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ABSTRACT

Did Soviet Elderly Employment Respond to Financial Incentives? Evidence from Pension Reforms[*]

This study answers the open question of whether workers respond to financial incentives in a command economy. To do this, I evaluate pension reforms in Soviet Russia in 1964 and 1969 that allowed pensioners to receive a greater share of their pensions if they worked, resulting in a progressive elimination of benefit reduction rates. Variation in group eligibility and variation in benefit reduction rates in eastern and western regions allow for the use of several difference-in-differences frameworks. I collect and digitize novel data from the Soviet archives on pensioner employment, constructing the first database of the Soviet old-age labor market. I find that Soviet pensioners are responsive to financial incentives. By 1969, after the benefit reduction rate fell from an average of 47.8 to 24.1 percent, pensioner employment rates rose by 5.7 percentage points, representing a 47 percent increase. Finally, I provide illustrative estimates of the employment elasticity with respect to the average net-of-tax rate that range from 0.6 to 1.4.

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Do workers in a command economy respond to financial incentives? In one common view of one of the largest command economies in history, the Soviet labor market was fundamentally different from a capitalist one. Such a view emanates from well-known differences such as the central determination of wages, a "duty" to work among prime-age citizens, limited geographic mobility, centralized planning, and the unavailability of part-time work. These differences may imply that incentives did not play a prominent role. Despite these differences, many economists and historians take an alternative view and argue that the forces of supply and demand were important in the Soviet labor market (Atkinson and Micklewright 1992, Granick 1987, Gregory and Kohlhase 1988, Nove 1977). For instance, Atkinson and Micklewright (1992) write "there was an active labour market in the Communist countries", and "wage differentials have been set with regard to incentives to invest in human capital, to enter occupations with unpleasant conditions, to bear responsibility, to work hard on the job and to move to industries or areas selected for an expansion of employment." Furthermore, workers enjoyed a high level of freedom in the choice of level of education, occupation, employer, and quitting their jobs at will. The coexistence of these two views makes the role of incentives in the Soviet Union an important empirical question which I shed light on using major pension reforms and novel labor market data.

Even though the Soviet Union represented the third largest labor market in the 20th century, reaching a population of 290 million people by 1990, little is known empirically about its labor market. The small previous literature on the Soviet labor market has several limitations (Brainerd 1998, Gregory and Kohlhase 1988, Katz 1998, Ofer and Vinokur 1985). First, it lacks historical data that are representative, large-scale, and span many years, and instead uses cross-sectional data from emigrants or surveys, and is entirely correlational. Second, it focuses on the period starting from the late 1980s, when the labor market started transitioning away from the Soviet system.

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Third, it focuses on determinants of wages, and not on the decision of whether to work.[1]

This paper is the first to evaluate the effect of several pension reforms in the Russian Soviet Federative Socialist Republic (from now on referred to as "Soviet Russia") on employment among old-age pensioners.[2] Facing a decline in population after World War II, the Soviet government was eager to increase its labor supply. This was an important goal because Soviet economic growth relied heavily on growth in labor supply (Allen 2003). Fascinatingly, the Soviet government decided to use financial incentives to induce pensioners to delay retirement, because unlike prime-age individuals, pensioners had a choice of whether to work.

Major reforms in 1964 and 1969 allowed working pensioners to keep a greater share of their pension. Pensions ranged between 30 and 120 rubles, but before 1964, individuals were only allowed to keep 15 rubles of the pension if current earnings did not exceed 100 rubles, and no pension if current earnings exceeded 100 rubles. This resulted in substantial benefit reduction rates – the benefits lost as a share of earnings while employed. The benefit reduction rate rose with current earnings and I estimate it was on average 47.8 percent before 1964.[3] Major reforms progressively eliminated the benefit reduction rate. After the 1964 reform, employed pensioners could receive a larger share of their pension: 50 percent in western regions, and 75 percent in eastern regions. I estimate an average benefit reduction rate of about 24.1 percent after the 1964 reform.[4] After subsequent 1969 reforms, employed pensioners could receive their entire pension, resulting in a 0 percent benefit reduction rate. Full-term pensioners, who achieved the required

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[1] In more recent work, Malkova (2018) evaluates the effect of paid parental leave in Soviet Russia on childbearing.
[2] Men became eligible for old-age pensions at age 60, while women at age 55.
[3] Because 81 percent of pensioners in 1959 had earnings below 100 rubles with an average pension (earnings) of 39.9 (52.6) rubles, while those with earnings of at least 100 rubles had an average pension (earnings) of 73.9 (142.3) rubles, I calculate the average benefit reduction rate: $0.81 * \frac{39.9-15}{52.6} + 0.19 * \frac{73.9}{142.3} = 0.478$.
[4] Because average pensions (earnings) in 1966 were 52.5 (95.5) rubles, and 75.5 percent of pensioners resided in western regions, I calculate the average of benefit reduction rate: $0.245 * \left(\frac{0.25*52.5}{95.5}\right) + 0.755 * \left(\frac{0.5*52.5}{95.5}\right) = 0.241$.

service record, were eligible for both reforms, while incomplete-term pensioners, who had a shorter service record, were not eligible for either reform.

I create the first database of the Soviet pensioner labor market, which allows me to empirically evaluate Soviet pension reforms. I collect and digitize handwritten administrative and survey statistics housed in the archives in Moscow, which were not publicly available before the Soviet Union collapse and have remained undiscovered to academic economists and historians. These data improve upon previously used data, because they are administrative, longitudinal, and are not on the transition period.[5] Importantly, these data contain the most reliable records on the labor supply of pensioners in the Soviet Union and contain annual, and oblast-level (Soviet Russia had 73 oblasts, which are like states) tabulations of the number of all pensioners and employed pensioners. First, I use oblast-level administrative records to construct employment rates from 1957 to 1975 separately for full-term and incomplete-term pensioners. Second, I use a 10-percent random sample of pensioners from tabulated oblast-level surveys done in 1959 and 1966 to construct employment rates within several earnings groups.

Variation in eligibility and variation in regional implementation of pension reforms enable the use of several difference-in-differences frameworks to causally estimate the effect of financial incentives on employment of pensioners. First, I compare full-term pensioners (treatment), whose benefit reduction rate fell from 47.8 to 24.1 percent, to incomplete-term pensioners (control), whose benefit reduction rate has not changed. This allows me to estimate the effect of the 1964 reform for *all* full-term pensioners. By 1966, employment rates among full-term pensioners rose by 2.8 percentage points representing a 25.8 percent increase. By 1969, these employment rates rose by 5.7 percentage points, representing a 47 percent increase. Second, I compare full-term

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[5] For previous work see: Brainerd 1998, Gregory and Kohlhase 1988, Katz 1998, Ofer and Vinokur 1985.

pensioners in the eastern and western regions, who experienced differential falls in the benefit reduction rate: eastern regions are the treatment group after the 1964 reform, while western regions are the treatment group after the 1969 reforms. After the 1964 reform, eastern regions experienced a larger decline in benefit reduction rates (from 47.8 to 13.7 percent) relative to western regions (from 47.8 to 27.5 percent). Over 4 years after the 1964 reform, employment rates increased by 1.7 percentage points (20.7 percent) more in *eastern relative to western* regions. After the 1969 reforms, western regions experienced a larger decline in benefit reduction rates (from 27.5 to 0 percent) relative to eastern regions (from 13.7 to 0 percent). Over 5 years after the 1969 reform, employment rates increased by 1.8 percentage points (9.3 percent) more in *western relative to eastern* regions. Third, I estimate heterogeneous responses to the 1964 reform within earnings groups by comparing eastern and western regions. Increases in employment rates are concentrated in the middle of the income distribution, with no effects outside of the 12th to 95th percentiles.

I use my estimates of the effect of pension reforms on employment to construct *illustrative* extensive-margin elasticities with respect to the average net-of-tax rate. The elasticities in the Soviet context range from 0.6 to 1.4 providing evidence on the role of incentives. Previous literature has provided a wide range of elasticity estimates for older workers. On one hand, several empirical studies on the earnings test – reduction in benefits once earnings pass a threshold, in the United States (Gelber et al. 2018) and Norway (Hernæs et al. 2016), and on responsiveness to income taxes in the United States (Alpert and Powell 2019) estimate substantial elasticities among older individuals. Similarly, several structural studies (French 2005, Laitner and Silverman 2012) estimate substantial elasticities, which are in the range of those found in the Soviet context. On the other hand, some empirical studies estimate small employment elasticities (Chetty et al. 2012).[6]

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[6] See Brown (2013), Gruber and Wise (1999) and Manoli and Weber (2016).

Further, small employment elasticities are identified in the context of the earnings test in the United States (Friedberg and Webb 2009, Gruber and Orszag 2003, Song and Manchester 2007, Haider and Loughran 2008), Canada (Baker and Benjamin 1999) and the United Kingdom (Disney and Smith 2002), and income tax changes in Sweden (Laun 2017).[7]

This study primarily contributes to understanding the Soviet labor market by uncovering employment responses to financial incentives in a *command economy* following pension reforms. Of course, responses to pension reforms depend on the structure of the labor market, generosity of social programs, and life expectancy, and thus may not generalize to other economies.[8] Nonetheless, this study's findings may have broader relevance to pension reform today. Many countries seek to provide incentives to delay retirement, because of the threat of the solvency of public pension systems. Because of political challenges of increasing the age of eligibility for public pensions or penalties for early retirement, changes in financial incentives can be an important vehicle to incentivize employment among older individuals.[9] The Soviet experience provides a success story in raising older-age employment through financial incentives.

I. Background on the Soviet Labor Market

The Soviet labor market is typically known for its constraints. First, the Soviet constitution stated that citizens had a duty to work. Anti-parasite laws allowed for administrative sentencing of unemployed individuals to compulsory work after four months of unemployment, but these laws were seldom enforced (Granick 1987). Pensioners, women, and full-time students were excluded from these laws. Second, the average length of a work week was 40 hours, where part-time work

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[7] Empirical studies of the earnings test find small adjustments in hours of worked (Friedberg 1998, Friedberg 2000).
[8] The Soviet government provided health insurance, education, and subsidized housing. The pension replacement rate (benefits as a fraction of previous earnings) was 64%, and life expectancy was 16 years past pensionable age.
[9] For instance, the United States may lower the Social Security or Medicare payroll taxes (Clark and Morrill 2017), while European countries may eliminate earnings tests.

was virtually impossible, and there was little overtime (Nove 1977). Third, the internal passport system and the administrative allocation of housing limited the geographic mobility of workers. Fourth, central planners set wages by establishing an occupational wage scale within each industry.

However, the labor market in Soviet Russia also provided many freedoms to its workers. Individuals were free to choose their education level, occupation, the enterprise of their employment, and whether to quit a job.[10] Even though empirical research on the Soviet labor market is sparse, many historians and economists have argued that relative to the controlled markets for other commodities, the labor market was the most similar to a capitalist economy. These scholars stipulate that, subject to institutional constraints, forces of supply and demand were an important influence on actual earnings (Atkinson and Micklewright 1992, Granick 1987, Gregory and Kohlhase 1988, Nove 1977). Nove (1977) states that market forces were at work because workers are not "subject to administrative allocation" and "very serious problems would arise if the wage rate in an industry, profession or region were such that the necessary labour force could not be attracted and retained."[11]

In addition to employment in state enterprises, the second market economy – all production and exchange that is directly for private gain, or against the law – also existed in Soviet Russia. The second economy only began to emerge in the 1960s (Rutgaizer 1992), with an estimated employment of less than 10 percent of the total labor force (Treml 1992). Pensioners were less active in this economy, where employed individuals made a disproportionate contribution to the second economy. Data from the Berkeley-Duke University questionnaire to recent Soviet emigres

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[10] Only graduates of vocational and higher education institutions were subject to job direction for 2 to 3 years after graduation (Granick 1987).
[11] Enterprises often adjusted centrally determined wages to attract workers by regrading workers to higher skill levels, and lowering production norms to pay higher bonuses to workers. This is because each enterprise received a planned wage fund, but had freedom in how to allocate funds across its member enterprises.

residing in the United States provide some of the best evidence on the second economy (Treml 1992). In 1979, individuals without jobs represented 18 percent of all adults, but accounted for only 3.6 percent of man-hours in the second economy. Employment in the second economy was mainly part-time, where individuals without jobs spent on average 119 hours per year in it.

II.   The Evolution of the Pension System in Soviet Russia

In the early 1950s, the Soviet welfare state consisted of both free and subsidized services, and cash transfers. Education and medical care were free for everyone. There was no housing market, because households were allocated space in accordance with household size through a system of bureaucratic allocation. Cash transfers consisted of sickness benefits, maternity and child allowances, and stipends to university students (McAuley 1979). A unified pension system did not exist and at least 1,000 acts governed pension provision. As a result, the right to a pension and replacement rates varied greatly across industries and occupations.[12] Therefore, inequities arose and individuals performing the same tasks in different industries could be eligible for vastly different pensions. Critically, in this period, all employed pensioners received their full pension.

A. 1956 Pension Law Providing Coverage to All State Employees

The 1956 Pension law was one of the most significant reforms in the Khrushchev era, because it covered most individuals in the Soviet Union by the same pension scheme (USSR Law 1956).[13] Only collective farmers were not eligible for these pensions, so the analysis in this paper focuses on all other workers.[14] The law introduced old-age, disability and survivor's pensions with the goal of respectively reducing the effect of risks from old age, invalidity, and the death of a

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[12] Workers in priority industries (e.g. coal, oil, metallurgical, railway, communications) and of certain occupations (leading professions, engineers, and supervisors) had a right to higher pensions (Astrakhan 1971).

[13] All full citations to Soviet laws and newspaper articles are listed in online appendix A. Laws have citations that start with USSR Law or Sovmin. I also cite two major newspapers: *Pravda* and *Izvestia*.

[14] In 1964, collective farmers became eligible for government pensions (USSR Law 1964). This reform does not affect my results, because my data exclude collective farmers.

family breadwinner to guarantee material provision for this population. The law extended pension provision into new sectors of the urban economy, clarified and streamlined the whole system, and greatly increased the level of benefits. Between 1956 and 1957, the number of old-age pensioners increased from 13 to 19 million, while their average pensions increased from 22 to 46 rubles.

This paper focuses on old-age pensions. Women with 20-year and men with 25-year service records received full-term pensions, while those with shorter records received incomplete-term pensions. Women became eligible for pensions at age 55 and men at age 60. Out of full-term pensioners, 11 percent were in the "preferential" category in 1964, because they worked in *difficult conditions* for at least half of their required service record. Preferential pensioners were divided into 2 groups: the "more difficult" involved hazardous work conditions (e.g. mines or hot shops), while "less difficult" were all other difficult conditions. The "more difficult" group men [women] became eligible for pensions at age 50 [45] with a 20 [15] year service record. The "less difficult" group men [women] became eligible for a pension at age 55 [50] with a 25 [20] year service record. Preferential pensioners had higher pensions relative to other full-term pensioners, because they worked in higher-paid occupations.[15] Incomplete-term pensioners needed at least a 5 year service record, and represented 15 percent of old-age pensioners.[16] Their pensions were proportional to their service record, and were on average 60 percent of the full-term pension in 1964.

The pension replacement rate depended on the value of previous earnings on a sliding scale. Individuals could choose between two ways to calculate previous earnings. Thus, a rational worker selected the way that would result in the highest pension. In the first way, previous earnings equaled average monthly pay in the last twelve months of work. In the second way, previous

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[15] This is because, similar work under more difficult conditions was rewarded with higher wages. Average preferential pensions were 153 percent of other full-term pensions in 1964.
[16] Incomplete-term pensioners could become full-term pensioners once they reached the full-term service record.

earnings equaled average monthly pay in any five years of continuous employment during the ten years prior to applying for pensioner status. The replacement rate begins at 100 percent for those earning 35 rubles or less, and then gradually reduces to 50 percent for those earning 100 rubles or more.[17] Preferential pensioners had a higher replacement rate, which begins at 100 percent for those earning 35 rubles or less, and then gradually reduces to 55 percent for those earning 100 rubles or more. The minimum pension was 30 rubles, while the maximum was 120 rubles.

In contrast to prior rules, the 1956 law did not allow employed pensioners to receive their full pension. Table 1 summarizes pension rules for employed pensioners, while table 2 summarizes their resulting average benefit reduction rates in three periods: 1957-1963, 1964-1969, and 1970-1975.[18] After the 1956 pension law, full-term pensioners whose monthly earnings did not exceed 100 rubles received a 15 ruble pension, while those whose earnings exceeded 100 rubles received no pension.[19] In 1959, 81 percent of pensioners had average previous earnings below 100 rubles, and had an average pension (earnings) of 39.9 (52.6) rubles; those with earnings above 100 rubles had an average pension (earnings) of 73.9 (142.3) rubles. Assuming no heterogeneity in pensions and that earnings for pension calculation are a good proxy for current earnings, I calculate the average benefit reduction rate of 47.8 percent ($0.81 * \frac{39.9-15}{52.6} + 0.19 * \frac{73.9}{142.3}$). The "less difficult" preferential pensioners could keep the same pension as other full-term pensioners, while the "more difficult" group could keep 50 percent of their pension. Employed incomplete-term pensioners could not receive their pension, resulting in a benefit reduction rate of 39.1 percent.

B. The 1964 Reform Lowering Benefit Reduction Rates

In the 1960s, the Soviet government was concerned because the labor force was smaller

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[17] See appendix table B1, and figure B1 for a summary of pension replacement rates.
[18] See appendix figures B2 and B3 for the evolution of the share of pension receivable by employed pensioners by pension type, earnings, and region.
[19] Pensioners did not receive higher benefits once they retired if they had some of their pension withheld.

than it desired (Lantsev 1976). World War II losses resulted in fewer prime-age workers, and labor force entrants twenty years later (Brainerd 2017). Moreover, the 1956 pension law substantially lowered the incentives to work among pensioners because of higher pensions and the inability for working pensioners to keep their full pension. The government viewed pensioners as an untapped labor resource, because many were still able to work. A study by the Central Institute of Evaluation of Work Ability in 1973 found that 84.6 percent of employed pensioners were able to work, while 37.8 [47.1)] percent of retired pensioners were fully [partially] able to work (Novitskii 1981). As a result, the government decided to provide financial incentives for pensioners to work.

On February 26, 1964, the Soviet government passed its first reform that allowed employed full-term pensioners to receive a higher share of their pension (Sovmin 1964).[20] The reform went into effect on April 1, 1964 and was to last until 1968, but lasted until the end of 1969. It provided greater work incentives in the eastern regions of Soviet Russia (Siberia, Far East, and the Urals) relative to the western regions (rest of Soviet Russia), likely because of their importance in industrial production. Appendix figure B4 shows a map of eastern and western regions, and table B2 shows their employment and educational attainment before the reform. Following the reform, in eastern regions, where 24.5 of the population resided, employed pensioners could keep 75 percent of their pension. In western regions employed pensioners could keep 50 percent of their pension. This resulted in an average benefit reduction rate of 24.1 percent.[21] Finally, the combined pension and earnings income could not exceed 200 rubles, so top earners did not benefit. The reform did not require enterprises to hire pensioners, and each enterprise could make its hiring choice based on their need of workers and pensioner qualifications (Izvestia 1964).

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[20] Pension reforms also applied to all Soviet republics, but this study focuses on Russia due to data availability.

[21] Average pensions (earnings) in 1966 were 52.5 (95.5) rubles. To calculate: $0.245 * \left(\frac{0.25*52.5}{95.5}\right) + 0.755 * (\frac{0.5*52.5}{95.5}) = 0.241$.

The majority of full-term pensioners were eligible for the reform, while incomplete-term pensioners continued receiving no pension if they worked. The government chose to target occupations with the greatest need in workers. All blue-collar and some white-collar workers were eligible: 85 percent of all workers in 1959 were in eligible occupations, while this share is likely larger for older individuals who were more likely to be in blue-collar occupations.

Individuals found out quickly about the reform, because its details were printed in major newspapers that were widely read. An article on March 6, 1964 listed all the details of the reform (Pravda 1964). There were follow-up articles in major newspapers, where the head of the pension department answered questions the readers had about the reform. One article mentioned that the newspaper readers supported the reform (Izvestia 1964).

C. 1969 Reforms Eliminating Benefit Reduction Rates

A smaller reform in February 1969 allowed employed full-term pensioners in a limited set of occupations to keep their entire pension in all regions (Izvestia 1969), which eliminated the benefit reduction rate. Furthermore, a major reform in December 1969, going into effect on January 1, 1970 and lasting until 1975, substantially expanded the February reform to include most occupations (Sovmin 1969).[22] Articles in major newspapers announced these reforms and their details (Izvestia 1970a, 1970b). Finally, the limit on the combined pension and earnings income rose to 300 rubles (from 200 rubles), but was again only applicable to a minority of top-earners. Importantly, employed incomplete-term pensioners continued not receiving a pension.

D. 1971 Reform Increasing the Minimum Pension

Following these reforms, the Soviet government wanted to improve the standard of living among pensioners. To achieve this goal, the government increased the minimum pension for all

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[22] A small set of ineligible occupations had the same rules as after the 1964 reform.

pensioners from 30 to 45 rubles per month on July 1, 1971 (Izvestia 1971), which has important implications for employment rates among pensioners in the 1970s. The increase in the minimum pension was substantial: as a share of the average pension in 1970, the minimum pension went up from 55 to 82 percent. The increase in minimum pensions likely reduced the incentives of lower earning pensioners to work. Previous literature has found both large (Costa 1995, Fetter and Lockwood 2016, Gelber et al. 2016) and small negative employment effects (Blau and Goldstein 2010, Danzer 2013, Krueger and Pischke 1992) after pension increases. Thus, both the increase in the minimum pension and the 1969 reforms likely affected employment rates in the 1970s.

III.   Theoretical Framework

In Soviet Russia, these pension reforms affected the decision of whether to work full-time or retire, and the decision of how many hours to work. This is because part-time work was virtually nonexistent. However, pension reforms may lead to intensive margin adjustments because workers could switch to jobs requiring different levels of effort. Thus, workers could change their effort-adjusted hours on the job without changing their work hours. This study focuses on employment rates, because the data do not allow me to measure hours of work or effort-adjusted hours of work.

Table 3 includes the sum of after-tax current labor income, E, and pension income by employment status in different periods. If not employed, a pensioner receives, P, where P is the full pension amount. On average, earnings taxes were negligible in Soviet Russia (McAuley 1979)[23], while retired pensioners received their full pensions. An employed pensioner receives, $E + (1 - b)P$, where b is the share of benefits lost if employed that changed after reforms.

Before 1964, b depended on current earnings. Panel A presents pensioners with current earnings, E_h, above 100 rubles, and pensions, P_h. If they worked, they received no pension,

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[23] I estimate an average pensioner had an effective 3 percent tax rate on labor earnings in 1959. Appendix table B3 shows the marginal tax rates by monthly earnings.

resulting in a total income of E_h, because $b = 1$. I construct the average net-of-tax rate (ANTR) which is defined as the "fraction of an individual's income that the individual keeps net of taxes and the benefit reductions when earning a positive amount rather than earning zero" (Gelber et al. 2018). The ANTR was $\frac{E_h - P_h}{E_h}$. Panel B presents pensioners with current earnings, E_l, below 100 rubles, and pensions P_l. If they worked, they received a 15 ruble pension, resulting in an income of $E_l + 15$, because $b = \frac{P_l - 15}{P_l}$. This resulted in an ANTR equal to $\frac{E_l - (P_l - 15)}{E_l}$.

After the 1964 reform, b equalized for all earnings, but was equal to 0.5 in western and to 0.25 in eastern regions. Employed pensioners received an income of $E + (1 - 0.5)P$ in western regions, and $E\_(1 - 0.25)P$ in eastern regions. Then, the ANTR increased to $\frac{E - bP}{E}$. After 1969, employed pensioners received an income of, $E + P$, because $b=0$. Then, the ANTR further increased to $\frac{E_h}{E_h} = 1$.

The lack of part-time work has implications on the magnitude of the theoretical effect of a fall in the benefit reduction rate on employment relative to in a more flexible labor market with part-time work. On the one hand, employment responses may be larger with part-time work.[24] An example of larger responses arises when, before 1964, pensioners earning over 100 rubles and receiving no pension have an incentive to reduce their earnings to under 100 rubles to receive a 15 ruble pension. In the presence of part-time work, some of these pensioners would reduce their hours to earn less than 100 rubles and keep working. Then, after the 1964 reform, they would choose to work more hours. But, their employment rate would not change, because they are already working. Without part-time work, some pensioners who would have reduced their hours to earn

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[24] This case relates to discussions in several studies on how constraints in the labor market may lead to larger labor supply responses to changes in the earnings test (Vroman 1985, Friedberg and Webb 2009, and Gelber et al. 2018).

less than 100 rubles in a flexible labor market would have stopped working before 1964. After the 1964 reform, their employment rate would go up due to greater incentives to work. On the other hand, employment responses may be smaller without part-time work. This is because it is more difficult to switch from no work to full-time than to part-time work after the pension reforms. With part-time work, some pensioners would choose to increase their hours, but only to work part-time. As a result, their employment rate would go up after the reforms. Without part-time work, pensioners who would have chosen to work part-time in a flexible labor market continue not to work. Thus, their employment rate does not change after the reforms.

IV.   Construction of Soviet Pensioner Employment Data

This paper has created the first database of the Soviet pensioner labor market. I collected and digitized archival data from the Russian Government Archive of Economics (RGAE) and the Government Archive of the Russian Federation (GARF) in Moscow on Soviet Russia. These documents were not released to the public before the Soviet Union collapse and were only used internally during the Soviet period. They became available to the public after the Soviet Union collapse and contain the most reliable data on the Soviet economy. I collected employment statistics of pensioners, which are hand-written and tabulated on standardized reporting forms. Pensioners are individuals who have claimed their pensions after applying for and receiving pensioner-status, and are in the data even if they are not receiving a pension due to current employment.[25] Appendix C contains descriptions of all the data sources. The paper uses two sets of data at the oblast-level: (1) administrative and (2) representative-sample survey.

First, I collected annual administrative, oblast-level data by pensioner type. To construct these data, the main statistical agency in each oblast aggregated individual pension records, and

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[25] To apply for a pension individuals presented their passport, documentation for years of service and previous salary and received a response within 10 days. If approved, pension payment started from the day of application.

then sent them to the Statistical Agency in Moscow[26]. The individual pension records used by the oblasts to tabulate these data are no longer available. These documents include counts of full-term (also separately preferential), and incomplete-term pensioners, and out of those totals, the number who are employed as of January 1 in each year. I refer to data from January 1, 1957 as 1957 data, and so on. These documents also contain the sum of pensions among all pensioners (regardless of employment status), that they would receive if they were not employed. These documents are available from 1957 to 1960, and from 1962 to 1975.[27] Unfortunately, data are not available in 1961, and that year's data are likely lost or destroyed. However, data for 1961 are available at the national level, and I use them to create descriptive graphs of employment trends. I use the data from 1957 to 1975 to construct annual employment rates (number employed pensioners divided by number of pensioners) and average pensions (sum of pensions divided by number of pensioners) separately by oblast, year and pensioner type.

Second, I collected data from two surveys conducted on July 1, 1959, and January 1, 1966. These surveys contain data on representative 10-percent random samples of all pensioners.[28] While the survey was done in all oblasts, I collected data for 38 oblasts, because some oblasts in the archives are missing or illegible. These data include counts of all and employed full-term pensioners by 14 previous monthly earnings ranges used for pension calculation.[29] Importantly, previous earnings ranges reflect earnings before the pension application and not current earnings. I use these data to construct employment rates for full-term pensioners (number employed

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[26] Titles of documents vary, but a good summary in *Year*: "Summary Report of the Central Statistical Office of the RSFSR of the Number of Pensioners, Sums of Their Pensions and Their Employment on January 1 of *Year*."
[27] Data in 1955 and 1956 are only available for all old-age pensioners, and not by pensioner type.
[28] The title for the 1959 survey is "Statistical Tables of the Central Statistical Agency of RSFSR of Sample Survey of Pensioners by ASSR, Krai, and Oblasts on July 1st, 1959". The title for the 1966 survey in *Oblast* "Statistical Tables of Statistical Agency in *Oblast* of Sample Survey of Number and Composition of Pensioners for 1965."
[29] Earnings ranges in rubles: <30, 30-39, 40-49, 50-59, 60-69, 70-79, 80-89, 90-99, 100-119, 120-139, 140-159, 160-179, 180-199, and ≥200.

pensioners divided by number of pensioners) in each year separately by oblast and earnings range.

Several caveats on the data are in order. First, no employment statistics of pensioners are available by age or sex. Moreover, annual data on employment by age (either national or by oblast) do not exist. Thus, employment rates in this paper reflect all pensioners: ages 60 and older for men, and ages 55 and older for women.[30] Thus, this paper analyzes adjustments in employment rates for *all* pensioners, which is important for the interpretation of results in terms of their magnitudes and patterns over time. In the first year following the reform, these data include many age cohorts of people that may have already decided to retire based on the rules before the reform and on their age. In each subsequent year after the reform, an additional cohort of individuals that were working at the time of the reform ages into pensionable age and thus enters into the data.

Second, pensioners in the data only include those who have claimed their pensions, but do not include those eligible who did not claim. Estimation results using pension claimants may be biased relative to using all individuals eligible for a pension if allowing pensioners to keep a greater share of their pension induced more pension claiming. This incentive only holds for individuals who, before 1964, would not receive a pension if they worked and earned over 100 rubles. All others had an incentive to claim the pension once eligible because they received some of their pension if they worked. However, individuals likely claimed their pension as soon as they became eligible, because of several benefits to doing so. First, older workers were uncertain of their ability to earn more than 100 rubles due to potential health limitations.[31] Thus, waiting to claim the pension could result in a lower pension as it would be based on earnings in more recent years. Second, individuals could have their pension re-calculated, even after claiming a pension if their

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[30] Preferential pensioners became eligible for pensions 5 or 10 years earlier.
[31] Consistent with this, a Soviet official regulation stated: "often the worker in the year before applying for a pension due to illness or due to old age needs to take an easier job with a lower salary." (Kolganov 1962)

most recent earnings gave them the right to a higher pension.

V.   The Overall Effect of Pension Reform on Employment Rates

Old-age employment rates experienced substantial changes between 1955 and 1975 in the aftermath of the 1956 pension law, the 1964 and 1969 pension reforms. Figure 1 shows that, before 1957, the old-age employment rate was high at 59 percent, likely because individuals could receive their full pension while still working, and because pension benefits were small on average. After the pension law of 1956, employment rates fell to 27 percent in 1957, which is consistent with high benefit reduction rates for employed pensioners and higher pensions. Employment rates fell to 10 percent by 1960, and remained relatively stable through 1964. After the 1964 fall in benefit reduction rates, employment rates increased to 17 percent by 1969. Similarly, after the 1969 fall in the benefit reduction rate, employment rates further increased to 24 percent by 1975.

To causally estimate the effect of a fall in the benefit reduction rate, I compare the employment rates of full-term and incomplete-term pensioners before and after the fall. Figure 2 shows a higher employment rate among incomplete-term relative to full-term pensioners in 1957, followed by stark declines in employment rates among both types of pensioners until the early 1960s. Incomplete-term pensioners may have experienced a greater decline in employment rates, because unlike full-term pensioners, the 1956 law did not allow them to receive their pensions if they worked. The 1956 law likely did not affect employment rates by the early 1960s, because employment rates stabilized at a low level at that time. Thus, I choose to start my formal analysis in 1962, because of potential effects of the 1956 pension law on employment rates between 1957 and 1960.[32] I do not start in 1961, because the data for this year are likely lost or destroyed.

A. Descriptive Evidence on Employment Responses to Pension Reforms

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[32] The data collected for this paper do not allow me to evaluate the 1956 pension law.

The evolution of employment rates of full-term (eligible) and incomplete-term (ineligible) pensioners provides descriptive evidence of a positive effect of a fall in benefit reduction rates on employment. From 1962 to 1964, full-term and incomplete-term pensioner employment rates followed similar trends.[33] From 1964 to 1969, full-term pensioner employment rates increased from 9.8 to 18.1 percent, a much higher increase than among incomplete-term pensioners.

Even though the gap in employment rates between full-term and incomplete-term pensioners rose after the 1969 reforms, this rise could be due to either the decrease in the benefit reduction rate, or the increase in the minimum pension. Full-term pensioner employment rates increased to 26.4 percent by 1975. On the other hand, incomplete-term pensioner employment rates declined from 10 to 7.4 percentage points from 1970 to 1975. However, the increase in the minimum pension in 1971 confounds the evaluation of the 1969 reforms, because it likely decreased pensioner work incentives. Thus, the comparison of full-term and incomplete-term pensioners may over-state the effect of 1969 reforms if incomplete-term pensioners decreased their employment the most due to the minimum pension reform. As a result, I do not evaluate the 1969 reforms using comparisons between full-term and incomplete-term pensioners. Instead, I evaluate these reforms using regional variation in the benefit reduction rates in section VI.

B. Generalized Difference-in-Differences Framework

I quantify the effect of the 1964 reform by comparing the difference between the employment rate of full-term and incomplete-term pensioners after the reform to the difference in the year prior to the reform in the following generalized difference-in-differences specification,

$$Y_{o,t,p} = Full_p + \gamma_{o,p} + \delta_{o,t} + \sum_{k=62}^{63} \theta_k Full_p 1(t=k) + \sum_{k=65}^{69} \pi_k Full_p 1(t=k) + \beta X_{o,t,p} + \epsilon_{o,t,p} \ (1)$$

where $Y_{o,t,p}$ is the employment rate in oblast o, on January 1 in year t, for a pensioner of type p

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[33] These trends were also similar between 1959 and 1960, suggesting parallel trends in a 6-year pre-period.

(full-term or incomplete-term); $Full_p$ equals 1 for a full-term and 0 for an incomplete-term pensioner; $\gamma_{o,p}$ are oblast fixed effects capturing time-invariant oblast level differences, and oblast by pensioner type fixed effects capturing time-invariant differences between full-term and incomplete-term pensioners within each oblast; $\delta_{o,t}$ are year fixed effects capturing changes common to all oblasts, and oblast by year fixed effects capturing changes of unobserved covariates in each oblast; $1(t = k)$ is a dummy for year t; and $X_{o,t,p}$ includes one variable representing the average pension in oblast *o*, year *t*, and for pensioner type *p*, which controls for changes within each oblast in the composition of each type of pensioner.[34] The year 1964, $1(t = 1964)$, is omitted which normalizes the estimates of θ and π to zero in 1964. The omitted observation on January 1, 1964 is before the reform which went into effect in April, 1964. It is unlikely that pensioners adjusted employment on January 1, 1964 in anticipation of the reform, because the reform was approved on February 26, 1964 (Sovmin 1964), and its first newspaper mention was on March 6, 1964 (Pravda 1964). The coefficients θ_{62} and θ_{63} test for parallel trends in employment rates before the reform. The coefficients of interest, π_{65} to π_{69}, measure the effect of a fall in the average benefit reduction rate from 47.8 to 24.1 percent.

The coefficients of interest may be biased downward if incomplete-term pensioners also increase employment after the reform. This is because the reform increases the net wage of an incomplete-term pensioner *after* he attains the service record to be eligible for a full-term pension. However, this incentive to work is minimal for the majority of incomplete-term pensioners. This higher net wage in the future provides the greatest incentives to work only for incomplete-term pensioners whose service record puts them very *close* to the full-term pension eligibility

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[34] The average pension represents the sum of pensions of all pensioners (pension paid if the pensioner were not employed) divided by the total number of pensioners.

requirement. However, these incentives to work are much smaller for incomplete-term pensioners who are several years away from reaching full-term pension eligibility. This is because they will need to work longer to receive a higher net wage, will realize the increase in net wage later, and will be older and likely in worse health once they work up to full-term pension eligibility. Given the average pension size of incomplete-term pensioners is 60 percent of full-term pensioners, and that pensions were proportional to years of work, it is likely that on average, an incomplete-term pensioner was *at least* five years of work away from a full-term pension. Thus, once reaching pensionable age, an average incomplete-term pensioner needs to work for at least five more years to qualify for the full-term pension. Given that the average duration of work past reaching pensionable age was about five years (Novitskii 1981), it is unlikely that an average incomplete-term pensioner would increase work as a result of the reform.

C. Results of the Overall Effect of the 1964 Pension Reform

Figure 3 and table 4 display estimates from equation (1), representing the covariate-adjusted differences in employment rates between full-term and incomplete-term pensioners relative to the difference in 1964.[35] My preferred specification including all controls from equation (1) is in column (3) of table 4. Columns (1) and (2) show that results are robust to gradually adding controls. All regression results are weighted by the oblast-level number of pensioners of each type in 1964. Standard errors are clustered at the oblast-level to allow for an arbitrary correlation structure within an oblast.[36]

The 1964 reform led to an increase in the pensioner employment rates. Consistent with the descriptive evidence in figure 2, the regression results point to similar employment rate trends

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[35] Using the log employment rate as a dependent variable in figure B6 does not change the pattern and statistical significance of coefficients. However, magnitudes are smaller and the increase from 1964 to 1969 is less steep.
[36] All the subsequent results in the paper are also weighted and clustered at the oblast-level.

among eligible and ineligible pensioners before the reform. The point estimates for 1962 and 1963 are small and not statistically different from zero, suggesting parallel trends. Employment rates rose immediately after the 1964 reform. In terms of magnitudes, a fall in the benefit reduction rate from 47.8 to 24.1 percent increased the employment rate by 2.8 percentage points by 1966, representing a 25.8 percent increase. Employment rates increased further by 5.7 percentage points by 1969, representing a 47 percent increase.

Theoretically, the size and trend in the estimated coefficients could be due to two channels: (1) a delay in retirement among pensioners or younger individuals close to pensionable age, or (2) return to work among previously retired pensioners. The delay channel among pensioners would result in an immediate increase in employment, but in a gradual increase among individuals close to pensionable age. The anticipation of new rules may increase employment among individuals close to pensionable age.[37] If labor supply choices have long-lasting consequences, then the treatment effect on pensioner employment may increase over time as younger workers have time to adjust their plans and age into the new rules. The return to work channel would result in a gradual increase in employment, because of the difficulty of returning to the labor force.

Descriptive evidence suggests that the delay in retirement channel is likely most important in explaining the trend in the estimated effect. Lantsev (1976) cites a survey where 16 percent of employed pensioners returned to work after a break, while Novitskii (1981) cites a 1976 survey where 21.2 percent of employed pensioners returned to work.[38] However, a greater share of employed pensioners may have returned to work immediately after the reforms, because they could not anticipate and plan for them, as they could by the middle 1970s.

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[37] For instance, Friedberg and Webb (2009) show that employment at younger ages increases after more generous anticipated earnings test rules.

[38] The average length of a break from work among pensioners was 5.5 months (Novitskii 1981).

Finally, the necessity of using employment rates for all pensioners (age 60/55 and above for men/women) may also explain the trend in the estimated treatment effect. The estimated effect may increase in the first few years after each reform because new cohorts of working age individuals at the time of the reform gradually reach pensionable age after the reform. This increase may result from the increase in the number of cohorts whose decisions of whether to retire at age 60 are affected by the reform. Likely, the reform affects employment behavior of these cohorts the most, because they can receive the higher net wage for a longer time, they are likely to be in better health, and they do not face costs to enter back into the labor market, if they are still employed.

VI.   Pension Reform: Comparison of Eastern and Western Regions

The prior section analyzed the effect of the 1964 reform by comparing full-term and incomplete-term pensioners. However, I was unable to estimate the effect of the 1969 reforms, because of potential confounding effects of the minimum pension increase in 1971. Now, I turn to regional variation in changes in benefit reduction rates, which is beneficial for several reasons. First, I independently estimate the effect of the 1964 reform using different variation, and where the benefit reduction rate drops from a different level. Finding an increase in employment rates using this variation further bolsters previous findings. Second, I can estimate the effect of the 1969 reforms, because the effects of the minimum pension increase are likely more similar across regions than across pension types. Moreover, I leverage that higher pensions of preferential pensioners make them much less affected by the minimum pension increase, and estimate the effect of the 1969 reforms on this group.

A. Evolution of Pensioner Employment Rates in Eastern and Western Regions

I compare the employment rates in the eastern and western regions among full-term, and separately among preferential pensioners, before and after the 1964 and 1969 reforms. Between

1965 and 1969, the eastern regions are the treatment group, because they experienced an additional 13.7 percentage point fall in the benefit reduction rate: from an average of 47.8 to 13.7 percent in the east relative to from an average of 47.8 to 27.5 percent in the west. After 1969, the western regions become the treatment group, because they experienced an additional 13.7 percentage point fall in the benefit reduction rate: from an average 27.5 to a uniform 0 percent in the west relative to from an average 13.7 to a uniform 0 percent in the east.

As in the previous section, I start my formal analysis in 1962, because it eliminates the period of differential adjustment to the 1956 law. Importantly, the 1956 law may have had different effects across regions, because of regional differences in the distribution of earnings, occupations, and demographic characteristics. Figure 4 (panel A) shows that employment rates of full-term pensioners were similar in 1957 across regions. But, eastern regions experienced a greater decline in employment rates in the late 1950s. The differential effect of the law across regions likely wore off, as employment rates stopped declining by the early 1960s.

The evolution of employment rates in the eastern and western regions provides descriptive evidence of a positive effect of pension reforms on employment rates. First, employment rates in figure 4 among eastern and western regions were on parallel trends between 1962 and 1964. Second, between 1965 and 1969, employment rates increased faster in eastern relative to western regions, consistent with their greater fall in the benefit reduction rate. Third, after 1969, employment rates increased faster in the western regions, consistent with their greater fall in the benefit reduction rate. Preferential pensioners (panel B) experienced a larger decline in the gap across regions between 1965 and 1969, and a larger increase in this gap after 1969.

B. Empirical Framework

The following generalized difference-in-differences framework compares the difference in

employment rates between the east and west after 1964, relative to the difference before 1964,

$$Y_{o,t} = \gamma_o + \delta_t + \sum_{k=62}^{63} \theta_k E_o 1(t = k) + \sum_{k=65}^{75} \pi_k E_o 1(t = k) + \beta X_{o,t} + \epsilon_{o,t} \quad (2)$$

where $Y_{o,t}$ is the pensioner employment rate in oblast o, and on January 1 in year t; γ_o are oblast

fixed effects, δ_t are year fixed effects, E_o equals 1 for an eastern and 0 for a western oblast. Annual

co-variates at the oblast-level, $X_{o,t}$, measuring output, economic activity, and average pension size,

control for other changes across oblasts.[39] The year right before the 1964 reform, $1(t = 1964)$, is

omitted which normalizes the estimates of θ and π to zero in January 1964.

The coefficients of interest, θ_{62} to θ_{63} and π_{65} to π_{75}, capture changes in the gap in

employment rates in eastern relative to western regions from 1962 to 1975 relative to 1964. First,

the coefficients θ_{62} and θ_{63} test for parallel trends before the 1964 reform. Second, positive

coefficients, π_{65} to π_{69}, would indicate the decrease in the gap in employment between eastern

and western regions due to the 1964 reform. Third, coefficients, π_{70} to π_{75}, that converge to zero,

would indicate the increase in this gap due to the 1969 reforms.

To separately estimate the effects of the 1964 and 1969 reforms, I estimate

$$Y_{o,t} = \gamma_o + \delta_y + \theta_1 E_o 1(62 \leq t \leq 63) + \theta_2 E_o 1(t = 65) + \theta_3 E_o 1(66 \leq t \leq 69) + \beta X_{o,t} + \epsilon_{o,t} \quad (3)$$

$$Y_{o,t} = \gamma_o + \delta_t + \pi_1 W_o 1(67 \leq t \leq 68) + \pi_2 W_o 1(t = 70) + \pi_3 W_o 1(71 \leq t \leq 75) + \beta X_{o,y} + \epsilon_{o,y} \quad (4)$$

where variable definitions are the same as in equation (2), and W_o equals 1 in a western oblast.[40]

The coefficient θ_3 measures the average effect of a 13.7 percentage point fall in the benefit

reduction rate over 4 years after the 1964 reform, while π_3 measures the average effect of a 13.7

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[39] The co-variates that I digitized from publicly available "Narodnoe Hozyaistvo" yearbooks include: production of plywood, leather boots, reinforced concrete, milk, eggs, meat, oil, canned goods, number of doctors per population, value of trade, and number of students enrolled in college. The average pension size comes from archival data.
[40] Note that $1(62 \leq t \leq 63)$ equals 1 in 1962 and 1963, $1(66 \leq t \leq 69)$ equals 1 from 1966 to 1969, $1(67 \leq t \leq 68)$ equals 1 in 1967 and 1968, and $1(71 \leq t \leq 75)$ equals 1 between 1971 and 1975.

percentage point fall in the benefit reduction rate over 5 years after the 1969 reform.[41] The

coefficients θ_1 and π_1 test for parallel trends across regions before the 1964 and 1969 reforms

respectively.

Causal identification rests on several assumptions. First, eastern and western regions

should respond similarly to the same fall in the benefit reduction rates. This may not be the case,

because responses depend on such factors as occupational, demographic, and health distributions.

Analysis of preferential pensioners, who are similar across regions, relaxes this assumption.

Finally, the 1964 reform should not result in increased migration of pensioners to eastern

regions. This is highly unlikely for several reasons. First, cross-regional migration rates were low

because of restrictions to mobility due to the severe housing shortage and the use of residence

permits (Brainerd 2017). Migration was very difficult, because to gain employment a residence

permit in the area was necessary, but to obtain a residence permit employment in the area was

necessary. Second, even if a pensioner were able to move, the costs likely outweighed the benefits.

Pensioners needed to leave their old jobs, family, and friends behind to navigate an unfamiliar

labor market. The remaining number of work years was uncertain due to potential future health

shocks, and restrictions on mobility made it difficult for pensioners to move back.

C. Results

The 1964 and 1969 reforms led to an increase in pensioner employment rates. Figure 5

displays estimates from equation (2), where qualitatively results are similar for full-term (panel

A), and preferential (panel B) pensioners. First, employment rates in eastern and western regions

are on parallel trends between 1962 and 1964, because the coefficients θ_{62} and θ_{63} are on a flat

trend and are not statistically different from zero. Second, employment rates increased more in

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[41] θ_2 and π_2 are estimated separately, because January 1, 1965, and January 1, 1970 are less than one year after each reform, and it may take time for employment to adjust.

eastern relative to western regions between 1965 and 1969 evidenced by positive coefficients π_{65} to π_{69}. Third, employment rates increased more in *western relative to eastern* regions between 1970 and 1975 evidenced by a convergence to zero of coefficients π_{70} to π_{75}.

Table 5 displays estimates from equations (3) and (4) that average the effects of the 1964 (panel A) and 1969 (panel B) reforms for full-term (column 1), and preferential pensioners (column 2). Employment rates among full-term pensioners increased by 1.7 percentage points (20.7 percent increase) in eastern relative to western regions over 4 years after the 1964 reform, and by 3.5 percentage points (36.7 percent increase) among preferential pensioners. Employment rates among full-term pensioners increased by 1.8 percentage points (9.3 percent increase) in western relative to eastern regions over 5 years after the 1969 reform, and by 5.2 percentage points (24.6 percent increase) among preferential pensioners. Higher responses among preferential pensioners may be due to pension eligibility 5 to 10 years before other full-term pensioners. Thus, a greater share of preferential pensioners may be able to work than other full-term pensioners.

Separate analysis of preferential pensioners is beneficial due to weaker identification assumptions. First, preferential pensioners are not affected by the minimum pension increase, because they have higher pensions. Second, preferential pensioners across eastern and western regions are more homogeneous than other full-term pensioners, because of common occupations. As a result, similar responses to the same falls in the benefit reduction rates are more likely.

D. Heterogeneous Effects by Earnings Groups

Does the increase in employment after pension reforms differ across the earnings distribution? Theoretically, differences in responses may be due to differences in the ability and willingness to work, the difficulty of work, the pension replacement benefit reduction rates. Therefore, it is ambiguous which earnings groups respond most to changes in the benefit reduction

rates. However, pensioners with current earnings above 200 rubles, should not respond to the 1964 reform, because income from work and pension could not exceed 200 rubles. Further, pensioners in eastern and western regions faced the same benefit reduction rates even after the 1964 reform once their current earnings reached 160 rubles with a corresponding pension of 80 rubles.[42] In western regions, these employed pensioners received a total income of 200 rubles (160+80*0.5). In eastern regions, these pensioners could not take advantage of a lower benefit reduction rate, because then their total income of 220 rubles (160+80*0.75) exceeded the 200 ruble limit.

To estimate heterogeneous effects, I use archival survey data that include tabulations of all and employed pensioners by previous average monthly earnings ranges used to calculate the pensions. Importantly, these earnings are not the same as current earnings. This analysis provides suggestive evidence on heterogeneity of treatment effects, so long as current earnings correlate with past earnings. These data are available on July 1, 1959 and on January 1, 1966 and are a representative 10 percent random sample of full-term pensioners.

I compare the difference in employment rates between eastern and western regions in 1966 to the difference in 1959 in the following difference-in-differences specification,

$$Y_{o,t,r} = \gamma_o + \delta_r + 1(t = 1966) + \pi East_o 1(t = 1966) + X_{o,t} + \epsilon_{o,t} \ (5)$$

where $Y_{o,t,r}$ is the employment rate of full-term pensioners in oblast o, year t, and earnings range r; γ_o includes oblast fixed effects; $East_o$ equals 1 for an eastern and 0 for a western oblast; and $X_{o,t}$ includes annual oblast-level co-variates from equation (2). The surveys include data by 14 earnings ranges, and δ_r includes these earnings range fixed effects. To help with power, I aggregate these earnings ranges into 7 earnings groups, and perform a separate regression within each group. For ease of interpretation, I construct earnings percentiles using the 1959 survey data, and present

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[42] Pension replacement rate was 50%, and I assume current earnings correspond to those for pension calculation.

results using both earnings groups in rubles and earnings percentiles. The analysis uses the following earnings groups in rubles followed by percentiles in parentheses: 0 to 29 (0-11.6), 30 to 39 (11.7-30.2), 40 to 59 (30.3-54.9), 60 to 79 (55-72.4), 80 to 99 (72.5-83.4), 100 to 159 (83.5-94.4), and at least 160 rubles (94.5-100).[43] The availability of only two years of data does not allow to test for parallel pre-trends in pensioner employment rates between eastern and western regions.

Most earnings groups experienced an increase in employment rates, except for those at the bottom and at the top of the earnings distribution. Table 6 shows that employment rates went up in all earnings groups from the 12th to the 94th percentile. I cannot reject similar treatment effects across earnings groups, because all confidence intervals overlap.[44] The coefficient is small and close to zero for individuals with previous earnings below 30 rubles. These individuals are likely older than the rest of the sample, because their previous earnings are below the minimum income of 30 rubles in my period of interest. As a result, I do not expect this group to respond due to the difficulty of re-entering the labor force, and health limitations. As expected, the coefficient is small and negative for individuals with earnings above 160 rubles. After 1964, the benefit reduction rate was the same in eastern and western regions for individuals earning over 160 rubles.

VII.   Illustrative Calculations of Extensive Margin Elasticities

Previous sections used several natural experiments to estimate the effect of financial incentives on older-age employment. Now, I construct employment elasticities among Soviet pensioners, and compare them to estimates in other countries today. The use of estimates using several reforms allows me to provide a range of elasticity estimates of older-age employment for increases in the average net-of-tax rate (ANTR) from different levels and of different sizes.

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[43] Some earnings groups consist of several earnings ranges: 40 to 59 (40-49, and 50-59), 60 to 79 (60-69, and 70-79), 80 to 99 (80-89, and 90-99), 100 to 159 (100-119, 120-139, and 150-159), ≥160 (160-179, 180-199, ≥200).
[44] Because I have few clusters in this analysis (38 oblasts), inference based on asymptotics is problematic. Instead, I construct confidence intervals using the clustered wild bootstrap procedure (Cameron et al. 2008).

This paper can only provide *illustrative* estimates of the employment elasticity of older workers, because of several limitations. First, estimates of the ANTR assume no heterogeneity in the ANTR changes. Due to a lack of individual-level data, this paper evaluates the ANTR at the average previous earnings, average pensions, and average benefit reduction rates among all pensioners. These averages are based on 1959 survey data tabulated by average previous monthly earnings for pension calculation. Doing this is a concern, because the ANTR is nonlinear in earnings and pensions: appendix table B6 and figure B9 show that percent changes in ANTR after the 1964 reform depend on previous earnings and range from 0 to 74 percent. Second, I assume that previous earnings represent current earnings of pensioners. Relative to previous earnings, current earnings may be lower due to deteriorating health, or higher due to more work experience.

Back of the envelope calculations provide evidence of sizable extensive margin elasticities in table 7. All calculations in this section are in appendix D. First, I construct elasticities for the 1964 reform when comparing full-term and incomplete-term pensioners. The ANTR among full-term pensioners increased from 51.7 percent before 1964 to 72.9 percent after the 1964 reform (see table B7), resulting in a 34.3 percent increase. According to estimates in table 4, this is associated with a 25.8 and 47 percent increase in employment rates among full-term pensioners by 1966 and 1969 respectively. I divide these percent changes in employment rates by the percent change in the ANTR: the short-term employment elasticity is 0.752 (0.258/0.343), while the medium-term elasticity is 1.37 (0.47/0.343).[45] Importantly, my estimated elasticities need not be constant over time and different levels of baseline employment, because they are not structural parameters – they are a function of deeper structural primitives, such as prices, adjustment costs and tastes (Chetty 2012). Still, the rise in elasticities could be due to increasing responsiveness as

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[45] I construct confidence intervals of elasticities using the parametric bootstrap method in Appendix D, section 3.

individuals anticipate new rules, or the gradual entry into my data of working-age cohorts at the time of the reform who age into pensionable age.

Second, I construct elasticities for the 1964 and 1969 reforms when comparing eastern and western regions. After the 1964 reform, the ANTR increased by 18.1 percent more in eastern regions, while employment increased by 20.7 percent, resulting in an elasticity over the next four years of 1.14. After the 1969 reforms, the ANTR increased by 16 percent more in western regions, while employment increased by 9.3 percent, resulting in an elasticity over the next 5 years of 0.59.

The elasticities of older workers in Soviet Russia are in the upper range of previous empirical elasticities in developed countries today. Previous empirical estimates of elasticities for older individuals range from 0 to 1.5.[46] The structural literature suggests that employment elasticities rise at older ages, because the share of workers who are near the employment margin rises with age (Blundell et al. 2016). Indeed, some empirical estimates of older-age elasticities (Alpert and Powell 2019, Gelber et al. 2018) are higher than the small elasticities among prime-age individuals (Chetty 2012, Ziliak and Kniesner 2005).

How do I interpret the elasticities estimated in this paper? In a life cycle model, the permanent increase in the ANTR for pensioners leads to an adjustment of employment rates due to a combination of income and substitution effects. As a result, this paper estimates a Marshallian elasticity. The substitution effect resulting from a pure increase in the net wage increases the incentives of pensioners to work. The income effect resulting from an increase in expected lifetime wealth decreases the incentives of pensioners to work, assuming leisure is a normal good.

VIII.   Conclusion

This paper is the first to evaluate pension reforms in Soviet Russia after assembling an

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[46] See Alpert and Powell (2019), Brown (2013), Gelber et al. (2018), Hernæs et al. (2016), and Laun (2017).

archival data set. Desperate to increase its labor supply, the Soviet government decided to focus on older workers by implementing major pension reforms. Fascinatingly, even in a command economy, it is the use of financial incentives that induced pensioners to work. This sheds light on the prior claims by economists and historians (Atkinson and Mickelwright 1992, Granick 1987) that market forces were at work in the Soviet labor market. Declines in the benefit reduction rate for employed pensioners in 1964 and 1969 played a major role in increasing pensioner employment rates from 10 percent in 1964 to 26 percent in 1975. Non-universal eligibility for these reforms may understate the effect relative to if everyone were eligible.

The interpretation of the effect of pension reforms depends on the macroeconomic environment in the Soviet Union. A potential threat to internal validity would occur if coincidental macroeconomic shocks affected outcomes differentially among treatment and control groups. Table B5 examines the evolution of the growth of the Gross National Product (GNP), labor, capital, land, and total factor productivity (TFP) in the Soviet Union. Growth of all variables was steady through 1970, but started slowing for GNP and TFP from the early 1970s. Thus, shocks should not affect estimates of the 1964 reform but may be a factor after the 1969 reforms. However, excess demand for labor that prevailed in the Soviet economy (Lane 1986) makes estimates of the 1969 reform less affected by the slowdown in growth. Supporting this statement, Allen (2003) explains that the decline in growth happened mainly because the Soviet economy reached its labor capacity by the 1970s and could not maintain the previously high growth in labor resources.

Moreover, specific characteristics of the Soviet labor market affect the interpretation of employment responses. First, employment is measured at the full-time margin, because of the lack of part-time work. Second, pensioner work in the second economy may over-state employment responses. The increase in employment can reflect switches from several types of activities: full

retirement, employment in a state job less than two months per year while receiving the full pension, or part-time work in the second economy. As a result, this paper's data without second economy employment may over-estimate the effect of pension reform. This is a minor concern, because older workers were not prevalent in an already small second economy at the time (Treml 1992), and could pursue state employment for two months while keeping their full pension.

Policies with the goal to provide incentives for older-age employment are of interest to many countries. The Soviet experience is a success story in raising older-age employment. Importantly, estimates in this paper also reflect potential effects of working longer and increased income on mortality, because employment rates may change mechanically depending on the number of living pensioners. Previous empirical literature has found ambiguous effects of working longer and increased lifetime income on mortality.[47] Evaluation of the effect of Soviet pension reforms on mortality is an important avenue for future research. In summary, this paper's main contribution lies in documenting experiments in the Soviet pension system with newly collected data, and uncovering a stark response to incentives among Soviet pensioners.

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[47] Previous literature found: (1) working longer did not change mortality (Hagen 2018), increased mortality (Hallberg et al. 2015), or decreased mortality (Kuhn et al. 2015), (2) increases in income decreased mortality (Jensen and Richter 2003), or increased mortality (Ruhm 2000).

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Table 1. Pensions Received by Different Types of Employed Pensioners

	October 1956 to March 1964	April 1964 to January 1969	February 1969 to 1975
Full-term (not preferential)	*Current earnings ≤ 100 rubles* : receive a 15 ruble pension.	*Eastern region and eligible occupation* (majority eligible): receive 75% of pension.	*February 1969 for some occupations* : receive full pension.
	Current earnings > 100 rubles: receive no pension.	*Western region and eligible occupation* (majority eligible): receive 50% of pension.	*January 1970 for majority occupations* : receive full pension.
		Everywhere and eligible occupation : sum of current earnings and pension may not exceed 200 rubles.	*Eligible occupation:* sum of current earnings and pension may not exceed 300 rubles.
		Everywhere and ineligible occupation : same rules as before 1964.	*Ineligible occupations* : same rules as before 1964.
Incomplete-term	Receive no pension.	Receive no pension	Receive no pension.
		Exception : if work is connected to agriculture, then receive full pension.	*Exception* : if work is connected to agriculture, then receive full pension.
Preferential	*Less difficult work conditions* : same rules as full-term pensions.	*Less difficult work conditions:* same rules as full-term pensions.	Same as all other full-term pensions.
	More difficult work conditions : receive 50% of pension with no limit on the sum of earnings and pension.	*More difficult work conditions and eligible occupation* : same rules as for full-term pensions, but no limit on the sum of earnings and pension.	
		More difficult work conditions and ineligible occupation : same rules as before 1964.	

Notes: These rules summarize the pensions employed pensioners could receive after the 1956 pension law, after the 1964 reform, and after the 1969 reforms.

Table 2. Average Benefit Reduction Rates of Employed Pensioners

	October 1956 to March 1964	April 1964 to January 1969	February 1969 to 1975
All Regions			
Full-term Pensioners	47.8%	24.1%	0%
Incomplete-term Pensioners	39.1%	39.1%	39.1%
Full-term Pensioners			
Eastern Regions	47.8%	13.7%	0%
Western Regions	47.8%	27.5%	0%

Notes: The benefit reduction rate is calculated as: the benefits lost as a share of earnings while employed. All numbers are estimated for an average pensioner. Sources: These numbers are calculated by the author using law details in table 1, the share of pensioners with earnings less than 100 rubles from the 1959 survey, and the share of pensioners residing in eastern regions. See appendix D (section 1) for details of calculation.

Table 3. Labor Income and Pension Income of Pensioners by Employment Status

Employment Status of Pensioner	October 1956 to March 1964	April 1964 to January 1969	February 1969 to 1975
A. After-tax Earnings (E_h) > 100 rubles			
Working	E_h	$E_h+(1-b)P_h$	E_h+P_h
Not Working	P_h	P_h	P_h
B. After-tax Earnings (E_l) ≤ 100 rubles			
Work	E_l+15	$E_l+(1-b)P_l$	E_l+P_l
No Work	P_l	P_l	P_l

Notes: This table represents the sum of labor and pension income of pensioners. P_h is the pension of pensioners currently earning (after taxes), E_h, where E_h>100 rubles, while P_l is the pension of those earning (after taxes), E_l, where E_l≤100 rubles. The share of benefits a pensioner lost if employed, *b*, is 0.25 for eastern regions, and 0.5 for western regions. Because the minimum pension is 30 rubles, $P_h \geq P_l > 15$. Earnings taxes are negligible, with an average of 3 percent for pensioners. Except for the presence of the benefit reduction rate for employed pensioners, pensions are not taxed.

Table 4. Effect of 1964 Reform Lowering Benefit Reduction Rates: Comparison of Full-term and Incomplete-term Pensioners

	(1)	(2)	(3)
	January 1964 Full-term Employment Rate: 9.5		
Pre-Period			
Full-term*1962	0.498	0.0218	0.175
	[0.612]	[0.761]	[0.792]
Full-term*1963	0.521	0.164	0.184
	[0.598]	[0.815]	[0.815]
After 1964 Reform			
Full-term*1965	2.365***	2.374***	2.384***
	[0.451]	[0.642]	[0.657]
Full-term*1966	3.178***	2.907***	2.815***
	[0.861]	[1.050]	[1.008]
Full-term*1967	3.972***	3.804***	3.647***
	[0.738]	[0.952]	[0.901]
Full-term*1968	4.814***	4.632***	4.436***
	[0.738]	[0.960]	[0.910]
Full-term*1969	6.155***	5.995***	5.667***
	[0.724]	[1.032]	[0.983]
Covariates	FE: Year, Oblast, Oblast by Full-term	FE: Year, Oblast, Oblast by Full-term, Year by Oblast	FE: Year, Oblast, Oblast by Full-term, Year by Oblast; $X_{o,t,p}$
Observations	1,168	1,168	1,168
R-squared	0.897	0.976	0.977
Number of oblasts	73	73	73

Notes: The coefficients represent the difference in employment rates between full-term and incomplete-term pensioners in each year relative to the difference in 1964. The full-term pensioners are the treatment group, because they experience a fall in average benefit reduction rates from 47.8 to 24.1 percent in 1964. I present θ and π from equation (1) using the pensioner employment rate as a dependent variable. Column (1) includes year fixed effects, oblast fixed effects, and oblast by full-term pensioner fixed effects. Column (2) adds year by oblast fixed effects. Column (3) adds average pensions by pensioner type, oblast, and year ($X_{o,t,p}$), which represent the sum of pensions if not employed divided by the number of all pensioners. Heteroskedasticity-robust standard errors clustered by oblast are in brackets. Regressions are weighted by the number of pensioners of each type in an oblast in 1964. Statistically significant at ***0.01, **0.05, and *0.10. Source: Data constructed by the author from the GARF archives.

Table 5. Effect of 1964 and 1969 Reforms Lowering Benefit Reduction Rates: Comparison of Eastern and Western Regions

	(1) Full-term Pensioners	(2) Preferential Pensioners
	A. Effect of the 1964 Reform	
1964 Employment Rate	7.393	7.950
East*(1962 to 1963)	0.0805	-0.562
	[0.855]	[0.558]
1964 Reform		
East*(1966 to 1969)	1.737**	3.486***
	[0.724]	[0.755]
Observations	584	584
R-squared	0.902	0.961
Number of Oblasts	73	73
	B. Effect of the 1969 Reform	
1969 Employment Rate	18.42	18.68
West*(1967 to 1968)	0.539	0.772
	[0.537]	[0.597]
1969 Reform		
East*(1971 to 1975)	1.793*	5.174***
	[0.963]	[1.124]
Observations	657	657
R-squared	0.883	0.954
Number of Oblasts	73	73

Notes: Panel A shows coefficients from equation (3), representing the difference in employment rates between eastern and western regions in grouped years relative to the difference in 1964. The dependent variable is the employment rate of full-term pensioners (including preferential) in column 1, and of preferential pensioners in column 2. The eastern regions are the treatment group, because from 1965 to 1969 they experienced an additional 13.7 percentage point fall in the benefit reduction rate relative to western regions. Panel B shows coefficients from equation (4), representing the difference in employment rates between western and eastern regions in grouped years relative to the difference in 1969. The western regions are the treatment group, because from 1971 to 1975 they experienced an additional 13.7 percentage point fall in the benefit reduction rate relative to eastern regions. Controls include year fixed effects, oblast fixed effects, and co-variates at the year and oblast level (see text). Heteroskedasticity robust standard errors clustered by oblast construct standard errors in brackets. Regressions are weighted by the number of pensioners of each type in an oblast in 1964. Statistically significant at ***0.01, **0.05, and *0.10. Sources: Data constructed by the author from the GARF archives, and "Narodnoe Hozyaistvo" yearbooks.

Table 6. Effect of 1964 Reform Lowering Benefit Reduction Rates by Previous Earnings: Comparison of Eastern and Western Regions

| Earnings for Pension Calculation (rubles)	Earnings Percentile in 1959	(1) Coefficient	(2) 95% Confidence Interval	(3) R-squared	(4) % Employed in 1959	(5) Number of Oblasts	(6) Number of Observations
All	0-100	2.524	[1.10, 3.89]	0.655	8.7	38	1,028
0-29	0-11.6	0.0525	[-6.30, 6.62]	0.711	1.7	34	68
30-39	11.7-30.2	2.552	[1.30, 3.80]	0.889	6.7	38	76
40-59	30.3-54.9	0.823	[-1.04, 2.67]	0.737	8.0	38	152
60-79	55-72.4	3.726	[1.56, 6.01]	0.642	9.5	38	152
80-99	72.5-83.4	1.18	[-1.48, 3.90]	0.685	9.7	38	152
100-159	83.5-94.4	3.816	[1.49, 6.06]	0.7	10.8	38	228
160+	94.5-100	-0.584	[-4.96, 4.11]	0.795	9.7	38	200

Notes: The table shows coefficients from equation (5), representing the difference in employment rates between eastern and western regions in 1966 relative to the difference in 1959. The dependent variable is the employment rate of full-term pensioners. Each row is a separate regression within an earnings group. Earnings are proxied by average previous monthly earnings for pension calculation. Earnings percentiles are constructed using the distribution of earnings in the 1959 survey. In 4 oblasts, there were no pensioners with earnings <30 rubles. The number of observations in an earnings group depends on the number of earnings ranges with data within that group. Column (2) presents confidence intervals constructed using the clustered wild-bootstrap. Regressions are weighted by the number of old-age pensioners in an oblast in 1959. Source: Data constructed by the author from the GARF archives, and "Narodnoe Hozyaistvo" yearbooks.

Table 7. Pensioner Employment Elasticity Estimates

| Benefit Reduction Rate Change	(1) Point Estimate	(2) Elasticity	(3) 95% Confidence Interval
A. 1964 Reform			
Full-term (treatment) vs. Incomplete-term (control) Pensioners			
Average of 47.8% to 24.1% after 1 year	2.8 (table 4)	0.75	[0.20, 2.81]
Average of 47.8% to 24.1% after 4 years	5.7 (table 4)	1.37	[0.69, 4.86]
Full-term Pensioners in Eastern (treatment) vs. Western (control) Regions			
13.7 percentage point reduction over 4 years	1.7 (table 5)	1.14	[0.21, 3.62]
Preferential Pensioners in Eastern (treatment) vs. Western (control) Regions			
13.7 percentage point reduction over 4 years	3.5 (table 5)	2.01	[1.00, 5.76]
B. 1969 Reforms			
Full-term Pensioners in Western (treatment) vs. Eastern (control) Regions			
13.7 percentage point reduction over 5 years	1.8 (table 5)	0.58	[-0.06, 2.31]
Preferential Pensioners in Western (treatment) vs. Eastern (control) Regions			
13.7 percentage point reduction over 5 years	5.2 (table 5)	1.4	[0.71, 5.43]

Notes: This table presents point estimates (tables 4 and 5), and corresponding elasticities with respect to the ANTR. ANTR is calculated as: (Earnings-Earnings taxes-Pension Reduction Rate*Pension)/Earnings. This paper evaluates the ANTR at average values of earnings, taxes, pension reduction rates, and pensions. Confidence intervals are calculated using a parametric bootstrap. See appendix D (sections 1, 2, and 3) for the construction of these elasticities and their confidence intervals.

**Figure 1. Evolution of Employment Rates among Old-Age Pensioners**
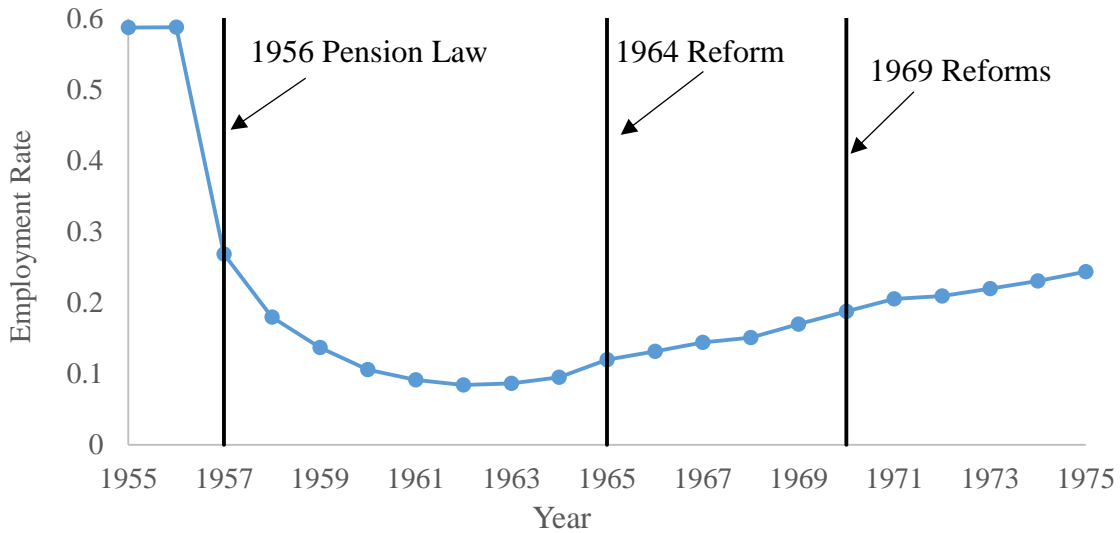
Notes: This figure shows the trend in employment rates among all old-age pensioners. The 1956 pension law increased the number of individuals eligible for pensions, raised pension replacement rates, and introduced benefit reduction rates for employed pensioners. The 1964 reform lowered the benefit reduction rate for employed pensioners. The 1969 reforms further lowered the benefit reduction rate to 0 percent. Sources: Data is constructed by the author from the GARF and RGAE archives.

Figure 2. Evolution of Employment Rates of Full-term and Incomplete-term Pensioners
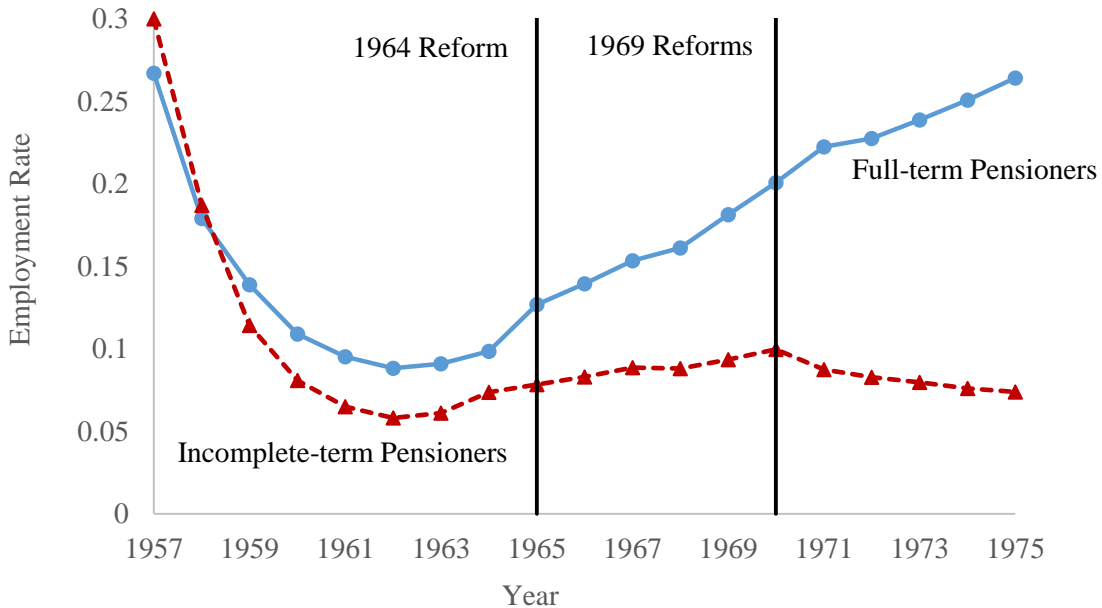
Notes: This figure shows trends in employment rates of full-term (solid line, circle) and incomplete-term (dashed line, triangle) pensioners. Sources: Data constructed by the author from the GARF and RGAE archives.
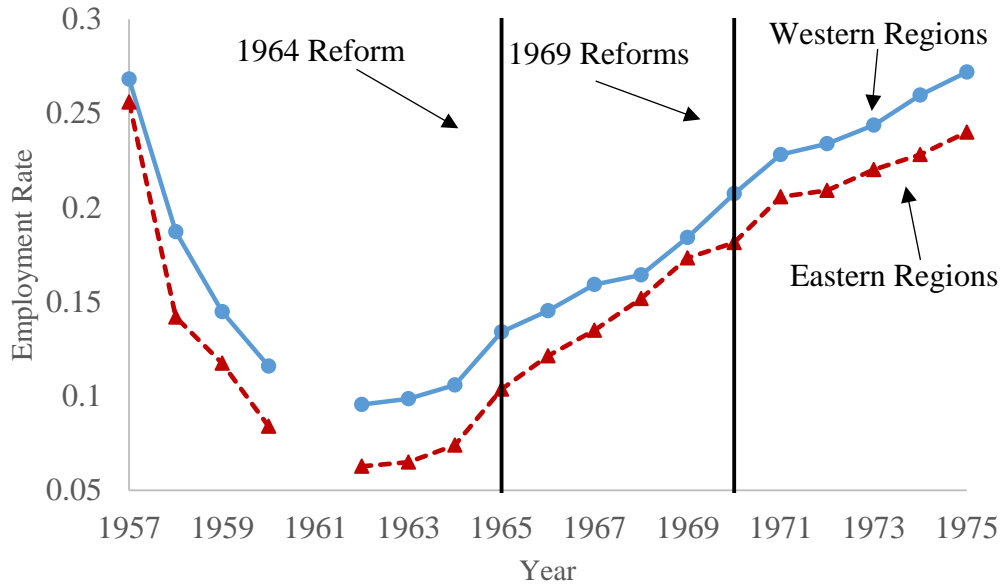
Figure 3. Effect of 1964 Reform Lowering Benefit Reduction Rates on Employment Rates: Comparison of Full-term and Incomplete-term Pensioners
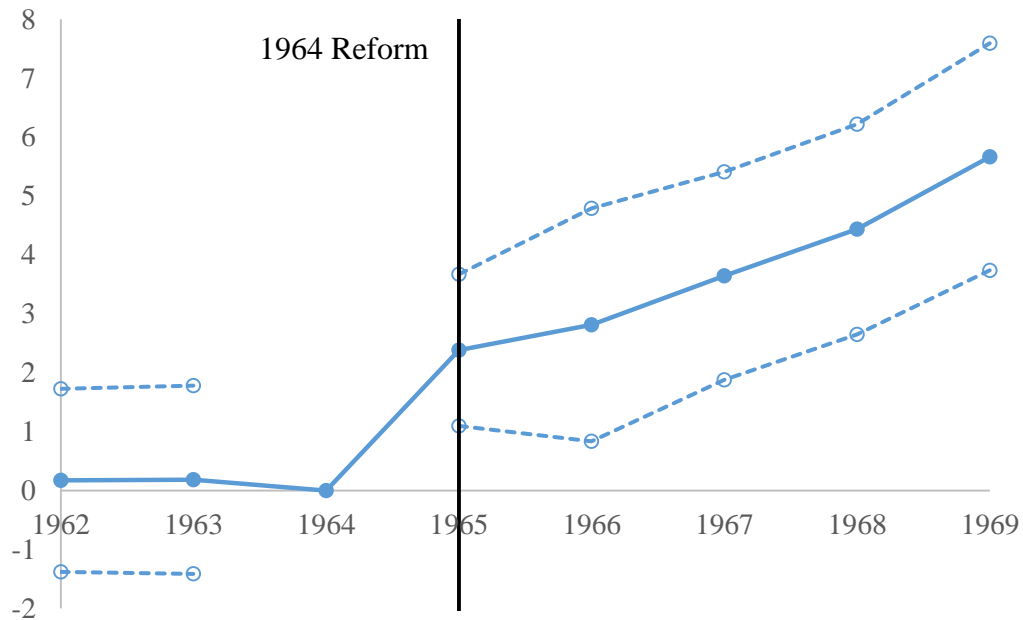

Notes: The coefficients represent the difference in employment rates between full-term and incomplete-term pensioners in each year relative to the difference in 1964. These coefficients are the same as in column (3) in table 4. The full-term pensioners are the treatment group, because they experience a fall in average benefit reduction rates from 47.8 to 24.1 percent in 1964. I present θ and π from equation (1) using the pensioner employment rate as a dependent variable. Heteroskedasticity-robust standard errors clustered by oblast construct 95-percent, point-wise confidence intervals (dashed lines). Regressions are weighted by the number of old-age pensioners of each type in an oblast in 1964. Source: Data constructed by the author from the GARF archives.

Figure 4. Evolution of Pensioner Employment Rates in Eastern and Western Regions
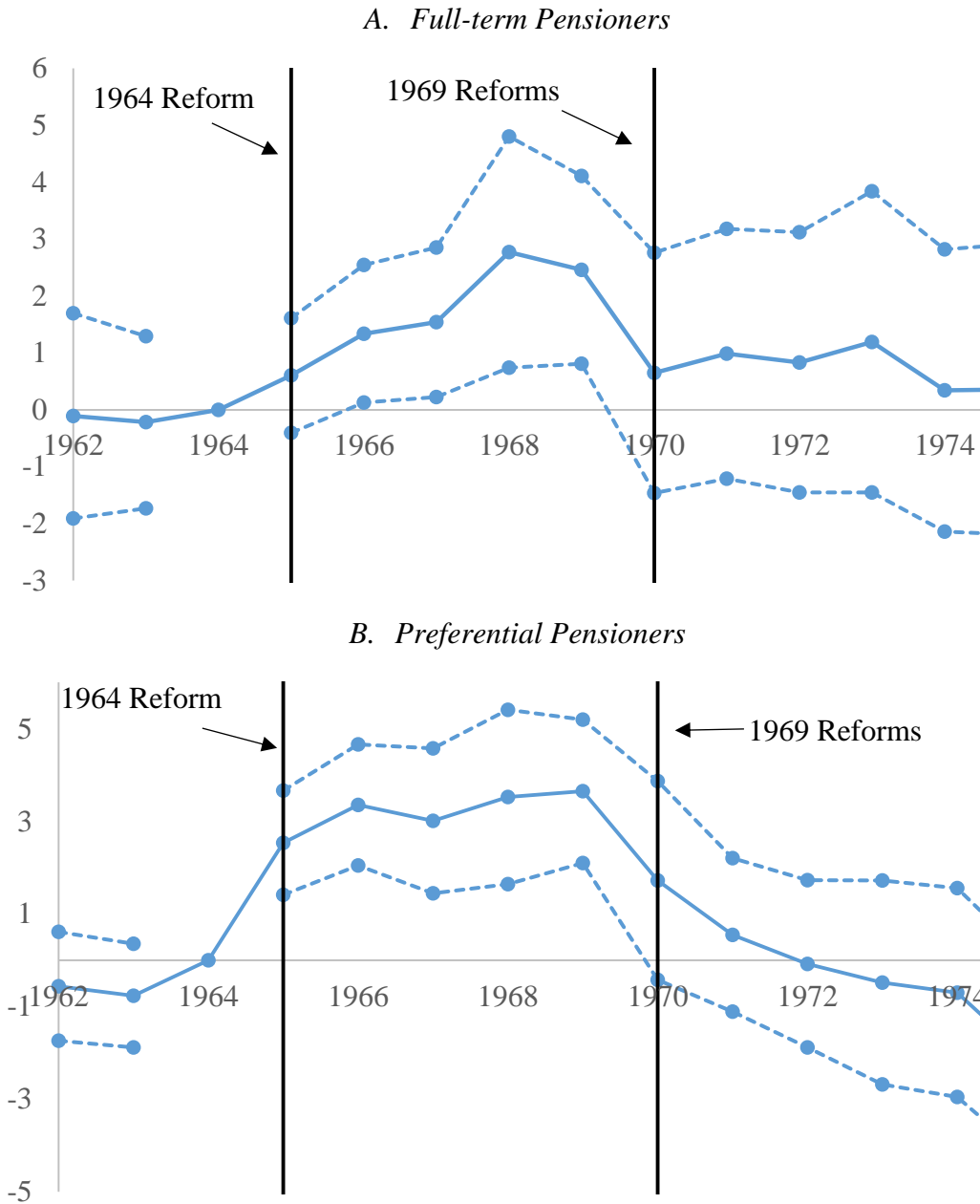
A. Full-term Pensioners

B. Preferential Pensioners
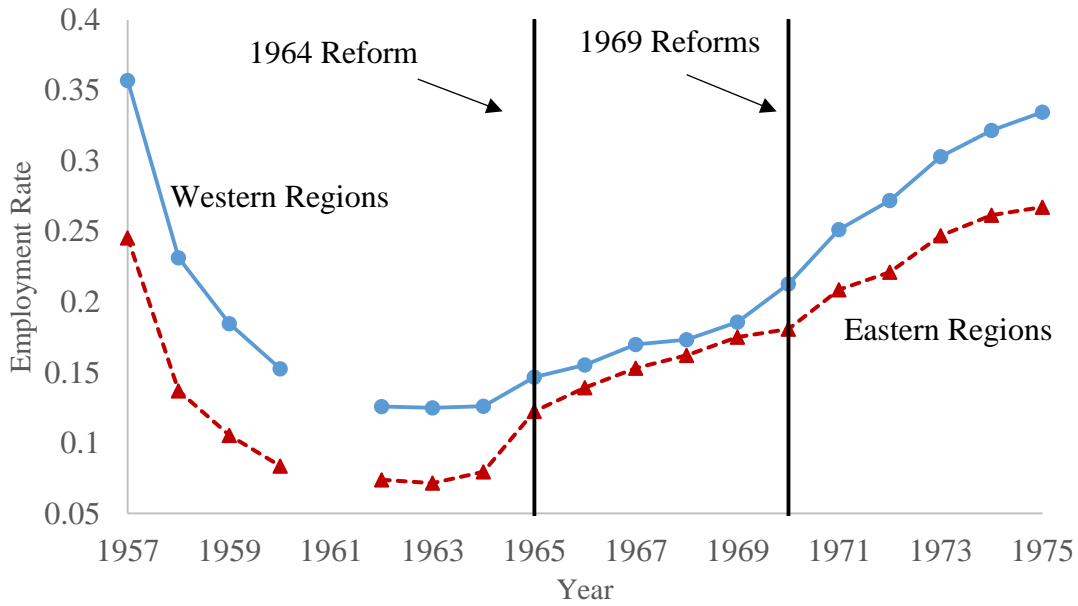
Notes: This figure shows the evolution of employment rates among eastern and western regions in Soviet Russia. Panel A presents full-term pensioners (including preferential), while panel B presents only preferential pensioners. Data from 1961 are likely lost. Sources: Data constructed by the author from the GARF archives.

Figure 5. Effect of 1964 and 1969 Reforms Lowering Benefit Reduction Rates on Employment Rates: Comparison of Eastern and Western Regions

A. Full-term Pensioners

B. Preferential Pensioners

Notes: This figure presents coefficients from equation (2), where the dependent variable is the employment of full-term (panel A), and preferential (panel B) pensioners. Coefficients present the difference in employment rates between eastern and western regions in each year relative to the difference in 1964. Heteroskedasticity robust standard errors clustered by oblast construct confidence intervals (dashed lines). Regressions are weighted by the number of pensioners in an oblast in 1964. Sources: Data constructed by author from the GARF archives, and "Narodnoe Hozyaistvo" yearbooks.

ONLINE APPENDIX

Table of Contents:

APPENDIX A

References to Soviet Laws and Newspaper Articles

<u>Soviet Laws</u>

USSR Law. 1956. "About State Pensions." on 24 July.

USSR Law. 1964. "About Pensions and Benefits to Collective Farmers." no. 2688-VI. on 15 July.

Sovmin USSR. 1964. "About Increasing Material Interest of Pensioners in Working in Production" Resolution no. 175 on 26 February.

Sovmin USSR. 1969. "About Further Increasing Material Interest of Able Old-age Pensioners to Continue Work after Claiming a Pension." Resolution no. 995 on 31 December.

<u>Newspaper Articles</u>

Izvestia, "Law on State Pensions" (July 15, 1956, p. 1)

---------, "Minister Answers Our Readers." (April 5, 1964, p.5)

---------, "Pensions and Wages". (April 1, 1969, p. 4)

---------, "Official Department: Procedure for Paying Pensions to Working Pensioners". (January 17, 1970a, p.2)

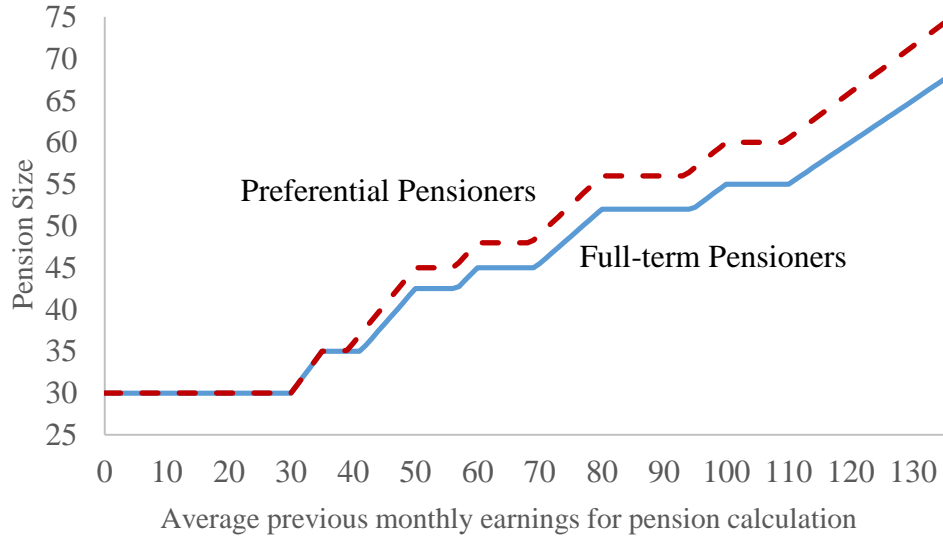---------, "Izvestia Legal Service: Return to Work." (February 7, 1970b, p.5)

Pravda, "In the USSR Council of Ministers." (March 6, 1964, p.1)

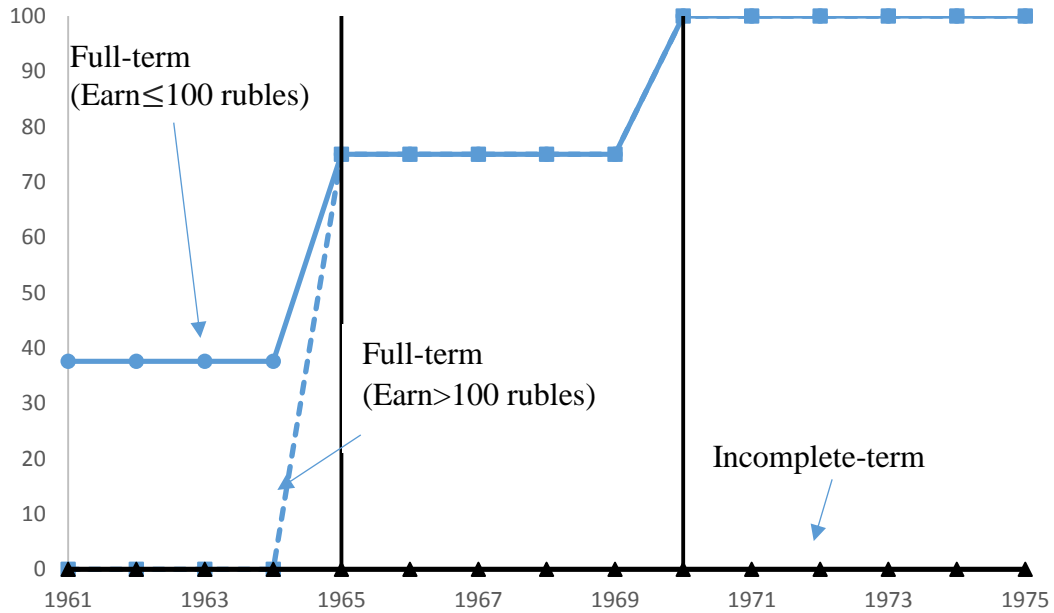---------, "Increase -1.5 Milliards" (July 1, 1971, p.6)

Supplementary Figures and Tables

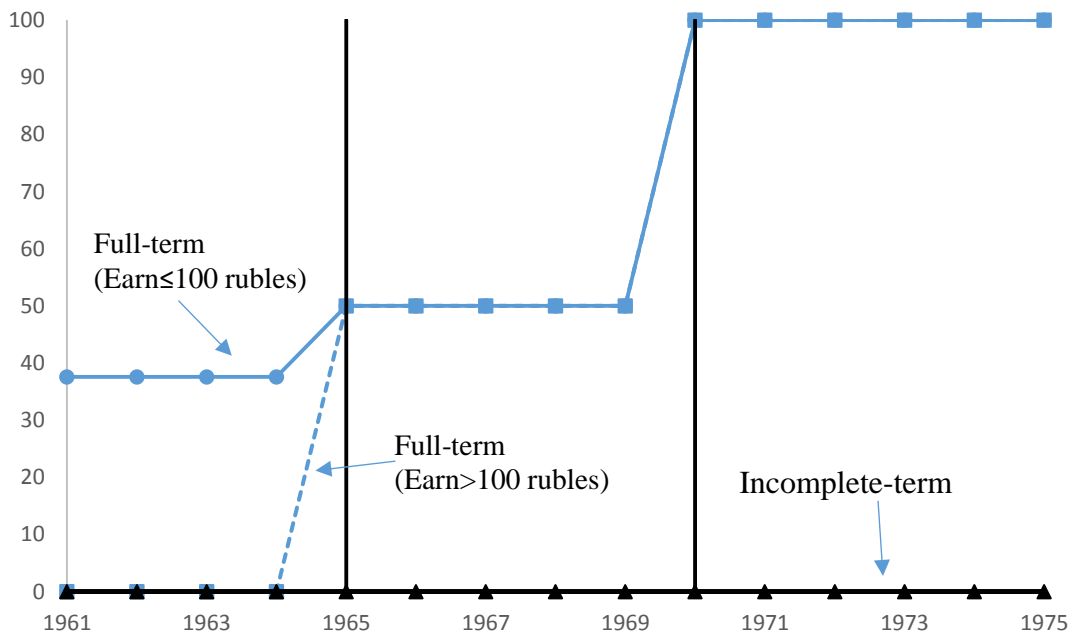### Figure B1. Pension Size by Previous Earnings

Notes: full-term pensioners (straight line), and preferential pensioners (dashed line). See table B1 for rules.

Figure B2. Percent of Pension Receivable by Employed Pensioners: Full-term and Incomplete-term Pensioners

A. Eastern Regions

B. Western Regions

Note: Percent of pension receivable is the pension that an employed pensioner receives as a share of the pension this pensioner would receive if retired. In years 1961 to 1964, for those with earnings not exceeding 100 rubles, it is calculated as 15/39.9, where 39.9 is the average pension of those whose earnings do not exceed 100 rubles. For everyone else, the numbers apply to everyone. Note that after 1965, the percent pension receivable is the same for all earnings levels.

Figure B3. Percent of Pension Receivable by Employed Pensioners: Eastern and Western Regions
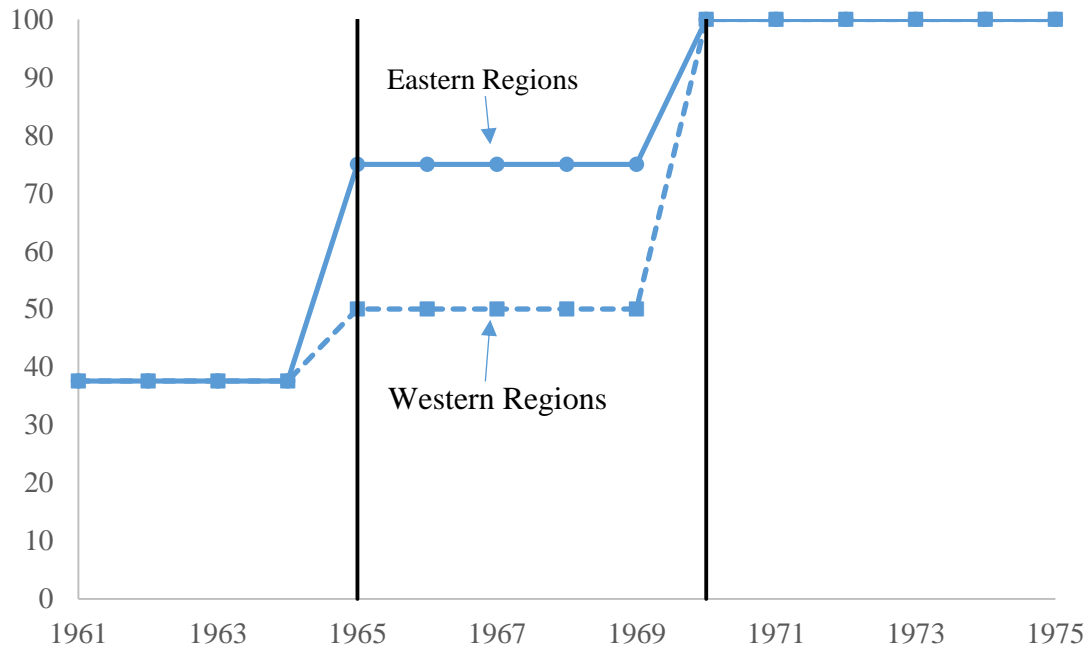
A. Earn ≤ 100 rubles
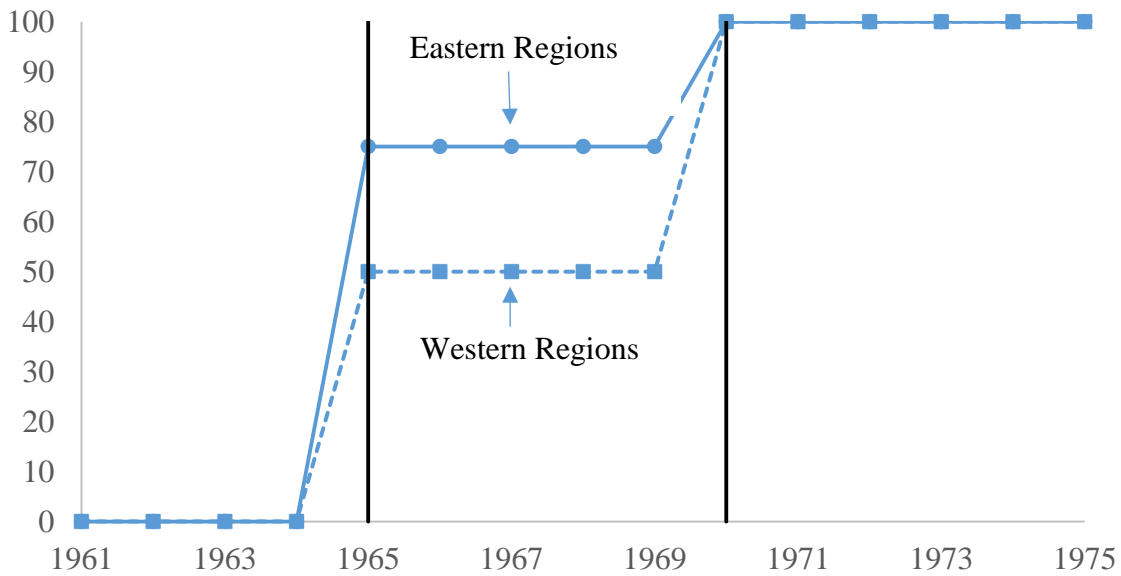

B. Earn>100 rubles

Note: Percent of pension receivable is the pension that an employed pensioner receives as a share of the pension this pensioner would receive if retired. In years 1961 to 1964, for those with earnings not exceeding 100 rubles, it is calculated as 15/39.9, where 39.9 is the average pension of those whose earnings do not exceed 100 rubles. For everyone else, the numbers apply to everyone. Note that from 1961 to 1964 and from 1970 to 1975 percent of pension receivable is the same in eastern and western regions in panels A and B.

Figure B4. Map of Eastern and Western Regions in Soviet Russia

Notes: The eastern regions are shaded (the Urals, Siberia and the Far East), while the western regions are white.

Figure B5. Evolution of Log Employment Rates of Full-term and Incomplete-term Pensioners
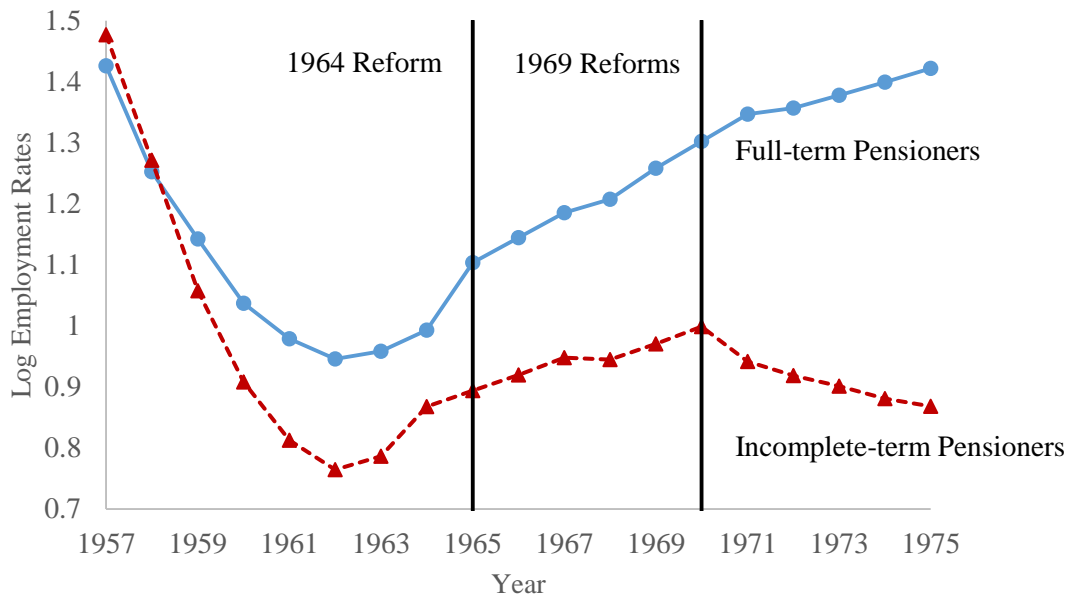
Notes: This figure shows trends in log employment rates of full-term (solid line, circle) and incomplete-term (dashed line, triangle) pensioners. Sources: Data constructed by the author from the GARF archives.

Figure B6. Effect of 1964 Reform on Log Pensioner Employment Rates: Comparison of Eligible and Ineligible Pensioners
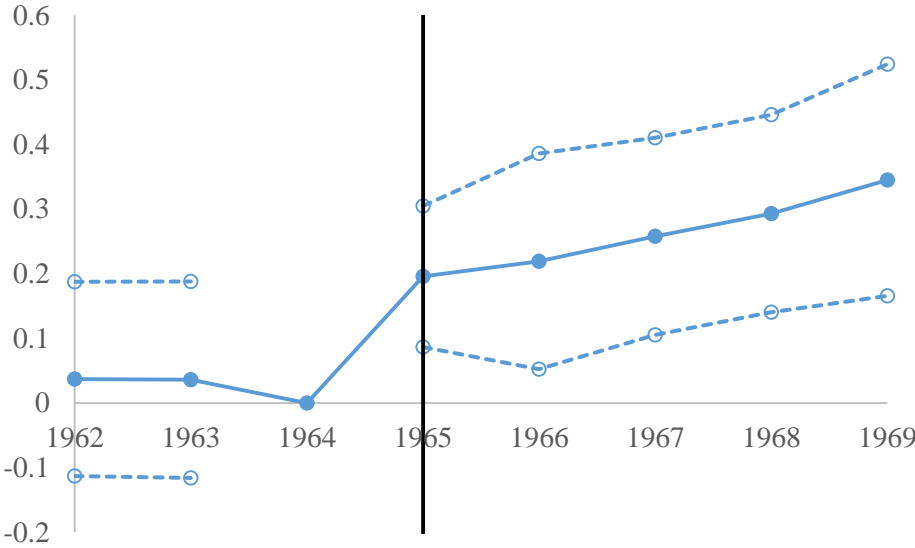
Notes: The dependent variable is the log of pensioner employment rate. Otherwise, the analysis is as described in notes for figure 3.

Figure B7. Evolution of Log Employment Rates: Eastern vs. Western Regions

A. Full-term Pensioners

B. Preferential Pensioners
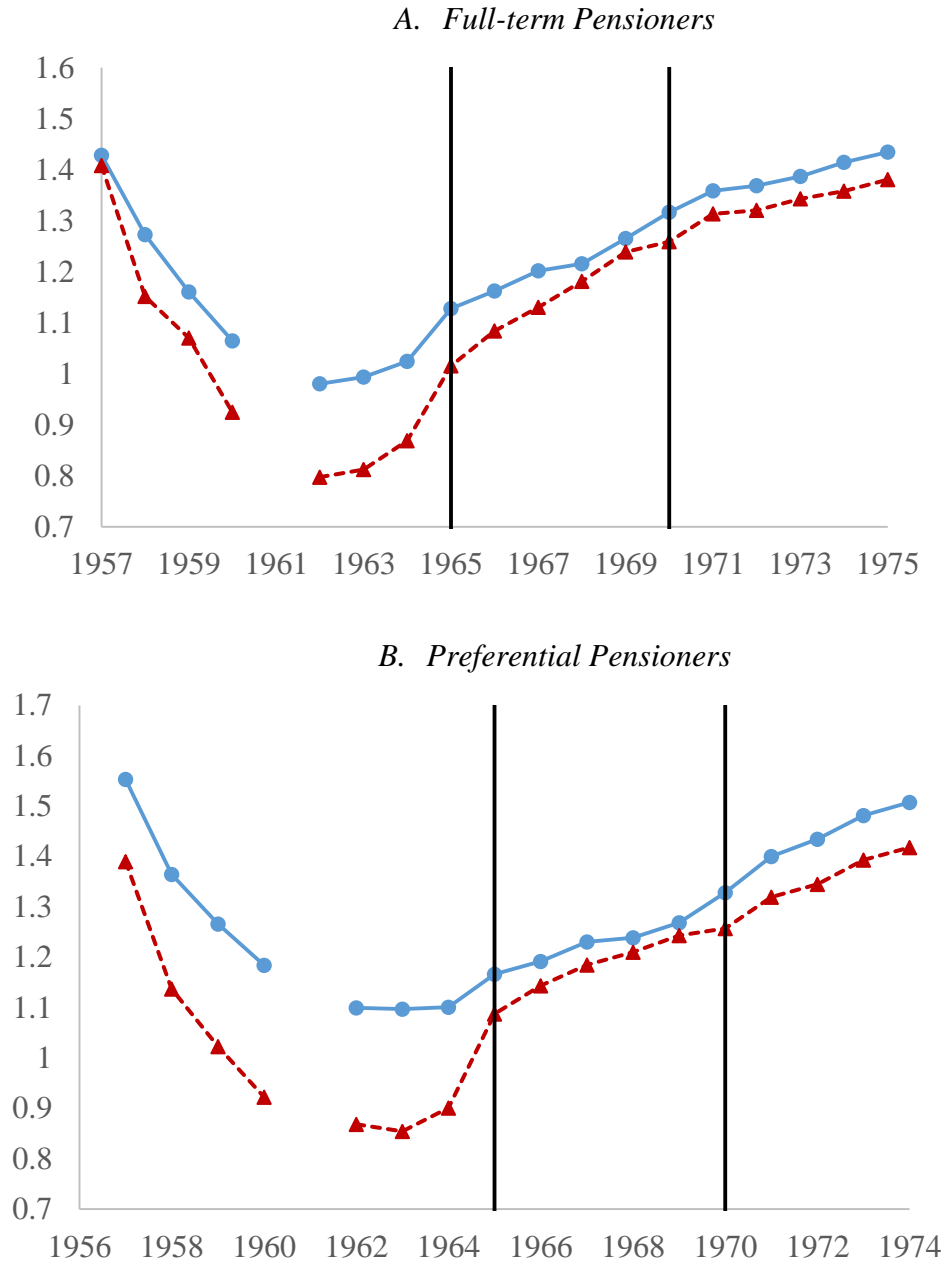
Notes: This figure shows the evolution of log employment rates among eastern and western regions in Soviet Russia. Panel A presents full-term pensioners (including preferential), while panel B only presents preferential pensioners. Data from 1961 are likely lost. Sources: Data constructed by author from the GARF archives.

Figure B8. Effect of 1964 Reform on Log Employment Rate: Comparison of Eastern and Western Regions

A. Full-term Pensioners

B. Preferential Pensioners
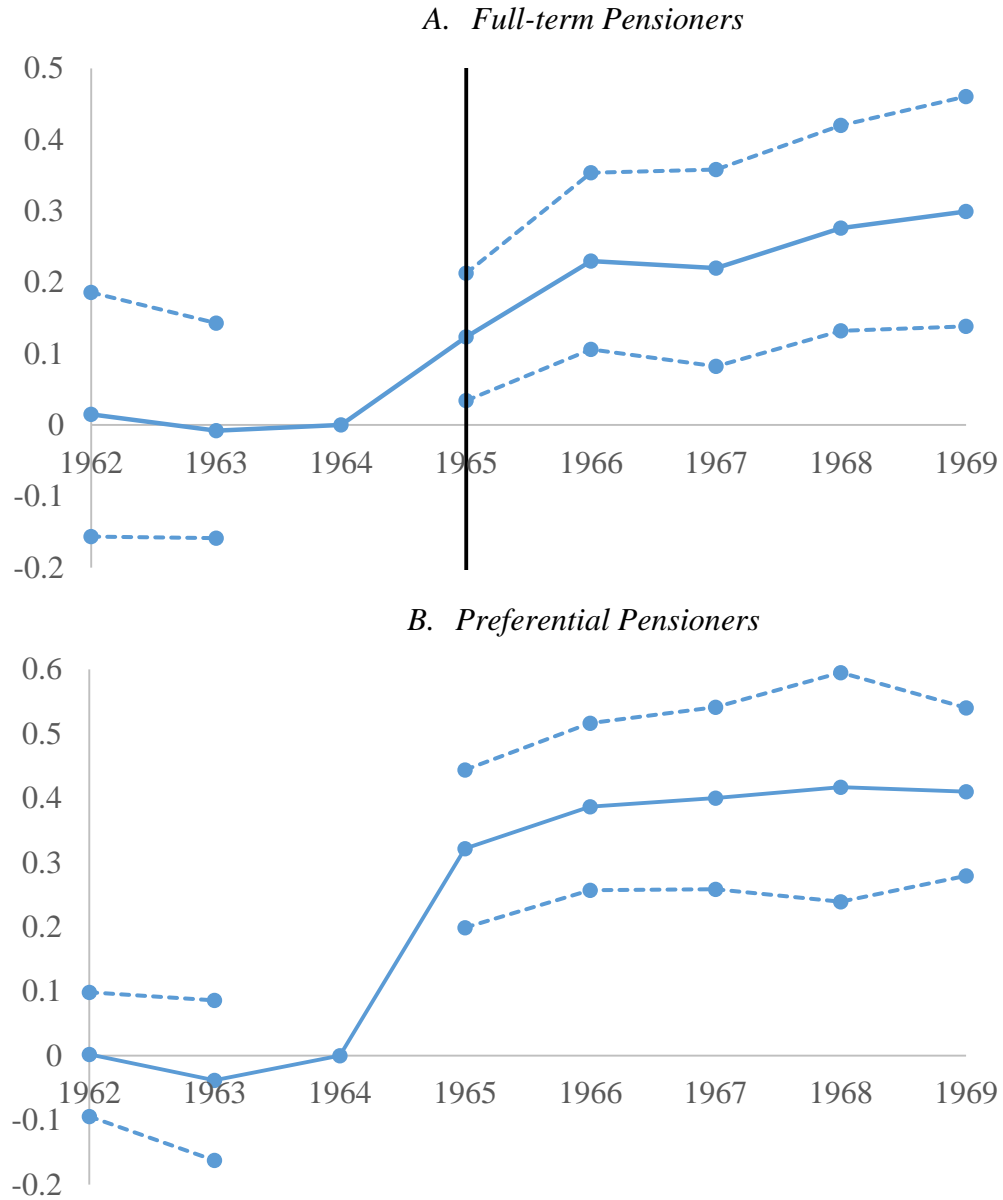
Notes: See notes for figure 5, with the difference of the dependent variable being the log of the employment rate.

Figure B9. Percent Change in the Average Net of Tax Rate (ANTR) for Full-term Pensioners after 1964 Reform
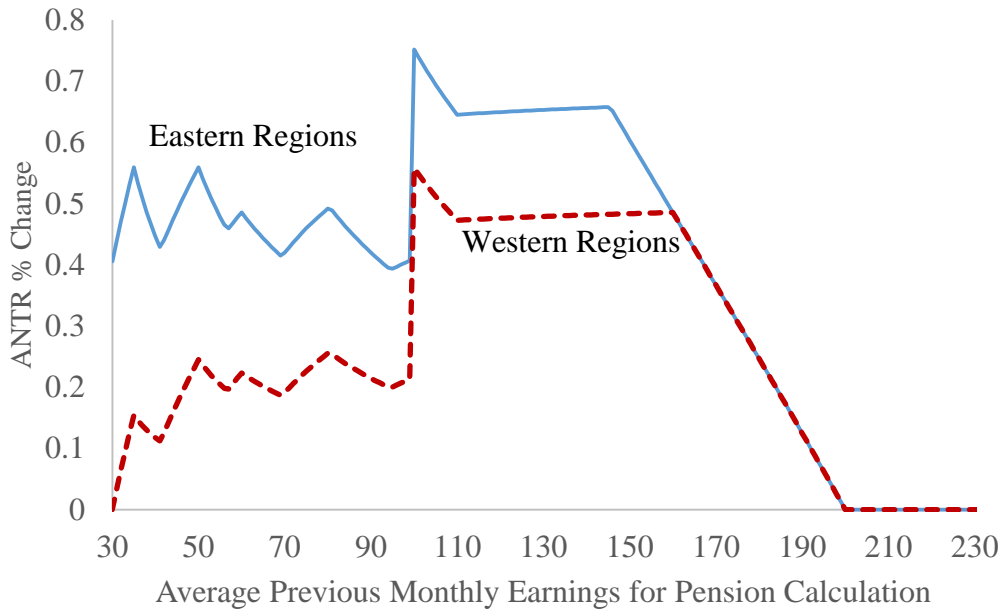
Notes: The figure shows percent change of ANTR after the 1964 reform among full-term pensioners for different levels of earnings. Current earnings are proxied by the average previous monthly earnings for pension calculation.

Figure B10. Percent Change in the ANTR for Full-term Pensioners after 1964 Reform: Eastern vs. Western Regions
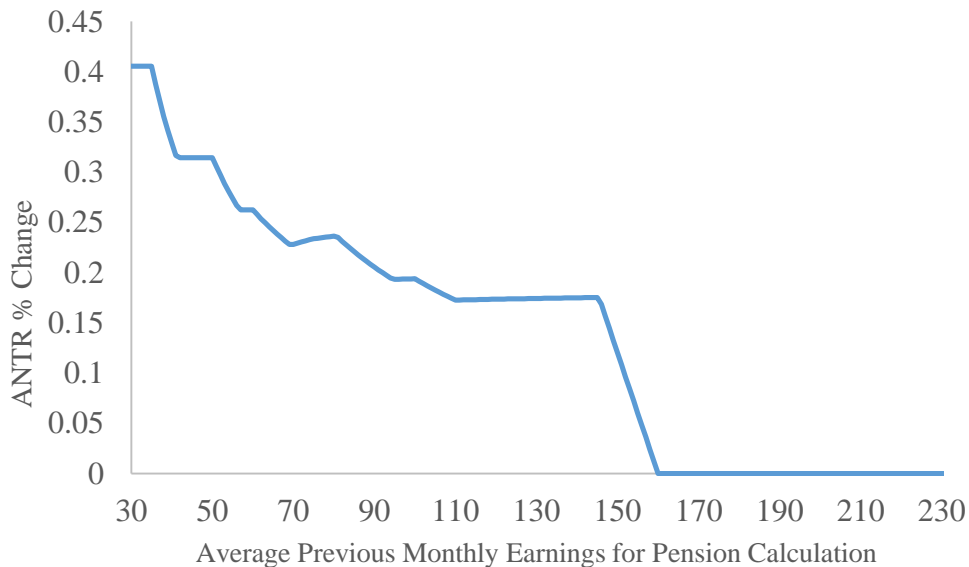
Notes: The figure shows percent change of ANTR in eastern relative to western regions after the 1964 reform among full-term pensioners. This graph excludes "more difficult" preferential pensioners, because the rules for them were different, but includes "less difficult" preferential pensioners. See details of calculations in Appendix D, section 4.

Figure B11. Percent Change in ANTR for "Less Difficult" Preferential Pensioners after 1964 Reform: Eastern vs. Western Regions
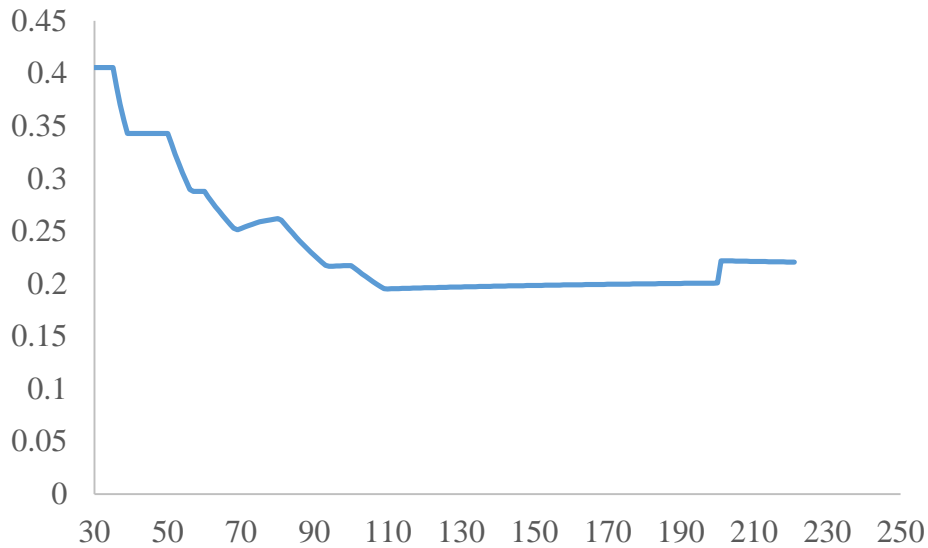
Notes: This figure shows percent change in ANTR in eastern relative to western regions after the 1964 reform among "less difficult" preferential pensioners. See details of calculations in Appendix D, section 4.

Table B1. Pension Replacement Rates

Monthly Earnings (y)	Type of Pension			
	Full-term (not preferential)		*Preferential*	
	Replacement Rate	**Minimum Pension**	**Replacement Rate**	**Minimum Pension**
$E \leq 35$	100	30	100	30
$35 < E \leq 50$	85	35	90	35
$50 < E \leq 60$	75	42.5	80	45
$60 < E \leq 80$	65	45	70	48
$80 < E \leq 100$	55	52	60	56
$E > 100$	50	55	55	60

Notes: Monthly earnings, E, are average previous monthly earnings for pension calculation. The replacement rate determines the pension as a share of monthly earnings. Within each earnings group, the pension may not be below the minimum pension amount.

Table B2. Characteristics of Eastern and Western Regions in Soviet Russia

	Eastern Regions	Western Regions
% Old-Age Pensioners Employed in 1963	7.2	10.2
1959 Census		
% Employed among all working age	74.1	76.9
% Blue Collar among all working age	74.3	69.8
% 50 to 59 year olds with at least High School	17.1	20.2
% 50 to 59 year olds with at least Some College	3	7.4
Number of Oblasts	25	48
Share of Old-Age Pensioners Living in Oblasts in 1964	24.5	75.5

Notes: These statistics are based on the entire population census of Soviet Russia. Source: 1959 Soviet census, and administrative data from RGAE archives.

Table B3. Marginal Income Tax Rates by Monthly Earnings

Monthly Earnings	Marginal Income Tax Rate
<=60	0%
61	25%
62	27%
63 to 69	29%
70 to 74	30%
75	27%
76 to 80	18%
81	70%
82 to 100	12%
>100	13%

Notes: No taxes were paid on earnings below 60 rubles. Also, for every additional 100 rubles over 100 rubles, pay an additional 13 rubles in taxes. Source: Pashkevich, Bogdan. 1970. *Manual for Salary Calculations*. Nauka i Tehnika. Minsk..

Table B4. Effect of 1964 and 1969 Reforms on Log Employment Rates: Comparison of Eastern and Western Regions

	(1)	(2)
	Full-term Pensioners	**Preferential Pensioners**
	A. Effect of the 1964 Reform	
East*(1962 to 1963)	0.003	-0.019
	[0.080]	[0.053]
1964 Reform		
East*(1966 to 1969)	0.251***	0.401***
	[0.067]	[0.069]
Observations	584	584
R-squared	0.916	0.944
Number of Oblasts	73	73
	B. Effect of the 1969 Reform	
West*(1967 to 1968)	0.048*	0.009
	[0.027]	[0.032]
1969 Reform		
East*(1971 to 1975)	0.078*	0.217***
	[0.046]	[0.057]
Observations	657	657
R-squared	0.905	0.942
Number of Oblasts	73	73

Notes: The dependent variable is the log of the employment rate. All other details of estimation are as in the notes to table 5.

Table B5. Annual Average Rates of Growth of GNP, Inputs, and Productivity in the Soviet Union

Years	1928-40	1950-60	1960-70	1970-75	1975-80	1980-85
GNP	5.8	5.7	5.2	3.7	2.6	2
GNP per capita	3.6	3.9	3.9	2.7	1.8	1.1
Labor (man-hours)	3.3	1.2	1.7	1.7	1.2	0.7
Capital	9	9.5	8	7.9	6.8	6.3
Land	1.6	3.3	0.2	1	-0.1	-0.1
Total Inputs	4	4	3.7	3.7	3	2.5
Total Factor Productivity	1.7	1.6	1.5	0	-0.4	-0.5

Notes: Labor is employment of full-time civilians and the military adjusted for hours. Capital refers to "reproducible fixed capital" and excludes changes in livestock inventories. Land is measured by area under cultivation, not farmland or arable land. Total inputs are weighted by 0.62 for labor, 0.33 for capital, and 0.05 for farmland. Source: Ofer, Gur. 1987. "Soviet Economic Growth: 1928-1985." *Journal of Economic Literature* 25(4): 1767-1833.

Table B6. Distribution of Percent Changes in the Average Net of Tax Rate (ANTR) for Full-term Pensioners

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			before 1964	1964 to 1969				
			Russia	*East*		*West*		*East vs. West*
Earnings Range	**Share in Range**	**Pension Replace Rate**	**ANTR**	**ANTR**	**ANTR Percent Change**	**ANTR**	**ANTR Percent Change**	**ANTR Percent Change**
<30	0.100	1	0.500	0.750	40.5%	0.500	0.0%	40.5%
30-39	0.178	1	0.429	0.750	56.0%	0.500	15.4%	40.5%
40-49	0.134	0.85	0.483	0.788	48.8%	0.575	17.4%	31.4%
50-59	0.111	0.77	0.503	0.808	47.4%	0.615	20.2%	27.2%
60-69	0.100	0.69	0.519	0.806	44.0%	0.634	19.9%	24.1%
70-79	0.079	0.65	0.492	0.780	46.0%	0.617	22.6%	23.4%
80-89	0.064	0.61	0.491	0.772	45.2%	0.620	23.2%	22.0%
90-99	0.046	0.55	0.528	0.783	39.4%	0.645	20.0%	19.3%
100-119	0.065	0.5	0.414	0.789	64.5%	0.664	47.3%	17.3%
120-139	0.043	0.5	0.407	0.782	65.3%	0.657	47.9%	17.4%
140-159	0.026	0.5	0.402	0.735	60.4%	0.652	48.4%	12.0%
160-179	0.017	0.5	0.398	0.575	36.7%	0.575	36.7%	0.0%
180-199	0.011	0.5	0.395	0.448	12.5%	0.448	12.5%	0.0%
≥200	0.028	0.5	0.337	0.337	0.0%	0.337	0.0%	0.0%

Column (1) presents ranges of average monthly earnings for pension calculation, while column (2) presents the share of pensioners in each earnings range using data from the 1959 survey. Individuals had to be paid at least 30 rubles in the 1960s (but earnings for pension calculation could be <30, because wages in an earlier time period were lower for older pensioners), so current earnings <30 rubles were not possible. Column (3) presents the pension replacement rates from table B1, where the replacement rates are the ones at the midpoint of the earnings range. So, these replacement rates evaluated at midpoints take the fact that the pension needs to also be above a minimum amount into account. Column (4) presents the ANTR before 1964, common to all regions. Column (5) presents the ANTR after 1964 but before 1969 in eastern regions, while column (7) represents it for western regions. Column (6) presents percent change in ANTR in eastern regions: ln(col 5)-ln(col 4). Column 8 presents percent change in ANTR in western regions: ln(col 7)-ln(col 4). Column 9 presents percent change in ANTR in eastern relative to western regions from 1964 to 1969: ln(col 5)-ln(col 7). See details of ANTR calculations in appendix D, section 4. Data: 1959 survey, table 1, table B1, and table B3.

Table B7. Average Net-of-Tax Rates (ANTR) for Employed Pensioners

	Before 1964	1964 to 1968	1969 to 1974
All Regions			
Full-term Pensioners	0.517	0.729	0.970
Incomplete-term Pensioners	0.579	0.579	0.579
Full-term Pensioners			
Eastern Regions	0.517	0.833	0.970
Western Regions	0.517	0.695	0.970

Notes: See calculations in Appendix D, section 1.

Data Construction and Sources

Data in this paper either came from the archives (RGAE or GARF), or from published sources. RGAE stands for Russian Government Archive of Economics, and is located at: 119435, ul. Bol'shaja Pirogovskaya, 17, Moscow, Russia. GARF stands for Government Archive of the Russian Federation, and is located at: 121059, Berezhkovskaya nab. 26, Moscow, Russia. To obtain these data I visited the archives and obtained the documents that are listed in this appendix. To obtain access to archival documents one needs to present a letter of introduction from your organization of employment, a description of work with archival documents, and identification. Then, I scanned or photographed pages corresponding to an oblast and year. Then, I digitized these hand-written data from the documents.

Archival Administrative Data

All the administrative data are from the archives and are count-level. I collected yearly data, which are as of January 1st of each year. Thus, when I use data in my analysis for year 1971, for instance, the data are as of January 1st, 1971. I collected both national-level, and oblast-level data. There are 73 oblasts in Soviet Russia. These data provide separate counts by pensioner type. These counts include: the number of individuals eligible for a pension (and out of those the number who are employed) and the total sum of pensions that a pensioner can receive if not employed.

The main dependent variable is the employment rate of a pensioner in a particular year, which is constructed as the number of employed pensioners divided by the total number of pensioners. As an independent variable, and in the illustrative elasticity calculations, I use the average pension size, which is constructed as the total sum of pensions divided by the total number of pensioners. None of the archival data are available by age or gender, thus all of my employment statistics are for all pensioners.

I have national data for all old-age pensioners for years 1956 to 1975. I have documents that contain national data from 1959 to 1975, and aggregate oblast-level data from 1956 to 1958 to construct national-level statistics. For full-term (also separately for preferential pensioners) and incomplete-term pensioners, I have data for years 1957 to 1960, and 1962 to 1975. A comprehensive search of both archives did not yield the data for 1961 and discussion with archival staff indicate they are likely lost, missing, or misplaced. Using these data I create the employment rate of full-term pensioners (all old-age minus incomplete-term), incomplete-term pensioners, and preferential pensioners.

National statistics

I aggregate oblast-level statistics to create national-level statistics for all old-age pensioners, incomplete-term pensioners, and full-term pensioners. Because data for 1961 at the oblast-level do not exist, I use the national statistics that are available for that year. These data are

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used for year 1961 in figure 1 and figure 2. All other years used in this paper's analysis also have national statistics, and they match the sums across all oblasts in those years.

The titles of the documents are: "Summary Report of the Central Statistical Office of the Russian Soviet Federative Socialist Republic of the Number of Pensioners, Sums of their Pensions and their employment on January 1 of *Year*". The documents are available in each year, and *Year* ranges from 1959 to 1975 for the data that I have collected.

Below are the locations in the archives of data for each year and the appropriate reference numbers for each document which are necessary to request documents from archival staff (fond, opis, delo).

1959: RGAE, fond 1562, opis 27, delo 583

1960: RGAE, fond 1562, opis 27, delo 955

1961: RGAE, fond 1562, opis 27, delo 1148

1962: RGAE, fond 1562, opis 27, delo 1274

1963: RGAE, fond 1562, opis 27, delo 1421

1964: RGAE, fond 1562, opis 27, delo 1561

1965: RGAE, fond 1562, opis 37, delo 2718

1966: RGAE, fond 1562, opis 44, delo 2805

1967: RGAE, fond 1562, opis 45, delo 2460

1968: RGAE, fond 1562, opis 45, delo 5961

1969: RGAE, fond 1562, opis 45, delo 9848

1970: RGAE, fond 1562, opis 46, delo 1690

1971: RGAE, fond 1562, opis 47, delo 1560

1972: RGAE, fond 1562, opis 48, delo 1392

1973: RGAE, fond 1562, opis 49, delo 1966

1974: RGAE, fond 1562, opis 50, delo 1851

1975: RGAE, fond 1562, opis 55, delo 2011

Oblast-level statistics by old-age pensioner type

Oblast-level statistics are available separately for full-term (and among them preferential pensioners separately) and incomplete-term pensioners. I was unable to find year 1961 in the archives. Oblast-level statistics by pensioner type are not available before 1957. I use these statistics to create figure 3, figure 4, figure 5, table 4, table 5, and table 7.

Each document's title has slightly different language, but they all contain the same data. I summarize the titles across all documents as: "Summary Report of the Central Statistical Office of the Russian Soviet Federative Socialist Republic (RSFSR) of the Number of Pensioners, Sums of their Pensions and their Employment on January 1 of *Year*". The documents are available in each year, and *Year* ranges from 1957 to 1975 for the data that I have collected. Below are the locations in the archives of data for each year (as of January 1) and the appropriate reference numbers for each document (fond, opis, delo).

1957: GARF, fond A413, opis 1, delo 2831, 2832

1958: GARF, fond A413, opis 1, delo 2946

1959: GARF, fond A413, opis 1, delo 3071

1960: GARF, fond A413, opis 1, delo 3202

1962: GARF, fond 374, opis 32a, delo 3118, 3119

1963: GARF, fond 374, opis 32a, delo 7076

1964: GARF, fond A413, opis 1, delo 3716

1965: GARF, fond 374, opis 35, delo 3195

1966: GARF, fond A413, opis 1, delo 4018

1967: GARF, fond A413, opis 1, delo 4172

1968: GARF, fond 374, opis 36, delo 7539

1969: GARF, fond 374, opis 36, delo 11333

1970: GARF, fond 374, opis 39, delo 507

1971: GARF, fond 374, opis 39, delo 1199

1972: GARF, fond 374, opis 39, delo 1820

1973: GARF, fond 374, opis 39, delo 2741

1974: GARF, fond 374, opis 39, delo 4003

1975: GARF, fond 374, opis 39, delo 4416

Oblast-level statistics for all old-age pensioners

These data represent oblast-level statistics for all old-age pensioners. Data by oblast in these years do not include counts by pensioner type. I use these data for years 1955 and 1956 in figure 1.

The titles of the documents are: "Summary Reports of the Ministry of Social Security of ASSR, Krai, Oblasts, and City Ministries of Social Security of the Number of Pensioners and

Their Employment." Below are the locations in the archives of data for each year (as of January 1) and the appropriate reference numbers for each document (fond, opis, delo).

1955: GARF, fond A413, opis 1, delo 2609

1956: GARF, fond A413, opis 1, delo 2702

Archival Survey Data

All the survey data are from the archives and are count level. The survey is a 10 percent random sample of all pensioners. The 1959 survey was done on July 1, 1959. The 1966 survey was done on January 1, 1966. These data include counts for full-term pensioners. Raw survey data are not available, and only tabulations using survey data are available. The counts are the number of pensioners, and of those the number employed. Each count is given for individuals whose previous average monthly earnings to determine pension size are in a particular range. Thus, these are not individual-level data, and earnings data are in the following ranges in rubles: <30, 30-39, 40-49, 50-59, 60-69, 70-79, 80-89, 90-99, 100-119, 120-139, 140-159, 160-179, 180-199, ≥200. These data contain information for 38 oblasts separately. The survey was done in all oblasts, but because not all documents are available in the archives, I was able to recover data for 38 oblasts. Some oblasts are not available in the archives, while data for some oblasts are unreadable.

The titles of the documents of the 1959 survey are: "Statistical Tables of the Central Statistical Agency of RSFSR of Sample Survey of Pensioners by ASSR, Krai, and Oblasts on July 1st, 1959." Below are the locations in the archives of data, where each document contains data for several oblasts, and the appropriate reference numbers for each document (fond, opis, delo).

1959 survey:

GARF, fond 374, opis 31

delo 4867, delo 4868, delo 4869, delo 4870, delo 4872, delo 4873, delo 4874, delo 4875

The titles of the documents of the 1966 survey are: "Statistical Tables of Statistical Agency in *Oblast* of Sample Survey of Number and Composition of Pensioners for 1965." Each document is done in a separate oblast, *Oblast*. Below are the locations in the archives of the data, where each document contains data for one oblast, and the appropriate reference numbers for each document (fond, opis, delo).

1966 survey:

GARF, fond 374, opis 35

delo 7822, delo 7824, delo 7827, delo 7828, delo 7829, delo 7832, delo 7833, delo 7834, delo 7835, delo 7836, delo 7837, delo 7838, delo 7839, delo 7841, delo 7846, delo 7850, delo 7851, delo 7853, delo 7855, delo 7857, delo 7858, delo 7859, delo 7860, delo 7863, delo 7865, delo 7869, delo 7870, delo 7872, delo 7873, delo 7880, delo 7883, delo 7884, delo 7886, delo 7887, delo 7890, delo 7891

Data from Non-Archival Sources

I have collected and manually entered data at the year and oblast level from published yearbooks. I have obtained these yearbooks at the University of Michigan library. These data are from the 1961-1975 "Narodnoe Hozyaistvo" yearbooks and are used as covariates. The statistics used in the analysis are: production of plywood, leather boots, reinforced concrete, milk, eggs, meat, oil, canned goods, number of doctors per population, value of trade, number of students enrolled in college.

I have collected and manually entered the count-level data at the oblast-level from the 1959 census. These data are from a published summary of statistics from the 1959 census. I have obtained this publication through interlibrary loan at the University of Kentucky library. I use these data to construct statistics in table B2.

APPENDIX D

Calculation of Pensioner Extensive Margin Employment Elasticities with Respect to the Average Net-of-Tax Rate (ANTR)

To obtain the elasticities in the text, I perform two calculations. First, I use back of the envelope calculations to estimate the percent change in the average net-of-tax income (ANTR). Second, I calculate the percent change in employment, using regression estimates presented in tables and figures in this paper.

I use aggregated survey data from 1959, and administrative data from the 1960s and the 1970s for all calculations. I use the 1959 survey data to estimate the benefit reduction rate before 1964. I use the average pension that a pensioner can receive if not employed from administrative data to calculate the ANTR after 1964. The earnings in all calculations correspond to average previous monthly earning for pension size calculation. As a result, these calculations assume that earnings of pensioners who continue working are close to more recent previous earnings.

In all calculations, and subject to the caveats discussed in the text, the ANTR is evaluated at the average values of earnings, tax on earnings, share of benefits a pensioner received if employed, and pension. The ANTR equals to: (average earnings – average tax on earnings*average earnings –share of benefits a pensioner receives if employed*average pension)/average earnings. Using the pensioner earnings distribution in 1959, I calculate the average earnings tax for a pensioner to be 3 percent. I use this earnings tax through all calculations. Note that pensioners did not pay taxes on their pensions, except for losses in pension benefits implied by the presence of benefit reduction rates for employed pensioners.

1. **Calculations of Benefit Reduction Rates (BRR), ANTR and percent change in ANTR**

   Tables 2 and B7 summarize the BRR and ANTR calculated in this section.

A. *Before 1964 Reform*

   First, I calculate the average BRR on pensions of employed full-term pensioners, and incomplete pensioners. I use 1959 survey data that gives me the counts of pensioners within each earnings group to calculate average earnings. Earnings are proxied by average previous monthly earnings for pension calculation. I then use the pension replacement rates within each earnings group (see table B1, figure A1) to calculate average pensions.

   In 1959, 81 percent of pensioners had earnings below 100 rubles, which entitled them to a 15 ruble pension if they worked, and 19 percent of pensioners had earnings above 100 rubles, where they received no pension if they worked. The average earnings were 71.4 rubles, and the average pension was 46.3 rubles. The average earnings (pension) for individuals earnings less than 100 rubles was 52.6 (39.9), while the average earnings (pension) for individuals earning more than 100 rubles was 152.3 (73.9) rubles.

$$\text{Average BRR} = 0.81 * \frac{39.9 - 15}{52.6} + 0.19 * \frac{73.9 - 0}{152.3} = 47.8\% \ (table \ 2).$$

I also calculate the average share of benefits lost while employed as a share of benefits if retired.

Average share of benefits lost $= 0.81 * \frac{39.9-15}{39.9} + 0.19 * \frac{73.9-0}{73.9} = 69.5\%$.

On January 1, 1964, the average pension was 50.9 and average earnings were 78.2. ANTR in 1964 (on January 1, right before 1964 reform) $= \frac{78.2-78.2*0.03-50.9*0.695}{78.2} = 0.517$ (*table B7*).

For incomplete-term pensioners, I assume the same average previous earnings as for full-term pensioners, and that their pensions are 60 percent of full-term pensions.

Average BRR $= \frac{50.9*0.6}{78.2} = 39.1\%$ (*table 2*).

BRR is always 1.

$\qquad$ 1964 ANTR $= \frac{78.2-78.2*0.03-50.9*0.6*1}{78.2} = 0.579$ (*table B7*).

B. *After 1964 and 1969 Reforms (all oblasts)*

First, I calculate the BRR for full-term pensioners. 25 eastern oblasts (where 24.5 pensioners reside) reduced their average share of benefits lost to 25% and 48 western oblasts (where 75.5 pensioners reside) reduced it to 50%.

$\qquad$ BRR in the east $= \frac{0.25*52.5}{95.5} = 13.7\%$

$\qquad$ BRR in the west $= \frac{0.5*52.5}{95.5} = 27.5\%$.

$\qquad$ Average BRR $= 0.245*\left(\frac{0.25*52.5}{95.5}\right) + 0.755*\left(\frac{0.5*52.5}{95.5}\right) = 24.1\%$ (table 2)

$\qquad$ Average share of benefits lost $= 0.245 * 0.25 + 0.755 * 0.5 = 43.9\%$.

In 1966, average pensions of full-term pensioners were 52.5 rubles, and average earnings were 95.5 rubles.

$\qquad$ 1966 ANTR $= \frac{95.5-95.5*0.03-52.5*0.439}{95.5} = 0.729$ (*table B7*).

$\qquad$ % change in ANTR $= \ln(0.729) - \ln(0.517) = 34.3\%$.

In 1969, average earnings of full-term pensioners were 99.5 rubles, average pensions were 54.75 rubles.

$\qquad$ 1969 ANTR $= \frac{99.5-99.5*0.03-54.75*0.439}{99.5} = 0.728$.

$\qquad$ % change in ANTR $= \ln(0.728) - \ln(0.517) = 34.3\%$.

Average earnings in 1975 were 129.1 rubles.

$\qquad$ 1975 ANTR $= \frac{129.1-129.1*0.03}{129.1} = 0.97$ (*table B7*).

C. After 1964 and 1969 Reforms (eastern relative to western oblasts)

Between 1965 and 1969, average earnings for full-term pensioners are 97.3 rubles, and average pensions are 53.5 rubles. Average earnings for preferential pensioners are 138 rubles, and average pensions are 75.3 rubles. Between 1971 and 1975, average earnings for full-term pensioners were 123 rubles, and average pensions were 61.5 rubles. For preferential pensioners, average earnings were 136.1 rubles, and average pensions were 80.6 rubles.

All full-term pensioners

ANTR for share of benefits lost of 50% from 1966 to 1969 $= \frac{97.3 - 97.3*0.03 - 53.5*0.5}{97.3} =$ 0.695 (*table B7*).

ANTR for share of benefits lost of 50% from 1966 to 1969 $= \frac{97.3 - 76.5*0.03 - 51*0.25}{76.5} =$ 0.833 (*table B7*).

% change in ANTR after 1964 $= \ln(0.833) - \ln(0.695) = 18.1\%$.

ANTR for share of benefits lost of 50% from 1971 to 1975 $= \frac{123 - 123*0.03 - 61.5*0.5}{123} = 0.72$.

ANTR for share of benefits lost of 25% from 1971 to 1975 $= \frac{123 - 123*0.03 - 61.5*0.25}{123} = 0.845$.

% change in ANTR after 1969 reforms $= \ln(0.845) - \ln(0.72) = 16.0\%$.

Preferential pensioners

ANTR for share of benefits lost of 50% from 1966 to 1969 $= \frac{138 - 138*0.03 - 75.9*0.5}{138} = 0.695$.

ANTR for share of benefits lost of 25% from 1966 to 1969 $= \frac{138 - 138*0.03 - 75.9*0.25}{138} = 0.833$

% change in ANTR after 1964 reform $= \ln(0.833) - 0.695) = 18.1\%$.

ANTR for share of benefits lost of 50% from 1971 to 1975 $= \frac{146.1 - 146.1*0.03 - 80.6*0.5}{146} =$ 0.694.

ANTR for share of benefits lost of 25% from 1971 to 1975 $= \frac{146.1 - 146.1*0.03 - 61.5*0.25}{146} =$ 0.832.

% change in ANTR after 1969 reforms $= \ln(0.832) - \ln(0.694) = 18.1\%$.

2. **Calculations of Percent Changes in Employment Rates and Employment Elasticities with Respect to the ANTR**

Next, I calculate employment elasticities with respect to the ANTR. I use my regression estimates to calculate percent changes in employment rates.

A. After 1964 and 1969 Reforms (all oblasts)

After BRR went down from 47.8 to 24.1% in all oblasts among full-term pensioners, their employment rates went up by 2.8 percentage points by 1966 (*table 4*). The employment rate was 9.5 in 1964. Employment rates went up by: $\ln(9.5 + 2.8) - \ln(9.5) = 25.8\%$.

$$\text{Elasticity} = \frac{0.258}{0.343} = 0.752 \text{ (table 7)}.$$

After BRR went down from 47.8 to 24.1% in all oblasts among full-term pensioners, their employment rates went up by 5.7 percentage points by 1969 (*table 4*). Employment rates went up by: $\ln(9.5 + 5.7) - \ln(9.5) = 47\%$.

$$\text{Elasticity} = \frac{0.47}{0.343} = 1.37 \text{ (table 7)}.$$

B. *After 1964 and 1969 Reforms (eastern relative to western oblasts)*

First, I estimate the elasticities for all full-term pensioners (including preferential pensioners). After a 13.7 percentage point reduction in the BRR in eastern relative to western oblasts, employment rates among full-term pensioners went up by 1.7 percentage points between 1966 and 1969 (*table 5*). Full-term pensioner employment rate in eastern regions by 1964 was 7.4 percentage points. Employment rates went up by: $\ln(7.4 + 1.7) - \ln(7.4) = 20.7\%$.

$$\text{Elasticity} = \frac{0.207}{0.181} = 1.14 \text{ (table 7)}.$$

After a 13.7 percentage point reduction in the BRR in western relative to eastern oblasts, employment rates went up by 1.8 percentage points between 1971 and 1975 (*table 5*). Full-term pensioner employment rate in western regions by 1969 was 18.42 percentage points. Employment rates went up by $= \ln(18.4 + 1.8) - \ln(18.4) = 9.3\%$.

$$\text{Elasticity} = \frac{0.093}{0.16} = 0.58. \text{ (table 7)}$$

Second, I estimate the elasticities for preferential pensioners. I do not have earnings distribution data for preferential pensioners to estimate their BRR. This is important, because I do now know the share of these pensioners who earn over 100 rubles, which is likely larger than that for other pensioners, because they earn more. As a result, I assume the same BRR for preferential pensioners as for other full-term pensioners, because the rules for them were similar.

After reducing the BRR from 27.5 to 13.7% in eastern oblasts, employment rates among preferential pensioners went up by 3.5 percentage points between 1966 and 1969 (*table 5*). Preferential pensioner employment rate in eastern regions by 1964 was 7.95 percent. Employment rates went up by$= \ln(7.95 + 3.5) - \ln(7.95) = 36.4\%$.

$$\text{Elasticity} = \frac{0.364}{0.181} = 2.01 \text{ (table 7)}$$

After reducing the BRR by 13.7 percentage points in western relative to eastern oblasts, employment rates went up by 5.2 percentage points between 1971 and 1975 (table 5).

Preferential pensioner employment rate in western regions by 1969 was 18.68 percent. Employment rates went up by= $\ln(18.68 + 5.2) - \ln(18.68) = 24.6\%$.

$$\text{Elasticity} = \frac{0.246}{0.181} = 1.4 \ (table \ 7).$$

3. Calculations of Confidence Intervals of Elasticities

I use a parametric bootstrap procedure to generate confidence intervals for the elasticity estimates (Johnston and DiNardo 1997). For this purpose, I generate 10,000,000 bootstrap draws of the reduced-form coefficients from normal distributions with means and standard errors equal to the point estimates reported in the paper in tables 3 and 4. First, I calculate the percent change in employment rates, by dividing my bootstrap draws by the appropriate pre-treatment mean. Second, I generate 10,000,000 bootstrap draws of the estimates of percent changes in net-of-tax labor income from normal distributions with means that are presented in calculations above, and standard errors equal to 20 percent of the mean. Finally, I obtain 10,000,000 realizations of elasticities, where I divide the percent change in employment rates by the percent change in net- of-tax labor income. The values of the 2.5^{th} and the 97.5^{th} percentiles of the distribution of my generated elasticities constitute a 95-percent confidence interval for my estimated elasticity. I present these confidence intervals in *table 7 (column 3)*.

Johnston, Jack, and John DiNardo. 1997. *Econometric Methods*. 4th ed. New York: McGraw-Hill.

4. Calculation of Distribution of Percent Changes in the ANTR

I have generated % change in ANTR for different current earnings levels. I have done this for grouped earnings in table B6, and for individual earnings levels in figures B9, B10, and B11. I measure current earnings as the average previous earnings for pension calculation. As discussed in the text, these are the higher of average monthly earnings over the last year of work, or average monthly earnings over 5 consecutive work years over the last 10 years before claiming the pension. As a result, I need to assume that a person's earnings after retirement correspond to their earnings for the calculation of their pension.

Table B6 includes calculations for full-term pensioners, and includes the share of pensioners within each earnings group. I calculate midpoints in each earnings range, and evaluate everything at the midpoint. For earnings under 30 rubles, I evaluate everything at earnings of 30 rubles, because individuals could not receive a lower wage in my time period of interest. For earnings over 200 rubles, I evaluate everything at 250. To generate the shares of pensioners before the 1964 reform, I use the distribution of average previous earnings for pension calculation from the 1959 survey data. Figures B9, B10, and B11 show results for individual earnings levels, but data do not exist to include the share of pensioners for each earnings level.

I will now go through the calculations in every column of table B6. These calculations are the same for figures B9, B10 and B11, except for no data on the share of individuals in each earnings group.

Column (1) presents the ranges of average previous earnings for pension calculation in the 1959 survey. Column (2) presents the share of pensioners in each earnings range. Column (3) presents the pension replacement rate in each earnings range (see table B1 and figure B1), where the replacement rates are the ones at the midpoint of the earnings range. So, these replacement rates evaluated at midpoints take the fact that the pension needs to be above a minimum amount into account. Column (4) presents the ANTR before 1964, which is the same in the eastern and western regions. Column (5) presents the ANTR after 1964 but before 1969 in the eastern regions. Column (6) presents $\Delta\ln[ANTR]$ in the eastern regions, and is calculated as: ln(col 5)-ln(col 4). Column (7) presents the ANTR after 1964 but before 1969 in western regions. Column (8) represents $\Delta\ln[ANTR]$ in the Western regions, and is calculated as: ln(col 7)-ln(col 4). Column (9) presents $\Delta\ln[ANTR]$ in eastern relative to western regions from 1964 to 1969, and is calculated as: ln(col 5)-ln(col 7).

ANTR is calculated using the same formula as in appendix D (section 1), but separately for each earnings group. All calculations below use the same variables: E are average previous monthly earnings for pension calculations that proxy for current earnings, Tax is the income tax on earnings E using the marginal tax rates in table B3, R is the pension replacement rate corresponding to average previous monthly earnings E, where $E*R$ is the pension amount.

Next, I present the formulas for ANTR for individuals in different periods, with different earnings groups, and in different regions.

(a) Before 1964 with current earnings under 100 rubles:

$$ANTR = \frac{E - Tax - (E * R - 15)}{E}$$

(b) Before 1964 with current earnings over 100 rubles:

$$ANTR = \frac{E - Tax - E * R}{E}$$

(c) After 1964 in eastern regions with current earnings under 146 rubles:

$$ANTR = \frac{E - Tax - 0.25 * E * R}{E}$$

I adjust the ANTR to take into account that the maximum sum of earnings and pensions cannot exceed 200 rubles in the period from 1964 to 1969. Once earnings are 146 rubles, then the sum of earnings and pensions exceeds 200 rubles: 146+0.5*146*0.75=200.75 rubles. While the pensioner still receives a positive portion of his pension, he does not receive 75 percent anymore.

(d) After 1964 in eastern regions with current earnings from 146 to 200 rubles:

$$ANTR = \frac{E - Tax - 0.25 * E * R - \max(E + E * R * 0.75 - 200,0)}{E}$$

(e) After 1964 in eastern regions with earnings over 200 rubles:

$$ANTR = \frac{E - Tax - E * R}{E}$$

(f) After 1964 in western regions with earnings under 160 rubles:

$$ANTR = \frac{E - Tax - 0.5 * E * R}{E}$$

I adjust the ANTR to take into account that the maximum sum of earnings and pensions cannot exceed 200 rubles between 1964 and 1969. Once earnings are 160 rubles, then the sum of earnings and pensions exceeds 200 rubles: 160+0.5*160*0.5=200 rubles. While the pensioner still receives a positive portion of his pension, he does not receive 50 percent anymore.

(g) After 1964 in western regions with earnings over 160 and under 200 rubles:

$$ANTR = \frac{E - Tax - 0.5 * E * R - \max(E + E * R * 0.5 - 200,0)}{E}$$

(h) After 1964 in western regions with earnings over 200 rubles:

$$ANTR = \frac{E - Tax - E * R}{E}$$