

Taxes, benefits and labour force participation: A survey of the quasi-experimental literature

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Abstract

We review the literature that uses quasi-experimental methods to estimate the elasticity of labour force participation with respect to the financial gain from work. We find a wide range of elasticities, with an average of 0.36. 27 out of 35 papers find elasticities larger than 0.1, providing strong evidence that individuals respond to incentives on the extensive margin of labour supply. Elasticities are larger for women, and have declined over time.

Keywords: participation elasticity, quasi-experimental methods, labour supply, extensive margin

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1. Introduction

The effect of taxes and benefits on labour supply is a central topic in economics. Working entails loss of leisure, which individuals trade off against the monetary reward from working. Therefore, financial incentives matter for the labour supply decisions of individuals. The labour supply decision consists of the intensive and extensive margins. The intensive margin is the choice of hours of work, given that the individual is working. In this case, the marginal tax rate is what matters. The extensive margin, which is the subject of this paper, concerns the choice of working or staying out of the labour force completely, i.e., the participation decision.

Both taxes and social benefits matter for the participation decision and these are summarized by the participation tax rate. Theoretically, a higher participation tax rate leads to a lower rate of labour force participation and employment. The strength of this response is measured by the participation elasticity, which shows the percentage increase in labour force participation when the financial gain from work (the difference between after-tax wages and out-of-work benefits) increases by one percent.

This paper surveys the literature that uses quasi-experimental methods to estimate the participation elasticity.³ Quasi-experimental methods use natural experiments and non-structural econometric methods, such as difference-in-differences, regression discontinuity design and instrumental variables, to estimate plausibly causal elasticities.

There is a larger and older structural labour supply literature which we do not survey, as it has been extensively reviewed several times before.⁴ Researchers have increasingly moved to using quasi-experimental methods because the older literature, which typically uses cross-sectional data, suffers from potential internal validity problems: Strong assumptions are needed in order to give the estimated elasticities a causal interpretation. People with higher (potential) after-tax wages participate in the labour force to a greater extent, but this may be caused by unobserved tastes for work. If highly motivated people are more inclined to work and also have higher earnings potential (conditional on observed covariates), elasticity estimates from cross-sectional studies will be biased upwards.

While studies using a structural approach are often criticized on the issue of internal validity, quasi-experimental studies may be weaker in external validity – the concern that results from any given research design only applies to the specific context of that study. The way to deal with this issue, argue Angrist & Pische (2009), is the accumulation of more evidence from different contexts, so that more general conclusions can be drawn, with some claim to external validity. This critique highlights the need for literature reviews, such as this one, in order to find policy-relevant parameter estimates.

We are aware of only one previous survey of the quasi-experimental extensive margin literature: Chetty et al. (2013), which cites 15 papers.⁵ We improve upon Chetty et al. (2013) by including a larger number of papers (35) and more recently published studies. In addition, we are stricter in what we deem to be quasi-experimental methods. We also only include papers that use policy as identifying variation (excluding papers that rely on before-tax wage trends, for example). This leads to our exclusion of eight of the studies in Chetty et al. (2013). Our motivations for each paper are stated in the appendix.

Of the 35 papers, about half use difference-in-differences methodology, for example comparing mothers benefiting from an in-work tax credit reform (such as the American earned income tax credit) to women without children. Most of the other papers use panel regression techniques such as fixed effects or correlated random effects (CRE).

³ *Research using quasi-experimental methods to estimate the elasticity on the intensive margin have already been reviewed previously by Saez, Slemrod & Giertz (2012) and Neisser (2017).*

⁴ *E.g., Meghir & Phillips (2010), Keane (2011) and McClelland & Mok (2012). Bargain & Peichl (2016) include a small number of quasi-experimental studies in their survey, though they do not make a clear distinction in their analysis.*

⁵ *Bettendorf, Folmer & Jongen (2014) provide a more limited survey of the effects of in-work tax credits, citing eight papers. Hotz & Scholz (2003) survey the American EITC literature.*

The studies find a wide range of elasticities. Six papers find elasticities close to zero, while four arrive at elasticities around 1 or larger. The average elasticity is 0.36. Groups with low employment rates tend to exhibit larger participation responses. This is expected, since it implies a larger number of individuals who could potentially enter the labour market. As many papers focus on these groups, the policy-relevant full-population elasticity is likely lower than 0.36; we assess it to be in the range 0.1–0.2.

We find that elasticities have declined over time, possibly due to increased female labour force participation. Americans seem to respond more strongly to incentives than Europeans. We also conclude that papers that use a difference-in-differences methodology find larger elasticities.

This paper is structured as follows. The next section reviews the theory underlying the participation elasticity, clarifying its definition. In section 3, we review the quasi-experimental literature on labour participation responses to financial incentives. In section 4, we conduct a meta-analysis of the elasticity estimates. Section 5 concludes.

2. Theory

As there are different definitions of the participation elasticity used in the literature, it is important to be clear about the definition we are using and the theoretical basis behind it.

In this section, we set up a simple theoretical model. We assume that individuals choose between working for a gross wage Y or not participating in the labour force, receiving a benefit B . Those who work pay an income tax denoted T . Utility is equal to disposable income, except that working individuals also incur a fixed cost of work q (expressed in money terms). This captures all the monetary and nonmonetary costs associated with working: loss of leisure, commuting and childcare costs etc.⁶

Individuals are identical in all dimensions except q . We can think of our model as applying to a subset of the labour force, such as low-income single mothers, where incomes and tax rates are similar. We hold Y constant, thus abstracting from the intensive margin.

Utility for workers is given by $u_w = Y - T - q$ and for non-workers by $u_{nw} = B$. Individuals work if

$$u_w > u_{nw} \Leftrightarrow Y - T - q > B \Leftrightarrow Y - T - B > q.$$

Thus, the individuals who work are those for whom the financial gain from work, $Y - T - B$, exceeds the fixed cost of work, q . As individuals only are heterogenous in q , the distribution of fixed costs of work will determine the rate of labour force participation. We denote the probability density function $f(q)$. The rate of labour force participation can be expressed

$$L = \int_0^{Y-T-B} f(q) dq.$$

⁶ The concept of fixed costs of work was introduced by Cogan (1981). It explains why individuals not only adjust their labour supply at the (intensive) margin, but also switch from not working at all to working a significant number of hours.

If the financial gain increases – due to lower taxes or benefits – some individuals will be incentivized to enter the labour force. To be precise, how many individuals will start working is determined by the density of fixed costs of work evaluated at the financial gain from work, i.e., those who are at the margin of entering employment:

$$\frac{dL}{d(Y - T - B)} = f(Y - T - B).$$

In the literature, the strength of this response is typically measured by the elasticity of labour force participation with respect to the financial gain from work, which can be expressed

$$\varepsilon_P = \frac{dL/L}{d(Y - T - B)/(Y - T - B)} = f(Y - T - B) \frac{Y - T - B}{L},$$

where the second step is the general definition and the third step applies in the context of our theoretical model. Our derivations illustrate that the participation elasticity is a population-level, not individual-level, parameter.

Using this elasticity definition has several advantages. First, it is now the most common elasticity definition in the literature. Thus comparison between countries, time periods and reforms is simplified. Second, the participation elasticity is a crucial parameter in optimal income tax models (e.g., Saez, 2002), which weigh the disincentive effects of income taxation against the benefits of redistribution. Third, quantifying the participation elasticity allows for ex-ante evaluation of policy reforms (see, e.g., Lundberg, 2017).

A related concept is the participation tax rate. This shows the percentage of the gross wage that an individual has to pay to the government in the form of income tax and foregone benefits: $\tau = (T + B)/Y$. The participation net-of-tax rate ($100\% - \tau$) is the financial gain from work expressed as a proportion of the gross wage.⁷ So if the financial gain from work increases by a given percentage, so will the participation net-of-tax rate. Therefore the participation elasticity can also be termed the elasticity of participation with respect to the participation net-of-tax rate.

Some papers use a different elasticity definition: the elasticity of participation with respect to the net wage (or, equivalently, the average net-of-tax rate), denoted

$$\varepsilon_Y = \frac{dL/L}{d(Y - T)/(Y - T)}.$$

The two elasticity definitions are equivalent if out-of-work benefits are zero. For, e.g., secondary earners, this may not be far from the truth, so the choice of elasticity concept will not matter much. Note that $\varepsilon_Y \geq \varepsilon_P$ for a given size of the derivative. If benefits are significant, the choice of elasticity definition can yield very different estimates. For example, if benefits correspond to three quarters of after-tax labour income, the elasticities will differ by a factor of four.⁸ As we include papers using both elasticity definitions, the exact elasticity concept used should be considered before drawing conclusions.

Theoretically, the participation elasticity is concerned with the impact on labour force participation, but the empirical literature typically analyzes employment because it is easier to observe at the individual level. Employment is usually what is relevant for policy purposes. In addition, when analyzing the full population, the only reasonable assumption is that Say's law will hold – supply will create its own demand such that increased labour force participation will translate into higher employment. Simply scaling up the labour market should not change any fundamentals, such as the unemployment rate, in the long run.

⁷ The participation net-of-tax rate can be expressed $1 - \tau = 1 - \frac{T+B}{Y} = \frac{Y-T-B}{Y}$. The numerator in the last step is the financial gain from work.

⁸ Some algebraic manipulation reveals that $\varepsilon_Y = \varepsilon_P(Y - T)/(Y - T - B)$. Setting $B = 0.75(Y - T)$ yields $\varepsilon_Y = 4\varepsilon_P$.

Table 1. Summary of participation elasticity estimates from quasi-experimental studies

Study	Country	Years	Identifying variation	Method	Sample	Elasticity
Alpert & Powell (2014)	US	1999–2009	Bush tax cuts	FE, IV	(a) women, (b) men, aged 55–71	0.75 (a) 0.55 (b)†
Bastian (2020)	US	1975	EITC introduction	DD	Mothers	0.58
Brown (2013)	US	1999	Pension reform	DB	California teachers near retirement	0.04
Chetty, Friedman & Saez (2013)	US	2000–2005	Geographical variation in EITC knowledge	IV	EITC-eligible parents	0.19†
Eissa & Hoynes (2004)	US	1984–1996	EITC expansions	Group IV	Married couples (aged 25–54) with children: women (a), men (b)	0.27 (a) 0.03 (b)†
Eissa (1995)	US	1987	Tax Reform Act of 1986	DD	High-income married women	0.4–0.6†
Eissa (1996)	US	1982	Economic Recovery Tax Act of 1981	DD	Married women aged 19–64	0.33–0.91†
French & Song (2014)	US	1990–1999	Random assignment of disability insurance judges	IV	Disability insurance applicants	1.53
Gelber & Mitchell (2012)	US	1975–2004	“variation across individuals and time in national and state policy changes”	FE	Singles aged 25–55: (a) women, (b) men	0.41 (a) –0.04 (b)†
Gelber et al. (2017)	US	1978–1987	Social Security earnings test	RKD	Retirees born 1918–1923: (a) all, (b) men, (c) women	0.49 (a) 0.25 (b) 0.49 (c)†
Hotz, Mullin & Scholz (2002)	US	1987–1998	EITC expansions	DD	California AFDC recipients	0.97–1.69†
Kumar & Liang (2016)	US	1998–2006	Over-time variation in tax rates and wages	CRE	Married women	0.35†
Kumar (2016)	US	1979–2007	Over-time variation in tax rates and wages	CRE IV	Married women	0.56†
Lin & Tong (2017)	US	2000–2009	Bush tax cuts, Obama recovery package	IV/IV-FD	Married couples aged 25–54: (a) men, (b) women	0.03/–0.01 (a) 0.10/0.08 (b)†
McClelland, Mok & Pierce (2014)	US	1999–2010	Bush tax cuts, state tax reforms	IV	(a) women, (b) men, born 1948–1978	0.02 (a) 0.004 (b)†
Milligan & Stabile (2007)	Canada	1998	Provincial variation in interaction between social assistance and National Child Benefit	DD	Single mothers aged 18–50	0.96
Bartels & Shupe (2018)	several	2008–2014	policy changes affecting demographic groups differently	Group IV	(a) women, (b) men, aged 25–54	0.14 (a) 0.08 (b)
Jääntti, Pirttilä & Selin (2015)	several	1970–2010	“compare otherwise similar groups of individuals who have been affected differently by tax reforms”	Group IV	Individuals aged 25–64	0.01
Blundell, Bozio & Laroque (2011)	UK	1978–2007	“differential changes across gender and education”	Control function	Individuals aged 34–54: (a) women, (b) men	0.34 (a) 0.25 (b)†
Meghir & Phillips (2010)	UK	1994–2004	Regional variation in housing benefit over time	IV	(a) single men, (b) married men, aged 22–59, low education	0.27 (a) 0.53 (b)†
Bettendorf, Folmer & Jongen (2014)	Netherlands	2002	Reform of single parent tax credit	(a) DD, (b) RD	Single mothers	–0.02 (a) –0.02 (b)
Bastani, Moberg & Selin (2020)	Sweden	1997	Housing benefit reform	DD	Married low-income women	0.13
Laun (2017)	Sweden	2007	EITC and payroll tax cut for older workers	DD	65-year-olds	0.22
Selin (2014)	Sweden	1971	Abolition of joint taxation of spouses	DD	Married women	1
Kosonen (2014)	Finland	1994–2005	Municipal variation in Home Care Allowance	DD	Mothers	0.83
Martinez, Saez & Siegenthaler (2018)	Switzerland	1997–2003	Swiss tax holiday	FE	20–60-year-olds	0
Sigurdsson (2019)	Iceland	1987	Icelandic tax holiday	DD	16–70-year-olds	0.1
Stefansson (2019)	Iceland	1987	Icelandic tax holiday	DD	16–67-year-olds	0

Study	Country	Years	Identifying variation	Method	Sample	Elasticity
<i>Papers where the elasticity is calculated by other authors*:</i>						
Eissa & Liebman (1996)	US	1987	Tax Reform Act of 1986	DD	Single mothers	0.3
Meyer & Rosenbaum (2001)	US	1984–1996	Tax reforms 1984–1996	DD	Single mothers	0.43
Card & Hyslop (2005)	Canada	1992–1995	Self-Sufficiency Project	RCT	Single parents	0.38†
Blundell, Brewer & Shephard (2005)	UK	1999	WFTC	DD	Single mothers	0.45
Francesconi & van der Klaauw (2007)	UK	1999	WFTC	DD	Single mothers	0.6
Gregg & Harkness (2003)	UK	1999	WFTC	DD	Single mothers	0.61
Leigh (2007)	UK	1999	WFTC	DD	Single mothers	0.07

Abbreviations:

EITC – earned income tax credit

WFTC – working families tax credit

DD – difference-in-differences

IV – instrumental variables

FE – fixed effects

FD – first differences

CRE – correlated random effects

RD – regression discontinuity

RKD – regression kink design

RCT – randomized controlled trial

DB – difference-in-bunching

* Chetty et al. (2013) or Bettendorf, Folmer & Jongen (2014). See text for details.

† The elasticity is expressed with respect to net wages instead of the financial gain from work.

3. A review of the quasi-experimental literature

Since the 1990s, an increasing number of papers use quasi-experimental methods to identify economic parameters, including the effect of taxes and benefits on labour supply. These papers, made possible by improved data access and econometric innovation, are primarily concerned with finding elasticity estimates that plausibly can be given a causal interpretation. The literature is called quasi-experimental because it strives to come as close as possible to the ideal of a randomized experiment. Because such experiments are rare in the social sciences, the literature uses real-world features, like reforms affecting groups differently, to estimate responses to policy changes. The methods most commonly used are difference-in-differences (DD), instrumental variables and regression discontinuity (see Angrist & Pischke, 2009, for a general description). Some papers use panel data with individual or group fixed effects. This is similar to DD in that it uses changes over time within individuals or groups to identify an elasticity.

We have identified 35 papers that use quasi-experimental methods to identify participation responses; see table 1.⁹ We have included all papers that we could find that fulfil our basic criterion – estimating a participation elasticity with quasi-experimental methods, using tax or benefit policy changes as the identifying variation. We include both journal articles and working papers.

As explained in the theory section, the ideal elasticity concept is the elasticity of labour force participation with respect to the financial gain from work. However, many papers instead report the elasticity with respect to the net wage, perhaps due to transfers being unobserved. As this is fairly common, we include such papers as well, although the estimates may be biased due to out-of-work benefits being omitted. Also recall that the elasticity with respect to the net wage is always larger than the elasticity with respect to the financial gain for a given participation response. Therefore the elasticity definition should always be considered when drawing conclusions from the papers. Studies that use a different elasticity definition than the two mentioned are not included in this survey as these estimated elasticities are not directly comparable.¹⁰

In seven cases, the paper does not itself report a participation elasticity. Instead, we report elasticities calculated by other authors (Bettendorf, Folmer & Jongen, 2014, or Chetty et al., 2013) using information in the papers.

The papers are summarized below. We group them by country and introduce the various econometric methods throughout the text. We start with the American literature, which is by far the largest and most diverse.

United States

The earliest papers in the quasi-experimental extensive margin literature use difference-in-differences methodology to estimate how American tax reforms affected labour force participation, especially among women. Of particular interest is the earned income tax credit (EITC), which is targeted at low-income workers with children and was increased several times during the 1980s and 90s. Hotz & Scholz (2003) survey the literature that estimate extensive margin responses to the EITC. One such paper is Eissa & Liebman (1996), who estimate that single mothers increased their labour force participation by 2.8 percentage points following the expansion of the EITC after the Tax Reform Act of 1986 compared to childless single women and controlling for demographic characteristics. Chetty et al. (2013) calculate that this implies a participation elasticity with respect to the financial gain from work of 0.3.¹¹

⁹ We found the papers by searching for “participation elasticity” and “extensive margin elasticity” together with “labour supply” on Google Scholar, and from references in other papers.

¹⁰ Some examples of such papers are Autor et al. (2016), Bargain & Doorley (2011), Carbonnier (2008), Jonassen (2013), Fadlon & Nielsen (2015), Gruber (2000), Koning & van Sonsbeek (2017) and Kostol & Mogstad (2014). Most of these papers focus on groups with weak labour force attachment and find quite sizeable responses, in line with the papers included in our analysis.

¹¹ Hotz & Scholz (2003) calculate a participation elasticity of 1.16 from the same paper. The difference is due to two factors. First, Hotz & Scholz (2003) define the elasticity with respect to after-tax wages while Chetty et al. (2013) define it with respect to the financial gain from work. Second, Chetty et al. (2013) use a \$1,000 tax cut in the denominator while Hotz & Scholz (2003) use \$500. We choose to report the more conservative estimate.

Hotz & Scholz (2003) report elasticities calculated from an unpublished study (Hotz, Mullin & Scholz, 2002) that uses data from California to analyze the 1990s EITC expansion. Making use of the fact that the expansion increased the return to work more for families with two or more children compared to one-child families, they estimate a participation elasticity between 0.97 and 1.69 depending on base year.

Bastian (2020) analyzes the introduction of the EITC in 1975. He shows that the employment rate of mothers increased significantly after 1975 compared to women without children, corresponding to a participation elasticity of 0.58 for a representative mother.

The EITC literature has recently been criticized by Kleven (2019), who shows that only the 1993 EITC expansion is clearly associated with an increase in the employment rate of single mothers. Further, Kleven argues that the employment increases of the 1990s can be better explained with macroeconomic conditions and welfare reform.

Eissa (1995) estimated a participation elasticity with respect to net wages of 0.4–0.6 for high-income women by examining the Tax Reform Act of 1986, using lower-income women as the control group. However, Liebman & Saez (2006) criticize this approach, arguing that lower-income women cannot serve as a control group and showing that the estimated effect (and therefore elasticity) varies greatly depending on which reference years are chosen.

In a related study, Eissa (1996) investigates the 1981 Kemp–Roth tax cut (the Economic Recovery Tax Act) using the same methodology. Comparing women married to husbands earning more than \$50,000 to those whose husbands earned \$30,000–50,000, she arrived at elasticities ranging from 0.33 to 0.91 depending on how the control group is formed and whether education-specific time trends are included. Because married couples are taxed jointly in the United States, the husband's income affects the wife's participation tax rate. As the tax cut flattened the tax structure, reducing marginal tax rates more for high-income couples, the fact that high-income women increased their labour force participation is evidence of their responding to the greater incentives for work.

Eissa & Hoynes (2004) use a repeated cross-section (the Current Population Survey) to examine how married Americans responded to tax reforms, notably several EITC expansions, over the period 1984–1996. Utilizing differences across demographic characteristics (such as number of children), they estimate participation elasticities of 0.27 for women and 0.03 for men.

Meyer & Rosenbaum (2001) use the same dataset and analyze the same time period, but instead focus on single women. They find an elasticity of participation with respect to gross wages of 1.07. However, as pointed out by Chetty et al. (2013), the elasticity should be expressed with respect to the increase in net earnings. They recalculate the elasticity to be 0.43.

Chetty, Friedman & Saez (2013) analyze the effects of the EITC using a different approach. They note that the EITC needs to be claimed by the taxpayer on the tax return and that take-up is not perfect. Further, they find evidence of substantial geographical variation in EITC knowledge across the United States. They do this by noting how many self-employment EITC filers – who have some freedom in how much income to report – locate exactly at the beginning of the plateau where the EITC is maximized, so-called bunching. If many small-business owners in a particular area bunch at this kink point, this indicates relatively widespread knowledge about the EITC. Thus having constructed an instrument for EITC take-up, the authors proceed to estimate a participation elasticity of 0.19.

More recently, it has become easier for researchers to use panel data of individuals to estimate labour supply elasticities. Using panel data can potentially alleviate the problem of unobserved individual heterogeneity by including individual fixed effects (FE) in the regression, implying that only within-individual variation over time is used to identify the elasticity.

One such paper is Gelber & Mitchell (2012), which examines the participation decisions of unmarried prime-age Americans during 1975–2004. The fact that they include individual fixed effects implies that the variation used is tax reforms that affected individuals differently. They find that a one percent increase in net wages raises the labour force participation

of single women by 0.43 percent. In alternative specifications, the elasticity varies between 0.26 and 0.75. However, for men the elasticity is slightly negative.

There are econometric difficulties (the incidental parameters problem) associated with nonlinear fixed effects models – such as probit, often used to model labour force participation – when the number of time periods is relatively small. A common technique for avoiding this is correlated random effects, CRE. This can be described as being in between random effects and fixed effects. CRE requires a few additional assumptions about individual heterogeneity.

Kumar (2016) uses the Panel Study of Income Dynamics to study how married women responded to tax reforms (as well as variation in wages) over the period 1979–2007. He reports results for both CRE and FE, as well as pooled panels without controls for unobserved individual heterogeneity. CRE is his preferred specification, but the FE and pooled regressions yield elasticities of a similar magnitude. However, it makes a big difference whether the endogeneity of after-tax hourly wages is accounted for. In Kumar's preferred specification, this is done by using lagged demographic variables as instruments. The participation elasticity thus estimated is 0.56 in a lifecycle model and 0.46 in a static model.

In a similar paper, Kumar & Liang (2016) study the same sample, also focusing on married women. However, instead of estimating one elasticity for the entire time period, like Kumar (2016), they look for evidence of changing elasticities over time. In the CRE specification, they find an elasticity of 0.53 in the first period, 1980–1984, increasing to 0.83 in 1984–1989. After that the elasticities are lower, around 0.35.

One strand of the literature has taken inspiration from the new tax responsiveness literature (in particular Gruber & Saez, 2002) which estimates the intensive margin elasticity on individual panel data using quasi-experimental methods. An econometric problem when estimating this elasticity is that when the income tax is progressive, the marginal tax rate will depend on taxable income, causing endogeneity. Gruber & Saez (2002) handle this problem by instrumenting for the current year marginal tax rate with last year's income and marginal tax rate.

Alpert & Powell (2014) implement this so-called simulated instruments methodology to examine how the 2001 and 2003 Bush tax cuts affected the labour supply of workers aged 50 or older, who may be on the margin of retirement. They find relatively high participation elasticities: 0.75 for women and 0.55 for men.

McClelland, Mok & Pierce (2014) study the same time period and use the same methodology, but instead look at secondary earners within prime-age married couples. They find very little evidence of participation responses to the Bush tax cuts, estimating elasticities close to zero (0.03 at most). In the main analysis, they control for individual heterogeneity using correlated random effects. They report results for a fixed effects model as a robustness check, but the magnitude of elasticities is similar.

In a very similar paper, Lin & Tong (2017) study the same group using the same reforms as identifying variation, but use a larger sample and a slightly different method. They also find small elasticities, very near 0 for men and at most 0.1 for women.

Gelber et al. (2017) examine the labour supply of Americans in their 60s using a feature of the old-age part of the Social Security system, the annual earnings test. For every dollar a retiree's earnings exceeds \$17,000, retirement benefits decrease by 50 cents. The authors show that labour force participation among retirees is increasing with prior earnings, but that the relationship has a noticeably smaller slope after the earnings test threshold. This is evidence of older workers with relatively high incomes dropping out of the labour force as a result of the Social Security annual earnings test. The method that uses the change in the slope of the treatment variable for identification is called regression kink design. Gelber et al. (2017) arrive at a participation elasticity of 0.49.

French & Song (2014) analyze a different part of the Social Security system – disability insurance. Americans who apply for disability benefit from the Social Security Administration but are denied can appeal to an administrative court. Assignment of cases to judges is essentially random, and judges vary considerably in their willingness to grant an appellant

disability benefit. This can be used to estimate the effects of disability insurance on labour supply. The authors find that the effects are very large: labour force participation falls by 26 percentage points after disability benefit has been granted, corresponding to an elasticity of 1.53. The elasticity is lower for older and college-educated individuals.

Brown (2013) looks at the retirement behaviour of California public school teachers. She uses a difference-in-bunching design. As Kleven (2016) explains, this is a method that takes advantage of a change in the size of a kink or notch in the taxation policy. By observing bunching around the discontinuity before and after the policy change, a labour supply elasticity can be calculated. Retired teachers receive a higher benefit the more years that they work. Brown uses two nonlinearities in the determination of retirement benefits for identification: First, after a certain age the benefit amount increases by less for each year. Second, teachers with 30 years of service receive a retirement bonus. She shows that teachers adjust their behaviour very little in response to these discontinuities, which implies an elasticity close to zero.

Canada

Milligan & Stabile (2007) analyze an EITC-type programme, the National Child Benefit, introduced in Canada in 1998. Variation across provinces, as well as the fact that the benefit amount depends on the number of children, is used to estimate the effect on labour force participation. They find that single mothers responded strongly to the increased incentives for work, arriving at a participation elasticity of 0.96.

In the 1990s, Canada ran a large-scale randomized trial of work incentives for welfare recipients, the Self-Sufficiency Project. Out of a sample of 5,000 individuals, half were randomly assigned to the project. If they started full-time work within a year, they received a generous benefit. Card & Hyslop (2005) show that the effects of the experiment were large: After one year, the treatment group had a 14 percentage points higher employment rate than the control group. Chetty et al. (2013) calculate that this implies a participation elasticity of 0.38. After the experiment ended, there was no longer any difference in outcomes between the treatment and control groups.

Cross-national studies

Another method borrowed from the intensive margin literature (Blundell et al., 1998) that is used by a number of papers is group instrumental variables (IV). The idea is to divide the sample into groups by, e.g., age, education and gender, and use group membership as an instrument for tax rates or net wages. This is equivalent to simply running a regression on group averages. The method is similar to difference-in-differences.

Jäntti, Pirttilä & Selin (2015) apply this method to a cross-national dataset of 13 countries (the United States, Canada, Australia, Israel and nine European countries). They create 1,200 groups based on country, age, education and gender. When running a regression across all countries and years without any controls, they estimate an elasticity of 0.2. However, this estimate could be biased due to changes over time or differences between countries that are unrelated to taxation. When they add group and year fixed effects, the elasticity is reduced to only 0.01.

In a related paper, Bartels & Shupe (2018) perform a group IV regression on 12 EU countries over the period 2008–2014. Defining groups as Jäntti, Pirttilä & Selin (2015), they find an average elasticity of 0.14 for women and 0.08 for men.

Britain and the Netherlands

Blundell, Bozio & Laroque (2011) use a group approach to estimate participation elasticities in the United Kingdom. The groups are defined by gender and education level, and differential changes in after-tax wages between these groups over time are used to identify the elasticity. They find an elasticity of 0.25 for prime-age men and 0.34 for prime-age women.

In Britain, the Working Families Tax Credit (WFTC) was introduced in 1999 with the purpose of raising the employment rate of lone parents and reducing child poverty. This reform is analyzed by Gregg & Harkness (2003), Blundell et al. (2005), Francesconi & van der Klaauw (2007) and Leigh (2007). The papers examine the labour supply response of single mothers, using single women without children as a control group. While none of the papers report participation elasticities, they are calculated by Bettendorf et al. (2014) to be 0.61, 0.45, 0.6 and 0.07, respectively.¹² The outlier is Leigh (2007), who uses a considerably shorter follow-up period than in the other papers.

Meghir & Phillips (2010) analyze the labour supply behaviour of British men. In identifying the elasticity they make use of the fact that housing benefit is tied to the level of rent, which has varied over time across regions of the UK. Using this as an instrument for net income when working, they estimate an elasticity of 0.27 for single men and 0.53 for married men, when restricting the sample to men with low education. For men with high education, the estimates are not significantly different from zero.

Bettendorf, Folmer & Jongen (2014) study an extension of eligibility of the EITC in the Netherlands using a difference-in-differences approach as well as a regression discontinuity method. Before 2002, only those single parents who had a child aged 13 or less were eligible for the EITC. This cut-off was increased by four years in 2002. In their DD analysis, they compare the labour supply of single mothers with children aged 12 to 16 years with single mothers who had older or younger children. In the regression discontinuity analysis, the effect is estimated by analyzing mothers to children just above and below the cut-off point of 16 years of age. The cut-off creates a discontinuity that can be used for identification. None of the methods find any evidence of participation responses.

Sweden and Finland

In many countries, spouses are taxed jointly, which combined with a progressive tax schedule raises the participation tax rate for the secondary earner in the household, which often affects the labour supply of married women. In 1971, Sweden transitioned from taxing married couples jointly to taxing them separately. Selin (2014) analyzes this reform, noting that it increased work incentives for secondary earners. The incomes of husbands affect to what extent the policy change creates an incentive for their wives to enter the labour market. By comparing women married to high- and low-income earners, he estimates the elasticity to be 1, with a higher elasticity for women with children.

In a similar reform, the Swedish housing benefit was altered in 1997 to be based on individual rather than household income. In practice, this resulted in lower housing benefit for one-earner couples and unchanged benefit levels for two-earner couples. The participation tax rate for secondary earners (usually women) thus fell. Bastani, Moberg & Selin (2020) examine how this affected labour supply. Comparing low-income mothers, who are eligible for the benefit, with low-income women without children, who are ineligible, they show that the labour force participation of the former group increased in the years following the reform, corresponding to an elasticity of 0.13.

Sweden introduced an EITC in 2007, but because this tax credit is payable to all workers, no natural control group exists and the reform has not been possible to evaluate using quasi-experimental methods. (Edmark et al., 2016) However, workers over 65 are eligible for a larger EITC, as well as lower payroll taxes – a reform which was also implemented in 2007. Laun (2017) uses those born during the previous calendar year, and thus ineligible for the two tax breaks, as a control group and finds that the reform raised employment in the treatment group. The effect implies a participation elasticity of 0.22.

Kosonen (2014) studies the Finnish Child Homecare Allowance (HCA), a benefit system offered to mothers who stay home to care for their children. He exploits variation over time in the municipality-specific component of the HCA. Using a difference-in-differences methodology, the participation elasticity for mothers is estimated at 0.86. Kosonen further

¹² Francesconi & van der Klaauw (2007) calculate an elasticity with respect to net income of 1.1.

concludes that the participation elasticity is highest for mothers with low and high education while being lower for individuals with a medium education level.

Iceland and Switzerland

In three recent papers, economists have used so-called tax holidays to identify a participation elasticity. Such a tax holiday occurred in Iceland in 1987. Up until 1987, Icelanders paid taxes on last year's income, so the 1987 tax liability was calculated on 1986 earnings. However, in 1988 the tax collection system was changed so that taxes were paid on the current year's income. Thus the 1988 tax liability was based on 1988 incomes – and 1987 incomes were never taxed. Sigurdsson (2019) and Stefánsson (2019) both analyze this tax holiday.

Stefánsson (2019) shows that the participation rate – defined as the proportion having positive labour income – did not deviate from the trend in 1987, implying a participation elasticity of zero.¹³

Sigurdsson (2019) uses a difference-in-differences design, comparing individuals in different tax brackets before the reform. Theory predicts that individuals paying higher tax rates should increase their labour force participation more, as they receive the largest tax cut when the tax rate falls to zero. However, Sigurdsson finds no such differences between tax brackets, also implying an elasticity close to zero (in fact slightly negative).

The difference-in-differences method can only observe labour market exits, as entrants had no income in the year before the reform. In order to capture labour market entries, Sigurdsson constructs a life-cycle model, using adjacent cohorts as control groups. Hence he arrives at an extensive margin elasticity of 0.1.¹⁴

In the late 1990s and early 2000s, Switzerland also transitioned to taxing current incomes, although the year of transition, and therefore of the tax holiday, differed by canton. Martinez, Saez & Siegenthaler (2018) analyze this reform and find no participation responses.

The tax holiday papers use a very convincing identification strategy, but the external validity may be questioned. In the standard model, people respond more to temporary than to permanent policy changes – the Frisch elasticity is greater than the Marshallian elasticity. However, it is easy to think of optimization frictions that make it difficult to participate in the labour market for just one year (and for employers to temporarily increase their labour force). Therefore, the low participation elasticities estimated may not be surprising.

4. Meta-analysis

There is a great deal of variation in the cited estimates. The literature is a long way from consensus. Nonetheless, a few conclusions can be drawn. There is evidence that people respond to incentives when deciding whether to work. 27 of the 35 studies find an elasticity larger than 0.1, at least for women. Women respond more strongly than men. All studies that report elasticities disaggregated by gender find a larger elasticity for women.

The estimates are summarized in figure 1. The 35 papers report 45 elasticities in total. The mean is 0.36 and the median is 0.27. Elasticities seem to have declined over time, consistent with the findings of Heim (2007), Blau & Kahn (2007) and Kumar & Liang (2016). Figure 2 shows a downward trend of about 0.11 per decade, which is substantial. A likely

¹³ Stefánsson (2019) and Sigurdsson (2019), as well as an earlier paper by Bianchi, Gudmundsson & Zoega (2001), find that working individuals increased the number of weeks worked during 1987. However, this is properly classified as an intensive margin response and therefore we do not include it in the table.

¹⁴ This can be calculated from table 6 in Sigurdsson (2019) by dividing the estimated semi-elasticity (0.07) by the employment rate (0.67).

explanation is increased female labour force participation, whereby the available pool of nonworkers has shrunk over time.

The same decreasing trend can be seen when analyzing estimates by publication year. However, we would be careful in drawing conclusions from this, as the studies were published during a relatively short time period, and the methods and study populations have varied over time.

Table 2 shows unconditional averages for different groups of papers. We see that elasticities are larger in North America. Women’s elasticities are greater than men’s. Married women (in this category we also include estimates pertaining to all women) seem to respond more than single women, possibly because they are typically the secondary earner in a couple, whose participation decision is more responsive to incentives.

Studies using difference-in-differences (DD) methodology find larger elasticities. There are several possible explanations for this, for example, that DD papers concentrate on the reforms where responses are likely to be the highest (e.g., EITC reforms targeted at single mothers).

Surprisingly, elasticities that are expressed with respect to net wages are on average lower than elasticities with respect to the financial gain from work, although, as shown in the theory section, the former definition always yields larger elasticities for a given magnitude of the participation response. The explanation could be that the use of this elasticity definition is correlated with unobserved study characteristics that cause a high estimate. It could also be due to chance.

Figure 1. Histogram of elasticity estimates (45 estimates from 35 papers)

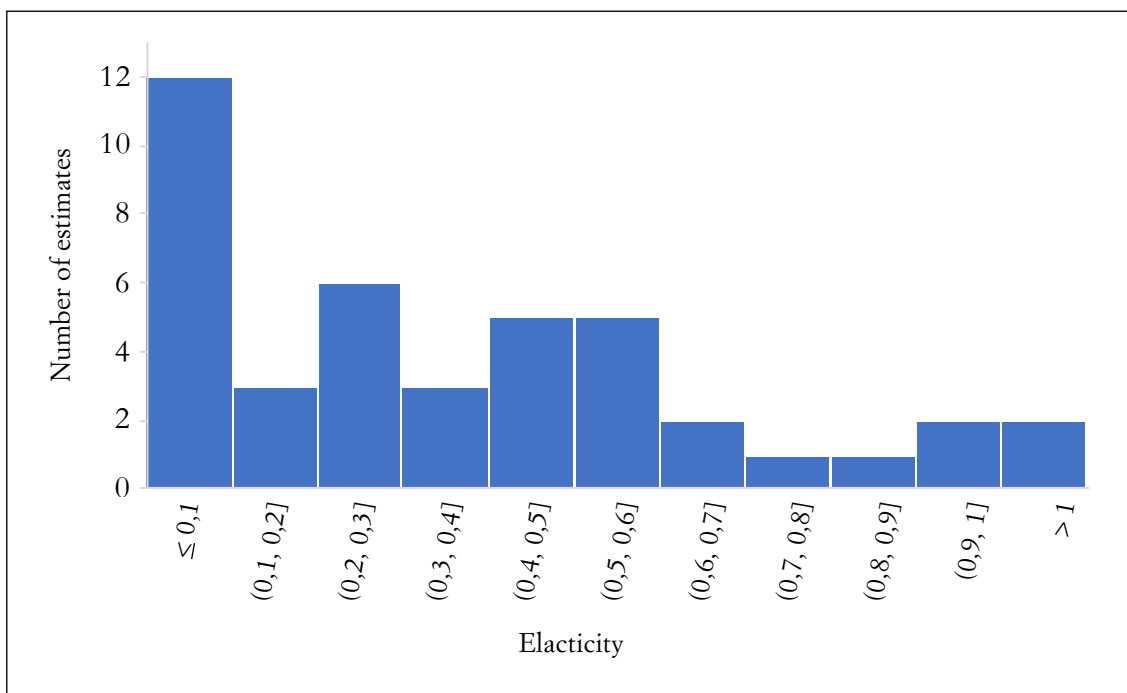


Figure 2. Elasticity estimates by year of the reform evaluated (or midpoint for studies spanning several years)

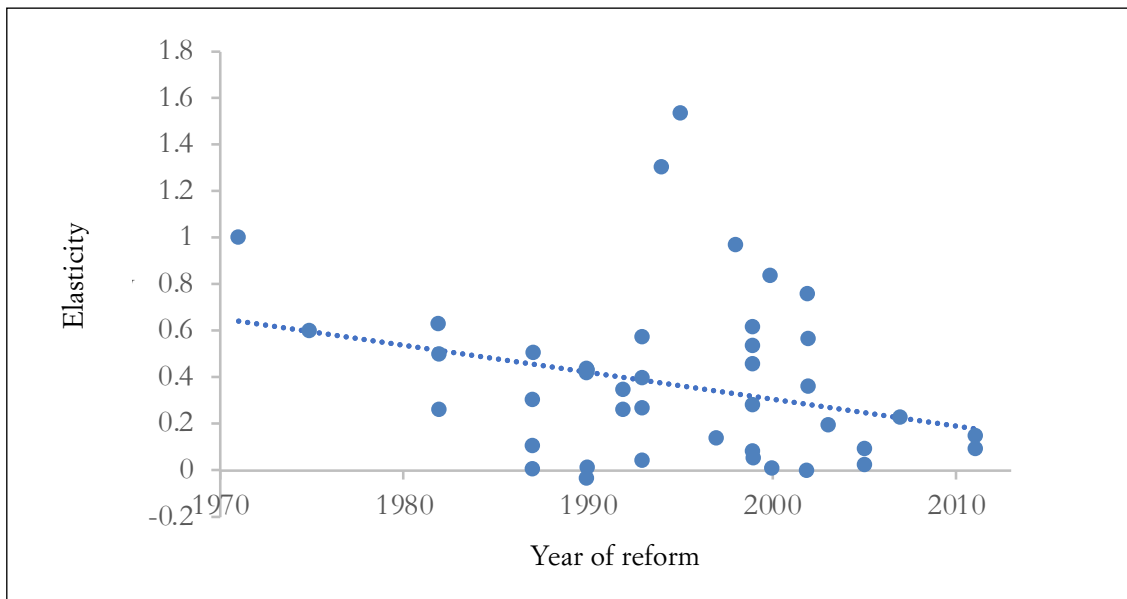


Table 2. Unconditional elasticity averages

Continent	Europe	North America	
	0.28 [20]	0.42 [25]	
Gender	Single women	(Married) women	Men/both genders
	0.4 [12]	0.44 [14]	0.28 [19]
Age	Older workers	Working age	
	0.38 [6]	0.36 [39]	
Elasticity denominator	Net wage	Financial gain from work	
	0.35 [23]	0.37 [22]	
Methodology	DD	Other methodologies	
	0.45 [20]	0.29 [25]	

Number of elasticity estimates in square brackets.

For policy purposes, it is important to have an estimate of the relevant elasticity for reforms affecting the full population. This matters when, e.g., parameterizing optimal income taxation models and evaluating general tax cuts or tax credits, such as the Swedish EITC. Most studies in our survey focus on specific reforms or subgroups, but nine estimate an elasticity for the general working-age population (typically ages 25–54) using techniques such as group IV or individual fixed effects regressions. The average elasticity in these papers is 0.1.¹⁵ However, for general tax cuts, the responses of indi-

¹⁵ The nine papers are Gelber & Mitchell (2012), Lin & Tong (2017), McClelland, Mok & Pierce (2014), Bartels & Shupe (2018), Blundell, Bozio & Laroque (2011), Jääntti, Pirttilä & Selin (2015), Sigurdsson (2019), Stefansson (2019) and Martinez, Saez & Siegenthaler (2018).

viduals at the margin of retirement are also important. As estimated elasticities for this subgroup are considerably higher than 0.1, we assess that the average full-population elasticity lies in the range 0.1–0.2.¹⁶

Overall, a clear pattern is that elasticities are greater for groups with a low employment rate, such as low-skilled single mothers. This is perhaps to be expected, as the elasticity by definition is decreasing in the employment rate for a given employment effect. In addition, a greater number of people out of work likely means a larger number of people at the margin of entering employment, which is what matters for the magnitude of the elasticity.¹⁷

5. Conclusion

Since the mid-1990s, a growing number of studies have used quasi-experimental methods to identify labour force participation responses to tax and benefit reforms. We have identified 35 such papers. We find that participation elasticities are larger for women and have declined over time. Americans seem to be more responsive than Europeans. The average elasticity across all studies is 0.36, although there is a large range from 0 to more than 1. Many papers focus on groups with a larger potential labour reserve, such as single mothers, where – as expected – estimated participation responses also are higher. We believe that the policy-relevant elasticity for the full population lies in the range 0.1–0.2.

We offer some advice for future research in this area. Researchers should use the elasticity definition that is now standard in the literature, i.e., the participation elasticity with respect to the financial gain from work. This allows for comparison between countries and reforms, and makes it easier to predict the effects of future reforms. Many papers do not report an elasticity at all. Although in some cases an elasticity can be calculated from information reported in the paper (which, e.g., Chetty et al., 2013, do), this also increases the risk of error.¹⁸ Preferably, the elasticity should be calculated by researchers who have access to the underlying data.

It is also worth noting that a relatively small number of countries is covered by our survey. The majority of papers are from the United States. Two are from Canada and the rest are from Western Europe. Some examples of major high-income countries that are completely absent are Japan, Australia and Germany. This suggests that there is much room for continued research. □

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¹⁶ The papers that focus on older workers are Alpert & Powell (2014), Brown (2013), Gelber et al. (2017) and Laun (2017). As shown in table 2, the average elasticity is 0.38.

¹⁷ See the discussion in the theory section and in Bastani, Moberg & Selin (2020).

¹⁸ Cf. footnote 12.

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Appendix: Comparison with Chetty et al. (2013)

The only previous general survey of the quasi-experimental participation elasticity literature that we know of is Chetty et al. (2013), which cites 15 papers. We include seven of those in our survey. Below are the papers left out, and our motivations for doing so.

Juhn, Murphy & Topel (1991): Regional wage trends (presumably before-tax) are used for identification – not policy variation.

Graversen (1998): The parametric and nonparametric DD estimates have different signs, indicating non-parallel trends that are difficult to control for.

Devereux (2004): Before-tax wages are used.

Liebman & Saez (2006): The authors report many different estimates, and state that it is unlikely that a suitable control group can be found.

Carrington (1996): The paper studies a labour demand shock. We are interested in the effects of policy.

Gruber & Wise (1999): Cross-country evidence only – not quasi-experimental.

Bianchi, Gudmundsson & Zoega (2001): The elasticity reported concerns the number of weeks worked, which departs from the conventional definition of the extensive margin.

Manoli & Weber (2011): In the published version (Manoli & Weber, 2016), the authors report a semielasticity and state that it is difficult to translate into an elasticity (p. 172).