leading to unemployment among low-wage workers. Figure 1, based on Wolaver et al. (2003), illustrates.[4]

FIGURE 1 AROUND HERE

Wolaver et al. (2003) report that health insurance coverage among low-wage workers is increased by 31 percent by the mandate policy, at a cost of an estimated 0.8-5.4 percentage-point decrease in full-time employment for low-wage workers.

If health insurance is not mandated, firms may also not offer health insurance coverage at all or lower the generosity of the coverage.[5] Finally, under the partial mandate as

[3]Note that this argument implies that the wages are set competitively.

[4]In Figure 1, the effect of minimum wage regulation is demonstrated for high-skilled workers (left) and low-skilled workers (right). A mandate on health insurance decreases the demand for labor for both types of workers. On the other hand, more workers desire to work more at each given level of compensation. The resulting equilibrium outcome differs between high-skilled and low-skilled labor markets. In the graph shown on the left, high-skilled workers value health insurance dollar by dollar, therefore the equilibrium wage drops, $W_1 < W_0$, and the employment level does not change, $E_1 = E_0$. Employers in this case are able to decrease wages with the increase in costs because the minimum wage constraint is below the new equilibrium level. However, for the low-skilled workers, the new market outcome (W_{min}, E_{D1}) has lower wages and lower employment compared to the initial equilibrium (W_0, E_0). The minimum wage constraint does not allow firms a full downward adjustment on wages for increased costs, and firms desire fewer contracts with low-skilled workers, thus leading to unemployment for this type of workers. In the Figure 1 (right), the amount of unemployed low-skilled workers is given by the difference between the number of workers E_{S1} willing to work at the minimal wage, and the demand for workers E_{D1} at this wage.

[5]Firms may also discriminate the low-wage worker by not offering health insurance, but providing it to high-skilled workers under the risk of discovery and loss of favorable tax treatment; or they may choose a

in Hawaii which requires coverage of full-time, but not part-time workers, firms may hire low-productivity workers under the part-time arrangement legally freeing themselves from offering health insurance.

Empirical literature on the effect of employer mandates on health insurance has been scarce. Thurston (1997) documents the shift from full-time to part-time employment in industries in Hawaii that were most affected by the implementation of the health insurance mandate. Buchmueller et al. (2011) examine the effects of the Hawaii mandate using the Current Population Survey data and confirm that the mandate increased insurance coverage for worker groups. They also demonstrate that the mandate resulted in an increased reliance on exempt part-time workers, but found no significant effect on wages. However, the authors acknowledge that "...as with our findings for wages, our data and empirical design do not allow us to rule out employment reductions arising from the mandate, especially for workers who face low probabilities of receiving [employer-sponsored insurance] in a voluntary market" (Buchmueller et al. 2011, p. 47).

Laboratory experiments have been long used to evaluate policy outcomes in situations when empirical evidence may be inconclusive (e.g., Plott 1987; Eckel and Lutz 2003). Using a laboratory experiment, Sherstyuk et al. (2007) demonstrate that a partial mandate (as in Hawaii) is likely to increase insurance coverage and lead to higher reliance on part-time exempt workers. However, Sherstyuk et al. (2007) assume no wage rigidities and fully adjustable wages, an unrealistic assumption that we aim to relax in this study. A possible distortionary effect of price controls in a competitive markets setting is well-studied and understood by both experimental researchers (e.g., Isaac and Plott, 1981) and college students in economics (e.g., Bergstrom and Miller, 2000, Chapter 5). However, to the best of our knowledge, no experimental study has previously considered joint effects of both health insurance regulations and wage controls. Experimental studies on labor markets focus mostly on either testing the model of gift exchange between employers and employees (e.g., Fehr et al. 1998) or on matching markets (e.g., Roth 2008). Research laboratory experiments on health care are scarce, with the notable exception of market design for kidney exchanges

costly option to withdraw themselves from the nondiscrimination clause, therefore become subject to state benefit mandate and state premium taxes; see Wolaver et al., 2003.

(Roth 2008; Kessler and Roth 2011). However, there are classroom experiments designed to illustrate adverse selection in the markets for health insurance (Mellor 2005; Hodgson 2014).

In this paper we use experimental laboratory to investigate the interaction of health insurance regulations and minimum wage laws. We adopt the competitive market setting, both because it is widely used in the health economics literature, and because we feel that the competitive model is a good starting point for the analysis.[6] Within the framework of the competitive labor market, we test whether health insurance regulations together with wage rigidities affect levels and structure of employment and health insurance coverage rates as the theory discussed above predicts (e.g., Wolaver et al., 2003). Specifically, our objective is to verify, with the help of experimental laboratory, the following theoretical predictions:

1. Health insurance, if provided voluntarily or mandated for all workers, reduces the share of part-time workers among employed.

2. For high-skilled workers, whose equilibrium wages are far above the minimum wages, the minimum wage regulation will have no effect in addition to the health insurance regulation. If the wages are fully adjustable, providing health insurance benefits will result in lowering wages in exchange for the benefits, with no effect on employment. If some workers under-value health insurance, then mandating health benefits for everyone will result in lower market efficiency due to over-insurance.

3. For low-skilled workers, if firms are unable to adjust their wages downward due to a binding minimum wage constraint, and health insurance is not mandated, the firms may not offer health insurance coverage at all. Under the partial mandate, the firms

[6]Further, experiments with market power design (e.g., Holt, Langan, and Villamil, 1986, and Davis and Williams, 1991) have shown that competitive predictions are weakened in the market with only two sellers, but competitive price, quantity, and efficiency levels are often observed, even in monopolies. Only an extreme market power design with excess supply of one unit at supra-competitive prices generates distortions; see Holt (1995) for further discussion. Thus, creating a setting where firms are able to exercise market power and set lower than competitive wages and employment levels would be non-trivial even without extra complications of modeling health insurance and minimum wage regulations. We choose to start with the simplest model that would allow us to consider the joints effects of these regulations – the competitive model.

will hire such workers part-time, resulting in increased share of part-time workers. In either case, health insurance coverage among employed will fall.

4. If firms cannot adjust their wages downwards by the cost of health insurance due to a binding minimum wage constraint, and health insurance is mandated for all workers, the firms will hire fewer workers thus leading to unemployment.

Our experiments confirm that health insurance mandates combined with minimum wages laws may lead to labor market efficiency distortions. We show that minimum wage laws may result in firms opting not to offer health insurance to low wage workers when the provision is voluntarily, and in a decreased demand for part-time workers. On the other hand, mandating insurance to full-time workers, but not part-time workers, leads to an increased share of those employed part-time. Wage rigidities below market equilibrium wage do not distort equilibrium efficiency or wage levels, but under the full mandate market outcomes could be still inefficient due to over-insurance. We also show that if the minimum wage constraints are binding, as is likely to be the case for low wage workers, health insurance mandates may lead to unemployment.

The rest of the paper is organized as follows. In Section 2, we describe a simple model of a competitive labor market that we will further use in the experiment, and summarize its predictions. In Section 3, we describe experimental design. Section 4 presents experimental results. Section 5 concludes and discusses the limitations and possible priorities for future work in this area.

2 Modeling framework

To consider the effects of health insurance mandates and minimum wage laws on the level and structure of employment and labor market efficiency, we adopt a simple model of a competitive labor market with employer-provided health insurance as in Sherstyuk et al. (2007). Assume that the benefits from health insurance differ across workers. This modeling feature will allow us to test whether unregulated markets with voluntary provision of health insurance lead to efficient sorting between workers into jobs with and without insurance. For

simplicity, we also assume that there are no external benefits from health insurance, that it, all benefits from health insurance are private.

Employer-based health insurance may be offered either on a voluntary basis, or is mandated for certain types of workers. In order to consider the effects of health insurance regulations on the structure of employment, we assume that workers and firms may choose between part-time and full-time employment. We assume there are no productivity differences if a worker chooses one-full time job or several part-time jobs; hence the differences in the structure of employment will be entirely attributed to the nature of regulation.

Formally, there are N workers, $i = 1, .., N$, and M firms, $j = 1, .., M$. Each worker i is characterized by a constant marginal disutility of labor e_i, and a fixed lump-sum private benefit b_i from health insurance coverage. If worker i supplies x_{ij} units of labor to firm j, is paid a per unit wage $w_{ij} \geq 0$, and firm j provides the share y_{ij} of his health insurance benefits, then this worker's utility from employment at this firm is given by $((w_{ij} - e_i)x_{ij} + b_i y_{ij})$. Assuming the worker may work for more than one firm, his total utility from employment is:

$$U_i = \sum_j ((w_{ij} - e_i)x_{ij} + b_i y_{ij}). \tag{1}$$

Suppose that each worker can supply up to $\bar{x}^w$ units of labor (the same for all workers). Then feasibility requires that $x_{ij} \geq 0, \sum_j x_{ij} \leq \bar{x}^w, y_{ij} \geq 0, \sum_j y_{ij} \leq 1$. Further, assume that health insurance is traded as a discrete good: $y_{ij} \in \{0, 1\}$ for all i, j. Finally, we constrain our attention to employer-provided health insurance, which implies that if $x_{ij} = 0$, then $y_{ij} = 0$.

Each firm j receives a constant marginal revenue v_j from each unit of labor hired, and it can hire a maximum of $\bar{x}^f$ units of labor (for technological reasons, or due to capacity constraints); this capacity constraint is the same for all firms. The cost of providing insurance for the firm is c_j per worker; for simplicity, we assume that this cost does not depend on the total number of workers insured and it does not vary across firms, $c_j = c$. Firm j total profit from employment is then given by

$$\pi_j = \sum_i ((v_j - w_{ij})x_{ij} - cy_{ij}), \tag{2}$$

with $\sum_i x_{ij} \leq \bar{x}^f$.

A labor market outcome is efficient if the allocation of workers across firms and the health insurance coverage matrices $\{x_{ij}\}, \{y_{ij}\}$ maximize the total surplus in the labor market, which is

$$S = \sum_{ij}((v_j - e_i)x_{ij} + \sum_{ij}(b_i - c)y_{ij}. \tag{3}$$

Efficiency prescribes that workers who fully value insurance (i.e., value it above the cost of its provision by firms) buy insurance, while others who under-value insurance do not buy it. For each worker i, define insurance-benefit-adjusted worker cost of labor as

$$\widetilde{e}_i = min\{e_i, e_i - \frac{b_i - c}{\bar{x}^w}\}. \tag{4}$$

Then an allocation of workers across firms is efficient only if it maximizes:

$$\widetilde{S} = \sum_{ij}(v_j - \widetilde{e}_i)x_{ij}. \tag{5}$$

If health insurance is mandated for all employed workers, then a firm's mandate-adjusted per unit revenue from employment is $(v_j - c/\bar{x}^w)$, and a worker's disutility of labor net of insurance benefit is $(e_i - b_i/\bar{x}^w)$. Let $\widetilde{\widetilde{e}}_i$ denote worker disutility of labor adjusted for mandated health insurance:

$$\widetilde{\widetilde{e}}_i = e_i - \frac{b_i - c}{\bar{x}^w} \geq \widetilde{e}_i. \tag{6}$$

The mandate-constrained efficient allocation of workers across firms maximizes

$$\widetilde{\widetilde{S}} = \sum_{ij}(v_j - \frac{c}{\bar{x}^w}) - (e_i - \frac{b_i}{\bar{x}^w}))x_{ij} = \sum_{ij}(v_j - \widetilde{\widetilde{e}}_i)x_{ij}. \tag{7}$$

It is then obvious that the full health insurance mandate may reduce labor market efficiency.

To test whether wage rigidities may cause distortions on the labor market, and whether they may have a different effect on the markets for high-skilled and low-skilled labor, we will consider two cases of minimum wage constraints. The first case is a wage floor below the equilibrium wage, or a *non-binding price floor*. Such non-binding minimum wage regulation is likely to apply to the market for high-skilled, high wage labor. Second, we will consider the wage floor above the equilibrium wage, or a *binding price floor*. This is more likely to be the case for low-skilled, low wage workers, as discussed in Section 1 above.

Consider the following numerical example. Suppose there are $M = 5$ firms and $N = 5$ workers in this model. Let $\bar{x}^w = \bar{x}^f = 2$. Table 1 presents the parameter values. (The same parameters will be used in the experimental design).

TABLE 1 AROUND HERE

Without regulation, as can be inferred from the table and expression 5 above, efficiency dictates that workers 1-4 should sell their labor to firms 6-9, and workers 1 and 2 should get insurance, while workers 3 and 4 should stay uninsured. The labor market surplus achieved at the fully efficient allocation is $\tilde{S} = 224$. If, however, insurance is mandated for all workers, then insurance-adjusted disutility of labor rises for workers 3 and 4. Although the composition of the employed workers remains unchanged, from expression 7, the mandate-constrained labor market surplus decreases to $\tilde{\tilde{S}} = 200$. On the other hand, if insurance is mandated to full-time workers, but not part-time workers (partial mandate), then efficiency can be restored if workers 3 and 4, who under-value insurance, take two part-time jobs instead of one full-time job, and thus avoid the wage reduction due to the mandated benefit.

Now consider the effects of minimum wages. Figure 2 illustrates the mandate-constrained market outcome with a non-binding minimum wage of 40, and Figure 3 illustrates the case of mandated health insurance with a binding minimum wage of 52.[7]

FIGURES 2 AND 3 AROUND HERE

The non-binding minimum wage of 40 does not affect the market outcome, and the mandate-constrained labor market surplus stays at $\widetilde{\widetilde{S}}_{40} = 200$, as under the full mandate with no wage regulation (Figure 2). However, the binding minimum wage of 52 creates excess supply of labor causing unemployment (Figure 3), and the surplus decreases further to $\widetilde{\widetilde{S}}_{52} = 180$. This illustrates that the full insurance mandate combined with the binding minimum wage law may distort efficiency even further as compared to the case when the wages are fully adjustable.

[7]In Figures 2-3, for the markets with insurance, demand for labor is constructed using firm insurance-adjusted marginal revenues ($v_j - c/\bar{x}^w$), and the supply of labor is constructed using worker insurance-adjusted disutilities of labor ($e_i - b_i/\bar{x}^w$).

Finally, as under fully adjustable wages, mandating health insurance to full-time workers only and not for part-time workers under the minimum wage law will cause higher share of part-time workers, but will not lower the efficiency any further.

3 Experimental design

The experiment is designed to study the interaction of two types of regulation on the competitive labor market outcomes: various types of mandates on health insurance provisions (no mandate, full mandate, and partial mandate), and minimum wage regulations (binding or non-binding). Accordingly, experimental treatments differ in the regulatory regime regarding provision of health insurance, and in whether the minimal wages are biding or not. We consider the following three regulatory regimes regarding the health insurance provision:

No mandate (N) Unregulated competitive labor markets. Labor is traded, and insurance is offered and accepted, on voluntary basis.

Full mandate (F) Firms are mandated to offer, and workers are mandated to accept health insurance. If a worker sells his labor to several firms (takes up several part-time jobs), then he should buy full health insurance from one of the firms. Insurance coverage cannot be split among several employers.

Partial mandate (P) Firms are mandated to offer health insurance to all workers whom they hire full-time. For part-time workers, insurance is offered on voluntary basis. Insurance coverage cannot be split among several employers.

Regarding the minimum wages, we consider two variations:

Price floor ABOVE the market equilibrium wage (A) , or a binding price floor. For our parameter values, we set $w \geq 52$ for any unit of labor traded.

Price floor BELOW the market equilibrium wage (B) , or a non-binding price floor. For our parameter values, we set $w \geq 40$ for any unit of labor traded.

Five treatments were implemented: NA, PA, FA, NB and FB. We used the simple model framework as discussed in Section 2 above, with five sellers (workers) and five buyers (firms) in the market, and the costs and benefits from employment and insurance as given in Table 1. Trading occurred in non-computerized double auction markets for a fictitious good (labor). Each buyer or seller could buy or sell up to two units of the good in each trading period. One unit of the good represented part-time employment and two units sold to the same buyer represented full-time employment. There was choice to trade units of the good separately (representing part-time employment) or in packages of two units (full-time employment). Depending on the treatment, each seller may (had to) request and each buyer could (had to) offer a fictitious service (insurance) in exchange for the good(s). The seller benefited from this service while buyers had to pay a cost if they provide service. Each treatment had up to four different concurrent double auction markets where the goods were traded in a different way:

Market A: separate units, no service (part-time employment with no insurance);

Market B: separate units, with service (part-time employment with insurance);

Market C: packages of 2 units, no service (full-time employment with no insurance);

Market D: packages of 2 units, with service (full-time employment with insurance).

The No Mandate treatments (NA, NB) had all markets in operation. Due to regulatory restrictions, under the Partial Mandate treatment (PA) there was no market C, and a sellers in market A was prohibited to sell two units to the same buyer. In the Full Mandate treatments (FA, FB) market C was also absent, and a seller had to trade the first unit in market B to be able to trade the second unit in market A. In all treatments a seller could benefit from the service only once in a period. Hence, a seller could sell at most one unit in market B.

Predictions for the equilibrium trades and wage ranges by treatment are given in Table 2. Derivations of wage ranges are outlined in Supplementary Appendices A and B.

TABLE 2 AROUND HERE

In equilibrium, all workers employed with insurance are paid a lower per unit wage than the workers employed without insurance. These equilibrium wages support efficient (for the No Mandate or the Partial Mandate with non-binding minimal wage), or mandate-constrained-efficient (for the Full Mandate with non-binding minimal wage) allocations. Under the non-binding minimum wage ($w_{min} = 40$), workers $1-4$ trade with firms $6-9$ (at different wages, depending on the mandate), as efficiency prescribes, but under the Full Mandate, all workers get insurance, although it is inefficient for workers 3 and 4 to do so. The market outcome further departs from efficiency if the minimum wage is binding ($w_{min} = 52$). Under the No Mandate and Partial Mandate institutions, workers $1-4$ still trade with firms $6-9$, but no insurance is provided (whereas it would be efficient for workers 1 and 2 to get insurance). The Full Mandate institution results in any three of five workers trade with firms $6-8$. Firms $9-10$ are not willing to hire any workers, and any two of five workers are not employed. There is an excess supply of labor and an insufficient demand for labor, which leads to unemployment.

Experimental procedures There were ten subjects in each session; half of them were buyers (firms) and half were sellers (workers). The experiment was non-computerized. All subjects were seated and assigned identification numbers. No communication was allowed. Instructions were read aloud by the experimenter. Each buyer or seller had own values as given in Table 1. The values were kept unchanged until period 5, after which they were rotated to equalize expected earnings. The problem was presented as an abstract market decision-making situation, where participants had an opportunity to earn money by buying or selling a fictitious good, with or without service. Trading occurred in a sequence of nine to ten trading periods. Each buyer or seller was allowed to buy or sell in any of the parallel markets, as explained above. Within each trading period, all bids and asks were placed on the screen using overhead projector. Each period lasted up to 5 minutes and closed if there was no activity for 20 seconds. In addition to the record sheet that the participants were required to complete, each participant had an optional transaction sheet to record the transactions and history of bids and asks. Each session lasted for about 2 hours. Subjects were paid in private in cash at the exchange rate of 0.10 US dollars per experimental pesos,

plus 5 dollars show-up fee. Individual earnings ranged from US $12 to $35.

4 Results

A total of 160 subjects participated in 16 experimental sessions, all recruited from the student population at a U.S. university. We conducted four session for each of the three different treatments with the binding minimum wage of 52 (No Mandate NA, Partial Mandate PA, and Full Mandate FA), and two sessions for each of the treatments with the non-binding minimum wage of 40 (No Mandate NB, and Full Mandate FB).[8]

First we summarize experimental results as compared to the equilibrium predictions, and then we compare the performances of labor markets across different treatments. Table 3 summarizes the results on labor market efficiency, employment level and structure, and coverage rate among workers, by treatment, and compares them with the theoretical predictions. Efficiency is defined in the usual way, as percentage of the actual labor market surplus to the maximal attainable in the absence of regulation. Table 4 lists market prices and the number of trades, by market. Table 5 contains more detailed data on employment and insurance coverage and wages.

TABLES 3- 4 AROUND HERE

To support our results statements below, we consider two levels of data aggregation in the analysis: (1) Observations per transaction (e.g., for comparing prices across markets) or per period data (e.g., for comparing efficiencies across treatments). Hypotheses are then tested using parametric tests, by regressing variables of interest on market or treatments dummies, and controlling for time trend when necessary; the standard errors are clustered at session level. (2) Session averages, as reported in Tables 3- 4. Hypotheses are then tested using non-parametric Wilcoxon-Mann-Whitney (WMW hereafter) rank-sum test.

[8]More sessions were conducted under the binding minimum wage treatments, as we expected the non-binding minimum wage case to be similar to the case with no wage rigidities, and the latter was already explored in Sherstyuk et al. 2007.

Result 1 (Overall market performance) *Overall, the markets reached levels of efficiency close to the equilibrium predictions. Most of the trades took place in the markets where positive volumes of trades were predicted, and at the prices close to equilibrium.*

Support: Tables 3– 4. Overall, the labor market efficiency was, on average, 8.48 percentage points below the equilibrium prediction; it was 5.39 percentage points below the equilibrium in the non-binding minimum wage sessions (NB and FB treatments), and 9.51 percentage points below the equilibrium prediction for the binding minimum wage sessions (NA, PA and FA treatments). The differences in efficiency deviations from the equilibrium prediction between treatments are not statistically significant (except for the Full Mandate binding minimum wage FA treatment, where a significantly larger deviation was observed, $p < 0.0001$). From Table 4, the overwhelming majority of trades were in the markets where trading was predicted in equilibrium; the average trading prices in each of these markets were within the equilibrium ranges in all treatments. Further, the prices fell within the exact equilibrium wage ranges in 65% of all cases overall (see Table 6 in the Supplementary Materials). Percentage of trades within equilibrium wage range out of trades in the "right" (those predicted in equilibrium) markets was 71.7%. [9] □

We next consider the effect of health insurance and minimum wage regulations on coverage rates, employment structure and labor market efficiency, by treatments. All experimental results are benchmarked against the qualitative theoretical predictions as discussed in Section 1.

Result 2 (Provision of insurance to part-time and full-time workers) *In line with the theoretical predictions, when providing insurance, firms preferred to hire full-time rather than part-time workers: the trades in the markets with part-time employment and insurance were rare.*

Support: Table 4. In all treatments, only $1.6 - 5.9\%$ of all trades took place in market B (part-time workers will insurance); these occasional trades were likely due to behavioral

[9] In addition, the cases when the trading prices were outside the equilibrium range, but fell within 5 pesos of equilibrium ranges, averaged over 21% out of all trades and 23% out of trades in the "right" markets.

imperfections. In comparison, when predicted by the theory, there was a significant number of trades in market D (full-time labor with insurance): on average, 2.85 workers (compared to 3 predicted) per period were hired in market D under FA, 1.8 workers (compared to 2 predicted) under NB, and 3.8 workers (compared to 4 predicted) under FB. □

Prediction 1 of Section 1 is therefore confirmed by our data.

Result 3 (No mandate and non-binding minimum wage) *Under No Mandate with non-binding minimum wage (NB), health insurance was provided on voluntary basis, and the coverage was close to the efficient level. Most of the workers who bought insurance fully valued it. Prices fully adjusted downwards in the full-time market with insurance as compared to the markets without insurance. Overall, the markets reached close to full efficiency.*

Support: Tables 3-4, 5. Under NB treatment, the average coverage rate among employed was 45.80%, just under the equilibrium prediction of 50% (Table 3). From Table 5, among 4.15 workers employed on average per period, 0.6 workers should have bought insurance but did not buy it, and 0.35 workers bought insurance although they valued it below cost. The average employment rate was 103.75% of efficient level, indicating an occasional over-employment. The average per transaction price in market D (full-time labor with insurance) was 90.64 pesos, which is significantly below the average price of 117.36 pesos in market C (full-time labor with no insurance); the full price adjustment hypotheses of $p_D = p_C - 32$ and $p_D = 2p_A - 32$ are both sustained[10] ($p = 0.2055$ and $p = 0.4425$, respectively). The average labor market efficiency was 94.83%, the highest among all treatments. □

TABLE 5 AROUND HERE

Result 4 (Full mandate and non-binding minimum wage) *As predicted, with non-binding minimum wage, the Full Mandate (FB) resulted in efficient employment level, full insurance coverage, but lower market efficiency than under No Mandate (NB). Efficiency losses were due to over-insurance.*

[10]The linear hypotheses were tested by regressing individual transaction prices on market dummies, with standard errors clustered at session level.

Support: Tables 3, 5. Under FB, employment was 100.63% of the efficient level, and not significantly different from it ($p = 0.6588$). While the coverage rate among employed increased substantially (100% under FB as compared to 45.80% under NB), efficiency decreased from 94.83% under NB to 83.68% under FB. The difference in efficiencies between FB and NB is highly significant ($p < 0.0001$). From Table 5, under FB, 1.75 among employed workers were over-insured on average per period. □

Results 3 and 4 confirm Prediction 2 of Section 1. These findings on the treatments with non-binding minimum wage are also consistent with those reported in Sherstyuk et al. (2007) on markets with no wage rigidities.

Result 5 (No mandate and a binding minimum wage) *As predicted, under a binding minimum wage constraint, markets with No Mandate (NA) resulted in full employment but inefficienly low insurance coverage.*

Support: Table 3. Under NA, employment was, on average, 98.68% of the efficient level, indicating no effect of minimum wages on employment for our setting ($p = 0.4085$ for the test of equality between the actual and the efficient employment). However, the average coverage rate was inefficiently low and close to zero: only 6.87% of employed workers were insured, as compared to 50% under the efficient outcome (and 0% under the equilibrium prediction). The labor market efficiency decreased to 87.73%, a levels significantly below that of 94.83% under NB ($p < 0.0001$), and also below the equilibrium prediction of 92.86%. □

Result 6 (Partial mandate and a binding minimum wage) *As predicted, mandating health insurance for full-time workers but not part-time workers under the binding minimum wage resulted in a higher share of part-time workers than with either no mandate or full mandate. In contrast to the theoretical prediction, the partial mandate also led to a higher coverage rate than no mandate, while achieving comparable efficiency. However, the insurance rate was still far below the efficient level.*

Support: Tables 3, 5. The share of part-time workers in the Partial Mandate (PA) treatment was 71.83%, as compared to 19.55% under the No Mandate (NA), and 5.77% under the Full

Mandate (FA) with binding minimum wage. The difference between PA and either NA or FA is highly significant ($p = 0.0143$, WMW rank-sum test). Regarding insurance coverage, the average insurance rate among employed workers under PA was 28.17%, as compared to 6.87% under NA (with the same theoretical prediction of 0% for both treatments; $p = 0.0143$ for the difference between PA and NA). However, the insurance rate under PA was still far below the efficient level of 50%; from Table 5, last column, per period, an average of 1.28 workers who fully valued insurance did not get it since firms could not afford to offer insurance. Regarding efficiency, the average per treatment efficiency was 81.41% for PA compared to 87.73% for NA (with the theoretical prediction of 92.86% for both treatments); the difference between PA and NA is not significant ($p = 0.4429$). □

Results 5 and 6 mostly confirm Prediction 3 of Section 1: a binding minimum wage reduces voluntary provision of health insurance by firms, and in the presence of partial mandate, leads firms to hire part-time workers instead of full-time workers because the former are exempt from the mandate. Efficiency is reduced due to under-insurance. However, curiously, we observe that a significant amount of insurance is still offered under the partial mandate, suggesting that a mandate may increase saliency of insurance provision and sometimes make the firms offer insurance even at the cost of lowering own profits.

Result 7 (Full mandate and a binding minimum wage) *As predicted, Full Mandate under the binding minimum wage resulted in full insurance coverage for those employed, but also led to unemployment. Efficiency losses under Full Mandate as compared to No Mandate and Partial Mandate were significant.*

Support: Table 3, 5. The average number of workers employed under FA was 3.01 (75.31% of the efficient level of 4 workers), as compared to 3.95 under NA (98.68% of the efficient level), and 3.66 under PA (91.41% of the efficient level); the differences between FA and NA, and FA and PA are highly significant ($p < 0.0001$, for the difference between FA and NA, and $p = 0.0183$, for the difference between FA and PA, Wald test[11]). From Table 5, an

[11]WMW ranksum tests give qualitatively similar results for all cases except for comparison between FA and PA employment, where it yields a non-significant difference due to a low average employment in Session 1 under PA.

average of 1.08 employed workers were over-insured, i.e., did not value insurance above its cost. The average efficiency under FA was 68.42%, as compared to 87.73% under NA and 81.41% under PA. Efficiency differences between FA and NA, and between FA and PA, are both highly significant ($p < 0.0001$ for the difference between FA and NA, and $p = 0.0209$ for the difference between FA and PA). □

From the above Result 7, Prediction 4 of Section 1 is also supported by the data. We also note that for FA treatment, efficiency losses are higher than predicted, and the efficiency deviations from equilibrium prediction are also higher than in other treatment (see Support for Result 1). This observation suggests that several binding regulations, when combined, may lead to efficiency distortions larger that those predicted by equilibrium, most likely due to behavioral factors.

5 Discussion

We presented the results of a laboratory experiment that was designed to test the effects wage rigidities combined with health insurance regulations.

Overall, all theoretical predictions as discussed in Section 1 are confirmed in our experimental data. We found, first, that health insurance regulations may have a significant effect on the structure of employment. As providing insurance constitutes a fixed cost for the firms, firms prefer to offer insurance to full-time workers rather than part-time workers: trading in the market for part-time labor with insurance was rare. However, firms switched from full-time to part-time employment when it allowed them to avoid the mandated provision of health insurance, as under the partial mandate, thus significantly increasing the share of part-time workers in the labor market. This result confirms and reinforces the empirical findings by Thurston (1997) and Buchmueller et al. (2011) on the effect of Hawaii health insurance mandate on the labor market, as well as the experimental findings by Sherstyuk et al. (2007) on the partial insurance mandate under no wage rigidities.

Second, we confirm that non-binding minimum-wage regulations do not distort efficiency level beyond the levels introduced by health insurance mandates; in the no mandate, non-binding minimum wage treatment, insurance was still offered on a voluntary basis and bought

by the workers who valued it above cost, with wages adjusting downwards by the cost of insurance.

Third, experimental labor markets were characterized by significant efficiency losses under wage rigidities when the minimum wage was binding. Under no mandate on insurance provision, trading in the markets with insurance was fully eliminated under the binding minimum wage, since the cost of health insurance could not be passed over from firms to workers. Thus, binding minimum wages may reduce labor market efficiency and may fully eliminate voluntary provision of health insurance by firms.

Finally, we confirmed that imposing a full mandate on provision of health insurance leads to over-insurance and, if the minimum wage is binding, may lead to reduced demand for labor and thus unemployment. The markets under full mandate and binding minimum wages were characterized by the lowest employment rate and the lowest labor market efficiency among all treatments considered.

There were three distinct sources of efficiency losses in our experiment: (1) behavioral imperfections, such as trading by extra-marginal workers and firms, over-insurance and under-insurance; (2) efficiency distortions due to health insurance regulations (employer mandates); and (3) efficiency distortions due to wage controls. Our results strongly suggest, however, that regulatory distortions outweighed the behavioral imperfections, thus providing a strong and convincing demonstration of the likely effect of the wage and health insurance regulations on the labor market outcomes.

One finding that departs from the theoretical prediction concerns the effect of the partial mandate. We found that the partial mandate with a binding minimum wage resulted in a significantly higher insurance coverage as compared to no mandate, with no significant losses in efficiency. From Table 5, we see that under the partial mandate fewer workers were under-insured as compared to no mandate (on average, 1.28 workers per period under partial mandate, as compared to 1.87 workers under no mandate). This is likely due to behavioral factors, where the presence of a mandate makes people more likely to offer, and to consider buying, the insurance. It is possible, however, that such tendency would eventually lower market efficiency, as offering health insurance in this setting is too costly for the firms.

An important limitation of our analysis is that we assume that all benefits from health

insurance are private, with no public benefits. This is a strong assumption, and one may find efficiency gains from wider insurance coverage if the public benefits of the coverage are taken into account. Further, we do not consider the problem of adverse selection that exists in markets with voluntary health insurance provision. This problem is often argued to be a fundamental reason for government intervention in insurance markets (Einav and Finkelstein 2011). Therefore, one should not seek direct policy implications from our conclusions. Likewise, our findings should not be interpreted as evidence against wider health insurance coverage, as proposed under the current health care reform, which puts an emphasis on "individual," rather than employer-provided, health insurance mandate. Exploring the effects of individual insurance mandate on the labor market is a promising avenue for future experimental research.

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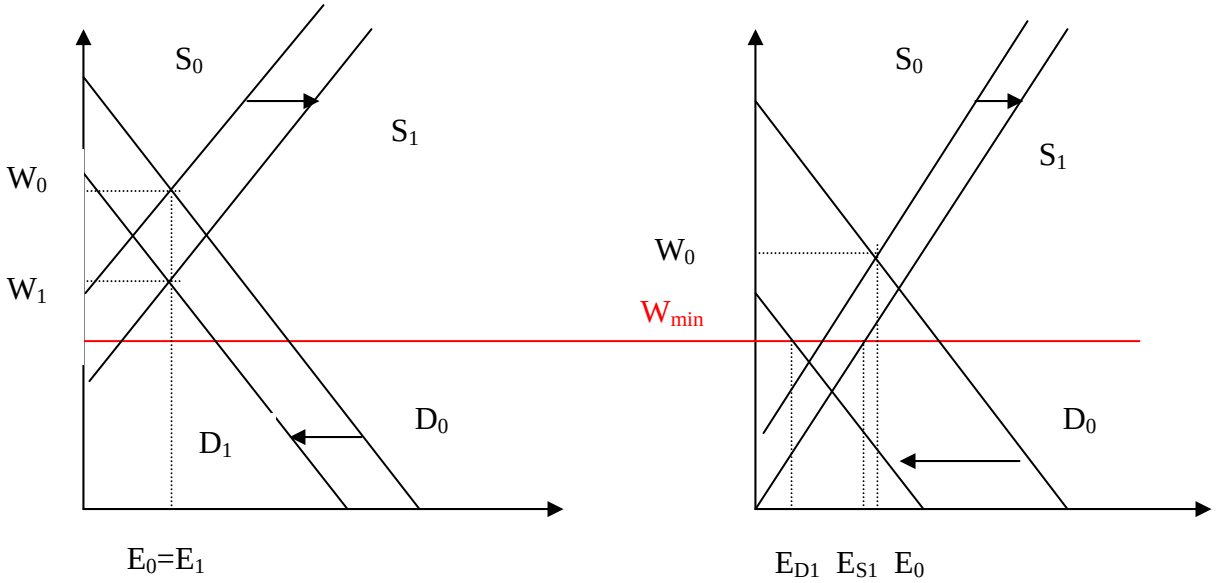
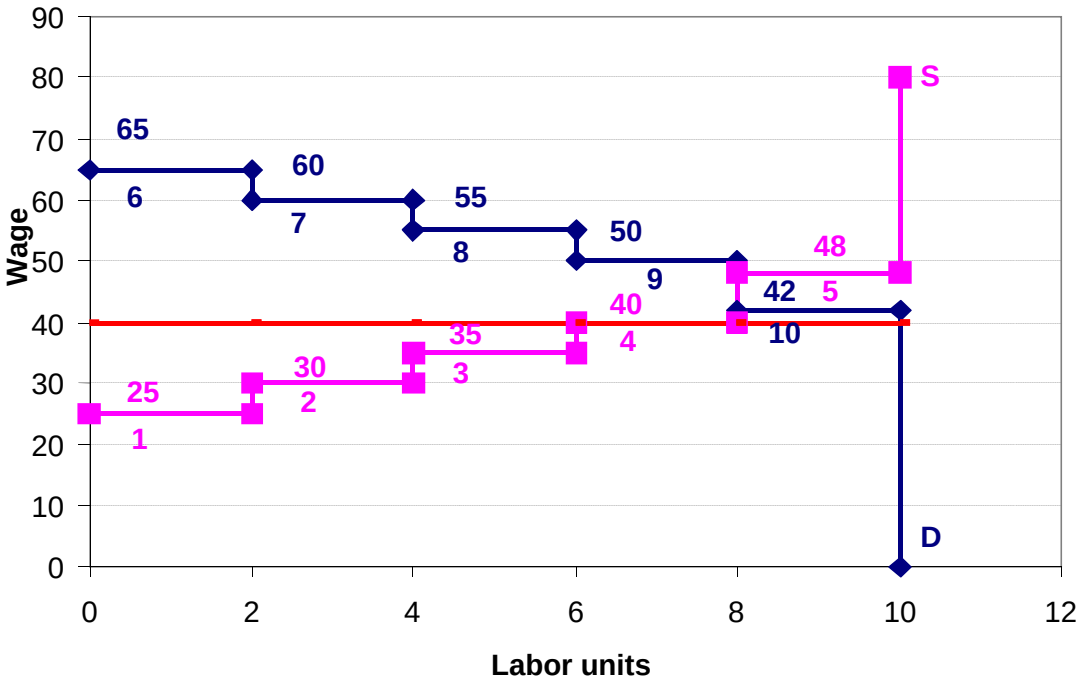


High-skilled, full time workers

Low-skilled, full time workers

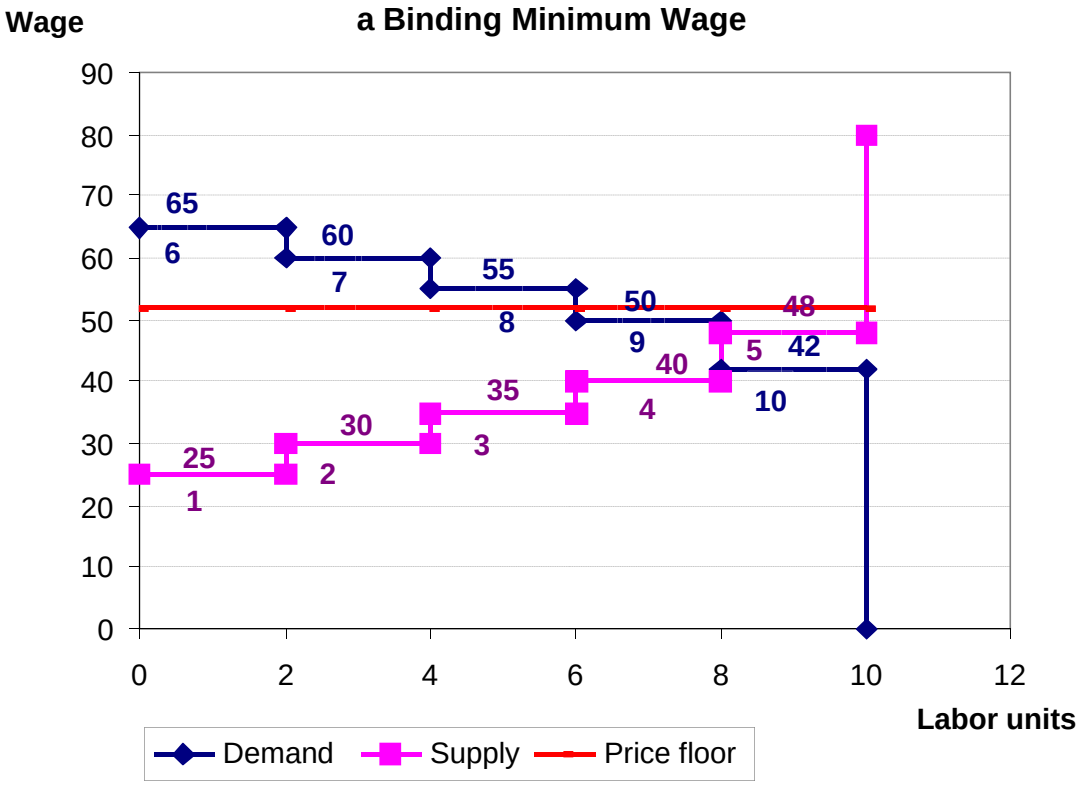
Figure 1: Effects of health insurance mandate and minimum wage regulations on competitive labor market

Figure 2. Mandate-constrained Market Outcome with a Non-Binding Minimum Wage



In the graph above firms revenues and worker labor costs are insurance-adjusted. Numbers 1 though 5 indicate workers and numbers 6 through 10 indicate firms. Workers 1 through 4 sell their labor to firms 6 through 9, all with insurance. Worker 5 and Firm 10 do not trade.

Figure 3. Mandate-Constrained Market Outcome with a Binding Minimum Wage



In the graph above firms revenues and worker labor costs are insurance-adjusted. Numbers 1 though 5 indicate workers and numbers 6 through 10 indicate firms. Workers 1 through 5 sell their labor to firms 6 through 8 all with insurance. Firms 9 and 10 do not trade in the market. Any two of the five workers are not unemployed (excess supply of labor is 4 units).

Table 1: Workers' and firms' costs and benefits

Workers (sellers)					Firms (buyers)		
ID	Labor cost e_i per unit	Insurance benefit b_i per worker	Insurance-adjusted labor cost: No mandate $\tilde{e}_i$ per unit	Insurance-adjusted labor cost: Mandate $\tilde{\tilde{e}}_i$ per unit	ID	Revenue v_i per unit	Insurance cost c per worker
1*°	45	40	41	41	6*	81	32
2*°	50	40	46	46	7*	76	32
3*	45	20	45	51	8*	71	32
4*	50	20	50	56	9*	66	32
5°	68	40	64	64	10	58	32

*-it is efficient for this trader to trade if the minimum wage is non-binding, ◊-it is beneficial for this trader to buy insurance if trades

Table 2: Equilibrium market trades and wage predictions by treatment

Treatment	Employed workers	Markets in which workers trade	Equilibrium Prices (Wages)		
			Market	Price Range	Price relations
No Mandate, Min Wage 52 (NA)	1, 2	2 separate units in A or 2-unit package in C	Market A	58-66	
	3, 4		Market C	116-132	Pc = 2Pa
Partial Mandate, Min Wage 52 (PA)	1, 2	2 separate units with two different firms in A	Market A	58-66	
	3, 4				
Full Mandate, Min Wage 52 (FA)	Three of any 1,2,3,4,5	2-unit package in D	Market D	104	
No Mandate, Min Wage 40 (NB)	1, 2	2-unit package in D	Market D	84-96	Pd = 2Pa - 32
	3, 4	2-unit package in C or two separate units in A	Market A	58-64	Pc = 2Pa
			Market C	116-128	
Full Mandate, Min Wage 40 (FB)	Three of any 1,2,3,4,5	2-unit package in D	Market D	84-96	

Table 3: Experimental Results Summary by Treatment

Policy Alternative	Session	Labor market efficiency, %		Employment, % efficient		Share of part-time workers out of all workers, %		Coverage rate among employed, %	
		Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual
No Mandate,	1	92.86	88.79	100.00	97.25	0-100	5.56	0.00	5.56
Min Wage 52	2	92.86	86.83	100.00	102.50	0-100	43.57	0.00	9.36
(NA)	3	92.86	87.05	100.00	95.00	0-100	19.05	0.00	10.33
	4	92.86	88.26	100.00	100.40	0-100	10.04	0.00	2.22
mean	**All**	**92.86**	**87.73**	**100.00**	**96.68**	**0-100**	**19.55**	**0.00**	**6.87**
(stdv)			**(0.84)**		**(3.27)**		**(16.97)**		**(3.72)**
Partial Mandate,	1	92.86	67.46	100.00	73.75	100.00	69.76	0.00	30.23
Min Wage 52	2	92.86	78.62	100.00	90.63	100.00	69.30	0.00	30.70
(PA)	3	92.86	88.34	100.00	102.50	100.00	76.11	0.00	23.89
	4	92.86	91.21	100.00	98.75	100.00	72.14	0.00	27.86
mean	**All**	**92.86**	**81.41**	**100.00**	**91.41**	**100.00**	**71.83**	**0.00**	**28.17**
(stdv)			**(10.75)**		**(12.77)**		**(3.12)**		**(3.11)**
Full Mandate,	1	80.36	66.16	75.00	76.25	0.00	9.76	100.00	100.00
Min Wage 52	2	80.36	69.20	75.00	75.00	0.00	0.00	100.00	100.00
(FA)	3	80.36	68.13	75.00	75.00	0.00	6.67	100.00	100.00
	4	80.36	70.18	75.00	75.00	0.00	6.67	100.00	100.00
mean	**All**	**80.36**	**68.42**	**75.00**	**75.31**	**0.00**	**5.77**	**100.00**	**100.00**
(stdv)			**(1.72)**		**(0.63)**		**(4.12)**		**(0.00)**
No Mandate,	1	100	95.36	100	105.00	0-50	16.39	50.00	52.11
Min Wage 40	2	100	94.29	100	102.50	0-50	17.00	50.00	39.50
(NB)									
mean	**All**	**100**	**94.83**	**100**	**103.75**	**0-50**	**16.70**	**50.00**	**45.80**
(stdv)			**(0.76)**		**(1.77)**		**(0.43)**		**(8.91)**
Full Mandate,	1	89.29	85.54	100	102.5	0	4.50	100.00	100.00
Min Wage 40	2	89.29	81.83	100	98.75	0	6.43	100.00	100.00
(FB)									
mean	**All**	**89.29**	**83.68**	**100**	**100.63**	**0**	**5.47**	100.00	**100**
(stdv)			**(2.62)**		**(2.65)**		**(1.36)**		**(0.00)**

Table 4. Market Prices (Wages) by Treatment

Treatment	Session	Market A		Market B		Market C		Market D	
		Price mean (st.dv.)	No of obs.	Price mean (st.dv.)	No of obs.	Price mean (st.dv.)	No of obs.	Price mean (st.dv.)	Number of obs.
No Mandate, Min Wage 52 (NA)	**Theory**	**58-66**		--		**116-132**		--	
	1	60.75 (1.71)	4	--	0	122.97 (3.19)	31	110.0 (0)	2
	2	59.15 (3.0)	34	53.5 (2.12)	2	119.19 (5.57)	21	104.5 (.71)	2
	3	63.29 (2.61)	14	--	0	130.04 (4.91)	27	104.25 (.5)	4
	4	59.29 (1.6)	7	52 (.)	1	118.78 (2.07)	36	--	0
mean (stdv)	**All**	**60.25 (3.18)**	**59**	**53.0 (1.73)**	**3**	**122.62 (5.90)**	**115**	**105.75 (2.66)**	**8**
Partial Mandate, Min Wage 52 (PA)	**Theory**	**58-66**		--		--		--	
	1	67.97 (3.24)	37	--	0	--	0	108.55 (3.01)	11
	2	60.8 (3.28)	40	--	0	--	0	105.22 (1.99)	9
	3	61.03 (1.86)	62	--	0	--	0	108.3 (5.4)	10
	4	62.47 (2.68)	57	--	0	--	0	104.09 (.30)	11
mean (stdv)	**All**	**62.71 (3.76)**	**196**	--	**0**	--	**0**	**106.54 (3.68)**	**41**
Full Mandate, Min Wage 52 (FA)	**Theory**	--		--		--		**104**	
	1	61.5 (4.95)	2	52 (0)	3	--	0	104.0 (0)	28
	2	--	0	--	0	--	0	105.9 (2.88)	30
	3	52.5 (.71)	2	52.5 (0.71)	2	--	0	104.36 (1.16)	28
	4	52.5 (.71)	2	52 (0)	2	--	0	104.46 (1.10)	28
mean (stdv)	**All**	**55.50 (5.17)**	**6**	**52.14 (.38)**	**7**	--	**0**	**104.70 (1.81)**	**114**
No Mandate, Min Wage 40 (NB)	**Theory**	**58-64**		--		**116-128**		**84-96**	
	1	59.33 (2.99)	12	62.5 (31.82)	2	118.4 (6.43)	15	93.05 (3.20)	20
	2	59.64 (6.96)	14	--	0	116.5 (4.51)	18	87.63 (5.8)	16
mean (stdv)	**All**	**59.50 (5.39)**	**26**	**62.5 (31.81)**	**2**	**117.36 (5.46)**	**33**	**90.64 (5.24)**	**36**
Full Mandate, Min Wage 40 (FB)	**Theory**	--		--		--		**84-96**	
	1	59.5 (13.44)	2	45.0 (7.07)	2	0	0	86.69 (3.22)	39
	2	49.5 (6.36)	2	40.0 (0)	3	0	0	90.89 (5.8)	37
mean (stdv)	**All**	**54.5 (10.34)**	**4**	**42.0 (4.47)**	**5**	**--**	**0**	**88.74 (5.09)**	**76**

Market A: Separate units, no insurance. Market B: Separate units, with insurance. Market C: Two-unit package, no insurance. Market D: Two-unit package, with insurance.

Table 5 Employment and Insurance

Treatment	Session	# workers employed*		Share of part-time workers out of all workers, %		Insurance rate among employed, %		# workers who over-insured (compared to equilibrium)		# workers who over-insured (compared to efficiency)		# workers who under-insured (compared to efficiency)	
		Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual
NA	**1**	4	3.89	0-100	5.56	0	5.56	0	0.22	0	0.11	2	1.89
	2	4	4.10	0-100	43.57	0	8.5	0	0.4	0	0	2	1.9
	3	4	3.80	0-100	19.05	0	10.33	0	0.4	0	0	2	1.7
	4	4	4.00	0-100	10.04	0	2	0	0.1	0	0	2	2
	All	**4**	**3.95**	**0-100**	**19.55**	**0**	**6.6**	**0**	**0.28**	**0**	**0.03**	**2**	**1.87**
PA	**1**	4	2.95	100	69.76	0	27	0	1.1	0	0.2	2	0.9
	2	4	3.63	100	69.3	0	26.88	0	1.13	0	0.38	2	1.63
	3	4	4.10	100	76.11	0	21.5	0	1	0	0.1	2	1.5
	4	4	3.95	100	72.14	0	27.5	0	1.1	0	0.2	2	1.1
	All	**4**	**3.66**	**100**	**71.83**	**0**	**25.72**	**0**	**1.08**	**0**	**0.22**	**2**	**1.28**
FA	**1**	3	3.05	0	9.76	100	100	~	~	0-2	0.8	~	~
	2	3	3	0	0	100	100	~	~	0-2	1.1	~	~
	3	3	3	0	6.67	100	100	~	~	0-2	1.3	~	~
	4	3	3	0	6.67	100	100	~	~	0-2	1.1	~	~
	All	**3**	**3.01**	**0**	**5.77**	**100**	**100**	**~**	**~**	0-2	**1.08**	**~**	**~**
NB	**1**	4	4.2	0-100	16.39	50	51	~	~	0	0.4	2	0.5
	2	4	4.1	0-100	17	50	39.5	~	~	0	0.3	2	0.7
	All	**4**	**4.15**	**0-100**	**16.7**	**50**	**45.25**	**~**	**~**	**0**	**0.35**	**2**	**0.6**
FB	**1**	4	4.1	0	4.5	100	100	~	~	2	1.9	~	~
	2	4	3.95	0	6.43	100	100	~	~	2	1.6	~	~
	All	**4**	**4.03**	**0**	**5.47**	**100**	**100**	**~**	**~**	**2**	**1.75**	**~**	**~**

*Number of workers employed is counted based on full-time emloyment: two part-time workers are coutned as one full-time.

Table 6 Shares of trades within equilibrium price (wage) range

Treatment	Session	Market A			Market B			Market C			Market D			All		
		Total number of trades	% of trades within eqm range		Total number of trades	% of trades within eqm range		Total number of trades	% of trades within eqm range		Total number of trades	% of trades within eqm range		Total number of trades	% of trades within eqm range	
			Out of all trades	Out of trades in "right" markets		Out of all trades	Out of trades in "right" markets		Out of all trades	Out of trades in "right" markets		Out of all trades	Out of trades in "right" markets		Out of all trades	Out of trades in "right" markets
Minimum Wage 52:																
NA	**1**	4	8.89	10	0	0	0	31	86.11	90	2	0	0	37	95	100
NA	**2**	34	42.42	45.1	2	0	0	21	33.11	34.36	2	0	0	59	75.53	79.46
NA	**3**	14	28.17	28.17	0	0	0	27	41.33	47.33	4	0	0	45	69.5	75.5
NA	**4**	7	10.5	10.5	1	0	0	36	72	73.5	0	0	0	44	82.5	84
	All	**59**	**22.5**	**23.44**	**3**	**0**	**0**	**115**	**58.14**	**61.3**	**8**	**0**	**0**	**185**	**80.63**	**84.74**
PA	**1**	37	18.67	32	0	0	0	0	0	0	11	0	0	48	18.67	32
PA	**2**	40	70.77	87.5	0	0	0	0	0	0	9	0	0	49	70.77	87,50
PA	**3**	62	78.21	91.07	0	0	0	0	0	0	10	0	0	72	78.21	91.07
PA	**4**	57	74.29	87.5	0	0	0	0	0	0	11	0	0	68	74.29	87.5
	All	**196**	**60.49**	**74.52**	**0**	**0**	**0**	**0**	**0**	**0**	**41**	**0**	**0**	**237**	**60.49**	**74.52**
FA	**1**	2	0	0	3	0	0	0	0	0	28	85.83	100	33	85.83	100
FA	**2**	0	0	0	0	0	0	0	0	0	30	53.33	53.33	30	53.33	53.33
FA	**3**	2	0	0	2	0	0	0	0	0	28	75.33	83.33	32	75.33	83.33
FA	**4**	2	0	0	2	0	0	0	0	0	28	70	80	32	70	80
	All	**6**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**114**	**71.12**	**79.17**	**127**	**71.12**	**79.17**
Minimum Wage 40:																
NB	**1**	12	14.76	15.67	2	0	0	15	19.43	19.67	20	38.76	39.67	49	72.95	75.01
NB	**2**	14	14	14	0	0	0	18	22.5	22.5	16	15	15	48	51.5	51.5
	All	**26**	**14.38**	**14.84**	**2**	**0**	**0**	**33**	**20.97**	**21.09**	**36**	**26.88**	**27.34**	**97**	**62.23**	**63.26**
FB	**1**	2	0	0	2	0	0	0	0	0	39	52.83	57.67	43	52.83	57.67
FB	**2**	2	0	0	3	0	0	0	0	0	37	51	56.67	42	51	56.67
	All	**4**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**76**	**51.92**	**57.17**	**85**	**51.92**	**57.17**

Market A: Separate units, without insurance. Market B: Separate units, with insurance. Market C: Two-unit package, without insurance. Market D: Two-unit package, with insurance.

Supplementary Materials

Appendix A: Equilibrium per unit wages in markets with non-binding minimum-wage

[NB] No Mandate and Non-binding Minimum Wage, $w_{min} = 40$

Regulatory constraints set by price floor of 40 yields additional constraints:

$$p_A \geq 40; \tag{8}$$

$$p_C \geq 80; \tag{9}$$

$$p_D \geq 80; \tag{10}$$

Workers 1 and 2 are willing to participate in market D. They prefer selling two units in market D than two units in C market, or two separate units in A market, or one unit in market A:

$$p_D + b_i - 2e_i \geq p_C - 2e_i, \qquad i = 1, 2; \tag{11}$$

$$p_D + b_i - 2e_i \geq 2p_A - 2e_i, \qquad i = 1, 2; \tag{12}$$

$$p_D + b_i - 2e_i \geq p_A - e_i, \qquad i = 1, 2; \tag{13}$$

$$p_D + b_i - 2e_i \geq 0, \qquad i = 1, 2; \tag{14}$$

Workers $3 - 4$ are indifferent between selling a package in market C, or two units in A. They prefer to sell in C that to sell in D, or one unit in A, or not to sell at all:

$$p_C - 2e_i = 2p_A - 2e_i, \qquad i = 3, 4; \tag{15}$$

$$p_C - 2e_i \geq p_D + b_i - 2e_i, \qquad i = 3, 4; \tag{16}$$

$$p_C - 2e_i \geq p_A - e_i, \qquad i = 3, 4; \tag{17}$$

$$p_C - 2e_i \geq 0, \qquad i = 3, 4; \tag{18}$$

Worker 5 prefers not to sell at all than to sell in any of the markets:

$$0 \geq p_A - e_5; \tag{19}$$

$$0 \geq p_C - 2e_5; \tag{20}$$

$$0 \geq p_D + b_5 - 2e_5; \tag{21}$$

$$0 \geq 2p_A - 2e_5; \tag{22}$$

Firms $6-9$ are willing to buy in any of the three markets, and are indifferent between buying in C, or D, or two units in A:

$$v_i - p_A \geq 0, \qquad i = 6, ..., 9; \tag{23}$$

$$2(v_i - p_A) \geq 0, \qquad i = 6, .., 9; \tag{24}$$

$$2v_i - p_C \geq 0, \qquad i = 6, .., 9; \tag{25}$$

$$2v_i - p_D - c \geq 0, \qquad i = 6, .., 9; \tag{26}$$

$$2v_i - p_C = 2v_i - p_D - c, \qquad i = 6, .., 9; \tag{27}$$

$$2(v_i - p_A) = 2v_i - p_C, \qquad i = 6, .., 9; \tag{28}$$

$$2(v_i - p_A) = 2v_i - p_D - c, \qquad i = 6, .., 9; \tag{29}$$

Firm 10 prefers not to buy at all, than to buy in any of the markets:

$$0 \geq v_5 - p_A; \tag{30}$$

$$0 \geq 2v_5 - p_C; \tag{31}$$

$$0 \geq 2v_5 - p_D - c; \tag{32}$$

$$0 \geq 2(v_5 - p_A); \tag{33}$$

The above constraints and the parameter values from Table 1 result the equilibrium prices (wages) in the three markets:

$$p_A = p_C/2; \tag{34}$$

$$p_C = p_D + 32; \tag{35}$$

$$58 \leq p_A \leq 64; \tag{36}$$

$$116 \leq p_C \leq 128; \tag{37}$$

$$84 \leq p_D \leq 96; \tag{38}$$

[FB] Full Mandate and Non-binding Minimum Wage, $w_{min} = 40$

$$p_D + b_i - 2e_i \geq 0, \qquad i = 1, .., 4; \tag{39}$$

$$0 \geq p_D + b_5 - 2e_5; \tag{40}$$

$$2v_i - p_D - c \geq 0, \qquad i = 6, .., 9; \tag{41}$$

$$0 \geq 2v_{10} - p_D - c. \tag{42}$$

The regulatory constraint is given by:

$$p_D \geq 80 \tag{43}$$

Combining the above equations and the parameter values from Table 1 we obtain that the equilibrium price for the market D is given by:

$$84 \leq p_D \leq 96 \tag{44}$$

Appendix B

[NA] No Mandate and Binding Minimum Wage, $w_{min} = 52$

The regulatory constraints set by price floor of about 52 yields additional constraints:

$$p_A \geq 52; \tag{45}$$

$$p_C \geq 104; \tag{46}$$

$$p_D \geq 104. \tag{47}$$

Worker 1 and 2 are willing to participate in market D. They prefer selling two units in market D than two units in C market, or two separate units in A market, or one unit in market A:

$$p_D + b_i - 2e_i \geq p_C - 2e_i, \qquad i = 1, 2; \tag{48}$$

$$p_D + b_i - 2e_i \geq 2p_A - 2e_i, \qquad i = 1, 2; \tag{49}$$

$$p_D + b_i - 2e_i \geq p_A - e_i, \qquad i = 1, 2; \tag{50}$$

$$p_D + b_i - 2e_i \geq 0, \qquad i = 1, 2; \tag{51}$$

Worker 3 and 4 are indifferent between selling a package in market C, or two units in A. They prefer to sell in C that to sell in D, or one unit in A, or not to sell at all:

$$p_C - 2e_i = 2p_A - 2e_i, \qquad i = 3, 4; \tag{52}$$

$$p_C - 2e_i \geq p_D + b_i - 2e_i, \qquad i = 3, 4; \tag{53}$$

$$p_C - 2e_i \geq p_A - e_i, \qquad i = 3, 4; \tag{54}$$

$$p_C - 2e_i \geq 0, \qquad i = 3, 4; \tag{55}$$

Worker 5 prefers not to sell at all than to sell in any of the markets:

$$0 \geq p_A - e_5; \tag{56}$$

$$0 \geq p_C - 2e_5; \tag{57}$$

$$0 \geq p_D + b_5 - 2e_5; \tag{58}$$

$$0 \geq 2p_A - 2e_5; \tag{59}$$

Firms $6 - 9$ are willing to buy in any of the three markets, and are indifferent between buying in C, or two units in A:

$$v_i - p_A \geq 0, \qquad i = 6, ..., 9; \tag{60}$$

$$2(v_i - p_A) \geq 0, \qquad i = 6, .., 9; \tag{61}$$

$$2v_i - p_C \geq 0, \qquad i = 6, .., 9; \tag{62}$$

$$2(v_i - p_A) = 2v_i - p_C, \qquad i = 6, .., 9; \tag{63}$$

Firm 10 prefers not to buy at all, than to buy in any of the markets:

$$0 \geq v_5 - p_A; \tag{64}$$

$$0 \geq 2v_5 - p_C; \tag{65}$$

$$0 \geq 2(v_5 - p_A); \tag{66}$$

The above constraints and the parameter values from Table 1 result in the following equilibrium prices (wages) in two markets:

$$p_A = p_C/2; \tag{67}$$

$$58 \leq p_A \leq 66; \tag{68}$$

$$116 \leq p_C \leq 132; \tag{69}$$

[FA] Full Mandate and Binding Minimum Wage, $w_{min} = 52$

Firms $6 - 8$ are willing to trade with any of five workers in D market. Firms 9 and 10 prefer not to buy at all than to buy in the market:

$$p_D + b_i - 2e_i \geq 0, \qquad i = 1, ..., 5; \tag{70}$$

$$2v_i - p_D - c \geq 0, \qquad i = 6, ..., 8; \tag{71}$$

$$0 \geq 2v_i - p_D - c, \qquad i = 9, 10; \tag{72}$$

The regulatory constraint is given by:

$$p_D \geq 104. \tag{73}$$

Combining the above equations and the parameter values from Table 1 we obtain that the unique equilibrium price for the market D is given by:

$$p_D = 104. \tag{74}$$

APPENDIX

Instructions
(NB)

General Information

This is an experiment in the economics of market decision making. Based on your decisions in this experiment, you can earn a significant amount of money that will be paid to you IN CASH at the end of the experiment. During the experiment all units of account will be in experimental pesos. At the end of the experiment the amount of experimental pesos that you earn will be converted into dollars at the conversion rate of ___dollars per pesos. Your earnings plus a lump sum amount of 5 dollars will be paid to you in private.

From this point onwards you are NOT allowed to communicate with any other participant except according to the rules specified below. If you have any questions raise your hand and we will answer your questions in private. From this point onwards, you will be referred to by your participant number. You are participant number_____.

In this experiment we are going to conduct a market in which some of you will be buyers and some of you will be sellers of a fictitious good. Participants 1 through 5 will be sellers and participants 6 through 10 will be buyers. Attached to the instructions you will find a sheet labeled "Seller" or "Buyer", which describes the value to you of any decisions you might make. YOU ARE NOT TO REVEAL THIS INFORMATION TO ANYONE. It is your own private information.

Trading will occur in a sequence of market days, or trading periods. In each period, each buyer is free to buy, and each seller is free to sell, up to two units of the good. Units of the good can be traded separately or in packages of 2 units. In addition, each seller may request, and each buyer may offer, to provide a fictitious service in exchange for the good(s). There will be four separate markets depending on how the goods are traded:

Market A: separate units, no service;
Market B: separate units, with service;
Market C: packages of 2 units, no service;
Market D: packages of 2 units, with service.

Trading in each period will close after 5 minutes or when there is no activity for 20 seconds (whichever occurs first). At the end of every period you will be required to record your earnings for that period on your record sheet to be described below. This procedure will repeat for a number of periods.

Specific Instructions for Buyers

During each period you are free to buy up to two units of the good from any seller or sellers in any of the markets A, B, C or D. For each unit you buy, you will receive a *resale value*, which is listed in row I of your record sheet. You may buy units of the good separately (in markets A and B), or in a package (in markets C or D). In addition, you may offer to provide a fictitious service to sellers, which costs you the amount listed in row III of your record sheet. Your earnings from a purchase (which are yours to keep) equal to the difference between the resale values of the units sold and the purchase price you paid, minus the cost of service if you provide it.

Your Earnings = Resale Value – Price – Cost of Service if Provided

Your total earnings in a period equal the sum of the earnings from all of the units that you purchase in that period. (All the numbers used in the examples below are hypothetical.)

Example 1: Suppose, for example, that your resale value for each of the two units of the good is 65, and the cost of providing service to sellers is 30. Suppose you buy one unit in Market A (separate units, no service) for 50 pesos and another unit in Market B (separate units, with service) for 40. Then your earnings are:

Earnings [Market A, one unit, no service] = 65 – 50 = 15
Earnings [Market B, one unit, with service] = 65 – 40 – 30 = –5
Total earnings = 15 – 5 = 10

Example 2: Suppose, instead of the above, that you buy both units as a package in Market D (2-unit package, with service) for 80 pesos. Then your earnings are:

Earnings [Market D, package, with service] = 2*65 – 80 – 30 = 130 – 80 – 30 = 20

Remember, you can buy no more than 2 units in total per period. You can buy two units in Market B, but you will have to pay the cost of providing the service for each of the units.

Specific Instructors for Sellers

During each period you are free to sell up to two units of the good to any buyer or buyers in any of the markets A, B, C or D. For each unit that you sell you will receive the unit's price minus your *production cost*, which is listed in row II of your record sheet. You may sell units of the good separately (in markets A and B), or as a package (in markets C or D). In addition, you may request to receive a fictitious service from buyers. If you obtain the service you will receive an extra pay, listed in row III of your record sheet. You can only receive one extra pay per period. Therefore, if you sell one unit in market B (separate units, with service) you cannot sell another unit in market B; you can only sell your second unit in market A (separate units, no service). Your earnings from a sale (which are yours to keep) equal to the difference between the price you receive for the unit and production cost, plus the extra pay from service if you receive it.

Your Earnings = Price – Production Cost + Pay from Service if Received

Your total earnings in a period equal the sum of the earnings from all of the units that you sell in that period. (All the numbers used in the examples below are hypothetical.)

Examples 3: Suppose, for example, that your production cost for each of the two units of the good is 30, and the extra pay from receiving service from a buyer is 20. Suppose you sell one unit in Market A (separate units, no service) for 45 and one unit in Market B (separate units, with service) for 50. Then your earnings are:

Earnings [Market A, one unit, no service] = 45 – 30 = 15

Earnings [Market B, one unit, with service] = 50 – 30 + 20 = 40

Total Earnings = 15 + 40 = 55

Example 4: Suppose, instead of the above, that you sell both units as a package in Market C (2-unit package, no service) for 95 pesos. Then your earnings are:

Earnings [Market C, package, no service] = 95 – 2*30 = 95 – 60 = 35

Remember, you can sell no more than 2 units in total per period. Also note, you cannot sell 2 units in Market B.

Market Organization

The market for this good is organized as follows. During each trade period each buyer is free to buy up to 2 units and each seller is free to sell up to 2 units of the good. Any buyer (seller) is free at any time during the period to raise his hand and make a verbal bid (ask) to buy (sell) a unit or units of the good in any of the markets A, B, C or D. The buyer (seller) must specify which market he will buy (sell) the unit(s) in and at (for) what price. **Buyers and sellers may name any price except for the following constraint. Price in markets A and B must be no lower than 40 pesos, and prices in markets C and D must be no lower than 80 pesos.**

For instance, if buyer 7 wishes to buy a unit in Market A (separate units, no service) for 55 pesos, he should call out "Market A, buyer 7 bids 55". If seller 3 wishes to sell a 2-unit package in Market D (2-unit package, with service) for 105 pesos, he should call out "Market D, seller 3 asks 105". The price in markets A and B is the price per unit, while the price in markets C and D is the price for the 2-unit package.

Each new bid (ask) in a given market must be higher (lower) than the highest (lowest) outstanding bid (ask) in that market. For example, if the highest bid in Market A is 55 pesos, any new bids in Market A must be higher than 55. Similarly, if the lowest ask in Market C is currently 180 pesos, any new asks in Market C must be lower than 180. Any buyer (seller) is free at any time to accept an outstanding ask (bid). The buyer (seller) must specify which market he is accepting the ask (bid) in. For example, if buyer 7 wishes to accept the outstanding ask in market B he should calls out "Market B, buyer 7 accepts the ask." If a bid (ask) is accepted a binding contract is closed between the buyer and the seller, and each of them will record the contract price in their record sheet. Any ties in acceptance will be resolved by a random choice of buyer or seller. Buyers (sellers) are free to simultaneously place bids (asks) in as many markets as they wish. However, once a buyer (seller) buys (sells) a unit in markets A or B he can no longer buy (sell) in markets C or D. Consequently, any bids (asks) that the buyer (seller) has in markets C or D will be automatically removed. Once a buyer (seller) buys (sells) 2 units he can no longer participate in the market until the next trading period. You also have the option to record the transactions in each period in the transaction sheet attached.

ARE THERE ANY QUESTIONS?

Please complete the following exercises. Use the tables below to help you solve them.

Exercises for Sellers

Exercise 1: Suppose that a seller sells a unit in Market A (separate units, no service) for 50 pesos and another unit in Market B (separate units, with service) for 50. Assume that the seller's production cost and extra pay from service are 20 and 30 respectively. What are the total earnings of the seller?

Exercise 2: Suppose that a seller sells a 2-unit package in Market D (package, with service) for 90. Assume that the seller's production cost is 35 per unit and his extra pay from service is 44. What are the total earnings of the seller?

Table 1 (Use this table to calculate the earnings for sellers)

	Row		Market A		Market B	Market C	Market D	Total Earnings
Ex. 1	I	*Price*						
	II	*– Cost*	20	20	20	40	40	
	III	*+ Extra Pay*			30		30	
	IV	***= Earnings***						
Ex. 2	I	*Price*						
	II	*– Cost*	35	35	35	70	70	
	III	*+ Extra Pay*			44		44	
	IV	***= Earnings***						

Exercises for Buyers

Exercise 1: Suppose that a buyer purchases one unit in Market A (separate units, no service) for 50 pesos and another unit in Market B (separate units, with service) for 100. The buyer's resale value is 85 per unit and it costs him 40 to provide the service. What are the total earnings of the buyer?

Exercise 2: Suppose that a buyer purchases a 2-unit package in Market D (package, with service) for 90. The buyer's resale value is 65 per unit and it costs him 20 to provide a service. What are the total earnings of the buyer?

Table 2 (Use this table to calculate the earnings for buyers)

	Row		Market A		Market B		Market C	Market D	Total Earnings
Ex. 1	I	*Resale Value*	85	85	85	85	170	170	
	II	*– Price*							
	III	*– Cost of service*			40	40		40	
	IV	***= Earnings***							
Ex. 2	I	*Resale Value*	65	65	65	65	130	130	
	II	*– Price*							
	III	*– Cost of service*			20	20		20	
	IV	***= Earnings***							

ARE THERE ANY QUESTIONS?

Period 0 will be used for practice. It will not count towards your earnings.

Record Sheet (N)

Seller: ID # 1

Period	Row		Market A		Market B	Market C	Market D	Total Earnings
			Unit 1, No Service	Unit 2, No Service	1 Unit, with Service	2 Unit Package, No Service	2 Unit Package, with Service	
0	I	*Price*						
	II	*Cost*	45	45	45	90	90	
	III	+ *Extra Pay*			40		40	
	IV	**= *Earnings***						
1	I	*Price*						
	II	*Cost*	45	45	45	90	90	
	III	+ *Extra Pay*			40		40	
	IV	**= *Earnings***						
2	I	*Price*						
	II	*Cost*	45	45	45	90	90	
	III	+ *Extra Pay*			40		40	
	IV	**= *Earnings***						
3	I	*Price*						
	II	*Cost*	45	45	45	90	90	
	III	+ *Extra Pay*			40		40	
	IV	**= *Earnings***						
4	I	*Price*						
	II	*Cost*	45	45	45	90	90	
	III	+ *Extra Pay*			40		40	
	IV	**= *Earnings***						
5	I	*Price*						
	II	*Cost*	45	45	45	90	90	
	III	+ *Extra Pay*			40		40	
	IV	**= *Earnings***						
6	I	*Price*						
	II	*Cost*	45	45	45	90	90	
	III	+ *Extra Pay*			40		40	
	IV	**= *Earnings***						
7	I	*Price*						
	II	*Cost*	68	68	68	136	136	
	III	+ *Extra Pay*			40		40	
	IV	**= *Earnings***						

Record Sheet Seller: ID # 1								
Period	**Row**		**Market A**		**Market B**	**Market C**	**Market D**	**Total Earnings**
8	I	*Price*						
	II	*Cost*	68	68	68	136	136	
	III	*+ Extra Pay*			40		40	
	IV	***= Earnings***						
9	I	*Price*						
	II	*Cost*	68	68	68	136	136	
	III	*+ Extra Pay*			40		40	
	IV	***= Earnings***						
10	I	*Price*						
	II	*Cost*	68	68	68	136	136	
	III	*+ Extra Pay*			40		40	
	IV	***= Earnings***						
11	I	*Price*						
	II	*Cost*	68	68	68	136	136	
	III	*+ Extra Pay*			40		40	
	IV	*= Earnings*						
12	I	*Price*						
	II	*Cost*	68	68	68	136	136	
	III	*+ Extra Pay*			40		40	
	IV	***= Earnings***						
13	I	*Price*						
	II	*Cost*	68	68	68	136	136	
	III	*+ Extra Pay*			40		40	
	IV	***= Earnings***						
14	I	*Price*						
	II	*Cost*	45	45	45	90	90	
	III	*+ Extra Pay*			40		40	
	IV	***= Earnings***						
15	I	*Price*						
	II	*Cost*	45	45	45	90	90	
	III	*+ Extra Pay*			40		40	
	IV	***= Earnings***						
Cumulative Earnings in Pesos								
Exchange Rate								
Cumulative Earnings in Dollars								

Optional Transactions Sheet (N)

Period	Market A			Market B			Market C			Market D		
	Seller	Buyer	Price	Seller	Buyer	Price	Seller	Buyer	Price	Seller	Buyer	Price