Nonlinear Relationship between Labor Demand Elasticities and Firm Size in Iran

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Abstract

This paper, at first, examines the determinants of the labor income share (LIS) and second calculates the own, cross, and output elasticities of the labor force demand for three sizes of firms in Iran's industry: 10-49 employees, 50-99 employees, and more than 100 employees. Since the dependent variable was limited to the interval 0 and 1, a Fractional Panel Probit technique has been used for the period 2004-2014 and provincial level. The findings from the first section of all groups showed that the relation between labor share income and wages, capital prices, and the ratio of skilled to non-skilled employees is positive. Labor income share is reduced by increasing real output, tax, the premium paid, and the value of raw materials. The share of labor income is reduced by increasing production can make sense that the rising in production is more capital-intensive than labor-intensive, and leads to a reduction of the labor income share. In the second part, the own wage elasticity was negative for all groups. The relationship between labor and capital price was positive that implies substitution elasticity between them. There is a positive sign for output-employment elasticity. The nonlinear relationship among the elasticities is consistent with our finding that within all groups, small and large firms have more own and output elasticities. There is a U-shape relationship between firm size and elasticities. In reverse, cross elasticity is high for medium-firm size. Based on research results and since the labor market of Iran is suffering from labor demand shortage, some suggestion to the economic policymaker may be helpful such as applying appropriate facility to increase industrial growth, eliminating production barriers, reducing the risk of investment, and improving human resources skills following the requirements of industrial sectors.

Keywords: Nonlinear Relationship, Firm Size, Labor Demand Elasticities, Labor Market of Iran, Fractional Panel Probit.
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1. Introduction

This paper examines the influence of firm size on labor demand share and employment elasticity. The relationship between firm size and

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job-creation is important for employment policy. Creating employment and using the potential capacity to increase job opportunities and reduce unemployment are important policy goals. Demand structure for labor is one of the basic policy questions and can play an important role in job creation.

Despite the various plans to increase job opportunities in Iran, job creation has not responded to the labor supply in Iran's economy. Labor supply has been significantly increased since the 2000s that was affected by increasing in the population growth rate during 1976-1986 and changing in the household lifestyle. Increasing the level of education, especially for women, changing attitudes toward the presence of women into the labor market, reducing household size, and rising living standards are some examples of changing patterns of household life that can be mentioned. Also, the economic growth rate has not caused the appropriate hiring of the labor force after the 1990s. The gap between job opportunities and the number of job seekers has made that employment be a critical element for Iran as a country with a young active population.

On the other hand, due to backward and forward linkage of the industry sector with other sectors, to be expected the growth of the industrial sector is led to the growth of services and agriculture sectors, which leads to higher economic growth and more employment.

Distribution of income among the inputs of production was the most efficient indicator of the relative welfare of social groups (Escosura and Rosés, 2003). Hence, the labor income share (LIS) is a beneficial variable for analyzing inequalities in income. LIS shows how much of national income dedicate to labor and consequently measures the functional income distribution (Trapp, 2013). Besides of importance of LIS in the labor market, labor demand elasticities, are a key parameter of interest, especially own wages, influencing the effectiveness of labor market policy (Lichter, 2015).

Generally, investigating the labor demand elasticity for industrial firms, based on size, is important. Therefore, this paper aims to estimate the demand elasticity of the labor force for industry firms in Iran to provide a policy strategy for relieving the unemployment crisis

The rest of the paper is organized as follows: Section 2 presents the

literature review. Section 3 discusses the methodology and data. The fourth section is devoted to empirical results. Finally, the last section gives concluding remarks and some policies that it is hoped that the policy will be suitable for increasing employment.

2. Theoretical Background and Previous Literature
2.1 Theoretical Background
Labor demand theory is part of a wider context. The basic assumption of the labor demand theory is that firms utilize the services of labor by combining them with other inputs, such as capital, to maximize the profits. The theory of labor demand sets out to explain the demand for the workforce, or the working hour of each employee (Cahuc et al., 2014).

In an economic context, the determination of employment behavior depends on assumptions that apply to firms. According to them, there are various methods for extracting the labor demand function. Theoretical background based on the hypothesis that 1) the number of inputs 2) market type: competitive or non-competitive 3) static and dynamic state of the model. It should be noted that in some models these cases can be merged, for instance, a combination of market type and some inputs (Nicholson and Snyder, 2011).

2.1.1 Number of Inputs
Theoretical consequences on labor demand can be generalized to N factor inputs, many beneficial insights into theory can be gained by examining the labor demand for labor and capital as input factors. Much of the terminology of labor demand is in the two-factor case that many cost and production functions from labor demand are derived developed from two input factors (Hamermesh, 1993).

For providing a theoretical outline to link to empirical work is assumed that production function is constant returns to scale that is described by F, follow as

$$Y = F(L, K), \quad F_i > 0, \quad F_{ii} < 0 \tag{1}$$

Where Y is output and L and K are respectively labor and capital inputs.

2.2.2 Market State: Competitive or Uncompetitive

The heart of neoclassical economics is the model of competitive markets. A labor market works according to the principles of perfect competition, if firms are perfectly informed about the quality of labor and all wages, an additional requirement for perfect competition is that all firms must be wage takers. In a competitive market, firms regard the wage as a given and labor demand results from the maximization of profit (Cahuc et al., 2014).

In an imperfect market the wage, price of labor services, is not achieved from the relation of supply and demand on the market. The wage is determined by factors such as the bargaining power and political and economic power of the labor unions.

2.2.3 Static and Dynamic State of Model

The static labor demand theory is essentially a branch of production theory and focuses on decisions of employers regarding the amount of labor to be used in production and on how these quantities change in response to marginal changes in product demand. the basic assumption of labor demand theory is that firms utilize the services of labor by combining them with other inputs (capital), to maximize their profits or minimizing cost (Addison et al., 2014).

The dynamic theory of labor demand is driven by two major goals: first, to explain the cyclical behavior of the productivity of labor; and, second, to understand the workings and the effects of job security policies (Addison et al., 2014). It was modeled in 3 approaches: labor demand approach, quantity constraint approach, and Job Search and Matching Approach (Burgess, 1992).

Table (1) summarizes the theoretical background based on their assumption about the labor market.

Table 1: Summary of Theoretical Background Related to Labor Demand

Assumption	Features
State of market	Wage taker and competitive market
	Imperfect market
Number of inputs	Production function with a single input (labor)
	Production function with 2 factors (labor and capital)
	Production function with N-inputs

Assumption	Features
Static state	Maximize profit
	Minimizing cost
Dynamic state	Labor demand approach
	Quantity constraint approach
	Job Search and Matching Approach

Source: based on the literature review.

Along with focusing on this two-factor function, this paper focuses on labor income share to understand what determines labor-demand elasticities. Hamermesh (1993) abridges what specifies an industry's equilibrium own-price elasticity with "the fundamental law of factor demand" (Slaughter, 2004). With regards to the fundamental law, equation (2) proved in Allen (1938) and discussed in details by Hamermesh (1993) that determines the own-price elasticity of labor demand at the industry level, that are modified such that

$$\eta_{LLj} = -[1 - s]\sigma_{LL} - s\eta_j \qquad (2)$$

Where η_{LLj} is the sensitivity of labor demand to wages that are defined to be negative based on the law. S is the labor share of the total revenue of the industry. J shows the industry. σ_{LL} is the elasticity of substitution between labor and all other factors in the production process. η_j is the elasticity of total demand j to prices in the sector J (elasticity for j's output market). The variables s, σ_{LL} and are defined to be positive.

According to equation (2), η_{LLj} consists of two parts. The first part is the substitution effect and it indicates for a given level of production, when the wage raise, how much the industry substitutes from labor towards other factors. The second part of the equation (2), $s\eta_j$, is output effect or scale effect. This explains how much labor demand changes after changing wags due to changes in the industry's output. Higher wages point to more cost, so moving along the product-market demand schedule leads to having lower industry's output.

In summary, when wage rise, both the substitution and scale effect decrease. The employer substitutes from labor for other factors and

with higher costs, the industry produces less output, which will reduce the demand for all factors, therefore, $\eta_{LLj} < 0$: the labor demand slopes downward and the own-wage price is negative (Slaughter, 2001).

2.2 Previous Literature

The debate about firm size and employment has been going on for a long time which starts with the seminal work of Gibrat (1931). Gibrat's law states that the proportional rate of growth of a firm is not dependent on its absolute size. This assumption was rejected by Birch's "The Job Generation Process" (1979) that was argued that the majority of net new jobs in the U.S. economy were created by small firms. Results of Birch were later focused on and challenged by other authors, especially by Davis et al. (1996). Davis et al. (1996) argued that the employment growth rate used by Birch is biased. To avoid bias, another definition based on the average employment of the two time periods was used by Davis et al. (1996). Their result implied that there is not any relationship between firm size and employment growth, unlike Birch's findings.

The results of a recent burgeoning literature show a broad variety of findings between firm size and job creation. The wide range of estimates reveals a negative relationship between firm size and job creation, for example, Broersma and Gautier (1997), Picot and Dupuy (1998), Machado and Mata (2000) Acquisti and Lehmann (2000), Voulgaris et al. (2005), Helfand et al. (2007), Neumark et al. (2011), Hijzen et al. (2010), Ayyagari et al. (2014), De Wit and De Kok (2014) and Dogan (2017) found a negative relationship between firm size and job creation. Wanger (1992), Haltiwanger et al. (2013), and Pyo et al. (2016) when control firm age without discovered that there is no or a positive correlation between the two. Hohti (2000), Kerr et al. (2014), Rijkers et al. (2014) exhibited larger firms are better net creators of jobs than small firms. Lever (1996) and Kölling (2012) discovered that firms with a high share of labor have larger elasticities.

There is merely one of the published studies taking an approach to investigate the relation between firm size and job creation in the case of Iran. Feizpour et al. (2010) found that Gibrat's Law is rejected for

manufacturing firms during the period 1995-98. The study confirms that size is an important variable in the study of firm growth and creating employment for manufacturing industries.

Javaheri (2013) investigated the relationship between firm size and its growth rate for Iranian insurance firms during 2003-2009. The results of the study did not support Gibrat's law.

Besides firm size analysis, this paper argues on the estimation of labor demand elasticity for the industry. If it is assumed that small and large establishments act on the same markets, elasticities are an appropriate measure for analyzing employment dynamics (Kölling, 2012). Therefore, some studies are reviewed which focused on industry labor demand elasticity such as Clark and Freeman, (1980) for U.S. manufacturing from first quarter 1950 to third-quarter 1976, Braconier and Ekholm, (2000) for Swedish multinational firms within the manufacturing sector, Falk and Koebel (2002) for Germany, Goldar et al. (2013) for India, Adam and Moutos (2014) for Eurozone.

In the next section, the data is described and then the model is derived for estimating LIS and calculating the elasticity for small, medium, and large enterprises.

3. Data and Methodology
3.1 Data
This paper uses annual panel data from 2004 to 2014 for the thirty Iran's provinces. The data have been collected from the central bank and annual census report of manufacturing establishments from the statistical center of Iran. The total number of observations is 330. The main purposes of this paper are to estimate the main determination of LIS and calculate the elasticities of labor demand regarding the firm size. To achieve this goal, three groups of manufacturing firms will be considered: firms with 10-49, 50-99, and firms with 100 employees or more. Hence, initially, the definitions of firm size are presented.

It should be noted that a standard international definition of a small and medium-sized enterprise (SME) does not exist (OECD, 2017). Different countries have different criteria for defining small and medium industries, which are due to the economic and industrial conditions governing in those countries. The size of the firm based on the number of employees is one of the most common criteria for

categorizing the scale of the manufacturing firm and different countries have dissimilar measurement criteria. In Iran, different organizations according to their activities provide different definitions for the classification of firms. The definition used in this paper is provided by the Central Bank of Iran. A size definition of Central bank based on employment is defined: a micro firm is defined as a business employing less than 10 people. A small firm, when numbers are between 10 and 49, a medium size is defined as one is employing from 50 to 99 and large firms as those employing 100 or more.

The latest International Labor Organization (ILO) estimation for SMEs and large firms in the formal sector points out that in developing economies, SMEs account for 52 percent of total employment, compared with 34 percent in emerging economies and 41 percent in developed economies. In table 2, the number of employees and the share of several manufacturing firms with 10 to 49, 50 to 99, and 100 or more are shown for Iran as a developing country, during the period of 2004 to 2014.

In the year 2004, there were 16,283 manufacturing establishments with 10 and more workers. The private and public sectors own 96 and approximately 4 percent of the establishments respectively. The number of manufacturing establishments is 12,365 in small firm size that private and public sectors own 98 and 2 percent respectively. In medium and large sizes the number of firms is 1920 and 1998. Private sector ownership is 95 percent in medium-size and 85 percent in large firms. Also, the total employed persons in the establishments were over one million and 77 thousand persons.

After one decade, total employed persons have been reached one million and 309 thousand persons, showing a 2 percent increase compared with the year 2004. In the year 2014, the private sector and public own 97.5 and 2.5 percent respectively of total firms.

The number of employees and share of firms that are showed in Table 2 belongs to both private and public sectors. The largest share of industrial firms is small enterprises. At the beginning of the 2000s, the number of small firms is more than three-quarters of the total. During a decade, the size of small firms has decreased and the number of medium and large enterprises has been added. The number of employees and the number of firms with more than 100 people during

this time have increased. Firms employing 100 or more have not only the lowest number of firms but also the largest amount of employees.

Table 2: Total Number of Employees and Share of Industrial Firms (%) 2004 to 2014

	Small (10-49 employees)		Medium (50-99)		Large (+100)	
	Number of employees	share of industrial firms	Number of employees	share of industrial firms	Number of employees	share of industrial firms
2004	267771	76	129030	12	679892	12
2005	266674	76	123983	11	670662	12
2006	266578	76	123341	12	681464	13
2007	289054	74	141856	12	783712	14
2008	273104	72	149268	13	839379	15
2009	256203	71	147277	14	848031	16
2010	244322	70	150630	15	853697	15
2011	235239	70	145771	14	861973	16
2012	237675	70	150594	15	816430	15
2013	230035	68	151476	15	898066	17
2014	221145	68	147988	15	939926	18

Source: Statistical Center of Iran.

Note: share of industrial firms is ratio of number of firms for each year to all manufacturing establishments.

In this study, LIS is the dependent variable. As World Economic Outlook reports the global labor share has declined significantly since the early 1980s in developed countries. It began trending down in the emerging market and developing economies in the1990s. Figure 1 shows labor share income for industrial firms with more than 10 employees in Iran from after year of Iran's Islamic revolution to 2015. LIS had fluctuation at the beginning of this period, but after 1992 the downward trend also began in Iran. The advances in technology that made the efficiency gains in capital producing sectors caused firms to shift away from labor toward capital (Karabarbounis and Neiman, 2013).
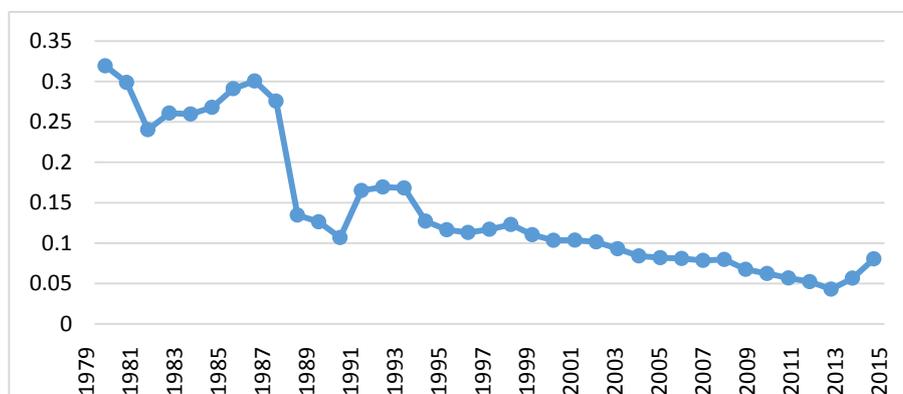
Figure 1: Labor Income Share for Iran's Industrial Firms with More Than 10 Employees, 1979 to 2015
Source: Statistical Center of Iran.
Note: Labor income share can be defined as the ratio of labor compensation (W.L) to the value of industrial output (P.Y).

Figure (2) shows LIS at Iran's manufacturing firm-level for 3 groups: with 10 to 49, 50 to 99, and 100 or more employees during 2004-2014. Along with this period, the industrial's LIS has not a stable trend for all groups.
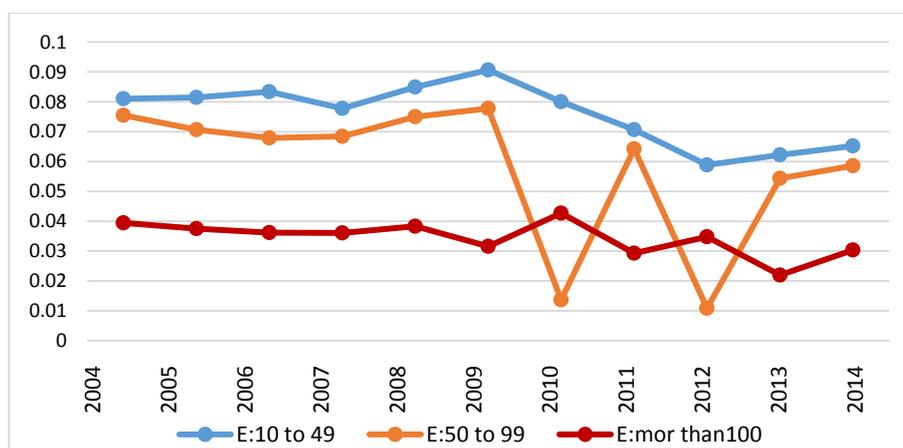

Figure 2: Labor Income Share for Iran's Industrial Firms for 3 Groups: with 10 to 49, 50 to 99 and 100 or More Employees. 2004 to 2014
Source: Researchers calculations based on Statistical center of Iran.
Note: there is not a time series data for these 3 groups similar to figure 1 for more than 10 employees.

3.2 Model
To study the labor demand, various functions have been used based on

different assumptions. Among the most commonly used methods, the Cobb-Douglas, CES, the generalized Leontiefcost, and the translog cost function can be mentioned. A model used in this study is assumed with homogenous employees, two factors of production (capital and labor), and heterothetic production function. In two stages, labor demand elasticities will be estimated. To achieve this goal, a model based on translog cost function (Hamermesh, 1993 and Kölling, 2012) is estimated indicating the affecting factors on LIS in each group of firms. In the second step, own-wage, cross, and output elasticity of labor demand are estimated.

2.2.1 Share of Labor Demand

In the first step, to estimate the affecting factors on LIS, the translog cost function is written as Equation(3).

$$LnC = LnY + a_0 + a_1 Lnw + (1-a_1)Lnr + 0.5b_1 Lnw^2 + b_2 Lnw\ Lnr + 0.5b_3 Lnr^2 \qquad (3)$$
$$+ dLnY\ Lnw + (1-d)lnY\ Lnr$$

where a_i, b_i and d are parameters. Ln is logarithm and C, Y, w and r are total cost, revenue wage, and capital user cost respectively. Applying Shephard's lemma to labor input and taking the ratio to labor costs follows:

$$s = a_1 + b_1 Lnw + b_2 Lnr + dLnY \qquad (4)$$

where $s = \dfrac{w.L}{Y}$ is share of labor income (w.L) in total revenue. LIS is the proportion of income generated from production that is spent on labor in the form of wages and associated on-costs (Conway et al., 2015). Here LIS in total production value is considered as the dependent variable.

For the empirical analysis of the labor demand elasticity of the industrial sector by the size, equation (5) must first be estimated.

The model used in this paper is based on Kölling (2012) that calculates labor demand elasticities in Germany. This paper aims to estimate the labor demand elasticities in Iran for the industrial sector by firm size. Therefore, model (5) is derived from (4).

$$s_{ijt} = \alpha_j + \beta_j Lnw_{ijt} + \gamma_j Ln\ r_{ijt} + \theta_j Ln\ y_{ijt} + \mu_j X_{ijt} + \delta_{ij} + \varepsilon_{ijt} \qquad (5)$$

Where

- i is related to each firm group: $i = 1, 2, 3$:*firm groups* 10-49 (small), 50-99 (medium), and +100 (large firms).
- j is the indices for the province ;$J = 1, \ldots, 30 \mid \left(Provience \right)$
- t indicates time; $t = 2004, \ldots, 2014 \mid \left(year \right)$
- δ_{ij} is an unobserved province's effect.
- ε_{ijt} is the error term.

For each firm group, the empirical model contains a range of general explanatory variables. The most important of these variables is wage. In previous literature, an explicit relationship between the wage and LIS doesn't exist. Own wage and cross elasticity of labor demand can determine a positive or negative relationship between the two. Assuming a negative own wage elasticity, if the cross elasticity between capital price and labor is positive and smaller than one, the share of labor income increases as wage increases. Also if the elasticity of substitution is more than one, the increase in wages leads to an increase in the share of capital, and the share of labor decreases.

Another explanatory variable used in the model is the price of capital. There is, as always, concern about the accuracy of the capital cost measure (Griffin, 1992). There is little variation to measure capital prices in different papers. For example, a few of which are mentioned. The cost of capital to a firm is equal to the rate of return on capital in Griffin (1992, 1996). The user cost of capital according to Jorgenson (1986) is another variable. Draper and Manders have derived the cost of capital from value-added, the costs of other inputs, and the stock of capital. Capital price is assumed to equal the price of acquiring new capital (Haouas and Yagoubi, 2004) and the book value of capital stocks (Hasan et al., 2007). In Kölling (2012) the yearly mean of the 12-month rate at which euro interbank term deposits within the Eurozone is used as an instrument for the costs of capital.

In this study, a variable that is closely related to the price of capital is chosen. Therefore, the firms' real payments paid to the bank are used as an indicator of the price of capital. The cross-elasticity between capital price and labor determines the effect of the rise in

capital price on the share of labor income. If there is substitution elasticity, the relation between them will be positive, and if it is complementary, the effect of capital price on LIS is negative.

The other variable is the value of real industrial output, which is an indicator of output. Acemoglu shows in several papers the impact of output on LIS depends on labor-intensive or capital-intensive technology (Schnider, 2011). If technology and techniques of production help to increase labor-intensive products, the relationship between LIS and output is expected negative and conversely.

Considering the theoretical background, the characteristics of Iran's labor market and the availability of data from industrial firms, other explanatory variables were added to the model. These variables include indirect taxes, premium payments, the value of raw material, and the ratio of skilled to unskilled employees that affect labor demand from the employer's side. It can be expected that as these variables increase, the employer's demand for labor force will be reduced, which leads to a reduction in LIS. It can be accepted the labor demand rise by increasing the employee's skill, as a result, LIS increase.

In the next part, a model of labor elasticities taken from (Kolling, 2012) is presented.

2.2.2 Labor Demand Elasticities

Based on the previous model, the own-wage, cross wage elasticity of labor demand and output elasticity of employment (employment elasticity of growth) are obtained in this part. Taking total differential of s:

$$\partial s = \partial w \frac{L}{Y} + \partial L \frac{W}{Y} - \partial Y \frac{WL}{Y^2} = \frac{\partial w}{w}s + \frac{\partial L}{L}s - \frac{\partial Y}{Y}s = \left(\frac{\partial w}{w} + \frac{\partial L}{L} - \frac{\partial Y}{Y} \right)s \qquad (6)$$

Elasticities are derived from partial marginal effects of the relevant variables:

$$\frac{\partial s}{\partial (\ln w)} = \frac{\left(\frac{\partial w}{w} + \frac{\partial L}{L} - \frac{\partial Y}{Y} \right)s}{\frac{\partial w}{w}} = b_1 \quad \Leftrightarrow \quad \frac{\left(\frac{\partial w}{w} + \frac{\partial L}{L} - 0 \right)}{\frac{\partial w}{w}} = \frac{b_1}{s} \quad \Leftrightarrow \quad \frac{\partial L}{L} \Big/ \frac{\partial w}{w} + 1 = \frac{b_1}{s}$$

$$\Leftrightarrow \quad \frac{\partial L}{L} \Big/ \frac{\partial w}{w} = \frac{b_1}{s} - 1 \Rightarrow \quad \eta_{LW} = \frac{\partial L}{L} \Big/ \frac{\partial w}{w} = \frac{b_1}{s} - 1$$

$$(7)$$

$$\frac{\partial s}{\partial (\ln Y)} = \frac{\left(\frac{\partial w}{w} + \frac{\partial L}{L} - \frac{\partial Y}{Y}\right)s}{\frac{\partial Y}{Y}} = d \quad \Leftrightarrow \quad \frac{\left(0 + \frac{\partial L}{L} - \frac{\partial Y}{Y}\right)}{\frac{\partial Y}{Y}} = \frac{d}{s} \quad \Leftrightarrow \quad \frac{\frac{\partial L}{L}}{\frac{\partial Y}{Y}} = \frac{d}{s} + 1 \Rightarrow \quad \eta_{LY} = \frac{\frac{\partial L}{L}}{\frac{\partial Y}{Y}} = \frac{d}{s} + 1$$

(8)

$$\frac{\partial s}{\partial (\ln r)} = \frac{\left(\frac{\partial w}{w} + \frac{\partial L}{L} - \frac{\partial Y}{Y}\right)s}{\frac{\partial r}{r}} = b_2 \quad \Leftrightarrow \quad \frac{\frac{\partial L}{L}}{\frac{\partial r}{r}} = \frac{\left(0 + \frac{\partial L}{L} - 0\right)}{\frac{\partial r}{r}} = \frac{b_2}{s}$$

(9)

where η_{LW} is own-wage elasticity, η_{Lr} is cross-wage elasticity and η_{LY} is the output elasticity of employment (Kölling, 2012).

The own-wage elasticity of demand: The own-wage elasticity of demand for a category of labor is defined as the percentage change in its employment induced by a 1 percent increase in its wage rate (Ehrenberg and Smith, 2012). It is expected that, according to the labor demand theory, the wage will be negatively related to labor demand. Because of increasing labor costs (wages) the demand for labor decreases. Some studies such as Berndt and Khaled (1979), Clark and Freeman (1980), Arellano and Bond (1991), Griffin (1992), Greenaway et al (1999), Haouas and Yagoubi (2004), Arnone et al. (2005), Hasan et al. (2007), Saens et al. (2008), Görg et al. (2009) and Kölling (2012) have discovered the negative effect of labor cost on labor demand.

In some studies, the effect of wage is related to several factors. These factors which include a level of employee's skill in Nissim (1984), Draper and Manders (1997), Falk and Koebel (2001), the type of labor (contract labor and permanent labor), in Haouas and Yagoubi (2004) and method used in Symons and Layard (1984), Aguilar and Rendon (2008) may change the expected results.

Moreover, the effect of wages in Iran's labor market depends on real or nominal wages. When the wage is considered as real the effect is small and sometimes insignificant (Kazerooni and Mohamdzade Akbari (2002); Akbarian and Mohtashami, (2006); Shahbazi and Fatahi 1396 (2017)) that Karimi Araghi and Souri (2006) mentioned real wages also had a positive and significant effect (which is consistent with efficiency- wage theory), even though its effect is very

small. When the wage is used as nominal, the effect is bigger but still less than one as like as Pezhman (2003), Molaei and Ashtiani (2012) and Kapsos (2005) that this result is compatible with the result of this paper.

The cross-wage elasticity of demand: The elasticity of demand for labor concerning the price of input capital is the percentage change in the demand for labor induced by a 1 percent change in the price of capital (Ehrenberg and Smith, 2012). The results from recent literature about Cross elasticity are mixed. Some studies [for example, Atkinson and Halvorsen (1984), Berndt and Khaled (1979), Funke (1999)] found a positive relationship between capital price and employment, and some [for example, Allen and Urga (1999)] estimated negative. Pencavel and Holmlund showed the effect of capital price on employment is about zero and Haouas and Yagoubi (2004) found that no relationship exists between them.

Output elasticity of employment: Employment elasticity is calculated as a change in the number of employed persons concerning a change in sectoral output/Value add or GDP. The output is one of the affecting factors in employment. However, the variable selected to represent the labor market situation strongly determines the relation. (Döpke, 2005). Although it is expected that increased production can reduce the unemployment rate and increase employment rates with increasing labor demand. The positive relation between employment and output (economic growth) can be obtained in the recent studies such as Arnone et al. (2005), Seyfried (2006), Aydiner-Avsar and Onaran (2010), Aljebrin (2012). Herman (2008) implies generally, although between economic growth and employment there is a positive and strong relationship, intensity differs from one period to another and from one country to another. Even in some, the negative relationship has been estimated. Negative elasticity is observed in Döpke (2001) for Portugal. Kapsos (2005), although shown in many cases, output elasticity of employment is positive, for some countries and regions had not been obtained. Korea from 1997 to 1999 had negative employment elasticity of output, Choi (2007).

3. Estimation
To investigate the effects of wage, capital price, output, and other

variables on LIS, the share of labor income was modeled as a continuous variable as shown in Equation (5). Since the dependent variable is a rate that is bounded by 0 and 1 (or 100%) or both that has been termed "fractional response variables" by Papke and Wooldridge (1996). It is needed to estimate a fractional response model by Papke and Wooldridge (2008).

Let s_{ijt} denote the fractional response variable (labor income share), defined on the interval [0, 1] therefore cannot be modeled as a linear function of the covariates. To be explained for cross-section (province) j, j=1,…,30; i group size index and at time t, t= 1, …T.

For a single fractional response, a Tobit approach for data censored at zero, an OLS estimator, or an IV estimator of a linear model has been used. Utilization of the logistic transformation (the log-odds conditional mean) is an alternative solution. Using these solutions to model leverage ratios also suffers from some drawbacks (Ramallho 2009, 2015; Gardeazabal, 2010).

Proposed quasi maximum likelihood estimation (QMLE) by Papke and Wooldridge (1996) can be applied to estimate the fractional response in univariate cross-sectional even when the response takes the boundary values. Papke and Wooldridge (2008) extend a single fractional response to a panel data setting while leading a constant unobserved effect that can be correlated with explanatory variables. Unlike their earlier work (Papke and Wooldridge, 1996) that focused on the logistic response function, they used the probit response function for its advantages in panel data and this is the procedure used in this paper.

To estimate "average partial effects" (APEs) the standard normal cumulative distribution function (Φ) for a set of the explanatory variable (X) is assumed and i (group size) can be dropped because it is not necessary:

$$E\left(s_{it}|x_{it}, c_i\right) = \Phi\left(x_{it}\beta_i + c_i\right) \tag{10}$$

Where c_i as unobserved establishment effects and β's values identify the directions of the partial effects because Φ is a monotonic function.

$$\frac{\partial E\left(s_{it}|x_{it}, c_i\right)}{\partial x_{it}} = \beta_j \phi\left(x_{it}\beta_i + c_i\right) \tag{11}$$

Because of time-constant unobserved nature in c_i and correlating with explanatory variables, calculating of APE in (11) is impractical. The partial (marginal) effects are obtained by taking derivatives for x_i:

$$E_c \left(\beta_i \phi \left(x_{it} \beta_i + c_i \right) \right) = \beta_i E_c \left[\phi \left(x_{it} \beta_i + c_i \right) \right] \qquad (32)$$

This paper focused on labor demand elasticities not calculating APE. Hence own-wage, cross and output elasticity are derived from the APE's by using the expected mean of the ф (Kölling, 2012):

$$\eta_{LW} = \frac{\hat{\beta}_{lnw} \sum_{t=1}^{T} \sum_{i=1}^{N} \phi \left(x_{it} \beta +_i \varepsilon \right)}{\sum_{t=1}^{T} \sum_{i=1}^{N} \Phi \left(x_{it} \beta +_i \varepsilon \right)} - 1 \qquad (43)$$

$$\eta_{Lr} = \frac{\hat{\beta}_{lnr} \sum_{t=1}^{T} \sum_{i=1}^{N} \phi \left(x_{it} \beta +_i \varepsilon \right)}{\sum_{t=1}^{T} \sum_{i=1}^{N} \Phi \left(x_{it} \beta +_i \varepsilon \right)} \qquad (54)$$

$$\eta_{LY} = \frac{\hat{\beta}_{lnY} \sum_{t=1}^{T} \sum_{i=1}^{N} \phi \left(x_{it} \beta +_i \varepsilon \right)}{\sum_{t=1}^{T} \sum_{i=1}^{N} \Phi \left(x_{it} \beta +_i \varepsilon \right)} + 1 \qquad (65)$$

After the estimation of equation (6) that its results discover the effected factors on a share of labor income. The average partial effect (APE) has been calculated by using previous coefficients. Own-wage, cross, and output elasticity are derived from APE and by using equations (43), (54), and (65). The results of model estimation and calculation elasticities are summarized in tables 3 and 4. A bootstrap was estimated using 1,000 bootstrap replicates to check the accuracy of standard errors.

Table 3 contains the estimations of the model for three sizes of firms. The χ^2 coefficient obtained from the Wald test also indicates the significance of the entire model for all groups. All variables are significant at a 90% confidence level except for a share of skilled to unskilled employees, in small firms, and premium paid in medium size.

Table 3: Estimation of the Labor Income Share by Fractional Panel Probit

Dependent variable: Labor income share	Small Firms		Medium Firms		Large Firms	
	10≤E≤49		50≤E≤99		E≥100	
	Coef	(p-value)	Coef	(p-value)	Coef	(p-value)
Log wage	0.103	0.000	0.36	0.001	0.22	0.000
Log output	-0.048	0.037	-0.35	0.000	-0.26	0.000
Log capital price	0.042	0.000	0.104	0.000	0.02	0.006
Log Premium paid	-0.051	0.022	-0.048	0.272	-0.047	0.006
Log raw material value	-0.044	0.000	-0.052	0.082	-0.085	0.005
Log indirect tax	-0.037	0.000	-0.066	0.004	-0.018	0.017
Share of skilled to unskilled	0.035	0.422	0.153	0.001	0.036	0.043
Constant	-1.07	0.000	-1.06	0.020	0.40	0.186
Wald χ^2	145.32		766.12		483.28	
Prob > χ^2	0.000		0.000		0.000	
Number of observations	330		330		330	

Notes:
-The dependent variable is the industry labor income share, expressed as the ratio of labor compensation (wage) to the value of industrial output. All covariates, except the share of skilled to unskilled, are in logs. All variables are significant at a 10% level except the share of skilled to unskilled in small groups and premium for medium group. The results are estimated by Fractional Panel Probit with Stata 14.
- E is the number of employees.

Based on these results, the effect of increasing wages in all groups leads to an increase in the share of labor income. This is similar to Caballero and Hammour (1998) and Acemoglu (2002b) that state firms employ less labor after a wage shock but labor share has not fallen in the short-run (Schneider, 2011) because of own wage and substitution elasticities. If the elasticity of substitution between labor and capital price be positive and less than unit, as wages increase, the share of labor income will increase. On the other hand, it is also expected that the absolute value of own-wage elasticity will be smaller than one, because only in this case, by increasing wages and reducing labor demand, the share of labor income will rise.

The capital price coefficient is positive and significant. The positive effect of this variable shows that if the payments to the banks increase, the share of capital decreases, and the share of labor income increases. Hence, it makes sense for the elasticity between the price of capital and labor to be positive and substitute.

Share of labor income falls by increasing the output of more capital-intensive products. According to Iran's transition economy, there are more possibilities for using technology in capital-intensive products. Chapter 3 of the World Economic Outlook reports that LIS has declined. It began trending down in the 1980s for advanced economies that lowest level over the past half-century is dedicated just before the global financial crisis of 2008. The impressive effect of technology is mentioned as one of the most important variables in reducing the share of labor income.

As expected, estimates of the coefficients of control variables were obtained negative. Share of labor income has declined by decreasing demand for labor by the employer due to the increase of premium paid, tax, and the rising value of raw material. The value of the industrial raw materials in recent years has been increased by sanctions on Iran and rising exchange rates that can make sense to a reduction in LIS in Iran's industry. Because of economic sanctions imposed against Iran, Iran's trading limited especially in the oil, gas, and petrochemicals and exports of refined petroleum products. Also, according to the Central Bank of Iran, the dollar exchange rate rose from 19000 Rls to 32000 Rls. rising of the exchange rate severely influenced Iran's economy that increased the value of raw material that most of them were imported. Imposing Sanctions and consequently, rising exchange rates caused negative effects on economic growth (Shirazi et al., 2016).

There is a positive relationship between the ratio of skilled to unskilled employees and the dependent variable. An important step towards increasing employment can be achieved by training workers according to the needs of industrial firms.

In the next step, elasticities are derived from the APEs which are presented in Table 4. The calculations confirm the results of the previous estimations.

Table 4: Own Wage, Cross, and Output Elasticities of Labor Demand for Different Firm Sizes

Labor Demand Elasticities	Small Firms		Medium Firms		Large Firms	
	10≤E≤49		50≤E≤99		E≥100	
	Coef	(p-value)	Coef	(p-value)	Coef	(p-value)
Own-wage elasticity	-0.87	0.000	-0.44	0.000	-0.61	0.000
Cross elasticity	0.06	0.000	0.15	0.000	0.03	0.029
output elasticity of employment	0.94	0.000	0.33	0.000	0.52	0.000

Note: p-value of labor demand elasticities are obtained by bootstrapping using 1000 replications. All elasticities are significant at a 10% level. The results are calculated by Stata 14.

All elasticities for every group are significant at a 90% confidence level. As expected, own-wage elasticity is negative that is consistent with the fundamental law of factor demand. An increase of 10% in wages reduces employment for the small, medium, and large firms by 8.7%, 4.4%, and 6% respectively. The absolute amount of this elasticity shows that the wage change has more influence in small firms and employment of the medium firms has less fluctuation to wage change.

Positive cross elasticity indicates a substitution relationship between capital price and labor. It implies that the employment will be raised by increasing capital price.

Economic growth creates job opportunities and employment. The results obtained support partially this prediction. The estimated effect on employment of a 1% increase in output is 0.94% at small, 0.33% at medium, and 0.52% at large enterprises. Comparing the obtained results can be revealed that increasing production of small firm productions creates appropriate job opportunities.

Wage and output elasticities of small firms, compared to other establishments, exhibit that an increase or decrease in employment is more with changing wages and output. The results confirm that firm size does matter for job creation or job destruction because the changing wage and output induced the employment of small firms to change more than other groups.

Absolut value of wage and output elasticity is high respectively for small, large, and small. There is not a linear relationship between firm

size and elasticities and a U-shaped form relationship exists between them. In reverse, cross elasticity is high for medium-firm size.

4. Conclusion

Considering the industry's potential in creating job opportunities and employment, this essay investigates labor demand elasticities for three sizes of Iran's industrial enterprises. Labor demand elasticities have been calculated in two steps. In the first step, the affecting factors on LIS were estimated, which can implicitly indicate on the labor demand side. With regards to the fact that the dependent variable was limited to the interval 0 and 1, a fractional panel probit model was used. In the next, by using estimates, own-wage, cross, and output elasticity were calculated.

As mentioned the dependent variable is Fractional, defined on the interval [0, 1], the Fractional Panel Probit was applied for estimating. This estimated method is one of the most important innovations between the present study and other studies, especially with the Iranian study. Own-wage, cross, and output elasticity are calculated from the previous regression. The method of calculating elasticity (using APE) is another distinctive feature of this research.

The findings from the first section for all groups showed that with increasing wage, capital price, and the ratio of skilled to unskilled employees, LIS increases. The effect of the output was obtained negative that reducing the independent variable (LIS) by increasing production can make sense that the increase in production is more capital-intensive than labor-intensive, and leads up to the reduction of LIS. There is a negative relation between tax, the premium paid, the value of raw material, and the dependent variable. The effect of the ratio of skilled to unskilled employees was obtained positive.

In the second part, according to the theoretical, the relationship between labor and wage was estimated as negative. As the price of capital and output rises, it will lead to an increase in the demand for the labor force of the industry. The positive coefficient indicates substitution elasticity between labor and capital price than with the rise in capital price, production techniques move towards labor-intensive and increase labor demand.

A negative elasticity for own-wage and less than one for

substitution elasticity primarily confirm the results of the previous estimations that supported the positive effect of wages on the labor share. Furthermore, elasticities for output and wage changes indicate that smaller firms have a significantly larger response to economic shocks. The results support that there is a relationship between firm size and job creation or destruction. Large firms have the smallest elasticity for capital price and labor. This indicates the cost of capital for large firms compared with larger enterprises has less influence, enabling large firms to have fewer financing restrictions.

Lack of competitiveness and structural weaknesses such as poor infrastructure, weak logistics, and trade facilitation, slow regional integration, and absence of accreditation frameworks are serious challenges to industrialization for developing countries (UNIDO, 2016) which are an obstacle for increasing industrial production capacity. In the end, based on research results and since Iran's labor market is suffering from labor demand shortage and high unemployment, to reduce such problems and increase the utilization of the industrial sector, there are some suggestions for employment creation and increase of production capacity.

Analysis of policies depends on labor demand elasticities. It can be deduced from the results' price elasticity, although a change of wage leads up to an increase in the share of labor income reduces the demand for the labor force. Hence, as applying wage policy, economic policymaker should note that the purpose of this policy is to support the worker to change LIS or change employment.

The derived positive output elasticity of employment implies that increasing production can increase labor demand, especially for small firms. To achieve this, efforts to eliminate production barriers and provide appropriate elements that can motivate industrial firms for utilizing their capacity. Moreover, facilitating credit and financing for investment may be suitable conditions to increase products and then create more employment.

An economic policy-maker, using appropriate policies such as tax breaks, paying part of the employer's insurance, and facilitating the supply of raw material can provide incentives for employers of industrial firms to increase labor demand. Preventing volatility and increasing exchange rates will lead to stabilizing imports of raw

materials that reduce the risk of investment, as a consequence rise in production and demand for labor. Training and increasing skills of employees aligned with the requirements of industrial sectors are also suggested to increase labor demand.

The conclusions of this study require some caveats. The first is the proxy of capital price and output. The choice of other variables as capital price or output proxy may affect the results. A further limitation is that only the province is analyzed as cross-sections. However, in the survey data, there is data for subsectors and their activity of industrial. Hence, the next step in this research project is to estimate labor demand income and calculate elasticities regards to industrial activities.

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