



Defined Contribution Funded Social Security and Labor Supply: Focus on Mexican Social Security Reform in 1997

Sungwoo Hong



Defined Contribution Funded Social Security and Labor Supply: Focus on Mexican Social Security Reform in 1997

Sungwoo Hong

Working Paper 20-03

**Defined Contribution Funded Social Security and Labor Supply:
Focus on Mexican Social Security Reform in 1997**

**KOREA INSTITUTE FOR
INTERNATIONAL ECONOMIC POLICY (KIEP)**
Building C, Sejong National Research Complex, 370,
Sicheong-daero, Sejong-si, Korea
Tel: 82-44-414-1251 Fax: 82-44-414-1144
URL: <http://www.kiep.go.kr>

Heungchong Kim, President

Published July 3, 2020 in Korea by KIEP
ISBN 978-89-322-4295-8 94320
978-89-322-4026-8 (set)
Price USD 3

© 2020 KIEP

Executive Summary

Countries adopting a defined benefit pay-as-you-go (DB PAYG) regime have two options to solve the issue of financial unsustainability: (1) a parametric reform, which alters policies within DB PAYG regime, and (2) a structural reform, which changes the regime from DB PAYG to a defined contribution funded (DC) system. In this study, focusing on the structural reform of Mexico in 1997, I investigate whether structural social security reform affects labor supply. The findings suggest that the change in the social security regime increased both labor force participation and work hours per week. However, in the case of the elderly, the intensive margin effect on labor supply was not statistically significant.

Keywords: Social security reform, Structural reform, Labor supply

JEL Classification: H55, J20

Contributor

Sungwoo Hong

Associate Research Fellow at the Korea Institute for International Economic Policy (KIEP). He received his Ph.D. in Economics in 2019 from University at Buffalo, The State University of New York. His research interests lie in labor economics and Latin America economy.

Contents

Executive Summary 3

1. Introduction 7

2. Mexican Social Security Reform in 1997 10

3. Data 14

4. Identification Strategy 17

5. Results 19

 5-1. Robustness check: Propensity score matching 26

6. Conclusion 28

References 29

Appendix 30

Tables

Table 1. Comparison between the old and new social security regime 11

Table 2. Descriptive statistics 15

Table 3. Estimation results: Extensive margin effect 23

Table 4. Estimation results: Intensive margin effect 24

Table 5. Estimation results by PSM: Intensive margin effect 27

Figures

Figure 1. Average of LFPR by birth cohorts: Age 40 to 49 19

Figure 2. Average of LFPR by birth cohorts: Age 50 to 59 20

Figure 3. Average of LFPR by age groups 21

Appendix

Table A1. Estimation results: Extensive margin effec with 5-year age range 30

Defined Contribution Funded Social Security and Labor Supply: Focus on Mexican Social Security Reform in 1997

Sungwoo Hong

1. Introduction

Dramatic changes in demographic factors such as fertility rate and life expectancy have been leading a number of countries to reform their social security systems. In particular, countries that adopted a defined benefit pay-as-you-go (DB PAYG) system are more likely to modify the scheme as compared to others that chose a defined contribution and funded (DC) scheme since the former is inherently vulnerable to changes in the demographic elements. In other words, these countries suffer from the solvency problem of the social security fund.

Given this concern, countries adopting DB PAYG regime have two options to tackle the financially unsustainable problem in accordance with Mesa-Lago (2006); (1) a parametric reform, which alters policies within DB PAYG regime, and (2) a structural reform, which changes the regime from DB PAYG to DC system. The existing literature has mainly investigated the parametric reforms such as an increase in the Normal Retirement Age (NRA), introduction of the Delayed Retirement Credit, and so on.¹ Meanwhile, very few studies have examined the impact

¹ With regard to the impact of the US parametric reform, see Benitez-Silva and Yin (2007), Blau and Goodstein (2010), Mastrobuoni (2009), Pingle (2006), and Song and Manchester (2007).

of the structural reform even though a number of economists argue that the reform could mitigate a distortion of labor supply under DB PAYG. Numerous studies by Martin Feldstein, including Feldstein (2005) and Feldstein and Samwick (2002), argue that a structural reform could tackle repetitive solvency concerns, suggesting a mixed social security system comprised of DB PAYG and DC regimes.

To look into a structural reform, Latin America might be a good starting point in the sense that many countries in the continent, including Mexico, attempted a structural reform by following Chilean case.² Furthermore, most previous studies about the Chilean social security reform have focused on the effect of reform on economic growth and national savings; they have found the reform could positively affect economic growth and national savings. However, it is still unknown to what extent the reform affects changes in labor supply. To fill this gap, I investigate the impact of structural social security reform on labor supply in Mexico. The reason I select the case of Mexico is that this country carried out a complete shift of its social security regime from DB PAYG to DC, whereas the reform of Chile in 1981 involved a removal of the means-test policy for pensioners in addition to a change from DB PAYG to DC. Eliminating the means-test for pensioners can be found in a reform within a DB PAYG scheme such that in 2000 the United States removed the retirement earnings test for beneficiaries without changing the DB PAYG structure. Therefore, the case of Chilean reform is not appropriate to test whether structural reform affects labor supply. Edwards and James (2010) examined the impact of Chilean social security reform in 1981 on the probability of dropping out of the labor force and found that labor force participation only for pensioners considerably rose due to the reform. The literature pointed out that the findings could stem mainly from the removal of the means-test.

Both Aguila (2011) and Aguila (2014) have documented the causal effects of the 1997 Mexican social security reform; the former analyzed the effect on individual consumption and savings, whereas the latter examined labor force participation and found a rise in early retirement due to the reform by using a simulation based on the option value and peak value methods. However, the simulation that

² Chile is a pioneer in Latin America which altered its social security regime from a DB PAYG to DC system.

Aguila (2014) used assumes that an individual continues to work until they retire, which cannot take into account the effect of reform on those who are out of labor force. Some of those out of labor force could have been affected by the reform if it enhanced the benefit amounts they could receive by encouraging them to work; that is, the reform could decrease the reservation wage of those who are out of labor force. Moreover, the assumption in the literature could be valid only for well-educated workers because these workers are likely to have long work experience or less likely to be displaced in the labor market, compared to others such as low educated workers. As a result, this current paper contributes to these previous studies in that it examines a pure structural reform from DB PAYG to DC system and allows for a policy effect on those out of labor force as well as ordinary workers in the private sector.

In order to identify the causal effects of social security reform on labor supply, I use birth cohorts as a proxy variable for the probability of affiliation with the new DC scheme and estimate the extensive and intensive margin effect. In addition, I estimate the latter effect by the propensity score matching method. The findings are that the change in the social security regime increased labor force participation and work hours per week; however, the intensive margin effect may not be statistically significant among the elderly.

There are some reasons for these outcomes. First, the shift from DB PAYG to DC regime may raise uncertainty as to the future benefit amounts and thus increase labor supply. Second, the DC system in general does not have a redistribution channel between young and old generations. This fact could result in low benefit amounts for those who do not substantially contribute to the social security in comparison to the old DB PAYG regime. Therefore, relatively low benefits may lead to an increase in labor supply. Last, the DC regime is a type of mandatory savings which fully links contributions during work to benefits after retirement. This feature could alleviate distortion in labor supply under PAYG systems.

This paper is organized as follows: Section II presents Mexican social security reform in 1997. Section III describes the micro data that I use, the National Urban Employment Survey. Section IV discusses the identification strategy, and Section V presents the results. Section VI concludes.

2. Mexican Social Security Reform in 1997

In many countries, a concern for the financial sustainability of their social security fund led to reform of the social security system to maintain the systems, including Mexico, who encountered a solvency problem in the early 1990s. Several factors could gradually exacerbate the fiscal sustainability of Mexican social security fund over a long period of time. One of the principal factors is a decrease in the ratio of workers to retirees; that is, the ratio of the contributors to beneficiaries of social security has been decreasing. The drop in the ratio could result from demographic factors such as dramatic changes in fertility rate and life expectancy³ and from a number of informal workers in Mexico who are not mandatorily required to contribute to social security.

In response to concerns over the solvency of the social security fund, the Mexican government implemented the new social security regime in July 1997. A fundamental alteration of the regime is that the government adopted a defined contribution and funded (DC) social security scheme; that is, the government replaced the previous scheme, a defined benefit pay-as-you-go, with the new scheme. The latter is a mandatory savings scheme, and thus each individual has his or her own savings account in which contributions he or she paid while working are accumulated. The balance in the accounts is managed by private fund managers (Administradoras de Fondos de Ahorro para el Retiro, AFOREs). People eligible for the new DC scheme are able to either buy an annuity from their AFOREs or withdraw the balance in lump-sum.⁴ In this new DC system, therefore, a contributor to social security is identical to its beneficiary, in contrast to the DB PAYG in which the social security benefits that retirees receive are financed by the contribu-

³ The fertility rate in Mexico has undergone a dramatic change. According to the World Bank, the fertility rate decreased from 6.83 to 3.47 between 1970 and 1990; the life expectancy between 1970 and 1990 rose from 61.37 years to 70.84, while the US life expectancy for the same periods increased from 70.81 years to 75.21 years.

⁴ Comisión Nacional del Sistema de Ahorro para el Retiro (CONSAR) reported that as of January 2020 AFOREs are managing 4,071,073 million pesos, and their net assets account for 16.5 percent of GDP as of the end of 2019. Furthermore, AFOREs yielded on average about 8.5 percent return rate over the last three years.

tions that current workers pay.

Although the new DC scheme was implemented, it did not apply to all workers. Those who had any work experience prior to the implementation and have not yet retired can choose between the previous social security and the new regimes; these workers are in general called the transition generation. Only the transition generation is required to choose between the two schemes when they claim their social security benefits.⁵ By contrast, those who started working after the implementation are affected only by the new DC scheme; these individuals are called the new generation.

The government changed some details in the social security system while altering the structure of the regime. Table 1 shows how the social security reform changed the details of the regime. The Normal Retirement Age and Early Retirement Age (ERA) for both men and women remained the same and fixed at age 65 and age 60, respectively. Under the new scheme, people who have accumulated a balance of at least the minimum guaranteed pension can retire between the ages of 60 and 64. However, those who possess a balance in their account that exceeds 130 percent of the minimum guaranteed pension, which is equivalent to the minimum wage in Mexico City and is at least guaranteed by the government, can choose to withdraw their balance before age 60.

Table 1. Comparison between the old and new social security regime

	Before SS reform (DB PAYG)	After SS reform (DC)
Normal Retirement Age	Age 65	Age 65
Early Retirement Age	Age 60	Age 60 ¹⁾
Contribution rate		
– Employer	7.95 percent	7.95 percent
– Employee	2.125 percent	2.125 percent
– Government	0.425 percent	0.425 + social quota

⁵ This is one of the differences from the Chilean reform in 1981, in which those who were working had to select between the old DB PAYG and new DC schemes when the reform was implemented. Those who switched to the new regime were given recognition bonds equivalent to the amount previously contributed in the PAYG system (Aguila 2011, p. 4).

Table 1. Continued

	Before SS reform (DB PAYG)	After SS reform (DC)
Minimum duration of contribution for the eligibility	500 weeks	1250 weeks
Benefits at NRA	A percentage of the average wage of the last 5 years prior to retirement ²⁾	Annuity based on the balance in the individual accounts
Benefits at ERA	A decrease by 5 percent for each age below the NRA	Annuity based on the balance in the individual accounts
Minimum guaranteed pension	Minimum wage ³⁾	Minimum wage ³⁾
Maximum pension amounts	10 times minimum wage ³⁾	25 times minimum wage ³⁾
Indexation of benefits	Minimum wage ³⁾	Inflation

Note: 1) The retiree is able to withdraw his/her balance even before age 60 if the balance in the accounts exceeds 130 percent of the minimum guaranteed pension.

2) If an individual contributes more than 500 weeks, he/she receives an additional fraction for each year in excess of 500 weeks. The fraction is a very marginal increase (Dion, 2006).

3) The minimum wage in Mexico City is used to compute the minimum guaranteed pension.

Source: OECD (2017); Social Security Administration (2017); the author has reorganized and revised the tables from Aguila (2011).

The contribution rate that the employer and employee pay remains same as in the previous scheme; the employer and employee contribute to the social security fund by 7.95 and 2.125 percent of employees' wage, respectively. The government pays an additional contribution to the social security system, called social quota, which is a flat-rate equivalent to US\$5 per month (Aguila, 2014). However, in the new regime, 2.8 percent out of the 7.95 percent that the employee pays, 1 percent out of the 2.125 percent that the employer pays, and 0.2 percent out of the 0.425 percent that the government pays are assigned into health service and disability insurance managed by the Mexican Social Security Institute. Hence, a total of 6.5 percent of total wage is accumulated in the individual account for future annuity or withdrawal.

The mandated duration of contribution to be eligible increased from 500 weeks to 1250 weeks. Under the old DB PAYG system the benefit was computed by the average wage of the last 5 years before the retirement, whereas under the new DC scheme it is determined by the balance in the individual account. If an

individual who opted for the DB PAYG scheme retires before age 65, he/she will receive less benefits than which he/she would have received when claiming it at age 65. For example, if the individual retires at age 64, he/she receives 95 percent of the amount that he/she could claim at age 65.

Under both schemes, the Mexican government guarantees the minimum pension amount, which is equivalent to the minimum wage of Mexico City. In addition, the government changed the indexation of the benefit amounts, and thus the amounts are adjusted by inflation, not by minimum wage.

As above mentioned, under DC social security systems contributors receive an annuity based on the contribution they paid while working. This implies that in general these DC schemes do not contain income redistributions between and within younger and older generations, whereas DB PAYG social security regimes do. Therefore, it is likely that the benefits under the DC schemes will be lower than those under the DB PAYG regime, which may lead to a rise in the poverty rate among the elderly.

To tackle this concern, countries adopting a DC regime are likely to introduce measures for contributors to secure at least moderate benefits. Mexico also took into account such measures, reforming the previous social security system. For example, the government increased the duration of contribution, raised the maximum pension amount from 10 times to 25 times minimum wage, introduced the social quota as an additional contribution, and changed the indexation of benefit from minimum wage to inflation. Probably, these modifications were necessary for the new generation to receive at least moderate amounts of benefits, in comparison to the old generation or the transition generation who could apply for the previous DB PAYG regime.

3. Data

I use the National Urban Employment Survey (ENEU) from 1997 to 2004, in order to identify a causal effect of the social security reform on labor supply.⁶ The ENEU is a quarterly survey and provides data on demographic characteristics and information on the employment status of interviewees living in urban areas such as marital status, age, educational attainment, working hours in the last week, whether they are economically active, and so on. The cities covered in the ENEU varied by periods; at the beginning of the survey the data covered 12 cities, and as of 2004 32 cities.

The ENEU has a considerable sample size and covers long durations of time, which contain sufficient periods before and after the implementation of the social security reform, relative to other datasets provided by the Mexican National Institute of Statistics and Geography. In addition, the ENEU is more likely to include appropriate sample for analysis than other data since informal workers, who are not under the social security system, tend to be distributed in rural areas or agricultural sectors. Therefore, the dataset provides me a substantial sample size to identify the causal effects of the reform on labor supply by exploiting the ENEU rather than other datasets interviewing individuals nationwide.

Interviewees rotate every five quarters; that is, they remain in the sample for five quarters, and then leave it. However, I pool the sample due to the lack of information that can identify each individual in the ENEU. In addition, I drop those who are younger than age 15 or older than age 64 from my sample to identify the causal effect of the social security reform on labor supply. The upper bound age 65 is at which the elderly are most likely to claim their benefits. Therefore, including individuals older than age 64 could pose certain challenges to investigate the causal effect; that is, it could be difficult to conclude whether an impact on labor supply resulted from the reform or a change in budget constraints after age 65.

Furthermore, I exclude women from the sample since their labor force partici-

⁶ The ENEU was first conducted in 1987 and then was replaced by the National Survey of Occupation and Employment from 2005. I will explain in the next section why I adopted this time period.

pation rate within this sample is about 47 percent, which is substantially lower in comparison to their male counterparts at approximately 84 percent. Finally, I drop both informal and public workers since the former is not covered under the social security system and the latter is covered under a differentiated social security scheme from the social security scheme, which covers only private workers.

Table 2. Descriptive statistics						
Variables	Overall		Cohort 38/47		Cohort 58/67	
	Mean	(S.D.)	Mean	(S.D.)	Mean	(S.D.)
LFPR	0.839	(0.368)	0.823	(0.381)	0.974	(0.160)
Age	33.2	(13.0)	57.1	(3.42)	37.6	(3.53)
Marriage	0.515	(0.500)	0.805	(0.396)	0.754	(0.431)
Elementary schooling	0.252	(0.434)	0.521	(0.500)	0.264	(0.441)
Secondary schooling	0.319	(0.466)	0.161	(0.367)	0.276	(0.447)
High schooling	0.192	(0.394)	0.057	(0.232)	0.166	(0.372)
2-year college	0.197	(0.398)	0.148	(0.355)	0.249	(0.433)
4-year college/higher	0.041	(0.197)	0.113	(0.317)	0.045	(0.206)
Work experience ¹⁾	0.892	(0.310)	0.998	(0.048)	0.995	(0.071)
Head of household	0.565	(0.496)	0.930	(0.254)	0.840	(0.367)
Income at work ²⁾	3,860	(5,520)	4,088	(7,240)	4,710	(5,911)
Observations	3,909,334		330,187		840,321	

Note: 1) The variable is a dummy which equals to one if an individual had any previous work experience; otherwise, it equals to zero.

2) The statistics of this variable is derived from those who are currently working.

Source: Author’s calculation on the basis of the data.

Table 2 presents the statistics of the entire male sample out of labor force, the unemployed, or workers not in the informal sector. The total observations are 3,909,334, of which 51.5 percent were married. Regarding educational attainment, 25.2, 31.9, 19.7, and 4.1 percent of the total sample had elementary, secondary, 2-year college, and 4-year college or higher, respectively. 89.2 percent of the total observation was currently working or had work experience. The workers on average earned 3,860 pesos for one week from their jobs.

ENEU data do not provide the birth year of each individual, and hence I compute the birth year from the age that the individuals report at the time of the interview for this survey. In Table 2, I present the statistics for the two birth cohorts, 1938 to 1947 and 1958 to 1967, as examples. The former cohort is more likely to be out of the labor market than the latter during the periods, 1997 to 2004. This difference in the labor force participation rate could stem from a variety of factors such as substantial difference in age, earnings, marital status, the social security reform, and so on. In the next section, I will explain the details of how to identify the causal effect of the social security reform on labor supply.

4. Identification Strategy

I investigate the causal impact of Mexican social security reform on labor supply by examining extensive and intensive margin effects. However, the ENEU does not include information on who is affiliated with the old PAYG or the new DC system. To tackle this challenge and identify the causal effect of the social security reform, I follow the identification strategy that Edwards and James (2010) used. In this literature, the researchers used birth cohorts as the proxy variable for the probability of the new regime affiliation of an individual. The reason is that young birth cohorts are more likely to be affiliated with the new DC system, whereas old cohorts are more likely to remain in the old DB PAYG system. In other words, the old cohorts tend to reach the ERA or NRA before the reform implementation, or receive more benefits in the old PAYG system than in the new DC one unless they made contributions to the system for substantial periods; Aguila (2011) found that based on the benefit formula of the old PAYG system, the transition generation would receive higher benefit in the new regime than in the old regime when they paid contributions for at least 22 years to the social security system. Furthermore, those who entered the labor market after the reform are affiliated only with the new DC regime. As a result, birth cohorts could indicate the probability of the new regime affiliation after the social security reform when I control a number of observable characteristics within the sample.

Due to the fact that Mexico experienced a severe economic crisis in 1995, in addition, a variety of policies could have been changed or introduced. Allowing for such a radical change as well as the identification strategy led me to select the observations for only after 1997, the implementation year of the reform, in estimating a causal effect of the reform on labor supply.

To identify an extensive margin effect on labor supply, I create 5-year birth cohorts on the basis of birth year 1933 to 1987; hence, there are 11 birth cohorts in total. I estimate the following probit regression by including the birth cohorts:

$$P(LFP_i = 1 | Cohort_{ci} X_i E_t) = \Phi(\sum Cohort_{ci} \alpha_c + X_i \beta + E_t \gamma + \varepsilon_i) \quad (1)$$

The dependent variable, LFP_i , is a dummy variable, which is equal to one if an individual is either employed or unemployed and zero if he/she is out of labor

force. $Cohort_{ci}$ indicates birth cohort dummy variables, X_i represents personal and household characteristics such as marriage, educational attainments⁷, previous work experience, head of household, and location of residence, and E_t presents year dummies which could control unobservable factors for each year. α_c is the coefficient of interest, which captures the effect of the reform on labor supply as the probability of affiliation with the new DC regime increases. I separately estimate equation 1 by ages such as the forties, the fifties, and sixties in order to control unobservable variables that could be related to age and affect labor supply, and to examine how outcomes vary by ages. For 1997 to 2004, indeed, there were no changes in social policies which affected the birth cohorts differently, and thus α_c could measure the causal impact on labor supply of the social security reform, but not of other policy changes.

To investigate an intensive margin effect on labor supply, I regress working hours on the same independent variables as in equation 1 by the ordinary least squares (OLS) as follows:

$$workhours_i = \sum Cohort_{ci}\alpha_c + X_i\beta + Z_i\delta + E_t\gamma + \varepsilon_i \quad (2)$$

The dependent variable, *workhours*, indicates how many hours an individual worked at their main job for the last week before the interview. I control additional individual characteristics, Z_i , to the variables in equation 1 such as earnings from the job and the sectors where an individual is currently working.⁸ These variables could affect individual working hours as well. As in estimating the extensive margin effect, I separately estimate equation 2 by ages and compare the outcomes.

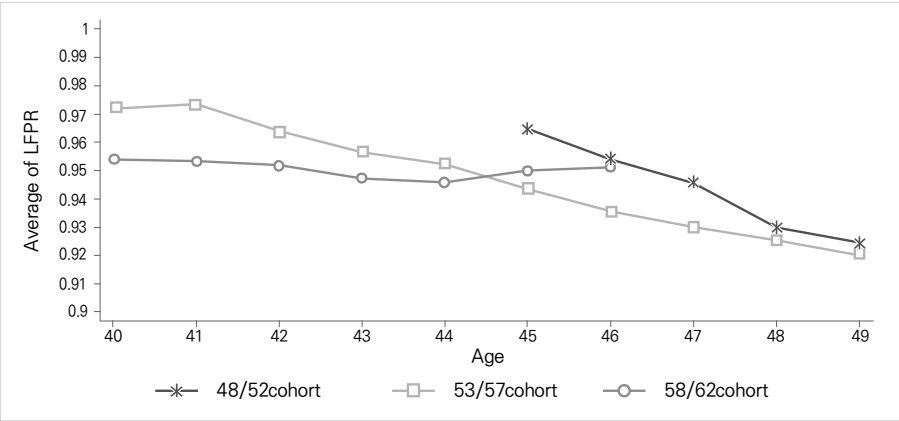
⁷ This variable is a categorical variable, which equals to 1 for an individual whose highest degree is elementary school, 2 for middle school, 3 for high school, 4 for 2 year-college, and 5 for 4-year university or higher educational institution.

⁸ I categorize the working sectors into 9 sectors as follows: 1. Agricultural, forestry, and fisheries, 2. Mining, 3. Manufacturing industry, 4. Construction, 5. Electricity, gas, and drinking water, 6. Commerce, restaurants, and hotels, 7. Transport, storage, and communications, 8. Financial service, insurance, and real estate, 9. Social and personal service.

5. Results

Figures 1 and 2 show the average of labor force participation rates across age and birth cohorts from ENEU data, excluding those working in the informal and public sectors. Figure 1 presents that younger birth cohorts are likely to show lower labor force participation rate (LFPR) than older birth cohorts, except for a few age ranges. For example, the LFPR of the 1953 to 1957 cohort at age 40 is about 97.2 percent, and the LFPR of the 40 years old from the 1958 to 1962 cohort is approximately 95.4 percent; LFPRs for the 1948/52 cohort and the 1953/57 cohort at age 45 are 96.5 and 94.3 percent, respectively.⁹ This may not be intuitive when we expect the social security reform to raise the LFPR of younger generations who are more likely to be affiliated with the new regime.

Figure 1. Average of LFPR by birth cohorts: Age 40 to 49



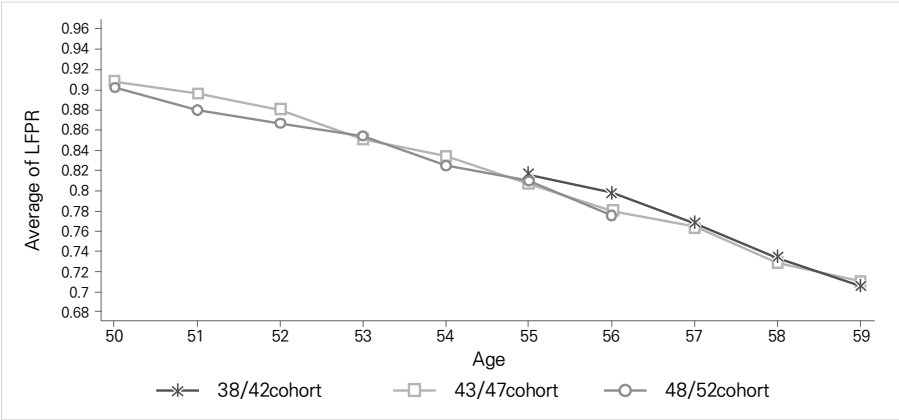
Source: Author's calculation based on ENEU data.

⁹ LFPR seems too high, compared to the average of LFPR of the total population ages over 15 in Mexico. According to the World Bank, for example, LFPR in 2004 was 60.7 percent. The possible reason for the high LFPR is that the sample includes only male workers who are living in urban areas and whose age is between 15 and 64.

Some factors are potentially related to this result that the graph may not be intuitive to interpret. First, the different birth cohorts at one age worked in different years and the labor market, which means that some cohorts might have been under a dissimilar situation to that facing other cohorts. Second, individual characteristics such as educational attainment may considerably vary among the birth cohorts; Table 2 shows that the level of schooling is higher in the younger cohort than in the older one.¹⁰ Third, the age range in Figure 1, age 40 to 49, may be too young to identify the causal effect of the social security reform, given the fact that 15 to 20 years remain until retirement.

Figure 2 presents the average of the LFPR across age 50 to 59 by birth cohorts. In contrast to Figure 1, the patterns of the LFPR in Figure 2 are fairly consistent across the ages; that is, younger cohorts are likely to have a lower LFPR than which older cohorts show although at some ages opposite patterns appear. The average of LFPR for all of the birth cohorts tends to decline faster in age 50 to 59 compared to the age 40 to 49 presented in Figure 1.

Figure 2. Average of LFPR by birth cohorts: Age 50 to 59

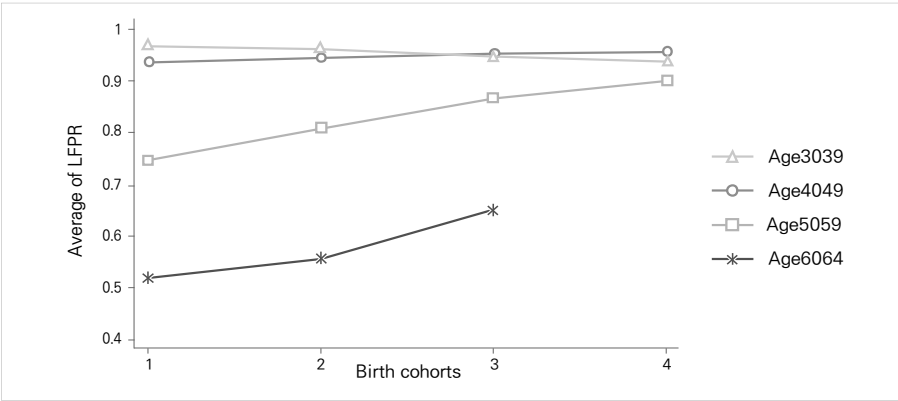


Source: Author's calculation based on ENEU data.

¹⁰ The reason that the 1938/1947 cohort have higher schooling in 4-year and higher college than the 1958/1967 cohort is that the latter is likely to be younger than the former in the sample. That is, the younger cohort is unlikely to have sufficient time to finish the high education.

Figure 3 depicts the average LFPR of each birth cohort over four groups by age. In the figure, the horizontal axis represents the birth cohort corresponding to each age group; for example, for the 30 to 39 age group, the 1958/62 cohort equals to 1, the 1963/67 cohort equals to 2, and so on.¹¹ In contrast to the two figures above, Figure 3 shows the outcomes that we expect. The average of LFPR tends to decrease with age, as individuals reach the NRA. In addition, the LFPR is likely to rise with birth cohorts. In other words, the younger birth cohorts within each age group show a higher LFPR than the older cohorts. By contrast, however, LFPR decreases with the birth cohorts in the youngest age group, 30 to 39. The decrease in LFPR for this age group may mainly stem from some factors other than the social security reform, or may not be statistically significant among the birth cohorts.

Figure 3. Average of LFPR by age groups



Source: Author's calculation based on ENEU data.

To complement the figures and quantify the causal effect of the social security reform, I estimate equation 1 and present the findings in Table 3. The reason that I

¹¹ For the age 40 to 49 group, the number 1, 2, 3, and 4 in the horizontal axis indicate the 1948/52, 1953/57, 1958/62, and 1963/67 cohorts, respectively. The horizontal axis presents the 1938/42 to 1953/57 cohort for the age 50 to 59 group and 1933/37 to 1943/47 cohort for the age 60 to 64 group.

separately estimate the equation by the age groups is that the impact of the social security reform on labor supply may vary among age groups. In column (1) of the table, which shows the outcomes for the age 40 to 49, the younger birth cohorts are more likely to take a part in the labor market than the older cohorts. The marginal effect of the 1953/57 cohort's labor force participation is 0.028, based on the coefficient; that is, the 1953/57 cohort have 2.8 percent points higher probability of labor force participation than that of the base birth cohort, 1948/52 cohort. Similarly, the results of marginal effects show that the 1958/62 and the 1963/67 birth cohorts have 4.4 and 5.2 percent points higher probability of labor force participation in comparison of the base cohort, respectively. Therefore, it is likely that the change in the social security regime increased labor supply.

I found analogous outcomes for the other age groups, age 50 to 59 and 60 to 64, to the group of age 40 to 49. In column (2), which shows the results for the age 50 to 59, the coefficient on each birth cohort implies that younger birth cohorts are more likely to enter the labor market than the older cohorts. The probabilities of the 1943/47, 1948/52, and 1953/57 birth cohort's labor force participation are 11.1, 19.4, and 23.9 percent points greater than that of the 1938/42 cohort, respectively. Coefficients in column (3) also imply that for the age 60 to 64, the younger the birth cohort is, the higher the probability of labor supply is. The marginal effects for 1938/42 and 1943/47 cohorts indicate 11.9 and 24.2 percent point higher probabilities of labor force participation than that of the 1933/37 cohort, respectively. Therefore, I found in all the age groups that the social security reform raised their labor supply.¹²

Table 3 presents that those who are married, highly educated, or head of household are more likely to participate in the labor market. In addition, those who had previous work experience show a higher probability of labor force participation than those without any work experience. As for the marginal effects for the 40 to 49 age group, a married individual has 3 percent points higher labor force participation than non-married, an increase in the educational category variable leads

¹² It may be pointed out that the findings did not result solely from the change in the social security regime. For example, difference in the life expectancy of each cohort could also affect the labor force participation. Therefore, controlling characteristics of each birth cohort in the equation would be necessary in future research.

to 0.6 percent points higher probability of labor force participation, and a head of household shows 5.8 percent points higher probability of participation than non-head of household. Those who previously worked in a different workplace have 28.9 percent points higher probability of labor force participation than those without previous work experience.

It may be pointed out that some cohorts do not appear in all of the age ranges; for example, an individual in the 1953 birth cohort was 43 or 44 years old in 1997, and thus the birth cohort does not include observations on subjects age between 40 and 42. This fact might lead the estimates in Table 3 to be biased. For this reason, I narrow down the age range and estimate equation 1. I present Table 6 in the appendix, and it shows consistent results with those in Table 3.

Table 3. Estimation results: Extensive margin effect

Dependent variable: Labor force participation	(1) Age 40 to 49	(2) Age 50 to 59	(3) Age 60 to 64
1938/42 cohort			0.309*** (0.014)
1943/47 cohort		0.365*** (0.009)	0.653*** (0.025)
1948/52 cohort		0.734*** (0.011)	
1953/57 cohort	0.237*** (0.011)	1.022*** (0.022)	
1958/62 cohort	0.428*** (0.012)		
1963/67 cohort	0.552*** (0.025)		
Marriage	0.324*** (0.009)	0.115*** (0.008)	0.045*** (0.012)
Education	0.068*** (0.003)	0.010*** (0.003)	0.050*** (0.004)
Work experience	3.189*** (0.092)	2.904*** (0.135)	2.301*** (0.277)
Head	0.639*** (0.010)	0.413*** (0.012)	0.249*** (0.018)
Year	Yes	Yes	Yes
Region	Yes	Yes	Yes
Num. of obs.	403,319	241,014	84,956
Pseudo R ²	0.119	0.053	0.024

Note: 1) The robust standard error is in the parentheses.
2) ***, **, and * present statistically significant at 1%, 5%, and 10% significance level, respectively.
3) The base birth cohorts for the 40 to 49, 50 to 59, and 60 to 64 age groups are 1948/52, 1938/42, and 1933/37 cohorts, respectively.
4) The dependent variable is a dummy variable, which equals to one if an interviewee is working or looking for a jobs; otherwise, zero.

Source: Author's calculation based on ENEU data.

Table 4 shows the results of the intensive margin effect of the social security reform on labor supply, which is measured by working hours per week. According to the table, it is likely that the change in the social security regime increased working hours per week in the age 40 to 49 and 50 to 59 groups, whereas the reform did not affect working hours in the 60 to 64 age group.

In column (1), which shows the results for the 40 to 49 age group, the coefficient on the 1953/57 cohort is not statistically significant, whereas the coefficients on the 1958/62 and 1963/67 cohorts are statistically significant. These outcomes present that younger cohorts are more likely to work more each week than older cohorts. For example, the 1958/62 and 1963/67 cohorts worked 0.26 and 0.43 hours more per week than the 1948/52 cohort did, respectively. Similarly, for the 50 to 59 age group, which is shown in column (2), the 1948/52 and 1953/57 cohorts worked 0.29 and 0.80 hours more than the 1938/42 cohort did, respectively. By contrast, column (3) indicates that for the 60 to 64 age group, the coefficients on the 1938/42 and 1943/47 cohorts are insignificant, and thus the intensive margin effect is not found in this age group.

These findings imply that the new DC scheme does not provide the elderly with an incentive to increase their work hours. Under the new regime the marginal utility from leisure may be greater than that from an increase in work hours since the increment in work hours may not lead to substantial rise in the amount of the social security benefits, in contrast to the old DB PAYG regime in which the benefit amounts were determined by the average wage of the last 5 years prior to retirement. This channel could offset the impact of the social security reform on working hours.

Table 4. Estimation results: Intensive margin effect

Dependent variable: Labor force participation	(1) Age 40 to 49	(2) Age 50 to 59	(3) Age 60 to 64
1938/42 cohort			-0.051 (0.362)
1943/47 cohort		0.141 (0.157)	0.334 (0.636)
1948/52 cohort		0.287* (0.172)	
1953/57 cohort	0.124 (0.095)	0.796** (0.302)	
1958/62 cohort	0.261** (0.105)		

Table 4. Continued

Dependent variable: Labor force participation	(1) Age 40 to 49	(2) Age 50 to 59	(3) Age 60 to 64
1963/67 cohort	0.433** (0.195)		
Marriage	0.071 (0.090)	0.049 (0.139)	-0.145 (0.316)
Education	-0.484*** (0.030)	-0.673*** (0.046)	-1.763*** (0.110)
Head	0.370*** (0.119)	0.092*** (0.212)	-0.541 (0.509)
Log(earnings)	1.946*** (0.057)	1.647*** (0.075)	2.168*** (0.142)
Working sector	Yes	Yes	Yes
Year	Yes	Yes	Yes
Region	Yes	Yes	Yes
Num. of obs.	149,729	71,088	15,157
R ²	0.076	0.059	0.072

Note: 1) The robust standard error is in the parentheses.

2) ***, **, and * present statistically significant at 1%, 5%, and 10% significance level, respectively.

3) The base birth cohorts for the 40 to 49, 50 to 59, and 60 to 64 age groups are 1948/52, 1938/42, and 1933/37 cohorts, respectively.

4) The dependent variable is working hours in the last week before the interview.

Source: Author's calculation based on ENEU data.

The coefficient on marriage is statistically insignificant in all of the age groups. The coefficient on educational attainment is statistically significant and negative for all of the age groups, which could stem from that a highly educated person is likely to be paid higher earnings per hour than workers of lower education; therefore, the former may have an incentive to lower labor supply due to the income effect dominating the substitution effect. The significant and positive coefficient on the earnings means a positive correlation between working hours and total earnings. The coefficients on the head are statistically significant and positive in the age 40 to 49 and 50 to 59 group, whereas it is insignificant in the age 60 to 64 group. The heads of household of the age 40 to 49 and 50 to 59 are likely to work 0.37 and 0.09 hours more than their counterparts, respectively.

From Tables 3 and 4, as a result, I found the causal effects of the reform on labor supply that is measured by both labor force participation and working hours. However, it is unlikely that the intensive margin effect is significant for the 60 to 64 age group.

5-1. Robustness check: Propensity score matching

In this subsection, I use the propensity score matching method as an additional identification strategy to investigate the intensive margin effect of the social security reform. As in Aguila (2011), the treatment group consists of male workers in private and formal sectors after the social security reform, whereas the control group contains only public workers. The latter is most likely to affiliate with Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE),¹³ which continually maintains the DB PAYG scheme and operates separately from Instituto Mexicano del Seguro Social (IMSS) for private sector workers. Furthermore, ISSSTE did not change its regime during the period of 1997 to 2004, which I analyze to identify the intensive margin effect of the social security reform. Therefore, the social security reform in 1997 was not relevant to ISSSTE.

To conduct the propensity score matching analysis, I take into account observable variables such as the birth cohorts in the preceding analysis, age, marriage, educational attainment, head of household, metropolitan areas where an individual is living, year and quarter when he/she is working.

Table 5 presents the average treatment effect on the treated (ATT) by the propensity score matching. It indicates the extent to which the working hours per week would have changed if the control group had been the treatment group, which measures a causal effect of the reform in terms of an intensive margin effect. The reason for the rise in the number of observations in this table in comparison to Table 4 is that one observation in the treatment group matches multiple observations in the control group. Table 5 presents that for the 40 to 49, 50 to 59, and 60 to 64 age groups, the shift to DC system increased work hours per week by 6.6, 7.1 and 5.3 hours, respectively. Therefore, I found consistent results with the findings from Table 4; however, the 60 to 64 age group may not raise work hours due to the reform on the basis of Table 4.

¹³ I implicitly assume that all of the public workers affiliate with ISSSTE.

Table 5. Estimation results by PSM: Intensive margin effect

Dependent variable:	(1)	(2)	(3)
Working hours last week	Age 40 to 49	Age 50 to 59	Age 60 to 64
ATT	6.619*** (0.077)	7.146*** (0.130)	5.277*** (0.471)
Num. of observations	438,649	214,349	45,055

Note: The robust standard error is in the parentheses.
Source: Author's calculation based on ENEU data.

6. Conclusion

This paper investigated whether the shift of social security from DB PAYG to DC increased labor supply, focusing on the Mexican social security reform in 1997. In contrast to the Chilean reform in 1981, the Mexican reform is a relatively pure structural reform. These characteristics of the reform provide a good opportunity to test the research question.

In order to identify the causal effect, I used the National Urban Employment Survey and estimated both extensive and intensive margin effects. As a result, I found that the reform encouraged labor force participation and increased work hours. However, the intensive margin effect was not found in the 60 to 64 age group.

There are a few rationales to explain the causal effect of the social security reform on labor supply. In general, the shift from DB PAYG to DC system leads to raising uncertainty on the future benefit, eliminating a redistribution channel between generations, and fully linking contributions during work to benefit amounts after retirement. These features on the changes of social security scheme could be attributed to increasing labor supply.

I did not investigate the way in which the social security reform affects to increase labor supply. The question of which channels dominated the others and led to raising labor supply is still unresolved.¹⁴ Identifying this is important to policy makers since measures to increase the uncertainty on the future benefit and remove the redistribution channel could be introduced within DB PAYG, whereas fully linking the contributions to the benefits is an intrinsic characteristic of the DC regime. That is, if the increase in labor supply resulting from the social security reform is due to the full linkage between the contributions and the benefits, the policy makers could take into account a structural reform as an alternative to a parametric reform. I leave this for future research.

¹⁴ For example, examining a causal impact of the social security reform by asset or total income could test whether the causal effect resulted from relatively low benefit amounts to those in the old DB PAYG, which stems from the removal of income redistribution between generations.

References

- Aguila, Emma. 2011. "Personal retirement accounts and saving" *American Economic Journal: Economic Policy*, 3(4): 1-24.
- . 2014. "Male labor force participation and social security in Mexico." *Journal of Pension Economics and Finance*, 13: 145-171.
- Benitez-Silva, Hugo and Na Yin. 2007. "An analysis of the effects of recent social security reforms using aggregate and public-use administrative micro data." Mimeo.
- Blau, David and Ryan Goodstein. 2010. "Can social security explain trends in labor force participation of older men in the United States?" *Journal of Human Resources*, 45: 328-363.
- Dion, Michelle. 2006. "Women's welfare and social security privatization in Mexico." *Social Politics*, 13: 400-426.
- Edwards, Alejandra Cox and Estelle James. 2010. "Impact of social security reform on labor force participation rates of pensioners and nonpensioners: Evidence from Chile." *Journal of Human Capital*, 4: 130-172.
- Feldstein, Martin. 2005. "Structural reform of social security." *Journal of Economic Perspective*, 19(2): 33-55.
- Feldstein, Martin and Andrew Samwick. 2002. "Potential paths of social security reform." *Tax Policy and the Economy*, 16: 181-224.
- Mastrobuoni, Giovanni. 2009. "Labor supply effects of the recent social security benefit cuts: empirical estimates using cohort discontinuities." *Journal of Public Economics*, 93: 1224-1233.
- Mesa-Lago, Carmelo. 2006. "Private and public pension systems compared: an evaluation of the Latin American Experience." *Review of Political Economy*, 18(3): 317-334.
- OECD. 2017. "Pension at a glance 2017."
- Pingle, Jonathan 2006. "Social security's delayed retirement credit and the labor supply of older men." Finance and Economics Discussion Series 2006-37. Board of Governors of the Federal Reserve System (U.S.).
- Song, Jae and Joyce Manchester. 2007. "Have people delayed claiming retirement benefits? Responses to changes in social security rules." *Social Security Bulletin*, 67: 1-23.
- Social Security Administration. 2017. "Social security program throughout the world."

Appendix

Table A1. Estimation results: Extensive margin effec with 5-year age range

Dependent variable: LFP	(1) Age 40 to 45	(2) Age 45 to 49	(3) Age 50 to 55	(4) Age 55 to 59
1938/42 cohort				
1943/47 cohort			0.256*** (0.033)	0.228*** (0.014)
1948/52 cohort		0.125*** (0.015)	0.521*** (0.035)	0.415*** (0.025)
1953/57 cohort	0.152*** (0.046)	0.284*** (0.030)	0.783*** (0.041)	
1958/62 cohort	0.278*** (0.047)			
1963/67 cohort	0.412*** (0.053)			
Marriage	0.365*** (0.012)	0.275*** (0.013)	0.142*** (0.011)	0.076*** (0.012)
Education	0.070*** (0.004)	0.063*** (0.004)	0.022*** (0.003)	−0.007* (0.004)
Work experience	3.093*** (0.098)	3.383*** (0.185)	2.974*** (0.165)	2.840*** (0.224)
Head	0.668*** (0.013)	0.595*** (0.015)	0.455*** (0.015)	0.321*** (0.018)
Year	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes
Num. of obs.	268,798	174,226	161,526	102,471
Pseudo R ²	0.142	0.087	0.043	0.028

Note: 1) The robust standard error is in the parentheses.
2) ***, **, and * present statistically significant at 1%, 5%, and 10% significance level, respectively.
3) The base birth cohorts for the 40 to 49, 50 to 59, and 60 to 64 age groups are 1948/52, 1938/42, and 1933/37 cohorts, respectively.
4) The dependent variable is a dummy variable, which equals to one if an interviewee is working or looking for a jobs; otherwise, zero.

Source: Author’s calculation based on ENEU data.

국문요약

공적연금의 운영방식으로 확정급여형 부과방식(defined benefit pay-as-you-go)을 채택하고 있는 국가들은 기대수명 증가 및 고령화와 같은 인구학적 요인의 변화로 인해 공적연금기금 안정화에 어려움을 겪어왔다. 이러한 국가들이 공적연금기금의 재정안정화를 위해 취할 수 있는 개혁의 방향은 크게 두 가지로 구분된다. 첫째는 모수적 개혁(parametric reform)으로 확정급여형 부과방식의 틀을 유지한 채 제도를 개선하는 것이며, 둘째는 구조적 개혁(structural reform)으로 확정급여형 부과방식을 확정기여형 적립방식(defined contribution funded)으로 제도 운영방식을 개혁하는 것이다. 본 연구에서는 1997년 멕시코의 공적연금 개혁사례를 활용하여 구조적 개혁의 노동공급효과를 추정하였다. 추정 결과 멕시코의 공적연금 개혁은 노동 참여와 주당 근로시간을 증가시킨 것으로 나타났다. 그러나 60세 이상의 노년층에서는 공적연금 개혁이 주당 근로시간을 유의미하게 증가시키지는 못하는 것으로 분석되었다.

핵심용어: 공적연금 개혁, 구조적 개혁, 노동공급

홍성우

서울시립대학교 경제학 학사 및 석사

뉴욕주립대학교 버팔로 경제학 박사

대외경제정책연구원 세계지역연구센터 선진경제실 미주팀 부연구위원

(現 E-mail: swhong@kiep.go.kr)

저서 및 논문

Essays on Social Security and Labor Issues, Ph.D dissertation

KIEP List of Working Papers (2018–2020.7)

■ 2020	20-01	Trump Tariff and Firm Relief: Winners and Losers from Steel Tariff Exclusion Request Yeo Joon Yoon and Wongi Kim
	20-02	Global Financial Imbalance: Firm-level Evidence from Korea Tae Soo Kang, Kyunghun Kim, and Yuri Kim
	20-03	Defined Contribution Funded Social Security and Labor Supply: Focus on Mexican Social Security Reform in 1997 Sungwoo Hong
■ 2019	19-01	Push vs. Pull Factors of Capital Flows Revisited: A Cross-country Analysis Tae Soo Kang and Kyunghun Kim
	19-02	Deeper Regional Integration and Global Value Chains Nakgyoon Choi
	19-03	Repercussions of Negatively Selective Migration for the Behavior of Non-migrants when Preferences are Social Oded Stark and Wiktor Budzinski
	19-04	The Effect of Export Insurance and Guarantees on Export Performance: An Empirical Analysis for Korea Kyunghun Kim and Hyelin Choi
	19-05	New Delhi's 'Act East' and the India-ASEAN Engagement: What They Mean for India-Korea Relations in the Indo-Pacific Jagannath P. Panda
	19-06	Institutional Quality, Trade Costs and Comparative Advantage Sangkyom KIM and Soon Chan Park
	19-07	Stakeholders' Interest Relations in Korea's Services Trade Liberalization: A Political Economy Analysis June Dong Kim
	19-08	The Effects of Technological Similarity and Diversity on Merger and Innovation Gu Sang Kang
	19-09	The Effects of US Sectoral Shocks through the World Input-Output Network Minsoo Han

■2018

- 19-10 How Does Protectionist Trade Policy Interact with FDI?
Jongduk Kim and Moonhee Cho
- 18-01 Vietnam's Low National Competitiveness: Causes, Implications
and Suggestions for Improvement
LE Quoc Phuong
- 18-02 Financial Market Integration and Income Inequality
Jae Wook Jung and Kyunghun Kim
- 18-03 Exchange Rates and Firm Exports: The Role of Foreign Ownership
and Subsidiaries
Hyelin Choi and Hyo Sang Kim
- 18-04 A Quantitative Trade Model with Unemployment
Kyu Yub Lee
- 18-05 A Study on the Dynamics of Foreign Trade and the Issues of
Regional Economic Integration in Central Asia
Kodirjon Maxamadaminovich Umarkulov
- 18-06 Sources of Comparative Advantage in Services: Institution vs.
Social Capital
Nakgyoon Choi and Soonchan Park
- 18-07 The Rise of China and the Rebound in Korea's Manufacturing
Employment
Kyong Hyun Koo and Unjung Whang
- 18-08 The Spillover Effects of Regional Trade Agreements on Trade
Dakshina G. De Silva · Soon-Cheul Lee · Robert P. McComb · Maurizio Zanardi



Defined Contribution Funded Social Security and Labor Supply: Focus on Mexican Social Security Reform in 1997

Sungwoo Hong

Countries adopting a defined benefit pay-as-you-go (DB PAYG) regime have two options to solve the financial unsustainability: a parametric reform and a structural reform. In this study, focusing on the structural reform of Mexico in 1997, I investigate whether a structural social security reform affects labor supply. The findings suggest that the change in the social security regime increased both labor force participation and work hours per week.

