Welfare Effects of Automatic-IRAs

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Abstract

Several states and municipalities in the United States require employers who do not offer retirement benefits to automatically enroll their employees in state-sponsored individual retirement accounts (IRAs). Several other states are considering similar legislation. Policymakers hope these programs will help workers increase their lifetime savings and well-being. However, from a theoretical perspective, it is not clear if forced saving will increase well-being in the presence of credit market imperfections. We quantify the welfare effects of being enrolled in an automatic IRA for individuals in a model with a credit wedge. A worker who is enrolled in an IRA with a contribution rate of 3% would be willing to give up 0-1.3% of lifetime consumption to avoid being enrolled in the program. For a small number of income and interest rate parameterizations, a worker would be willing to give up 0.3% in order to have access to the program. Using a simple rule of thumb model, we find workers who save less than 5% privately would be willing to give up up to 6.7% of lifetime consumption in order to be enrolled in the IRA program.

1 Introduction

Nearly 30% of non-retired Americans 45 years and older claim to have no retirement savings. Additionally, less than half of the same group perceive their own retirement savings to be on track for retirement. The majority of retirement savings

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are derived from employer-based plans, yet on average, only 58% of workers in the
U.S. have access to these plans through their employers, and only 49% choose to par-
ticipate (Board Of Governors of the Federal Reserve System (2019)). To help combat
the widespread shortage of retirement savings, several states have begun facilitating
automatic enrollment in Individual Retirement Accounts (IRAs). These state-run
programs establish a means for employees to contribute to retirement accounts that
otherwise may not have been easily accessible to them. As of 2020, 6 states and
the city of Seattle have adopted auto-enrollment IRA programs as a state-facilitated
effort to assist retirement savings among private sector workers.¹

Auto-enrollment in IRAs has the potential to increase a worker’s welfare by in-
creasing her lifetime savings. Preliminary data from the auto-enrollment program in
Oregon show a majority of employees provided access to the program are participat-
ing and the average contribution rate is about 5% (Chalmers et al. (2019)). Empirical
evidence from other settings suggests that many households respond to defaults in
making savings decisions (Madrian and Shea (2001), Beshears et al. (2016) and Chetty
et al. (2014)). Automatic enrollment could raise the overall saving rate of workers—so
long as workers do not fully offset increased saving in IRAs with decreased saving or
increased borrowing in other assets.

It is also possible that automatic enrollment in an IRA will not impact a worker’s
well-being at all. This is the case if IRA contributions are completely offset by
decreases in other types of savings and/or increases in debt. In the absence of credit
market frictions, this is the prediction of neoclassical model as well as a model with
present bias (Findley and Cottle Hunt (2019)).

Automatic enrollment in an IRA also has the potential to decrease a worker’s wel-
fare by distorting her consumption profile. An worker who is automatically enrolled

¹Programs in Oregon, California, Illinois are notable early examples of state-run IRA programs. See
in an IRA may be forced to save more than she would have preferred. If she is unable to unwind this forced saving because of credit market imperfections, she will consume less during her working years than she wanted to, which could reduce her lifetime well-being.

Additionally, IRAs may offer a different rate of return than private savings. If the IRA rate of return is higher than the return on private savings (because of preferential tax treatment, or because the IRA is invested in different assets than private savings), automatic enrollment could increase the lifetime income of workers, and increase their well-being. By the same logic, if the IRA rate of return is lower than the return on private savings (because of fees related to the program), then automatic enrollment in the IRA would decrease lifetime income and well-being of workers.

The impact of automatic enrollment in an IRA on a worker’s lifetime well-being is a quantitative question that depends on the rate of return of the IRA and private saving as well as on the frictions in the credit market. We attempt to put upper and lower bounds of the welfare effect of automatic enrollment in an IRA by considering several different cases.

As a lower bound, we calculate the welfare effect of auto-enrollment into an IRA in a fully rational model with a credit wedge. We calculate the percent of lifetime income a worker would be willing to give up in order to be enrolled in an IRA. In a small number of parameterizations, workers would be willing to give up 0.3% or less of their lifetime consumption to have access to the automatic IRA. For most parameterizations we consider, workers would need to be compensated to be enrolled in an IRA. We calculate the welfare effect assuming that workers stay in the program after they are automatically enrolled. We focus on the role of automatic saving on life-cycle consumption while abstracting away from the decision to opt-out of the program.\(^2\) We consider this a lower bound, because workers are not allowed to opt-

\(^2\) According to Oregon’s annual report to the legislature in 2018, the opt-out rate was 27.75% amongst workers. Using administrative data from the OregonSaves program, Belbase and Sanzen-
out in our analysis. In reality, a worker who was harmed by automatic enrollment in an IRA could choose to withdraw from the program and avoid the negative effects.

If there is a credit wedge and the rate of return on private saving and on the IRA are both low, automatic enrollment in an IRA reduces lifetime utility for workers, even if the IRA offers a tax advantage. For example, if the return on the IRA is 1%, the return on private savings is 0.85% (reflecting a 15% capital gains tax), and the interest rate on borrowing is 4%, a worker would be willing to give up between 0.4%-0.9% of lifetime consumption in order to avoid being enrolled in an IRA with a 3% contribution rate. These negative welfare results apply to all three life-cycle wage profiles we consider which correspond to different education levels. The most harmed workers are those with college degrees who have steeper wage profiles. Workers are harmed by the IRA because they are forced to contribute early in life when they would prefer to borrow. Their only option to unwind the forced saving is to borrow at a high interest rate, which reduces their well-being. These numerical results suggest that a tax-advantage alone is not enough to make automatic enrollment in an IRA desirable.

On the other hand, if the rate of return on private savings and the IRA are higher, the tax advantage of the IRA may be sufficiently large to offset the negative welfare effects that result from the credit wedge and forced savings associated with automatic enrollment. For example, if the IRA offers a 3.45% return, the private rate of return is 3% (reflecting a 15% tax advantage), and the interest rate on borrowing is 5%, then workers with a high school degree or less would be willing to give up between 0.05%-0.3% of consumption in order to be enrolled in the IRA. In this case, the access

bacher (2018) find that 29% of plan participants opt-out and 4% set the contribution rate to zero. The Center for Retirement Research (2015) estimates that the opt-out rate for the Connecticut Retirement Security Program will likely be around 19%. See Bernheim et al. (2015) for theoretical consideration of the opt-out decision of 401(k) participants. Researchers have also used data on whether or not people stay enrolled in retirement plans to estimate the implied cost of opting out. Choukhame (2019) finds opt-out costs to be $250 every time an individual changes their contribution rate. Earlier work done by DellaVigna (2009), DellaVigna (2018), and Bernheim et al. (2015) finds opt-out costs to be thousands of dollars.
to a higher rate of return via the IRA increases lifetime resources enough to offset the reduction in utility that comes from consuming less early in life. However, even with this parameterization, we find that workers with a steeper wage profile (corresponding to a college degree) are still harmed by automatic enrollment in the IRA.

As a upper bound, we model an individual who does not optimize, but rather follows a simple rule of thumb to determine how much to save. We find the welfare effect for non-optimizing individuals to be between 0.8% and 6.7% for individuals who do not save (i.e., their rule of thumb savings rate is zero percent). We find positive welfare effects for rule of thumb savings rates below 5%.

We also explore several intermediate cases in the rational model by varying the size of the credit wedge as well as the rates of return on the IRA and on private savings. The true effect of automatic enrollment in IRAs will depend on if workers opt-out of the IRA and if they unwind IRA savings. Our analysis suggests that workers who are already saving optimally may be harmed by automatic enrollment in an IRA if they are unable to unwind forced savings. However, workers who follow a rule of thumb and do not save very much could benefit from the program. The effect of the program on workers’ well-being will depend on the the default investment options of the IRA plans, the associated program fees, an the opt-out rate of participants.

Our analysis relates to a growing body of papers exploring the effects of defaults on behavior and optimal defaults. Carroll et al. (2009) explore the effect of requiring individuals to make explicit choices from themselves in the context of 401(k)s. They find that active decisions are optimal because consumers have a strong propensity to procrastinate. However they also find that financial illiteracy favors default enrollment over active decision enrollment. Choi et al. (2003) models optimal 401(k) default rates in a model with present bias (quasi-hyperbolic discounting), and finds optimal default contribution rates between 0% to 15%. In contrast to these papers, we take the parameters of the state-run IRA program as given, and calculate the
welfare effect of being enrolled in the program.

Our paper also relates to Harris et al. (2018) who find that nation-wide automatic IRAs could affect 24.2 million workers aged 25–64. Many of these workers have high-interest debt. Automatic enrollment in IRAs could negatively impact these workers if they are unable to unwind IRA savings (without increasing their high-interest debt) or if they do not actively opt-out.

Our results suggest that automatic enrollment in an IRA may make some workers worse off by forcing them to save at stages of the life cycle when their wage is low and the marginal utility of consumption is high. If workers face credit constraints, such a higher interest rate on borrowing than the return on savings, it may be too costly for them to unwind the forced saving of the IRA program, and as a result they may end up saving more than they would prefer when young which reduces their overall lifetime utility. Although well-intentioned, automatic enrollment in state-run IRAs may have unintended negative consequences for workers who are already saving optimally, face credit constraints, and are unable or unsure how to opt out of the program. Workers who are not saving at all, or who follow a simple rule of thumb when making savings decisions, have the greatest potential to be helped by automatic enrollment in an IRA.

2 Model

Time is continuous and indexed by $t$. An individual is born at $t = 0$,retires at date $t_R$, and dies at $t = T$. The individual receives disposable income $y_1(t)$ during the working life, and $y_2(t)$ during retirement. Consumption is denoted $c(t)$ and private asset holdings are denoted $k(t)$, which can be positive (saving) or negative (borrowing). The individual is born with no assets $k(0) = 0$ and also dies with no assets $k(T) = 0$. 
We allow for the interest rate to depend on the state of asset holdings. If assets are positive and the individual is saving, the after-tax interest rate is \( r_S \). If assets are negative and the individual is borrowing, the interest rate is \( r_B \). If the individual is enrolled in an IRA, the assets invested in the IRA grow at rate \( r_{IRA} \) which may be the same or higher than the private return on saving, reflecting the tax advantages of saving in a Roth IRA. The individual discounts future utility at the rate \( \rho \).

The individual solves the following utility maximization problem:

\[
\max \int_0^T e^{-\rho t} u(c(t)) dt
\]

subject to:

\[
\dot{k} = y(t) - c(t) + \mathbb{1}\{k(t) < 0\} r_B k(t) + \mathbb{1}\{k(t) > 0\} r_S k(t),
\]

\[
k(0) = 0,
\]

\[
k(T) = 0,
\]

where \( \mathbb{1}\{k(t) < 0\} \) is an indicator function that equals 1 if assets are negative and zero otherwise, and \( \mathbb{1}\{k(t) > 0\} \) is an indicator function that equals 1 if assets are positive. Here \( y(t) \) is a piece-wise equation that refers to disposal income over the entire life-cycle

\[
y(t) = \begin{cases} y_1(t) & t \leq t_R \\ y_2(t) & t > t_R. \end{cases}
\]

We will provide more details on the functional form of \( y(t) \) in Section 2.3. For now it is sufficient to note that the individual earns wage income, pays Social Security taxes, and contributes to an IRA during the working years and receives Social Security benefits and an IRA annuity in retirement. Utility is given by the CRRA function:

\[
u(c) = \frac{c(t)^{1-\sigma}}{1-\sigma}.
\]
This is a multi-stage control problem with state-dependent and time-dependent switches the state equation. The most common approach to solve a model with a credit spread \((r_b > r_s)\) is to break asset holdings into two separate variables, one for debt and one for savings, each with corresponding inequality constraints, as in Davis et al. (2006) or Hurst and Willen (2007). We follow Caliendo and Findley (2019), and solve the problem directly with a single asset variable.\textsuperscript{3}

The Hamiltonian for this problem is

\[
H : e^{-\rho t} u(c(t)) + \mu(t) \left[ y(t) - c(t) + 1 \{ k(t) < 0 \} r_B k(t) + 1 \{ k(t) > 0 \} r_S k(t) \right]
\]

with necessary conditions

\[
H_c = e^{-\rho t} u'(c(t)) - \mu(t) = 0 \tag{8}
\]

\[
H_k = \mu(t) \left[ 1 \{ k(t) < 0 \} r_B k(t) + 1 \{ k(t) > 0 \} r_S k(t) \right] = - \frac{d\mu(t)}{dt}. \tag{9}
\]

Solving the costate equation for \(\mu(t)\) yields:

\[
\mu(t) = \mu(0) \exp \left[ - \int_0^t \left( 1 \{ k(t) < 0 \} r_B k(t) + 1 \{ k(t) > 0 \} r_S k(t) \right) dv \right]. \tag{10}
\]

Combining the equation above with the maximum condition yields an expression for consumption:

\[
c(t) = \mu(0)^{-1/\sigma} \exp \left[ \frac{1}{\sigma} \int_0^t \left( 1 \{ k(t) < 0 \} r_B k(t) + 1 \{ k(t) > 0 \} r_S k(t) \right) dv - \rho t \right]. \tag{11}
\]

From the maximum condition equation, we know that \(\mu(0)^{-1/\sigma} = c(0)\). Therefore,

\[
c(t) = c(0) \exp \left[ \frac{1}{\sigma} \int_0^t \left( 1 \{ k(t) < 0 \} r_B k(t) + 1 \{ k(t) > 0 \} r_S k(t) \right) dv - \rho t \right]. \tag{12}
\]

\textsuperscript{3}In an appendix, Caliendo and Findley (2019) prove that the direct approach is equivalent to the two-asset approach of Davis et al. (2006).
Together equations (12) and (2) implicitly define optimal consumption $c(t)$ as a function of assets $k(t)$ and an unknown constant $c(0)$. Using the terminal condition $k(T) = 0$, we find the initial value of consumption $c(0)$ computationally using the shooting method.

2.1 Social Security Details

Individuals pay Social Security taxes at rate $\tau$ on wage income up to a wage cap $w_c < 1$. After retirement, individuals receive Social Security benefits $b(\bar{w})$ that depend on their wage earnings over the last 35-years of working period, which we will denote $\bar{w} = \int_{t_R-35}^{t_R} w(v)dv$. Social Security benefits (PIA) are a piece-wise linear function of earnings that replace 90% of earnings ($\bar{w}$) up to the first bend point, 32% of earnings ($\bar{w}$) between the first and second bend points, and 15% of earnings ($\bar{w}$) between the second and third bend points. Beyond the third bend point, the function is flat. We use a conventional estimate of the bend points relative to average wages, $0.2\bar{E}(w)$, $1.24\bar{E}(w)$, and $2.47\bar{E}(w)$ (as in, e.g., Alonso-Ortiz (2014)).

2.2 IRA Details

The individual has two types of saving assets: a Roth IRA, $A(t)$, that grows at the tax-free rate $r_{IRA}$ and is annuitized at retirement by the retirement plan provider, and a private saving or borrowing account, $k(t)$. If enrolled in an IRA, the individual contributes after tax income $\hat{w}(t) = w(t) - \min\{\tau w(t), \tau w_c\}$ to the IRA at rate $\delta$, up to a maximum contribution amount $m$.

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4Technically, US Social Security benefits depend on the highest 35 years of earnings, rather than the last 35 years. We assume that wages are hump-shaped with peak earnings in middle age and lowest earnings early in life. Thus, the basing benefits on the last 35 years of earnings is close to the true US system.
During the working-life the IRA evolves according to the law of motion:

\[
\dot{A} = \text{min}[\delta \dot{w}(t), m] + r_{IRA} A(t) \quad \text{for } t \in [t, t_R].
\]  

(13)

During retirement, the IRA evolves according to the law of motion:

\[
\dot{A} = r_{IRA} A(t) - a \quad \text{for } t \in [t_R, T],
\]  

(14)

where \(a\) is the constant annuity that exhausts the IRA balance at the date of death.

The equation for \(a\) is

\[
a = \frac{\text{min}[\delta \dot{w}(t), m] \int_{t_R}^{T} e^{-r_{IRA}v} dv}{\int_{t_R}^{T} e^{-r_{IRA}v} dv}.
\]  

(15)

2.3 Income Details

Given the assumptions above, take-home pay is given by:

\[
y_1(t) = (w(t) - \text{min}[\tau w(t), \tau w_c]) - \text{min}[\delta (w(t) - \text{min}[\tau w(t), \tau w_c]), m]
\]  

(16)

\[
y_2(t) = a + b(\bar{w}).
\]  

(17)

In our numerical analysis, we will consider three different wage profiles \(w(t)\) to correspond to three different education levels.

3 Analytical Results without Credit Frictions

As a baseline for our analysis, we briefly consider the standard life-cycle model without credit market frictions. The individual can borrow and save at the same rate \(r = r_s = r_b\). Given this simplification, the problem outlined in Section 2 can be solved
analytically. Equation (12) simplifies to

$$c(t) = c(0) \exp \left[ \frac{1}{\sigma} \int_0^t r k(t) dv - \rho t \right] = c(0) e^{\frac{r - \rho}{\sigma}}, \quad (18)$$

which can be combined with equation (2) to solve for

$$c(t) = \left( \int_0^{t_R} e^{-rv} y_1(v) dv + \int_{t_R}^T e^{-rv} y_2(v) dv \right) \int_0^T e^{\left( \frac{r - \rho}{\sigma} - r \right) v} dv \right) e^{\frac{r - \rho}{\sigma}}, \quad (19)$$

with the corresponding asset path

$$k(t) = \int_0^t e^{r(t-v)} (y_1(v) - c(v)) dv \quad t \in [0, t_R] \quad (20)$$

$$k(t) = e^{r(t-t_R)} k(t_R) + \int_{t_R}^t e^{r(t-v)} (y_2(v) - c(v)) dv \quad t \in [t_R, T]. \quad (21)$$

In the absence of credit market frictions, the individual chooses their optimal consumption path according to equation (18), and simply unwinds any forced saving that is imposed through the IRA by saving less privately and/or borrowing. If the IRA has the same rate of return as private savings, then participation in the IRA does not change the individual’s lifetime resources, and thus does not change their consumption profile. The individual is not any better or worse off with the IRA, since they can borrow and save at the same rate, and can fully unwind the IRA. We show this analytically in Appendix A.
4 Numerical Results with Credit Frictions

4.1 Parameterization

We parameterize the model to match the US economy. The wage profile is hump-shaped over the life-cycle, according to the functions in Cocco et al. (2005), who use the Panel Study on Income Dynamics (PSID) to estimate income as a function of age and education level.\(^5\) The wage profile for a worker who did not graduate high school is \(w_{\text{noHS}}(t)\), for a high school graduate is \(w_{\text{HS}}(t)\), and for a college graduate is \(w_{\text{college}}(t)\) according to:

\[
\begin{align*}
    w_{\text{noHS}}(t) &= \lambda e^{-2.1361 + 0.1684(t+20) - 0.0353 \frac{(t+20)^2}{10} + 0.0023 \frac{(t+20)^3}{100}} \\
    w_{\text{HS}}(t) &= \lambda e^{-2.1700 + 0.1682(t+20) - 0.0323 \frac{(t+20)^2}{10} + 0.0020 \frac{(t+20)^3}{100}} \\
    w_{\text{college}}(t) &= \lambda e^{-4.3148 + 0.3194(t+22) - 0.0577 \frac{(t+22)^2}{10} + 0.0033 \frac{(t+22)^3}{100}}.
\end{align*}
\]

Figure 1 plots the income profiles for all three education levels.

We assume workers with a high school degree or less begin work at age 20 \((t = 0)\) and college graduates begin work at age 22 \((t = 2)\). All workers retire at age 65 \((t_R = 45)\) and pass away age 80 (model age \(T = 60\)). We set the CRRA parameter \(\sigma = 2\) which is near the middle of reported values, and we set the discount rate \(\rho = 0.03\). We parameterize Social Security using the actual benefit earning rule with bends points as in Alonso-Ortiz (2014). The tax rate is set to 10.6% to correspond to the Old Age Survivors portion of Social Security payroll taxes. For most of our analysis, we assume the IRA contribution rate \(\delta = 0.03\). Contribution rates vary by state and range between 3% to 5%. We set the contribution max \(m\) to the ratio of the

\(^5\)They model three separate third-order polynomials corresponding education groups because Atanassio (1994) and Hubbard et al. (1995) find evidence that that wage hump is not the same for different income levels.
Figure 1: Disposal income without an IRA for the three life-cycle education levels.
the actual contribution limit of $6,000 and the average wage.\textsuperscript{6} Table 1 summarizes the parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda$</td>
<td>Chosen so average wage income is equal to 1</td>
</tr>
<tr>
<td>$\rho$</td>
<td>Rate at which individual discounts future utility</td>
</tr>
<tr>
<td>$\tau$</td>
<td>Social Security tax rate on wage income</td>
</tr>
<tr>
<td>$\delta$</td>
<td>IRA contribution rate</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Inverse Elasticity of Substitution</td>
</tr>
</tbody>
</table>

Table 1: Baseline Parameterization

We consider four cases for interest rates in our analysis. Case 1: interest rates on saving are low (real return of 0.85%) and there is a small credit wedge (the interest rate on borrowing is 4%). Case 2: interest rates on saving are low (real return of 0.85%) and there is a large credit wedge—so large it is effectively a binding no-borrowing constraint. Case 3: interest rates on saving are moderate (real return of 3%) and there is a small credit wedge (the interest rate on borrowing is 5%). Case 4: interest rates on saving are moderate (real return of 3%) and there is a binding no-borrowing constraint. In all four cases, the return on the IRA is 15% higher than the private return on savings to account for the tax savings of a Roth IRA. The interest rate parameters are summarized in Table 2.

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r_s$</td>
<td>0.0085</td>
<td>0.0085</td>
<td>0.03</td>
</tr>
<tr>
<td>$r_{IRA}$</td>
<td>0.01</td>
<td>0.01</td>
<td>0.0345</td>
</tr>
<tr>
<td>$r_b$</td>
<td>0.04</td>
<td>$\infty$</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Table 2: Interest rate parameterizations

Figure 2 plots the life-cycle consumption, income, and private savings profiles for a worker who graduated high school with and without an IRA when the interest rate of saving is low and there is a small credit wedge (Case 1). The consumption path

\textsuperscript{6}Note that $m$ does not influence our analysis because the contribution rate is relatively small (3%). A worker would have to earn over $120,000 and contribute 5% of the wage to their IRA in order for the contribution max to be relevant, which is higher than the maximum wage in any of our profiles.
is kinked because the individual faces a credit wedge. Early in life the individual borrows with an interest rate \( r_B = 0.04 \) and later in life the individual saves with an interest rate \( r_S = 0.0085 \). Being enrolled in an IRA crowds out private saving (increases borrowing early in life), but less than one-for-one because borrowing is more expensive than saving. Thus, consumption is lower earlier in life and higher late in life with an IRA.

### 4.2 Welfare Results

Being enrolled in an IRA has two competing effects for an individual. Saving in a tax-advantaged Roth IRA increases the lifetime resources of the individual, which increases their lifetime consumption. However, the IRA contributions are automatic and are costly to unwind early in life when the individual would prefer to borrow rather than save. This reduces lifetime welfare. We use a consumption equivalent variation technique to measure the net effect. We calculate the fraction of lifetime consumption an individual with an IRA would be willing to give up such that their discounted lifetime utility is equal to their discounted lifetime utility without an IRA using the following equation:

\[
\int_0^T e^{-\rho t} u(c(t)) \, dt = \int_0^T e^{-\rho t} u(c^{IRA}(t)(1 - \Delta)) \, dt.
\]

Here \( c(t) \) is consumption without an IRA and \( c^{IRA}(t) \) is consumption with an IRA. The compensating variation \( \Delta \) is the consumption equivalent variation. If \( \Delta \) is positive, enrollment in the IRA increases the well-being of the individual. For example, if \( \Delta = 0.2\% \), then an individual would be willing to give up 0.2\% of their lifetime consumption in order to be enrolled in an IRA. Welfare results of the automatic IRA under the four cases are presented in Table 3.

**Case 1: Low interest rates small credit wedge.** When interest rates are low
Figure 2: Consumption, disposal income, and private savings for a worker with a high school diploma with low interest rates and a small credit wedge (Case 1). The black lines depict the life-cycle paths for an individual who does not have access to an IRA. The gray lines depict the time paths for an individual who contributes 3% to the IRA.
Table 3: Welfare results of being enrolled in an IRA with a contribution rate of 3% for various interest rate and education parameterizations. All other parameters at baseline values.

and there is a small credit wedge, being enrolled in an IRA makes individuals at all three education levels worse off. The welfare effect of being enrolled in the IRA for an individual who did not finish high school is -0.38%. The welfare effects of being enrolled in the IRA for high school and college graduates are -0.68% and -0.89%.

The welfare effects are negative in this parameterization because the tax benefit of a Roth IRA is relatively small because interest rates are small. The tax benefit of the Roth IRA is avoiding capital gains taxes on the accumulated earning of the IRA account. If the interest rate is low then the tax benefit isn’t as meaningful. The small tax benefit here is offset by the negative effect of the credit wedge, meaning the overall negative welfare effect is slightly negative.

Case 2: Low interest rates binding no-borrowing constraint. With a binding no-borrowing constraint we again find slightly negative welfare effects for all three income profiles. The welfare effect for individuals who did not finish high school is -0.43%. For those who did complete high school the welfare effect is -0.79%. For those who finished college we find the welfare effect to be more negative than the other two at -1.26%.

The tax benefit in this case is also relatively small. The effects of the no-borrowing constraint is even worse than the moderate credit wedge in Case 1. Individuals cannot borrow to unwind the forced saving so they end up worse off than if they were never
enrolled in the IRA.

**Case 3: Moderate interest rates small credit wedge.** With a moderate interest rate and a small credit wedge the welfare effects of enrollment in an IRA depend on education level. The welfare effect for individuals with a high school diploma or less is small and positive while the welfare effect is small and negative for individuals who finished college. For individuals who did not complete high school the welfare effect is 0.30%. For those who finished high school the welfare effects are close to zero and positive. Individuals who finished college would be willing to give up 0.33% of lifetime consumption to avoid being enrolled in the program.

In this case the tax benefits are larger than in Case 1 and Case 2 because the interest rate is higher. The benefit of not paying taxes on the interest earnings is larger than the negative effects of the credit wedge because individuals earn more interest over the life-cycle. The welfare effects here is still relatively small, however, because the individual is forced to save more than she would like to when young and can only borrow at a high interest rate to offset the forced savings.

**Case 4: Moderate interest rates binding no-borrowing constraint.** With a moderate interest rate and a no-borrowing constraint the welfare results again depend on education level and are lower than in the previous case (with a credit wedge). Individuals who did not complete high school had positive welfare effects of 0.23%. Individuals who completed high school had slightly negative welfare effects of -0.11%. Individuals who completed college face larger negative welfare effects of -0.81%.

In this last case, the tax benefit is the same as Case 3. The benefit of not paying taxes in the case on the interest earnings is larger for the individuals who did not finish high school than for the two other individuals modeled. The negative effects of the no-borrowing constraint are slightly larger than the negative effects of the moderate credit wedge. Just as in Case 3, the tax benefit of avoiding capital gains
taxes is relatively large (because the interest rate is moderate). However, the cost to individuals of forced savings more than offsets the tax benefits. This is because the individual faces a binding no-borrowing constraint and cannot unwind forced savings if they were not already saving a positive amount.

4.3 Administrative Fees

Most automatic IRA enrollment programs have built in fees charged to participants to cover associated administrative costs and operating expenses. Fees are charged in the form of an annual asset-based expense, which is a percentage of total assets under management in the participant’s retirement account. Across all active Auto-IRA programs, fees range from 0.75-1%, which reduces the net return of saving in an IRA.

Adding fees to our analysis of the automatic IRA enrollment program reduces the welfare gains of participating in an IRA. The total return on an IRA is the IRA interest rate minus the asset based fee. If the interest rate is not high, the net return on the IRA will be minimal, or even negative if IRA saving returns are especially bad. The tax advantage given by the structure of Roth IRAs will be depleted by the very nature of the program fees themselves. The tax advantage from enrolling in an IRA is reduced as a direct result of additional fees. As an illustrative example, we consider an administrate fee of 1%. Cases in which interest rates are high seem to be most sensitive to the addition of program fees, as compared to cases with smaller interest rates. In Case 3, with moderate interest rates and a small credit wedge, we see an average welfare loss of 0.7% across all levels of education. For a high school graduate, the welfare effect of being enrolled in an IRA is -0.64% when a 1% fee is taken into consideration, as oppose to a 0.045% positive welfare effect when the fee is left out.
5 Rule of Thumb Saving

The analysis of the previous sections is based on a rational model that assume individuals solve complex dynamic optimization problems. The welfare role of automatic IRAs is relatively small in a fully rational model since individuals already save optimally. In this section we consider the welfare role of automatic IRAs in a setting with non-optimizing individuals who follow a simple rule of thumb to make all saving/consumption decisions. The welfare role of forced saving is potentially large in this setting.

5.1 Model Details Rule of Thumb

Suppose that instead of optimizing, individuals save a constant fraction $s$ of their disposable income every instant. At retirement, their saving account balance is annuitized.

The individual consumes:

$$c(t) = (1 - s)\hat{w}(t) \quad \text{for } t \in [0, t_R)$$

$$c(t) = S + a(w) + b(\bar{w}) \quad \text{for } t \in [t_R, T]$$

where $\hat{w}(t) = w(t) - \min[\tau w(t), \tau w_c]$ is after tax income, $a(w)$ is the IRA annuity payment, $b(\bar{w})$ is the Social Security benefit, and $S$ is the annuity that depletes the private savings account.

The private annuity $S$ is found by solving the differential equations:

$$\dot{k} = rk(t) + sy_1(t) \quad \text{for } t \in [0, t_R]$$

$$\dot{k} = rk(t) - S \quad \text{for } t \in [t_R, T],$$

where $y_1(t)$ is the marginal utility of consumption.
which implies
\[
S = \frac{\int_0^{t_R} e^{-rv}s(\hat{w}(v) - \min[\delta\hat{w}(v), m])dv}{\int_{t_R}^{T} e^{-rv}dv}.
\] (29)

In the limit as the savings rate approaches zero, the model collapses to a simple, hand-to-mouth model in which the individual consumes their income in every period and never saves. In the absence of social security, the welfare gain of any forced saving, such as automatically enrolling a worker in an IRA, would increase welfare by nearly 100%. With social security, the welfare gain of the IRA depends on the size of the Social Security system as well as the contribution rate of the IRA. As the IRA contribution rate increases, the individual’s take-home pay decreases. This decreases both their consumption and their private savings.

5.2 Rule of Thumb Welfare Results

The welfare gain of being enrolled in the IRA is decreasing in the household’s private savings rate \(s\). As \(s\) approaches zero, the welfare gain becomes large. For high savings rates, the welfare gain is negative. This is because when \(s\) is high, individuals are already saving a larger percentage of their take-home pay, so the auto-IRA may force them to save so much that their utility decreases.

We use a the same consumption equivalent variation technique to measure the welfare effect of being enrolled in an IRA. This welfare metric calculates the fraction of lifetime consumption an individual with an IRA would be willing to give up such that their discounted lifetime utility is equal to their discounted lifetime utility without an IRA. These results are shown in Table 4.

With low interest rates and small credit wedge (Case 1), the welfare effects of being enrolled in an IRA are large and positive for small savings rates. The welfare gains become negative at a savings rate \(s\) of around 3% for the income profile for individuals
Consumption Equivalent Variation

Case 1: \( r_s = 0.0085, r_b = 0.04, r_{IRA} = 0.01 \)

<table>
<thead>
<tr>
<th>Savings Rate</th>
<th>0%</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No High School</td>
<td>0.75%</td>
<td>0.32%</td>
<td>-0.85%</td>
<td>-1.66%</td>
</tr>
<tr>
<td>High School</td>
<td>0.87%</td>
<td>0.41%</td>
<td>-0.83%</td>
<td>-1.66%</td>
</tr>
<tr>
<td>College</td>
<td>3.00%</td>
<td>2.18%</td>
<td>0.10%</td>
<td>-1.18%</td>
</tr>
</tbody>
</table>

Case 3: \( r_s = 0.03, r_b = 0.05, r_{IRA} = 0.0345 \)

<table>
<thead>
<tr>
<th>Savings Rate</th>
<th>0%</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No High School</td>
<td>3.49%</td>
<td>2.27%</td>
<td>-0.35%</td>
<td>-1.64%</td>
</tr>
<tr>
<td>High School</td>
<td>3.54%</td>
<td>2.29%</td>
<td>-0.36%</td>
<td>-1.65%</td>
</tr>
<tr>
<td>College</td>
<td>6.77%</td>
<td>4.67%</td>
<td>0.53%</td>
<td>-1.28%</td>
</tr>
</tbody>
</table>

Table 4: Welfare results for different savings rates in a simple rule of thumb saving model.

who have not finished high school. For those who have finished high school and those who have finished college, welfare gains became negative at \( s \) of around 5%. These results are presented in Table 4. These results are displayed graphically in Figure 3 which plots the welfare effect \( \Delta \) as a function of the private savings rate \( s \) for all three education profiles.

The welfare effects are larger when the return on the IRA is higher. For example with moderate interest rates and a small credit wedge (Case 3), the welfare effect of being enrolled in an IRA is positive for rule of thumb savings rates below 6%. A worker with a college degree who does not save privately would be willing to give up over 6% of her lifetime consumption in order to be enrolled in the IRA.

6 Robustness

The curvature of the utility function as well as the rate at which the individual discounts the future could both influence the welfare effect of being enrolled in an IRA. We consider robustness along both margins. In the baseline parameterization,
Figure 3: Consumption Equivalent Variation in a simple rule of thumb saving model with low interest rates and a small credit wedge (Case 1) where $r_s=0.0085$, $r_b=0.04$, $r_{IRA}=0.01$.

the inverse elasticity of substitution $\sigma$ is set to 2. If the curvature of the utility function is increased and $\sigma = 5$ the welfare effects of being enrolled in an IRA qualitatively similar. Being enrolled in an IRA reduces welfare by more (or increases welfare by less) in Cases 2-4. The welfare effects are still negative but smaller in magnitude in Case 1. The welfare results are smaller (more negative) because the individual prefers a flatter consumption profile when $\sigma$ is higher. If the individual cannot unwind the forced savings in the IRA by reducing their private savings one-for-one it causes their consumption to be lower in working years, which reduced total lifetime utility. Workers would be willing to give up more of their lifetime consumption to avoid being enrolled in an IRA program when the IES is higher. The welfare results with $\sigma = 5$ are presented in Table 5.

In our baseline parameterization, the individual discounts future utility at rate $\rho = 0.03$, which corresponds to the return on private savings for the moderate interest rate cases (Case 3 and 4). If the discount rate is lower, the individual benefits more (or is harmed less) by being enrolled in an IRA because the worker values retirement
### Consumption Equivalent Variation

<table>
<thead>
<tr>
<th>Income</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No High School</td>
<td>-0.18%</td>
<td>-0.56%</td>
<td>0.23%</td>
<td>-0.24%</td>
</tr>
<tr>
<td>High School</td>
<td>-0.56%</td>
<td>-1.41%</td>
<td>-0.13%</td>
<td>-1.21%</td>
</tr>
<tr>
<td>College</td>
<td>-0.82%</td>
<td>-2.44%</td>
<td>-0.45%</td>
<td>-2.44%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interest Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r_s$</td>
</tr>
<tr>
<td>$r_b$</td>
</tr>
<tr>
<td>$r_{IRA}$</td>
</tr>
</tbody>
</table>

Table 5: Robustness welfare analysis with $\sigma = 5$ and all other parameters are baseline values.

consumption relatively more than the baseline parameterization. Being enrolled in the IRA increases retirement consumption relative to not being enrolled in the program. If $\rho = 0.0085$, the private return on savings in the low interest rate parameterizations, the welfare effects are slightly larger, but the sign does not change.

### 7 Conclusion

Automatic enrollment in an IRA has the potential to increase a worker’s lifetime consumption and well-being by directing saving into a tax-advantaged account. However, in the presence of credit frictions, automatic enrollment in an IRA could reduce a worker’s well-being by forcing them to save early in life when they would prefer to borrow. Additionally, program fees could reduce the net rate of return of saving in an IRA and could potentially eat away any tax advantage associated with the account. We quantify these competing effects using a life-cycle model with a credit wedge. We consider both a fully rational model and a rule of thumb model to put upper and lower bounds on the potential effects of automatic enrollment on lifetime well-being.

Workers who face a credit wedge and are already following an optimal saving-consumption path are harmed by automatic enrollment in an IRA for most parameterizations we consider. In the rational model, workers with a relatively steep income
profile that corresponds to wages of a college graduate are harmed by automatic enrollment in an IRA for all parameterizations we consider. These workers would be willing to give up between 0.3%-1.3% of lifetime consumption to avoid being enrolled in the IRA. This is because the IRA forces the worker to save early in life when they would prefer to borrow. The worker can unwind some of this forced saving by borrowing, but it is expensive because the interest rate on borrowing exceeds the interest rate on saving. This result holds even if the IRA offers a higher rate of return than private savings because of the tax advantage associated with a Roth IRA. Similarly, when interest rates are low, workers with flatter income profiles corresponding to high school graduates and non-graduates, enrollment in an IRA reduces lifetime utility. Only when interest rates are sufficiently large do workers with a high school degree or less benefit from enrollment in an IRA in the presence of a credit wedge.

In contrast, if workers do not save optimally but instead follow a simple rule of thumb to make savings decisions, automatic enrollment in an IRA can improve lifetime well-being. Workers of all education levels would be willing to give up some of their lifetime consumption in order to be enrolled in an IRA if they are following a rule of thumb and save less than 5% of their income. The welfare gains are largest for highest earners, who benefit the most from saving a higher fraction of their income. A college educated worker who does not save at all would be willing to give up over 6% of their lifetime consumption to be enrolled in an IRA with a 3% contribution rate if interest rates are moderate (IRA return of 3.45%).

Our results suggest that automatic enrollment in an IRA is most beneficial for workers who save very little on their own. In contrast, workers who are already saving optimally and face a credit wedge or other borrowing constraint could be harmed by enrollment in the program. Our calculations assume that workers stay enrolled in the IRA. In practice, workers who are harmed could opt-out of the program. Policymakers face a trade-off of creating barriers to opting-out that are sufficiently strong to keep workers who could benefit from the program enrolled, while simultaneously ensuring
that workers who are harmed by the program are able to opt-out. The characteristics of who remains enrolled in state-sponsored IRAs and who opts out is an open question that merits future research.
References


A Analytical Results: Perfect Credit Markets

For simplicity in this section only, we assume the wage is constant over the life-cycle $w(t) = w$, and that the wage is low enough such that the maximum IRA contribution never binds. In that case, the IRA contribution in any moment is simply a fraction $\delta$ of after-tax wage-income. We will also assume the wage is below the social security tax cap. Given these assumptions, equation (19) becomes:

$$c(t) = \left( \int_0^t e^{-rv}(1-\delta)(1-\tau)w\,dv + \int_t^T e^{-rv}(a+b(w))\,dv \right) e^{\frac{-r}{\sigma}t}, \quad (A.1)$$

Letting $g = \frac{r-\rho}{\sigma}$ denote the growth rate of consumption over the life-cycle and integrating, (A.1) can be written as:

$$c(t) = \left( \frac{(1-\delta)(1-\tau)w(1-e^{-rt_T})r^{-1} + (a+b(w))r^{-1} (e^{-rt_T} - e^{-rT})}{\frac{e^{(g-r)t_T-1}}{g-r}} \right) e^{gt}. \quad (A.2)$$

Differentiating,

$$\frac{\partial c}{\partial \delta} = e^{gt} \left( \frac{g-r}{e^{(g-r)t_T-1}} \right) \left( -\frac{(1-\tau)w}{r} (1- e^{-rt_T}) + \left( \frac{e^{-rt_T} - e^{-rT}}{r} \right) \left( \frac{\partial a}{\partial \delta} \right) \right). \quad (A.3)$$

Noting that

$$\frac{\partial a}{\partial \delta} = \frac{w(1- e^{-rt_T})}{e^{-rt_T} - e^{-rT}}, \quad (A.4)$$

equation (A.3) can be simplified:

$$\frac{\partial c}{\partial \delta} = e^{gt} \left( \frac{g-r}{e^{(g-r)t_T-1}} \right) \left( -\frac{w}{r} (1- e^{-rt_T}) + \left( \frac{e^{-rt_T} - e^{-rT}}{r} \right) \left( \frac{w(1- e^{-rt_T})}{e^{-rt_T} - e^{-rT}} \right) \right) \frac{\partial c}{\partial \delta} = 0.$$