USDA

United States Department of Agriculture

Economic Research Service

Economic Research Report Number 257

September 2018

Participation in USDA's Supplemental Nutrition Assistance Program (SNAP): Effect of Local Labor Market Conditions in Oregon

Erik Scherpf, Bruce Weber, Deana Grobe, and Mark Edwards

United States Department of Agriculture

Economic Research Service
www.ers.usda.gov

Recommended citation format for this publication:

Scherpf, Erik,Bruce Weber, Deana Grobe, and Mark Edwards. *Participation in USDA's Supplemental Nutrition Assistance Program (SNAP): Effect of Local Labor Market Conditions in Oregon,* ERR-257, U.S. Department of Agriculture, Economic Research Service, September 2018.

Cover is a derivative of images from Getty Images.

United States Department of Agriculture

Economic Research Service

Economic Research Report Number 257

September 2018

Participation in USDA's Supplemental Nutrition Assistance Program (SNAP): Effect of Local Labor Market Conditions in Oregon

Erik Scherpf, Bruce Weber, Deana Grobe, and Mark Edwards

Abstract

This study investigates the relationship between local economic conditions in Oregon and spell lengths of USDA's Supplemental Nutrtion Assistance Program (SNAP). Using different indicators of economic conditions and different definitions of local labor market areas, the report finds evidence that improved labor market conditions were associated with an increased probability that a SNAP recipient in Oregon ended a participation spell. When local labor markets are delineated as commuting zones—our preferred definition—our results suggest that a 10-percent increase in local employment raises the average recipient's probability of program exit by nearly 7 percent. The report shows that—when labor market conditions are measured in a more localized way than is typically done—SNAP recipients are found to be more responsive to labor market conditions.

Keywords: Supplemental Nutrition Assistance Program, SNAP, Oregon SNAP, SNAP spell, labor market conditions, unemployment, Great Recession, ABAWD, able-bodied adults without dependents

Acknowledgments

The authors would like to thank Jim Ziliak, Caroline Danielson, Matthew Rabbitt, USDA, Economic Research Service (ERS), and Danielle Deemer, USDA, Food and Nutrition Service, for technical peer review. The authors would also like to thank the Oregon Department of Human Services for providing the data used in this report. Thanks also to Maria Williams and Curtia Taylor, USDA, ERS for editorial and design services.

Contents

USDA
United States Department of Agriculture

A report summary from the Economic Research Service *August 2018*

Participation in USDA's Supplemental Nutrition Assistance Program (SNAP): Effect of Local Labor Market Conditions in Oregon

Erik Scherpf, Bruce Weber, Deana Grobe, and Mark Edwards

What Is the Issue?

During the Great Recession (2007-09), USDA's Supplemental Nutrition Assistance Program (SNAP) served as part of the safety net for millions of low-income households. However, during the economy's recovery, SNAP caseloads declined slowly despite improving labor market conditions. What explains the sluggish post-recession decline of SNAP caseloads? Or, put another way, how responsive are SNAP recipients to improving labor market conditions that would help them off the program?

The responsiveness of SNAP caseloads is typically measured by how they move with the unemployment rate, usually at the State or national level. However, measuring economic conditions for a State or larger region may not reveal the conditions facing most SNAP recipients, who are often geographically clustered in particular areas or work in specific industries. To gain a better understanding of the post-recession adjustment in SNAP caseloads, ERS attempted to delineate the local labor markets that are more relevant to SNAP recipients, focusing on one case-study State: Oregon.

In this report, ERS examined the relationship between the length of SNAP "spells" (continuous periods of SNAP enrollment) and labor market conditions at the local level, both overall and by specific industries. Researchers compared spells for two groups: individuals who began a new SNAP spell in 2005, before the Great Recession, and those who began a new spell in 2009, toward the end of the Great Recession.

It should be noted that the Oregon SNAP caseload differs demographically from many other States' caseloads, so this report's results may not apply to other States or to the country as a whole. For example, Oregon SNAP serves a higher proportion of SNAP recipients who are white and who are working compared to other States. Oregon also provides one of the more accessible social safety nets and was among the States hardest hit by the recession. (In Oregon, recession-era unemployment climbed as high as 12 percent, compared to the national high of 10 percent.) These two factors suggest that Oregonians who turn to SNAP might tend to remain in the program longer than the average SNAP participant. As a result, findings from Oregon might serve as conservative estimates of the effects of labor market conditions on SNAP spell duration.

ERS is a primary source of economic research and analysis from the U.S. Department of Agriculture, providing timely information on economic and policy issues related to agriculture, food, the environment, and rural America.

What Did the Study Find?

- Using three different measures of labor market conditions—the unemployment rate, employment aggregates, and new hires—local labor market conditions were strongly linked to the probability of leaving SNAP for both the 2005- and the 2009-entry groups.
- Labor market conditions showed the largest effects on SNAP spell lengths when labor market areas were defined as commuting zones (CZs), which attempt to capture areas where people both live and work. The results show that three in five recipients ended benefit receipt in a year or less. When labor market conditions were measured using CZs, a 10-percent increase in aggregate employment raised the share of recipients who finished their SNAP spell in 12 months or less by about 5.3 percentage points (or about 8.8 percent).
- Using a different definition of labor market areas resulted in smaller, but still positive, estimated effects: a 10-percent increase in county-level employment raised the probability that a SNAP recipient would finish a spell in 12 months or less by between 1.5 and 2 percentage points (or between 2 and 3 percent).
- Increases in both total employment and new hires in the manufacturing and the food service and lodging industries were associated with a higher probability of able-bodied, working-age adults exiting SNAP. SNAP recipients were most responsive to changes in manufacturing employment. Using new hires as the local labor market indicator, however, recipients were most responsive to changes in the food service and lodging industry.
- When labor market conditions were measured at the local level, researchers estimated a greater responsiveness by SNAP recipients to labor market conditions, as opposed to what other researchers have measured at the State or national levels.

How Was the Study Conducted?

Multiple administrative sources from Oregon provided data covering a 10-year period from January 2005 through December 2014. The sample was drawn from SNAP spells that began during 2005 and 2009, and include records of SNAP receipt, unemployment insurance wages, and benefits. Using this linked administrative dataset, ERS investigated the relationship between local labor market conditions and SNAP-spell length by estimating discrete-time hazard models. The models yielded estimates of the effect of labor market variables on the "hazard" (or probability) that a recipient left the program in a given month, conditional on the length of the SNAP spell to that point. A recipient was considered to have left the program if he or she has 2 consecutive months of nonreceipt. Different definitions of labor market area and different measures of labor market conditions were evaluated.

Participation in USDA's Supplemental Nutrition Assistance Program (SNAP): Effect of Local Labor Market Conditions in Oregon

Introduction

Enrollment in the Supplemental Nutrition Assistance Program (SNAP) grew rapidly during the Great Recession. Spending on SNAP benefits increased from roughly $37 billion at the outset of the recession to a peak of $75 billion following the recession, while average annual enrollment in the program rose from 26.3 million recipients in 2007 to a high of 47.6 million in 2013, nearly 4 years after the recession's official end. Historically, movements in the SNAP caseload have run counter to the business cycle: rising during economic contractions and falling again during expansions.

Despite a halting and uneven recovery, the persistence in the SNAP caseload following the recession was unexpected. New recipients who entered the program during the Great Recession were believed to have stronger attachment to the labor market and less prior program exposure than typical pre-recession SNAP recipients.[1] Once the economy improved, it was thought that these newer recipients would find it easier to move back into the labor market and exit from SNAP. Why then have SNAP caseloads remained high despite the apparent improvement in labor market conditions? Or, put another way, how responsive are SNAP recipients to improving labor market conditions that would help them off the program?

These questions can be informed by assessing the responsiveness of SNAP enrollment to labor market conditions. However, in assessing the relationship between the labor market and the SNAP caseload, a national—or even statewide—labor market indicator may not capture the local employment opportunities available to SNAP recipients. National and State unemployment measures can miss important heterogeneity in the pace and strength of recovery across and within States. Measuring conditions in local labor markets could more accurately capture the relevant employment opportunities for SNAP recipients. Moreover, if the economic recovery was driven largely by industries in which SNAP recipients were unlikely to find work, then further disaggregating local labor market indicators by industrial sector may help determine whether SNAP recipients respond as historically expected to labor market conditions.

This study uses a unique match of SNAP administrative records from the State of Oregon with substate local economic indicators to analyze the relationship between local labor market conditions and program spell lengths. A sample of individuals entering new SNAP spells was drawn at two different points in the business cycle: once in 2005, well before the Great Recession, and again in 2009, at the height of the economic downturn in Oregon. These spells were followed until the end of 2014. Linked to the SNAP records were unemployment insurance (UI) wage and benefit data from the Oregon Employment Department and labor market indicators from the Quarterly Workforce Indicators (QWI).

Since there is no consensus definition of local labor markets, we examine three different definitions based, in turn, on county boundaries, commuting zones (CZs), and workforce investment areas

[1] By one estimate, more than two of every five SNAP recipients during the Great Recession were first-time recipients (Grieger, 2014)

(WIAs). Similarly, we evaluate several different labor market indicators, including total employment, new hires, and earnings, both for the labor market area (LMA) as a whole and disaggregated by sector.

We measure the effect of local labor market conditions on SNAP exit using discrete-time hazard models that control for differences in individual characteristics, such as gender, race (and ethnicity), and age, as well as SNAP case composition. We also control for differences in recipients' prior SNAP participation and employment history.[2] The hazard model allows us to analyze how these factors relate to the amount of time people spend on SNAP. Specifically, the hazard model estimates the probability that a current recipient will leave SNAP in a given period, conditional on their other characteristics included in the model. The benefit of analyzing durations of SNAP receipt using a hazard model (discussed in greater detail below) over conventional statistical methods, such as ordinary least squares, is that it is better able to accommodate spells of SNAP receipt for which we are not able to observe an end date in our sample. Excluding spells for which we cannot determine the end date, referred to as right-censored spells in the statistical literature, would skew the analysis sample toward shorter spells and therefore bias our results; likewise, including right-censored spells can also bias results if they are not accounted for with the appropriate statistical techniques. For example, if we simply assumed that all right-censored spells ended at the last observed period in the sample, we would also be underestimating the true length of SNAP spells.[3]

Our use of longitudinal microdata on individual recipients distinguishes our research from prior similar research that has relied on aggregate caseload data. The aggregate caseload at a given point in time reflects the inflow of new recipients along with recipients in the middle of ongoing spells, with no way to distinguish between the two. The aggregate caseload also reflects a mix of short and long spells, but in any given snapshot of the caseload, longer spells are overrepresented (referred to as length-biased sampling). The use of microdata in this study helps disentangle the effect of labor market conditions on spell lengths from the effect on program entry. For each cohort, we take a sample of new entrants during that year (a flow sample), so we avoid the length-bias and left-censoring inherent in a snapshot (stock sampling). (See, for example, Klerman and Haider (2004) for a discussion of these issues.)

Our results tell a fairly consistent story across LMA definitions and labor market indicators. In general, local labor market conditions are positively and significantly related to the likelihood of SNAP exit. The estimated effects are largest, and most precisely estimated, for CZs. Using data on new hires, instead of total employment, reveals a consistently significant and positive association across LMAs. Contrary to the picture of diverging employment rates and SNAP caseloads at the national or State level, the results from this study furnish evidence that the decisions of able-bodied SNAP recipients to leave the program are responsive to local (and, in some cases, sector-specific) labor market conditions.

---

[2] We omit in-spell wage and employment information due to endogeneity concerns. Similarly, we have access to linked administrative records of other State welfare programs, such as Temporary Assistance for Needy Families (TANF), UI, and other State programs, such as employment-related daycare, medical assistance, mental health care, and child welfare. In our preferred specification, we omit these measures because entry decisions into these programs were likely made at the same time as decisions to enter SNAP. We do, however, test the robustness of our results by including these variables and find that their inclusion leaves the results nearly unchanged. Receipt of medical assistance benefits has the largest (negative) estimated coefficient on the hazard of exit from SNAP.

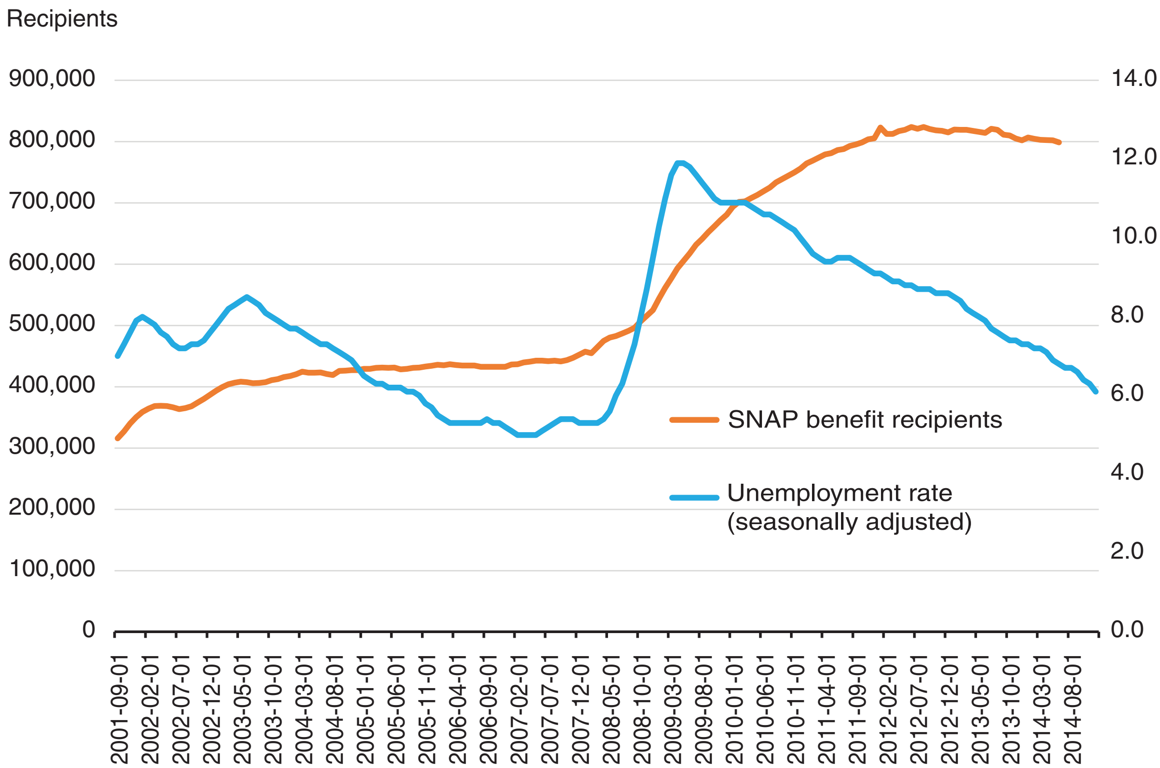
[3] Another benefit of modeling durations, such as time spent on SNAP, using a hazard function is that it allows the researcher to examine the effect of time-varying explanatory variables, such as the quarterly local economic indicators used in this study.

Oregon as Case Study

Reflecting the national trend, Oregon saw a steep rise in SNAP enrollment during and after the Great Recession (see fig. 1). The number of Oregon households receiving SNAP benefits increased from 225,000 at the outset of the recession to about 350,000 by recession's end and continued to climb after the recession officially ended, reaching 445,000 in 2012. Oregon was among the States hit hardest by the recession, so the jump in its SNAP caseload was not surprising. Unemployment in the State spiked from a pre-recession rate of about 5 percent to a high of 12 percent during the recession. Nearly every industry in the State experienced significant job losses. The manufacturing sector lost the largest total number of jobs during the recession, while the construction sector lost the largest share of jobs (Oregon Office of the Secretary of State, 2017). After the recession, the unemployment rate in Oregon declined gradually but steadily, falling by nearly half of its recession peak by the end of 2014.[4] The State SNAP caseload, however, held fairly steady at its peak recession level, beginning a sustained decline only in the latter half of 2014.[5]

Figure 1

Oregon unemployment rate and Supplemental Nutrition Assistance Program (SNAP) caseload, 2000-15



Source: Federal Reserve Economic Data.

[4] The statewide unemployment rate did not return to pre-recession levels until the fall of 2015.

[5] Poverty, which typically follows SNAP caseloads more closely than the unemployment rate, predictably also rose during the recession, from a rate of 13 percent in 2007 to a high of 17.3 in 2011, but adjusted slowly following the recession, falling to only 16.6 percent by 2015.

One of the shortcomings of relying on data from a single State is that the results may not generalize to other States. Oregon is among the less racially diverse States, and this lack of diversity is reflected in its SNAP caseload as well. The median income in Oregon is slightly below the national average and the poverty rate slightly above. Oregon also has one of the highest rates of food insecurity in the country, at about 16 percent.

However, Oregon does make an interesting case study for several reasons. First, Oregon displayed substantial variation over time and geography in the State's labor market conditions. As discussed above, Oregon was strongly affected by the recession, with Portland one of the hardest hit metropolitan areas, not just in the United States but in the world (Global Metro Monitor, 2010). In the years since the end of the recession, parts of Oregon, and the Portland area in particular, experienced a strong recovery, surging ahead of even pre-recession employment. Yet, there remain important regional differences in the pace and robustness of recovery in Oregon, with many rural areas lagging behind (Perkowski, 2017). A number of rural areas in the State, especially those in the eastern half of the State, have yet to recover all, or even most, of the jobs lost during the recession. This regional and temporal variation is important for identifying labor market effects with our model.

Oregon also boasts one of the highest SNAP participation rates in the Nation, as well as one of the most accessible safety nets. Starting in the early 2000s, Oregon increased its SNAP outreach efforts, established a "no-wrong-door" policy, shifted caseworkers from TANF to SNAP, and even implemented a "same or next day" interview policy for program applicants (Edwards et al., 2016). Because of these SNAP policy changes, Oregon makes an interesting test case for evaluating program-induced dependence and the labor market's effects on receipt of program benefits. Given its relatively accessible and generous safety net, Oregon is a State in which we should be most likely to find evidence of program dependence and a dampened effect of labor market conditions.

An analysis of a single State also precludes us from exploiting variation in SNAP policies across States. Over 2005-09, there were no consequential changes to Federal SNAP policy. Oregon maintained statewide waivers of the able-bodied adults without dependents (ABAWD) work requirements for the entire period of this study, which ended in 2015. In 2016, Multnomah and Washington counties transitioned off waivers.

Oregon did, however, undertake one policy change with potential relevance to how long individuals stay in the program. From 2005 to 2011, more SNAP households were certified for SNAP benefits for 12 months, rather than for 6 months, of receipt. At the end of the certification period, households need to apply for recertification if they wish to continue to receive benefits. Appendix table A9 shows the shares of SNAP households with different certification periods for two groups of recipients, at three points in time. In January 2005, just over half of nonelderly SNAP units without earnings and about two-thirds of nonelderly SNAP households with earnings were subject to certification periods of 7 to 12 months.[6] The percentage of households in both groups with 12-month certification periods increased to 87.7 percent by January 2009, and by January 2011, nearly everyone was subject to a 12-month certification period.

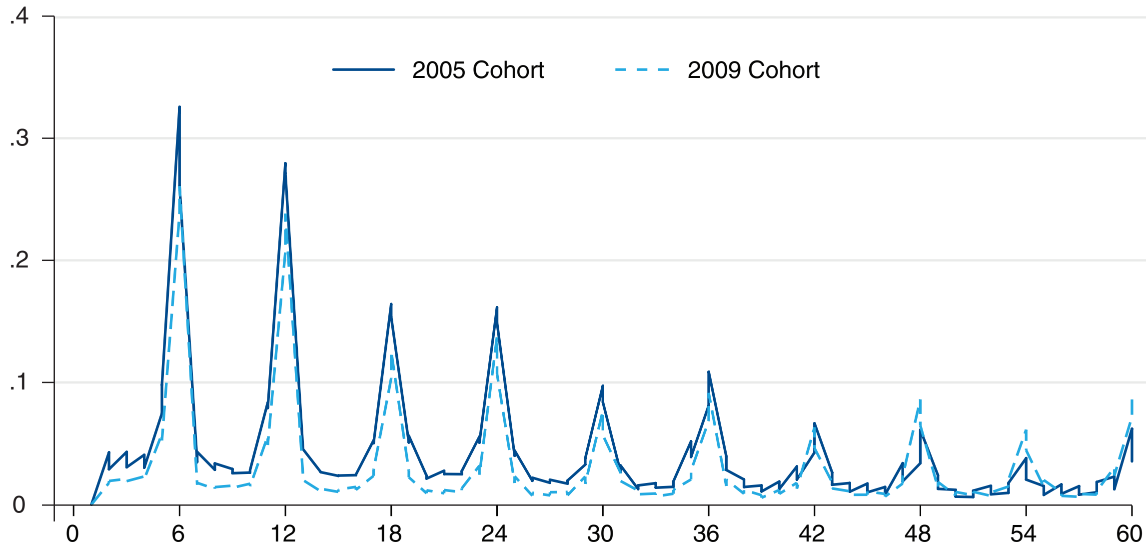
It is not a priori clear what effect the lengthening of certification periods had on spell lengths. Longer certification periods would seem to be associated with longer spells. But even with a longer certification period, SNAP households were still required to report changes in income that would alter their eligibility status (i.e., changes that put households over 130 percent of the Federal poverty

[6] Despite this official range of months, in practice, certification periods generally occur at 6 months or 12 months.

level). In fact, Oregon adopted the policy that SNAP households must report any change in earnings of $100 or more. Despite these reporting requirements, Ribar et al. (2008) note that recipients have weak incentives to report such changes and that, in the case of South Carolina, the likelihood of program exit was five to six times higher in recertification months than in other months. Indeed, we find a similar pattern of pronounced spikes when predicted exit hazards are plotted by spell month (fig. 2). Mills et al. (2014) show that the increased likelihood of exit at 6-month multiples is also due to program churn, which arises when recipients fail to recertify in a timely manner and consequently do not receive benefits for 1 or more months despite maintaining eligibility.

Figure 2

Predicted hazard by Supplemental Nutrition Assistance Program (SNAP)-entry cohort



Note: Dots indicate extreme values.
Source: Bureau of Labor Statistics, Local Area Unemployment Statistics.

However, empirically identifying the effect of lengthening certification poses a challenge, especially with data on only a single State. Although there was variation over time in this policy, it is based on a household characteristic (i.e., the presence of earnings) that is implicitly tied to the SNAP exit decision. Recertification policy also changed in the same direction and similar magnitude for both groups of affected recipients. And finally, there is no substate geographic variation in this policy that would allow for analysis of the differential effects.

Since the policy change occurred between the two SNAP entry cohorts examined in this study, the effect, if any, will likely be captured by the variable in the model that identifies the SNAP entry cohort to which a recipient belongs. We control in our model for the number of months that an individual spent on SNAP (i.e., using a monthly step function in time on the program). This means that our model will control for the greater likelihood of individuals to exit SNAP at 6- to 12-month intervals.

Measuring Local Labor Market Conditions

Local labor markets can be defined variously. One approach is to simply use State boundaries to delineate labor markets, but this is a rather broad definition of a labor market, which in larger States, almost certainly obscures important geographic heterogeneity. Alternatively, researchers have defined labor markets using Metropolitan Statistical Areas (MSAs), but this definition necessarily excludes nonmetropolitan areas (Bound and Holzer, 2000; Card, 2001; Notowidigdo, 2013). Another common approach is to take local labor markets to be coterminous with counties (Foote et al. 2015; Monte et al., 2015). This approach is straightforward to implement, since county-level employment and wage are data readily available (e.g., from the Quarterly Census of Employment and Wages (QCEW) as well as the Quarterly Workforce Indicators (QWI)). It also has the advantage of providing comprehensive geographic coverage.

A county-based definition of local labor market areas has two main drawbacks, however. One is that county borders may arbitrarily restrict labor markets to State borders. Another drawback is that, as primarily political and administrative units, county boundaries may not always align well with the notion of a labor market as "a set of relationships between employers and workers that are spatially bounded by places of work and residence" (Tolbert and Sizer, 1996). A definition of a local labor market area that attempts to better capture an area in which individuals both live and work is the commuting zone (CZ). CZs group counties based on commuting flow data and hierarchical cluster analysis. And CZs are not artificially restricted to State boundaries, but can include one or more States.[7] First developed by Tolbert and Sizer (1996), CZs have seen wider application in recent years (Autor et al., 2016; Chetty et al., 2014).

We, therefore, test the sensitivity of our estimates to different definitions of local labor markets, using both counties and CZs. As an additional check on the robustness of our results to the definition of LMA, we also employ a less commonly used definition of local labor markets known as Workforce Investment Areas (WIAs). The designation of these substate areas were originally mandated under the Workforce Development Act of 1998 and were meant to facilitate the administration of workforce development projects and the allocation of Federal, State, and local funds to those projects. The Act charged States (specifically, Governors) with taking into account specified factors, including consistency with LMAs, in designating WIAs. WIAs also have the drawback of being confined to a given State.[8] But for our purposes, they have the advantage of forming larger areas—larger even than CZs—while still being based on the concept of an integrated economic

[7] CZs are quite similar to another geographic unit of analysis intended to capture local economies: the labor market area (LMA). CZ definitions have been updated more recently and have recently seen much wider application than LMAs. Hence our decision to employ CZs.

[8] Restricting labor market areas to State boundaries, as when labor markets are counties, may distort estimates of labor market effects. This would be of particular concern in cases where a major metropolitan area spills over into two (or more) States, especially if the major employment hub lies outside of the State under consideration. In that case, the relevant employment conditions for residents of that labor market would not be captured. Oregon, however, does not share any major metropolitan areas and, hence, LMAs, with other States. The Portland metropolitan area spills over into Washington State, but in this case, restricting the LMA to Oregon captures the major hub of employment in the area, namely Portland. Oregon also shares some smaller, mostly rural, CZs with counties in Idaho and Northern California, none of which are centered on a major metropolitan area.

market area.[9] Given the small cell sizes for some rural counties, the higher level of geographic aggregation may improve the precision of our estimates.

[9] A potential drawback to using commuting zones is that, with the public-use employment data, more observations are lost when aggregating one or more counties into a single area. (The rule we follow is that if an individual received SNAP benefits in a CZ that contained any counties with suppressed observations, the entire spell is dropped.) Fortunately, this is not the case with WIAs, as the QWI are made available for WIAs without any suppressed data, presumably because the standards for suppressing data were applied after the data were aggregated to WIAs.

Other Measurement Issues

The responsiveness of SNAP to the economy depends on how the relevant caseload is defined. Many recipients in the caseload will not respond to economic conditions because they are unable or unlikely to work: these are the elderly and the disabled who, nationally, account for about one in five SNAP recipients. Children typically make up another 45 percent of the SNAP caseload, so only about one-third of the caseload would likely have been responsive to changes in economic conditions.[10]

In Oregon, SNAP benefits are distributed under two programs: the Self Sufficiency Program (SSP) and Aging and People with Disabilities (APD). Recipients receiving SNAP benefits under the latter program are, as the name suggests, elderly or disabled, and therefore not subject to the program's work requirements and not likely to be responsive to changing labor market conditions. In 2009, households receiving APD SNAP made up about one-quarter of the total SNAP caseload in Oregon. By mid-2012, the two APD and SSP subcaseloads began trending in opposite directions: the APD caseload continued to climb, while SSP began a gradual decline. The number of APD SNAP households increased from 80,000 in mid-2012 to roughly 125,000 at the end of 2015, while SSP SNAP peaked at about 335,000 in mid-2012 and fell to about 285,000 by the end of 2015. As a result of these countervailing movements in the two subcaseloads, the share of the total SNAP caseload in Oregon accounted for by APD SNAP households rose to approximately 30 percent by the end of 2015 (Office of Forecasting, Research And Analysis, 2016).[11]

The fact that the SNAP caseload is made up of two subgroups that differ in terms of their ability to respond to labor market conditions cannot, of course, fully account for the asymmetric adjustment of the caseload to different phases of the business cycle. The caseload, which rose as labor market conditions deteriorated, should also have come back down as they improved. In Oregon, however, it appears that the sluggish downward adjustment of the SNAP caseload was driven in part by the steady increase in the APD portion of the caseload following the recession. This increase changed the composition of the overall caseload in a way that made it less responsive to economic conditions and has, in part, masked the greater responsiveness of the SSP (i.e., nonelderly and able-bodied) portion of the caseload to improving economic conditions.[12] A significant advantage of using administrative records (i.e., microdata), relative to aggregate caseload data, is that we can identify under which of these two programs individuals received SNAP benefits.[13] In this report, we focus only on individuals in SSP SNAP households. The reasons behind the sustained increase in the APD caseload merits separate consideration.

[10] This doesn't take into consideration the difficulty that some adults with children, especially single parents, may have in finding stable employment.

[11] The administrative records in this study allow us to identify whether a participant received SSP or APD SNAP, and we focus only on those receiving SSP SNAP. This is one of the advantages of using microdata: studies relying on aggregate caseload data are generally not able to isolate nonelderly and able-bodied adult participants.

[12] Apart from the relative mix of households receiving SNAP under SSP or APD SNAP, caseload composition may have also changed in a way that could reduce the sensitivity of the overall caseload aggregates to labor market indicators if SSP household included more children following the recession.

[13] We could easily sort recipients by age, a variable also available in the administrative records, but determining which recipients qualified as disabled would not be possible without the information on whether individuals were receiving benefits under SSP or APD SNAP.

Another reason for the post-recession divergence between the unemployment rate and the SNAP caseload could be that the unemployment rate is a misleading indicator of labor market health when the labor force participation rate—defined as the share of people age 16 and over who are either employed or have recently looked for work—is falling. For instance, individuals who become discouraged in their job search and cease actively seeking work are not officially counted as unemployed and, therefore, are not captured in the calculation of the unemployment rate. This consideration is particularly relevant for Oregon, which in recent years has seen a dramatic decline in its labor force participation rate. From 2012 to 2013, for instance, Oregon experienced its largest year-to-year drop in labor force participation since records on this measure were kept (Oregon Employment Department, 2014).[14]

The unemployment rate may also be an inadequate indicator of local (i.e., substate) labor market conditions because it is known to suffer from modeling error at the level of smaller geographic areas, which could be significant for smaller counties in Oregon.[15] The employment-to-population ratio obviates many of the shortcomings of the unemployment rate. First, it is conditional not on the labor force but on the population (in our case, the working age population), so the denominator of the ratio will still capture discouraged job seekers; that is, unless they move to another LMA or out of State. Second, employment aggregates rely on administrative data, rather than survey data, and thus are considered to be subject to less measurement error, particularly for small areas, than the unemployment rate. Lastly, employment aggregates are readily available at a much more granular level than unemployment rates.

Finally, movements in the SNAP caseload may also become less tied to employment-based indicators, whether it be the unemployment rate or the employment-to-population ratio, if individuals increasingly use SNAP as a work supplement rather than as a work substitute. Employment and SNAP receipt were traditionally seen as largely mutually exclusive: a job was a sure path off the program. Now, SNAP may more closely resemble a work support program. SNAP recipients may move back to work (or they may have been working even prior to starting to receive SNAP benefits), but they may be able to find only part-time jobs or jobs that do not pay enough to lift them above the program's income-eligibility threshold. Indeed, in 2016, roughly 43 percent of Oregon's SNAP caseload was employed, which was well above the national average of 31 percent. And among those who were employed, 70 percent were working less than full time, and 40 percent were employed less than half time (Office of Forecasting, Research and Analysis, 2016). This may be partly because the industries that employ the majority of SNAP recipients offer few full-time jobs.[16] This increasing trend, evident in Oregon, of working while receiving SNAP benefits diminishes the likelihood of a strong link between labor market conditions and program exit.

[14] The Oregon Employment Department Workforce and Economic Research Division estimates that about half of the decline in Oregon's labor force is due to the aging of its population. Lower labor force participation rates among younger workers from the ages of 16 to 24 account for another quarter of the decline. Labor force participation is also down among prime-age workers (from ages 25 to 54) and is projected to continue to decline through 2022. Moreover, at the county level in Oregon, lower labor force participation rates are also highly correlated with high unemployment rates.

[15] Another shortcoming of the unemployment rate is that it is not broken out by industry at the county level.

[16] In our hazard analysis, we omit measures of in-spell employment since individuals' labor supply decisions tend to be made simultaneously with their SNAP participations decisions. Including such potentially endogenous variables could bias our results.

Data Sources and Study Sample

The data for this study were drawn from multiple Oregon administrative data sources and cover a 10-year period from January 2005 through December 2014. SNAP and other program participation records come from the Integrated Client Services (ICS) Data Warehouse provided by the Oregon Department of Human Services (DHS); unemployment insurance (UI) wage and benefit data come from the Oregon Employment Department.

Our sample includes working-age adults from Oregon households that entered SNAP in 2005 (January-December) and in 2009 (January-December). Households that received SNAP through the Aging and People with Disabilities Program (APD) and households headed by persons younger than 18 and older than 59 were omitted from the study. Random samples of 50,000 SNAP participants were selected from the study population from both the 2005 and 2009 entry cohorts. For each subject in the sample—including all other members of the SNAP case unit associated with the individual selected to be in the sample—we received SNAP participation start and end dates, demographic information (race, ethnicity, gender, date of birth, preferred language, head of household status), and census block.[17] In addition, information on program receipt was available on these families 5 years prior to the beginning of the study period, allowing us to calculate total months of prior SNAP participation.

The ICS data also contained information on service start and end dates for other DHS-related programs. These included Temporary Assistance for Needy Families (TANF), Employment Related Day Care (ERDC), mental health, alcohol and drug, child welfare, medical assistance, and low-income housing assistance. Further, the ICS data were linked with quarterly wage data and unemployment benefits information from the UI system, provided by the Oregon Employment Department, which contained data on quarterly hours worked and wages, employer identifier, industry code, and unemployment benefit amount and benefit receipt date.

The sample for the multivariate analysis is restricted to the first observed SNAP spell.[18] We sampled adults who had SNAP spells that began either in 2005 or 2009. Individuals included in the sample were designated either as household heads or other adults (18 years or older). Our analysis sample comprises over 91,000 SNAP spells, roughly evenly divided between the two entry cohorts. Individuals selected for the sample had full (Oregon) employment (second quarter (Q2) 2003 to first quarter (Q1) 2014) and SNAP histories (2001 to 2014) matched to their records. While our focus is on the first new spell started in either 2005 or 2009, we are able to determine prior attachment to SNAP and the workforce in Oregon for each sample member.[19] We follow first spells begun in 2005 or 2009 for up to 5 years. As a result of this long window of observation, we have few right-censored

[17] We refer here to the SNAP case members unit rather than to household members, since the SNAP administrative records record only individuals in the household who belong to the SNAP case unit. There may be individuals living in the household who do not belong to the SNAP case unit.

[18] In this study, we ignore higher-order spells to maintain analytical tractability (higher-order spells refer to all of an individual's spells on SNAP observed in the data beyond the first).

[19] The timespan of the available employment and SNAP data means that work and SNAP histories are more limited for the 2005 cohort. To construct commensurate pre-spell measures, we restrict individuals' work histories to 1 year, and SNAP history to 5 years, prior to entry. Individuals were considered to have prior SNAP exposure if they had any receipt (in Oregon) in the 5 years prior to starting SNAP receipt. Likewise, individuals in the sample were considered to have had prior labor market attachment if they were found to have worked at all in one of the previous four quarters prior to entering SNAP.

spells (i.e., spells whose end date is not observed in the data) in our analysis: about 4 percent of the over 91,000 spells are right-censored after 5 years.[20] We also observe a substantial proportion of individuals with multiple spells during this period.

[20] An additional 242 spells, or 0.3 percent, end in the death of the SNAP recipient.

Descriptive Statistics

How long do spells of SNAP receipt in Oregon last? And how did spell length differ by entry cohort? Table 1a shows that the greatest differences are in the tails of the spell length distribution: more than one in five spells starting in 2005 ended after 5 months or less, whereas only one in eight spells starting in 2009 ended that quickly. Conversely, nearly 1 in 5 spells that began in 2009 lasted 25 months or more, while only 1 in 10 new spells in 2005 lasted that long. Roughly half of spells ended between 6 and 12 months. Table 1b presents the quartiles (and mean) of completed (non-right-censored) spells. The mean spell length was 4.5 months, and the median spell length 5 months, longer in the 2009 cohort than in the 2005 cohort. At the 25th percentile, however, the spell lengths are the same in both cohorts.

Table 1a
Distribution of spell lengths (months)

	Spells		
Months	2005	2009	All
1-5	21.83	12.52	17.26
6-12	51.39	48.52	49.98
13-24	16.88	19.17	18.00
25+	9.90	19.79	14.75
Total	100.00	100.00	100.00
Spells	40,849	39,340	80,189

Notes: Only completed (non-right-censored) spells are considered.

Source: USDA, Economic Research Service researchers' tabulations using Oregon administrative records.

Table 1b
Distribution of spell lengths (in months)

	All spells		Complete spells	
	2005	2009	2005	2009
Mean	15.3	21.2	11.8	16.3
25th percentile	6	6	6	6
Median	9	12	7	12
75th percentile	18	30	13	23
Total spells	88,418		80,189	

Note: "All spells" includes right-censored spells; spell length is determined by the right-censored value.

Source: USDA, Economic Research Service researchers' tabulations using Oregon administrative records.

Demographic characteristics of our sample are shown, by cohort, in table 2. Roughly half of the sample was female, with an average recipient age of just over 32, and an average case unit size of about 2.3. The proportion of single-parent households decreased 5 percentage points from the 2005 to 2009 cohort, dropping from 19 percent of recipients to 14. The racial and ethnic composition of new SNAP recipients remained largely unchanged. Roughly four of every five SNAP recipients in Oregon were White, non-Hispanic; about 10 percent were Hispanic; and another 5 percent were Black, non-Hispanic.

Table 2
SNAP case unit composition at spell start

	Cohort		
	2005	2009	Difference
Female (%)	52	48	-4***
Age (years)	32.27	32.38	0.11
Average number of case members	2.37	2.31	-0.06***
Single-parent household (%)	19	14	-5***
Average number of adults:			
Between 18 and 49 years old	1.31	1.31	0.00
Between 50 and 59 years old	0.11	0.14	0.03***
Over 60 years old	0.00	0.01	0.00***
Total	1.42	1.45	0.04***
Average number of children:			
Under 1 year old	0.09	0.07	-0.01***
Between 1 and 5 years old	0.33	0.28	-0.05***
Between 6 and 18 years old	0.54	0.50	-0.04***
Total	0.95	0.85	-0.09***
Race and ethnicity (%):			
White, non-Hispanic	81	80	-1**
Hispanic	9	10	1***
Asian, non-Hispanic	2	2	0**
Black, non-Hispanic	5	4	-1***
Other, non-Hispanic	3	4	1***
Any SNAP case member receiving (%):			
Medical assistance	41	33	-9***
Child welfare	2	1	-1***
Mental health care	0	0	-0*
Employment-related day care	2	1	-1***
TANF	4	3	-1***
Unemployment insurance (%)	12	25	12***

—continued

Table 2
SNAP case unit composition at spell start—continued

	Cohort		
	2005	2009	Difference
Average monthly UI benefit ($)	76.74	235.59	158.85***
SNAP and work history			
Total months of SNAP (in 60 months)	23.48	18.17	-5.31***
Quarters worked (in last 4)	3.24	3.39	0.15***
Prior jobs in last year	4.04	4.02	-0.01
Average quarterly income ($)	3, 133.71	3, 821.43	687.73***
Observations	44, 313	44, 105	

Notes: SNAP = Supplemental Nutrition Assistance Program. TANF = Temporary Assistance for Needy Families. Due to rounding, differences do not necessarily *exactly* reflect the results of subtracting the 2005 cohort numbers from the 2009 cohort numbers. Significance level: *** $p < 0.001$.

Source: USDA, Economic Research Service researchers' tabulations using Oregon administrative records.

The age composition of SNAP units did not change substantially between the 2005 and 2009 entry cohorts. There was a small increase in the average number of total SNAP household members, driven, it appears, by an increase in the average number of older working-age household members (50-59 years old). Similarly, relatively small changes occurred in the average number of children per SNAP household between 2005 and 2009. The average number of older children per SNAP household (either between 1 and 5 years of age or between 6 and 18 years of age) decreased between 4 and 5 percentage points.

In terms of other program receipt by new SNAP recipients, the only substantial differences between the two cohorts were for medical assistance, which fell by 9 percentage points between 2005 and 2009, and UI, which increased by about 12 percentage points over the same period. In 2009, nearly one-quarter of new SNAP enrollees were receiving UI as of the quarter in which their SNAP spell started—roughly twice the proportion of new recipients receiving UI benefits in the 2005 cohort—and received an average of $159 more in UI benefits than their 2005 counterparts. These findings are consistent with a higher proportion of individuals coming on to the program in 2009 as a result of a job loss.

We also find that recipients in the 2009 cohort had nearly 5 fewer months of previous SNAP receipt (in the 5 years prior to the observation period). Interestingly, however, there was no difference between the two cohorts in the average number of jobs held in the past year. SNAP households in the 2009 cohort earned an average quarterly income that was nearly $700 more than that of recipients in the 2005 cohort. This result may again reflect the stronger labor force attachment of 2009 recipients, as well as the higher average wages paid in industries that employed SNAP recipients in 2009 (table 3). In general, then, new SNAP cases in 2009 appear more likely to have had a recent connection to the labor market and less likely to have been recently enrolled in SNAP. Demographically, however, the profile of new SNAP cases changed very little across cohorts.

Table 3
County economic conditions in Oregon, 2005 and 2009

	Cohort		
	2005	2009	Δ%
County unemployment rate	8.6	13	+47.39
County working-age population (20 to 64)	60,954	64,249	+5.41
County labor force	50,498	54,704	+8.33
Quarterly employment			
Food and accommodation	3,711	3,878	+4.51
Retail	5,144	5,077	-1.30
Manufacturing	5,968	5,488	-8.04
All industries	43,275	43,902	+1.45
Quarterly new hires by industry			
Food and accommodation	840	579	-31.13
Retail	723	386	-46.61
Manufacturing	511	193	-62.15
All industries	6,102	3,842	-37.04
Average monthly wage by industry			
Food and accommodation	951	1,076	+13.21
Retail	1,725	1,845	+7.00
Manufacturing	3,061	2,964	-3.17
All industries	2,298	2,555	+11.18
Average monthly new hire earnings by industry			
Food and accommodation	778	831	+6.84
Retail	1,130	1,172	+3.70
Manufacturing	2,073	2,161	+4.27
All industries	1,393	1,632	+17.14
Observations	36	36	

Source: USDA, Economic Research Service researchers' tabulations using Oregon administrative records.

County-level economic conditions in Oregon changed substantially between 2005 and 2009. Table 3 summarizes these changes. Across counties in Oregon, the average working-age population grew an average of 5.4 percent between the 2005 and 2009. Average county employment actually increased by 1.45 percent between 2005 and 2009, but was outstripped by the increase in the county labor force, which grew 8.3 percent. This difference in growth rates is reflected in the nearly 50-percent rise in the average county unemployment rate over this period. The average weekly wage also rose by nearly 13 percent. The effect of the Great Recession on the Oregon labor market is most evident in new hiring, which declined on average 37 percent at the county level.

Trends in employment also exhibited substantial variation across industries (see table 3). Employment in food and accommodation services actually grew nearly 5 percent between 2005 and 2009, exceeding growth in overall employment (1.4 percent). Employment in manufacturing, by contrast, declined by 8 percent over this period. Retail employment remained relatively stable, declining by 1 percent. Wages, however, increased in many industries. The food and retail sectors saw wage increases of 13 and 7 percent, respectively; manufacturing wages decreased by 3 percent. New hires data evinced considerably more dramatic changes over this period. Between 2005 and

2009, average quarterly new hires at the county level fell nearly 40 percent. And among the three industries considered here, manufacturing saw the most precipitous drop, with average quarterly new hires declining 62 percent between 2005 and 2009. New hires in retail fell 47 percent, and those in food and accommodation fell 31 percent. Relative to the aggregate employment data, the new hires data underscore the tightening of the job market during the Great Recession, particularly in the industries highlighted here.

For average monthly new hire earnings, the differences relative to overall earnings are smaller for food and retail and larger overall and for manufacturing. Whereas overall earnings in manufacturing declined, new hiring earnings in manufacturing saw an increase, and retail registered the smallest increase among the industries considered here. And as expected, new hire earnings are uniformly smaller than the earnings of all employees.

The results are qualitatively and quantitatively similar when economic conditions are measured at the CZ level (table 4). One difference is that the decline in total manufacturing employment is more muted in CZs. Earnings of new hires also rose substantially more at the CZ than at the county level (14.88 vs. 4.27 increase).

Table 4

Commuting zone (CZ) economic conditions in Oregon, 2005 and 2009

	Cohort		
	2005	2009	Δ%
CZ Working-age population (20 to 64)	129,078	136,057	+5.41
Quarterly employment			
Food and accommodation	8,963	9,301	+3.77
Retail	12,290	12,133	-1.27
Manufacturing	13,263	12,633	-4.75
All industries	104,289	105,821	+1.47
Quarterly new hires by industry			
Food and accommodation	2,081	1,373	-34.02
Retail	1,699	926	-45.47
Manufacturing	1,134	458	-59.64
All industries	14,911	9,597	-35.64
Average monthly wage by industry			
Food and accommodation	2,626	2,954	+12.49
Retail	4,783	5,146	+7.58
Manufacturing	8,259	8,075	-2.22
All industries	6,439	7,193	+11.70
Average monthly new hire earnings by industry			
Food and accommodation	2,203	2,326	+5.57
Retail	3,104	3,260	+5.05
Manufacturing	5,226	6,003	+14.88
All industries	3,945	4,611	+16.88
Observations	17	17	

Source: USDA, Economic Research Service researchers' tabulations using Oregon administrative records.

Figures 3 through 5 are intended to convey a general impression of differences in labor market conditions across counties and CZs in Oregon.[21] The time series of the unemployment rate in most Oregon counties broadly follows the pattern evident at the State level (fig. 1): a prominent spike in the unemployment rate around 2009 and a gradual decrease thereafter. Employment-to-population ratios (using working-age population) appear more stable, displaying less time variation within counties. The same is true for variation in this ratio by CZs.

Figure 3

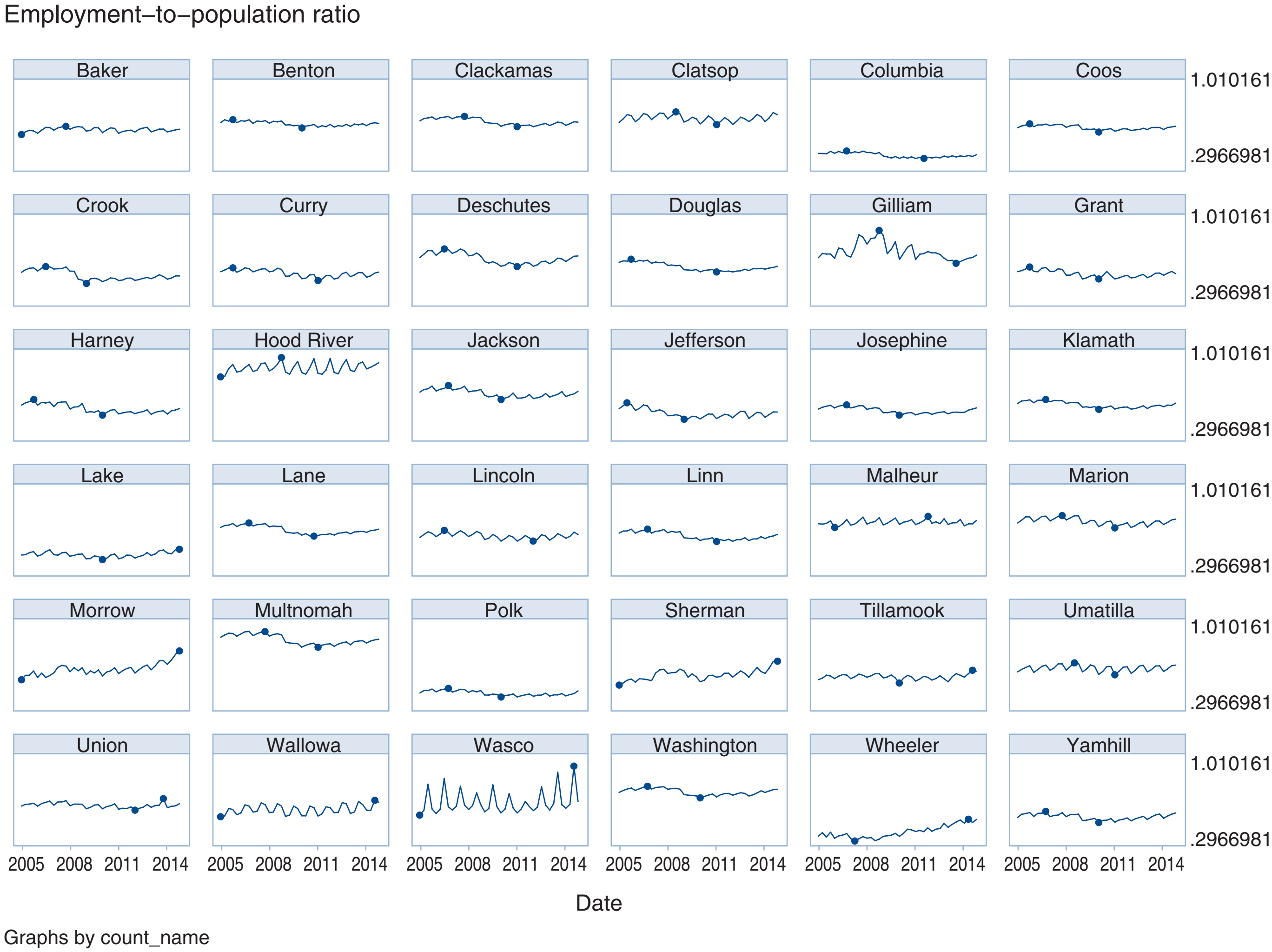
Unemployment rate by county, Oregon 2005-14

Note: Dots indicate extreme values.
Source: Bureau of Labor Statistics, Local Area Unemployment Statistics.

[21] The graphics used here are known as sparklines, a term introduced by Tufte (2006), who described them as "data-intense, design-simple, word-sized graphics."

Figure 4

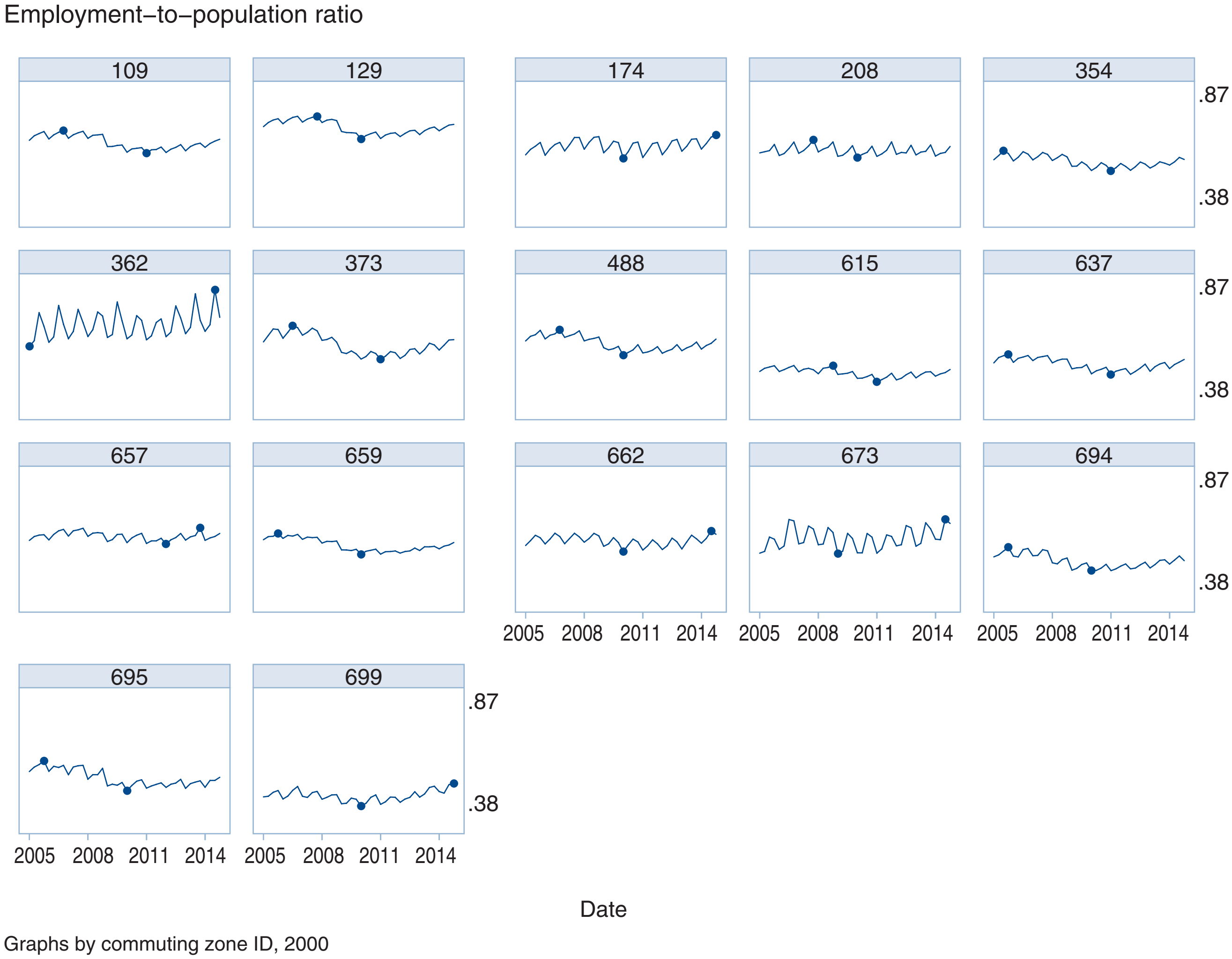
Employment-to-population ratios by county, Oregon 2005-14



Note: Dots indicate extreme values.
Source: Bureau of Labor Statistics, Local Area Unemployment Statistics.

Figure 5

Employment-to-population ratios by commuting zones, Oregon 2005-14



Note: Dots indicate extreme values.
Source: Bureau of Labor Statistics, Local Area Unemployment Statistics.

Empirical Approach

To investigate the relationship between local economic conditions and SNAP spell durations, we estimate discrete-time hazard models of SNAP exit. As discussed above, hazard models estimate the relationship between local economic conditions (as well as the other explanatory variables in the model) and the probability (i.e., the hazard) of exiting SNAP in a given month. Formally, the hazard is defined as the probability that an individual's SNAP spell will end in the current month, *t*, given that the spell lasted until month *t-1*. For individual, *i*, the hazard, or probability, of ending a SNAP spell in month *t* is given by

Equation (1) $\lambda_i(t) = \Pr(T_i \mid T_i \geq t, Z_{ict}) = F(\gamma_t + Z'_{ict}\gamma),$

where $F(\cdot)$ denotes the complementary log-log function. The hazard function, $\lambda_i(t)$, in equation 1 completely characterizes the distribution of the duration of spells, *T*.[22] The vector Z_{ict} contains the explanatory variables of the model, and γ_t denotes the vector of duration dependence parameters and represents the effect of spell length on the exit hazard. The subscripts *i*, *c*, and *t* index individuals, counties, and time, respectively. Specifically, we have

Equation (2) $Z'_{ict}\gamma = X'_{it}\beta + L'_{ct}\delta + \alpha_0 LMA + \alpha_1 Time + \alpha_2 LMA \cdot Trend$

The vector X_{it} contains characteristics of the individual and the SNAP household, some of which are time varying, and L_{ct} contains the time-varying, county-level labor market variables. The model also controls for LMA (county, CZ, or WIA) and time unit (year-month, year-quarter, or year) fixed effects. Our preferred specification also adds LMA-specific linear time trends. With LMA-specific time trends in the model, the labor market variables of interest are identified from differences in deviations from county employment trends in Oregon.[23] By absorbing time-invariant and (linearly) trending county-level variation, these specifications remove much of variation in the labor market variables that could be attributed to potentially confounding omitted variables.

Identification of the local labor market effects in the model also hinges on exogenous variation in these measures. One threat to exogeneity occurs if SNAP participants' mobility decisions are themselves driven by local economic conditions. For instance, as Hoynes (2000) notes, individuals who anticipate an extended spell on SNAP may choose to move to an area with a lower cost of living, but where economic activity is often also depressed. Alternatively, SNAP recipients may move to an area with a stronger labor market in an effort to seek better job prospects. Both of these scenarios would lead to an exaggerated estimated effect of local labor market conditions on SNAP spell lengths, and hence program exit hazards. As it happens, very little movement between counties was recorded in our data, so that concern about potentially endogenous, in-spell moves is largely obviated.

In this study, attention is restricted to single spells: we analyze exits from individuals' first SNAP spells that began in either 2005 or 2009, ignoring any other SNAP spells we may subsequently observe for an individual. We impose this restriction for analytic tractability, and leave multi-spell

[22] From the hazard function, one can recover the conditional density function, *f (t, Z)*, the cumulative distribution function, *F(t, Z)*, and the survivor function *S(t, Z) = 1-F(t, Z)*.

[23] Without county-specific time-trends, the effects of the labor market are identified from within-county differences in employment trends.

analysis for future work. For single-spell per person data, the log likelihood function takes the following form:

Equation (3) $log\ L = \sum_{i=1}^{N} \sum_{t=1}^{\bar{t}} [(1-y_{it}) log(1-\lambda_i(t)) + y_{it} log\lambda_i(t)]$,

where $\bar{t}$ is the longest observed duration, N is the number of individuals in the sample, and y_{it} is equal to 1 if individual i is observed to exit SNAP in period t and is equal to 0 otherwise.

We measure local economic conditions using three different measures: monthly unemployment rates from the Local Area Unemployment Statistics (LAUS) and quarterly total employment and quarterly new hire counts from the Quarterly Workforce Indicators (QWI). We are interested not only in the effect of overall local economic conditions but also local conditions in those industries that are the major employers of current and former SNAP recipients. Because employment among SNAP recipients tends to be concentrated in a few industries, these industry-specific measures may better represent the employment opportunities open to SNAP recipients than do overall labor market-level conditions.

With both employment and SNAP records in hand, we are able to determine the industries that employ the most (current, former, and future) SNAP recipients in Oregon more accurately than is possible with household survey data (see appendix table A10). The industries that we consider in this report are retail trade, accommodation and food services, and manufacturing. Tabulations show that these industries are four of the top six employers of SNAP recipients in our sample (as a proportion of total person-months).

In addition to measures of local economic conditions, our models control for individual and case-level characteristics. At the individual level, we control for the gender, age, race and ethnicity, and whether the individual was deemed the head of his or her SNAP case unit. Also included in our model are variables describing the composition of the SNAP case, including the number of case members, prime-working-age members (18-49), older working-age members (50-60), and elderly members (over 60, following the SNAP definition of elderly).

Similarly, we control for the number of children in the case unit, by age: the number of children under age 1, between 1 and 5 years of age, and between 6 and 17 years of age. From the UI wage records, we obtain information on wages earned, hours worked, and industry of employment for each case member. This information is used to create variables that measure pre-spell labor force attachment and prior program participation. For estimation on the full sample, we include a dummy variable equal to 1 if the individual belongs to the 2009 entry cohort to control for cohort-specific effects.

Our models control for time and labor market area (LMA) fixed effects. The time-fixed effects control for macroeconomic and other contextual effects that vary by year but similarly affect all counties in Oregon. We employ different time periods—months, quarters, and years—for the time-fixed effects to test the sensitivity of our results. Because our employment and earnings measures are recorded quarterly, with the value fixed as of the beginning of the quarter and constant for the remainder of the quarter, we include dummy variables for each month of the quarter to control for the varying proximity of our monthly labor market indicator to the month in which the SNAP receipt was recorded.[24]

The LMA fixed effects control for unobserved factors particular to each area, but which do not change over time. These will differ depending on the LMA definition employed in each specification. Thus, identification of our variables of interest comes from within-LMA variation in local (and industry-specific) economic conditions. Our preferred specifications include an LMA-specific linear time trend to control for unobservable factors that might have been smoothly trending over time. We also include indicator variables to control for the across-the-board increase in benefits levels under the American Reconstruction and Rehabilitation Act (ARRA) that took effect in April 2009 and to control for the expiration of the ARRA benefit increase in October 2013.

Last, we model duration dependence, or the effect of a household's time enrolled in SNAP, on the probability of program exit. There are a number of ways to model duration dependence, such as by assuming a particular functional form for the unit of time —in this case, months—on the program. The logarithmic or quadratic functional forms are frequently used. In this report, however, we model duration dependence flexibly, as a monthly step function, an approach that may obviate the need to explicitly account for unobserved individual heterogeneity, a common problem in duration models (Meyer, 1991; Wooldridge, 2010). Our large sample size permits us to implement this non-parametric approach.

[24] For example, in the first month of the quarter, the effect of employment on the exit hazard will be based on the contemporaneous value of employment; in the second month, the one-period lagged value; and in the third month, the two-period lagged value.

Empirical Results

We estimate the effect of local labor market conditions on the hazard of a SNAP recipient leaving the program, testing the sensitivity of our results to different definitions of labor market areas and labor market indicators. Labor markets are delineated in three different ways, using county boundaries, CZs, and WIAs, each representing a progressively larger geographic area. We also examine two different labor market indicators: aggregate employment and new hires, controlling in each case for the associated earnings measure and the working-age population in the given labor market area.

We look first at the relationship between the county-level unemployment rates and the SNAP exit hazard, despite the potential shortcomings of this indicator for substate geographies discussed above (table 5). In each cohort, the county-level unemployment rate is negatively related to the probability of SNAP exit.[25] In the full sample, a 1-percentage-point increase in the county unemployment rate, at the mean, is associated with a roughly 5-percent decrease in the SNAP exit hazard.[26]

Next, we examine the relationship between employment-to-population ratios and the SNAP exit hazard (table 6). To be precise, the numerator of this ratio is the quarterly count of total employment (measured as of the beginning of each quarter), and the denominator is the annual estimated working-age population (measured as of July 1 of each year). This ratio is constructed for each of the three labor market areas considered in this study. Our preferred specification includes area-level fixed effects to control for any unobserved time-invariant factors that may be correlated both with local labor market conditions and with local SNAP recipients' propensity to leave the program. We also include time-fixed effects to capture potential statewide time-varying unobservable confounding factors. We test the sensitivity of our results to the use of year-month, year-quarter, and year fixed effects. Last, our model also includes area-specific linear time trends, so that the effect of our chosen labor market indicator is identified from deviations from the within-area trends.[27]

[25] Using the complementary log-log link function, exponentiated coefficients are interpreted as hazard ratios, which, similar to the more familiar odds ratios that obtain in models using logit link functions, denote a negative effect when less than unity and a positive effect when greater than unity.

[26] Unfortunately, the typical goodness-of-fit measures are reported with this type of estimator (i.e., panel cloglog estimator). Using a logit estimator in place of cloglog (these produce qualitatively the same results) does permit one to run Pearson's and Hosmer-Lemeshow goodness-of-fit statistics following estimation. We have run these tests, and they produce very high chi-squared statistics, which indicate very good fit but generally should be met with some skepticism. We rely, therefore, primarily on the log-likelihood statistics, which are more informative about the relative fit of the models. Nevertheless, given the number of unrestricted parameters in our model (monthly step function for time in spell, area fixed effects, year-quarter fixed effects, month in quarter indicators, area-specific time trends, etc.), the fit of our models is undoubtedly very good. In fact, the more relevant concern may actually be overfitting.

[27] There is some disagreement about whether geography-specific time trends should be included in such a model (Klerman and Danielson, 2016). With the inclusion of area and time period fixed effects, our model already controls for a great deal of unrestricted variation, raising the question of whether—by including both time and area fixed effects, geography-specific time trends, and our flexible parameterization of duration dependence (a dummy variable for each month)—we also, in our effort to remove as much omitted variables bias as possible, throw out useful variation in the local labor market variables of interest (Pischke and Angrist, 2009).

Table 5
Hazard models of SNAP exit: county-level unemployment rate

Panel A: 2005 cohort	
Log working-age population	0.102
	(0.145)
Average weekly wage	0.984
	(0.044)
County unemployment rate	0.944***
	(0.010)
Log-likelihood	-88,319
Panel B: 2009 cohort	
Log working-age population	0.259
	(0.471)
Average weekly wage	1.055
	(0.033)
County unemployment rate	0.947***
	(0.009)
Log-likelihood	-90,800
Panel C: full sample	
Log Working-age population	0.436
	(0.358)
Average weekly wage	1.033
	(0.029)
County unemployment rate	0.949***
	(0.039)
Duration effects	X
Seasonal effects	X
Year effects	X
County fixed effects	X
County time trend	X
Probability of exit < 12 months	0.599
Marginal effect of -1.0 p.p. change	0.019
Log-likelihood	-179,562
Observations	1,087,630

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.10, ** p<0.05, and *** p<0.01. SNAP = Supplemental Nutrition Assistance Program. Under each column heading (County, CZ, and WIA) are two subcolumns. For each column heading, the lefthand subcolumn displays results from a model that includes industry-specific labor market variables, whereas the righthand subcolumn displays results from a model that includes total area labor market variables only and omits industry-specific variables.

Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Table 6

Hazard models of SNAP exit: quarterly employment by geographical area

	County		CZ		WIA	
Panel A: 2005 cohort						
Log working-age population	0.158	0.168	0.060	0.116	0.014*	0.012*
	(0.191)	(0.210)	(0.131)	(0.282)	(0.027)	(0.025)
Avg. monthly earnings (100s)	1.024*	1.026*	1.009*	1.011**	1.032**	1.030**
	(0.011)	(0.011)	(0.004)	(0.004)	(0.011)	(0.010)
Log employment						
Total area		1.659		4.325*		4.013*
		(0.557)		(2.766)		(2.537)
Food and accommodation	1.110		1.297		1.831	
	(0.221)		(0.305)		(0.575)	
Retail	1.371		1.261		0.742	
	(0.494)		(0.355)		(0.227)	
Manufacturing	1.111		2.392**		1.890*	
	(0.187)		(0.682)		(0.527)	
Log-likelihood	-89,152	-89,152	-89,183	-89,184	-89,202	-89,204
Panel B: 2009 cohort						
Log working-age population	0.074	0.071	0.006	0.020	0.013	0.056
	(0.128)	(0.117)	(0.017)	(0.046)	(0.039)	(0.158)
Avg. monthly earnings (100s)	1.011	1.012	1.002	1.004	1.027***	1.026***
	(0.010)	(0.010)	(0.003)	(0.002)	(0.007)	(0.007)
Log employment						
Total area		1.565		5.048**		1.332
		(0.701)		(2.794)		(0.721)
Food and accommodation	1.104		1.749		1.390	
	(0.294)		(0.624)		(0.400)	
Retail	1.298		1.314		1.324	
	(0.296)		(0.510)		(0.494)	
Manufacturing	1.092		1.726		1.213	
	(0.297)		(0.620)		(0.416)	
Log-likelihood	-91,513	-91,513	-91,547	-91,548	-91,567	-91,568
Panel C: full sample						
Log working-age population	0.220	0.238	0.075**	0.043***	0.034**	0.034**
	(0.190)	(0.209)	(0.066)	(0.041)	(0.042)	(0.042)
Avg. monthly earnings (100s)	1.017	1.017*	1.005*	1.006**	1.027***	1.026***
	(0.009)	(0.009)	(0.002)	(0.002)	(0.006)	(0.007)
Log employment						
Total area		1.548		4.642***		1.863
		(0.363)		(1.427)		(0.763)
Food and accommodation	1.070		1.461*		1.386*	
	(0.160)		(0.219)		(0.207)	
Retail	1.465*		1.475		1.271	
	(0.242)		(0.386)		(0.338)	

—continued

Table 6
Hazard models of SNAP exit: quarterly employment by geographical area—continued

	County		CZ		WIA	
Manufacturing	1.085		1.566***		1.214	
	(0.120)		(0.200)		(0.211)	
Duration effects	X	X	X	X	X	X
Year-quarter fixed effects	X	X	X	X	X	X
Area fixed effects	X	X	X	X	X	X
Area time trend	X	X	X	X	X	X
Prob. of exit ≤ 12 months		0.610		0.610		0.610
Marginal effect of +10%Δ		0.015		0.053		0.021
Log-likelihood	-181,082	-181,083	-181,125	-181,126	-181,154	-181,157
Observations	1,085,418	1,085,418	1,085,418	1,085,418	1,085,418	1,085,418

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01 and *** p<0.001. CZ = commuting zone. WIA = workforce investment area. SNAP = Supplemental Nutrition Assistance Program. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading). Under each column heading (County, CZ, and WIA) are two subcolumns. For each column heading, the lefthand subcolumn displays results from a model that includes industry-specific labor market variables, whereas the righthand subcolumn displays results from a model that includes total area labor market variables only and omits industry-specific variables.
Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Perhaps not surprisingly, the effect of employment is strongest using CZs, which are meant to capture better than counties the geographic area in which people work and live. The estimated coefficients on total area employment are significant at the 5-percent level for each cohort, but are highly significant in the full sample (at the 0.1 percent level), suggesting lower power to detect effects in the split sample, especially in the models that include higher frequency (year-month and year-quarter) time-fixed effects and time trends. In CZs, employment in the local manufacturing sector evinces a large positive, highly significant coefficient for the 2005 cohort, but an attenuated, insignificant coefficient for the 2009 cohort. (In the full sample, manufacturing remains attenuated, relative to the 2005 estimate, but highly significant.)

This asymmetry may stem from the fact that, over this period, employment in manufacturing declined more than any other industry in Oregon—in some areas of the State, quite precipitously—and was generally slower to rebound than other industries (and in many cases did not rebound). As a result, there may not have been sufficient post-recession variation in manufacturing employment to precisely identify an effect. In the full sample, we also find evidence that employment in the food and accommodation sector (in CZs and WIAs) and retail (in counties) was significantly related to the hazard of SNAP exit.

Although our primary interest is in the effect of employment, our models also control for two other local labor market variables: earnings and the working-age population. The coefficients on average monthly earnings are uniformly positive, as expected, and precisely estimated for CZs and WIAs. The magnitudes may appear small; however, a unit increase here corresponds to a $100 increase in monthly earnings.[28] The coefficient on working-age population is in each instance less than

[28] The log function is not applied to this variable, so the coefficient cannot, as with the other labor market variables, be interpreted as a percentage-change effect on the hazard ratio.

unity, which may at first appear to imply a negative relationship with the probability of exit. Recall, however, that as the denominator of the employment-to-population ratio, this term actually enters the model with a negative sign when the log function is applied to the employment-to-population ratio.[29] Hence, the relationship between population and the hazard is positive.

We have tested the robustness of our results to the inclusion of year-month, rather than year-quarter, fixed effects and the results are virtually unchanged (appendix table A1). Controlling only for year effects, rather than the higher frequency year-month or year-quarter effects, produces results that are qualitatively similar but that differ in magnitude and statistical significance (appendix table A2). Swapping out higher frequency month or quarter time effects for year effects produces estimated coefficients that tend to be much larger and more strongly significant. The size of the estimates is especially amplified at the county level.

In the specification using year effects (appendix table A2), there is much clearer evidence—across all labor market definitions—that total area employment and employment in the food and accommodations sector are strongly and positively related to SNAP exit. Employment in manufacturing also remains positively related to SNAP exit in CZs and WIAs. Oddly, however, employment in the retail sector changes sign but remains insignificant, except for CZs and WIAs in the 2005 cohort. This is a consequence of including the other sector-specific variables in the model; in specifications in which the sector-specific employment variables enter the model individually, each of these variables, including retail employment, is positive and significantly different from zero.[30]

Another robustness check involves omitting the area-specific time trends. It could be argued, for instance, that their inclusion reduces the time-varying, area-specific variation with which to identify the labor market effects. In appendix table A5, the results for total area unemployment are essentially unchanged (although curiously, in the full sample, the magnitude of the coefficient on total CZ employment is attenuated, yet more precisely measured). One other notable change when time trends are omitted is that manufacturing is no longer significant.

Aggregate employment, or more precisely the employment-to-population ratio, is a commonly used indicator of local labor market conditions in the literature (Hoynes, 2000; Lindo, 2013; Klerman and Danielson, 2016). However, Herbst and Stevens (2009) argue that new hires data more accurately reflect new job opportunities than aggregate employment data do. In particular, aggregate earnings data likely do not reflect, as well as new hires data, the wages available to individuals entering (or re-entering) the labor market, since the aggregate data include the earnings of many workers with long labor market attachments. One drawback to using new hires data is that the cell sizes tend to be much smaller; however, there is greater variability in this measure than in total employment.

Results based on new hires data are slightly different, but the overall pattern remains essentially the same (table 7). Total area new hires are positively associated with SNAP exits, but the coefficients are now more precisely measured in the 2009 cohort (and the full sample). In the 2005 cohort, the effect of new hires in the food and accommodation sector is positive and significant across LMAs, whereas in the 2009 cohort, this effect is smaller and insignificant. New hires in retail and manufacturing are positive and significant in the 2009 cohort but not in the 2005 cohort.

[29] Using the well-known property of logarithms, we have: $\ln(EMP/POP) = \ln(EMP) - \ln(POP)$.

[30] These results are available on request.

Table 7

Hazard models of SNAP exit: new hires by geographical area

	County		CZ		WIA	
Panel A: 2005 cohort						
Log working-age population	0.583	0.416	1.004	0.492	0.195	0.130
	(0.760)	(0.584)	(2.118)	(1.038)	(0.445)	(0.280)
Avg. monthly earnings (100s)	1.013	1.014	0.999	0.999	1.005	1.002
	(0.012)	(0.012)	(0.002)	(0.002)	(0.022)	(0.021)
Log new hires						
Total area		1.110		1.273		1.377*
		(0.120)		(0.203)		(0.198)
Food and accommodation	1.210*		1.259*		1.262*	
	(0.098)		(0.116)		(0.116)	
Retail	1.047		0.994		0.968	
	(0.078)		(0.052)		(0.044)	
Manufacturing	0.956		1.019		0.99	
	(0.046)		(0.064)		(0.050)	
Log-likelihood	-89,130	-89,135	-89,168	-89,170	-89,189	-89,188
Panel B: 2009 cohort						
Log working-age population	0.511	0.323	0.192	0.145	0.242	0.116
	(0.763)	(0.470)	(0.418)	(0.316)	(0.711)	(0.337)
Avg. monthly earnings (100s)	0.998	0.998	0.998*	0.999	1.004	1.002
	(0.007)	(0.007)	(0.001)	(0.001)	(0.007)	(0.007)
Log new hires						
Total area		1.208**		1.232**		1.183*
		(0.070)		(0.085)		(0.084)
Food and accommodation	1.035		1.069		1.072	
	(0.053)		(0.065)		(0.085)	
Retail	1.082*		0.992		0.977	
	(0.034)		(0.075)		(0.079)	
Manufacturing	1.045		1.062*		1.032	
	(0.035)		(0.029)		(0.029)	
Log-likelihood	-91,346	-91,345	-91,384	-91,383	-91,417	-91,416
Panel C: full sample						
Log working-age population	0.445	0.397	0.31	0.197	0.157	0.102*
	(0.339)	(0.316)	(0.287)	(0.183)	(0.168)	(0.114)
Avg. monthly earnings (100s)	1.002	1.002	0.999	0.999	1.004	1.001
	(0.005)	(0.005)	(0.001)	(0.001)	(0.008)	(0.008)
Log new hires						
Total area		1.190**		1.308***		1.270***
		(0.080)		(0.081)		(0.083)
Food and accommodation	1.120**		1.162***		1.154*	
	(0.046)		(0.052)		(0.069)	
Retail	1.077		1.01		0.981	
	(0.044)		(0.052)		(0.053)	

—continued

Table 7
Hazard models of SNAP exit: new hires by geographical area—continued

	County		CZ		WIA	
Manufacturing	1.005		1.063*		1.025	
	(0.022)		(0.027)		(0.025)	
Duration effects	X	X	X	X	X	X
Year-quarter fixed effects	X	X	X	X	X	X
Area fixed effects	X	X	X	X	X	X
Area time trend	X	X	X	X	X	X
Prob. of exit ≤ 12 months		0.610		0.610		0.610
Marginal effect of +10%Δ		0.0060		0.0092		0.0083
Log-likelihood	-180,897	-180,898	-180,946	-180,945	-180,991	-180,988
Observations	1,084,401	1,084,401	1,084,401	1,084,401	1,084,401	1,084,401

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01, and *** p<0.001. SNAP = Supplemental Nutrition Assistance Program. CZ = commuting zone. WIA = workforce investment area. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading). Under each column heading (County, CZ, and WIA) are two subcolumns. For each column heading, the lefthand subcolumn displays results from a model that includes industry-specific labor market variables, whereas the righthand subcolumn displays results from a model that includes total area labor market variables only and omits industry-specific variables.
Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

As with the results for aggregate employment, allowing the unrestricted, statewide time-fixed effects to change yearly, rather than monthly (appendix table A3) or quarterly (see table 7), once again leads to a number of different results (appendix table A4). Coarser time-fixed effects mean there is more residual (within-area) variation with which to identify local labor market effects and this leads to more precisely estimated coefficients on the variables of interest. The relationship between total area new hires is strongly and positively related to SNAP exit across all three labor market definitions in both cohorts and the full sample. New hires in food and accommodation are consistently strong and positive across LMAs in the 2005 cohort (and the full sample), while the same is true for new hires in retail in the 2009 cohort (and the full sample). This specification again yields a significant positive coefficient on new hires in manufacturing in CZs.

To get a better sense of the economic significance of the results discussed so far, we simulate the marginal effect of a 10-percent increase in our labor market variable of interest (total employment or new hires) on the probability that a new SNAP spell ends in 12 months or less. Formally, we use the results from the models estimated above to generate the predicted cumulative distribution function (also called the failure function) of months on SNAP, once at the actual values of the labor market indicator of interest and again assuming a 10-percent increase in that labor market indicator. Whereas the hazard function gives the probability of SNAP exit at a given spell length, the cumulative distribution function gives the probability of exit occurring *at or before* a given spell length. In a sense, the cumulative distribution function combines the individual exit hazards over time.[31] For example, the hazard function at a spell length, *t*, of 12 months gives the probability that a SNAP

[31] The cumulative distribution function is defined as $F(t) = 1 - exp[\sum_{t=2}^{12} ln[1-\lambda(t)]]$ where λ(t) is the contemporaneous hazard. The first month is omitted from this formula because we have removed all 1-month spells; hence, no hazard is defined for the first month of a spell. This formula makes clear that the cumulative distribution function—sometimes called the discrete-time failure function—is the obverse of the survival function.

spell that has lasted 11 months will end in the 12th month. On the other hand, the cumulative distribution function evaluated at a spell length of 12 months will give the probability of a spell ending at any time between the first and 12th month of a spell.[32] The difference in the cumulative distribution function, measured at 12 months, is the marginal effect reported in tables 5, 6, and 7. We do not estimate these statistics for the specifications that include sector-specific labor market indicators.

Here, for instance, we estimate the effect of a 10-percent increase in total labor market area employment and new hires on the full sample. Looking first at total employment in table 6, the 12-month probability of SNAP exit across the three labor market areas is 0.61. In other words, given the observed labor market conditions, the probability that a new recipient's SNAP spell will end in 12 months or less is, on average, about 61 percent. Or alternatively, in a given SNAP entry cohort, about 61 percent will have ended that SNAP spell after 12 months.[33] To calculate the marginal effect, we increase LMA employment by 10 percent for each observation in our sample and re-estimate the cumulative failure function; the difference, in percentage points, is the marginal effect reported in table 6.

As expected, larger estimated hazard ratios translate into larger marginal effects. Using counties as our labor market definition, a 10-percent increase in county-level employment produces a 1.5-percentage-point rise in the 12-month cumulative hazard; the same 10-percent increase in WIA-level employment generates a slightly larger 2.1-percentage-point increase in likelihood that a SNAP recipient ends his or her spell in 12 months or less. For CZs, a 10-percent increase in total employment raises the cumulative hazard 5.3 percentage points, from a baseline probability of 0.61, which translates into an increase of about 8.7 percent over the baseline hazard of exit in 12 months or less. The marginal effects for the specifications using year-month fixed effects and monthly area-specific time trends are nearly identical.

The models using new hire data (see table 7) produce 12-month failure functions that are nearly the same as the total employment model; however, in line with the lower estimated coefficients in these models, the marginal effects of a 10-percent increase in new hires are considerably smaller. Using counties, CZs, and WIAs, the same increase in new hires brings about 0.6-, 0.9-, and 0.8-percentage-point (or 1, 1.5, and 1.4 percent) increases, respectively, in the 12-month failure function. It is important to note that new hires data exhibit far more volatility than do total employment data, so that a 10-percent change is not as unusual in the former as in the latter. Recall, for example, that between 2005 and 2009 new hires fell 30 to 50 percent. For example, a 40-percent change in new hires implies a 6-percent increase in the probability of a SNAP spell ending in 12 months or less.[34]

Although our primary interest is in the labor market indicators, results from the other covariates in the model are also informative (table 8). These estimates are derived from the full sample, CZ model in table 6. Women had lower exit hazards than men; relative to Whites, non-Hispanic Blacks and Asians had a lower exit hazard, while Hispanics had a higher exit hazard. Not surprisingly, recipients in cases with other prime-age adults have a relatively high probability of ending a spell;

---

[32] Recall that we have dropped 1-month spells in this analysis, so technically we are measuring the probability of a spell ending at any time between the second and 12th month.

[33] It is possible, however, that they ended that spell and started another.

[34] In table 5, we simulated the effect of a 1-percentage-point *decrease* in the unemployment rate on the 12-month probability of SNAP exit—a more natural metric for the unemployment rate. The 1-percentage-point decrease in the unemployment rate was associated with a 1.9-percentage-point (or 3.2 percent) increase in the probability of SNAP spell ending in 12 months or less.

surprisingly, however, individuals in cases with at least one elderly adult also had a relatively high probability of program exit, and the magnitude of the coefficient is relatively large. As expected, recipients with prior SNAP exposure have a significantly lower exit hazard, while those with prior labor force attachment exhibit a significantly higher hazard.

Table 8
Hazard models of SNAP exit: quarterly employment by cohort

	Cohort		
	2005	2009	Full sample
Female	0.827***	0.932***	0.878***
	(0.010)	(0.011)	(0.006)
Age	0.970***	0.966***	0.969***
	(0.008)	(0.008)	(0.005)
Age-squared	1.000**	1.000***	1.000***
	(0.000)	(0.000)	(0.000)
Non-head adult	1.185***	1.267***	1.229***
	(0.022)	(0.017)	(0.014)
Black, non-Hispanic	0.930**	0.936	0.932*
	(0.021)	(0.048)	(0.026)
Asian, non-Hispanic	0.969	0.878**	0.920***
	(0.040)	(0.044)	(0.016)
Hispanic	1.061	1.088*	1.073**
	(0.035)	(0.036)	(0.025)
Other, non-Hispanic	1.001	1.138***	1.065*
	(0.036)	(0.035)	(0.028)
Case members	0.979*	0.991	0.985***
	(0.009)	(0.007)	(0.004)
Prime-age adults (18-49)	1.069**	1.034	1.052*
	(0.026)	(0.038)	(0.025)
Older working-age adult (50-60)	0.999	0.959	0.978
	(0.029)	(0.032)	(0.023)
Elderly adult	1.413***	1.363***	1.389***
	(0.114)	(0.070)	(0.056)
Children under 1 year	0.698***	0.662***	0.679***
	(0.021)	(0.019)	(0.013)
Children between 1 and 5 years	0.789***	0.760***	0.774***
	(0.021)	(0.013)	(0.013)
Children between 6 and 18 years	0.798***	0.817***	0.804***
	(0.015)	(0.018)	(0.007)
Primary language English	1.03	1.081	1.058
	(0.067)	(0.057)	(0.059)
Metro area	1.092*	1.044	1.069
	(0.043)	(0.053)	(0.043)

—continued

Table 8

Hazard models of SNAP exit: quarterly employment by cohort—continued

	Cohort		
	2005	2009	Full sample
Prior SNAP receipt	0.911***	0.825***	0.868***
	(0.016)	(0.013)	(0.012)
Prior LF attachment	1.254***	1.244***	1.253***
	(0.015)	(0.014)	(0.013)
Log-likelihood	-89,184	-91,548	-181,124
Observations	454,321	631,097	1,085,418

Notes: Omitted categories are male; White, non-Hispanic; and children between 6 and 17 years. Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01 and *** p<0.001. Estimates derived from model in table 6. SNAP = Supplemental Nutrition Assistance Program.

Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Conclusion

In this study, we examined the relationship between local labor market conditions and the duration of Supplemental Nutrition Assistance Program (SNAP) spells in Oregon, evaluating three different definitions of local labor market areas and three measures of labor market conditions. The relationship between labor market conditions and SNAP exit was found to be strongest when local labor markets were defined as commuting zones (CZs). This result is reasonable, given that CZs are created from counties in a way that attempts to better capture areas where people tend to work and live. Using the employment-to-population ratio to measure local labor market conditions in CZs, we estimate that a 10-percent increase in employment (holding population constant) raises the probability of exit within a year by about 8.7 percent.

Recently, as SNAP caseloads have remained high during the economic recovery, there has been much discussion about whether SNAP caseloads are responsive to labor market conditions, especially in States, like Oregon, with relatively accessible social safety nets. This study provides evidence that SNAP recipients in Oregon are responsive to local labor markets and that conditions in certain industries may matter more than in others. (Moreover, these SNAP-relevant industries may change over time.) We also find no evidence that the 2009-SNAP-entry cohort was any less responsive to labor market conditions than the 2005-SNAP-entry cohort.

Particularly when local labor markets are defined as CZs—our preferred labor market definition—recipients in the 2009-entry cohort, despite having longer spells on average than their 2005 counterparts, appear to have been slightly more responsive to overall local labor market conditions. The evidence suggests that they stayed in the program longer because local labor market conditions took longer to improve sufficiently. That recipients in the 2009-entry cohort may have been even more responsive than their 2005-entry counterparts could also be ascribed to compositional differences between the two cohorts; most notably, new recipients in 2009 were more likely to have had recent labor force attachment and less likely to have recently received SNAP benefits.[35]

The report has several implications. First, it illuminates the relationship between SNAP receipt and labor market conditions at the local and sector-specific level. This more granular analysis may better capture employment opportunities open to individual SNAP recipients. By identifying which local industries are most strongly tied to the likelihood of program exit for individual recipients, this report provides a guide for evaluating policy interventions as well as SNAP recipients' responsiveness to economic opportunities. Our results suggest that, in CZs, a 10-percent increase in employment could decrease by about 8.7 percent, on average, the probability of a given spell lasting longer than 12 months. Since we examine SNAP spell lengths, conditional on entry, our results do not account for the effect of economic changes on the program entry rate.[36] Finally, our findings (albeit for only one State) that able-bodied recipients' decisions to exit SNAP are responsive to local economic conditions may help to inform the discussion over program work requirements.

[35] Interestingly, however, some of the significant sector-specific results in the 2005 cohort sample become smaller and insignificant in the 2009 sample. Most notably, the significant effects of employment in the manufacturing sector and the effects of new hires in the food and accommodation sectors are not found for the 2009 cohort.

[36] The caseload at a given point in time is determined by the rate of entry on to the SNAP and the average duration of SNAP receipt.

The analysis in this report can be extended in a few directions. One is to extend the basic discrete-time model to allow for unobserved individual heterogeneity, which, if present, may bias estimates from our basic model.[37] Another extension is to take into account the fact that, even within the 5-year window of observation, many individuals experience multiple SNAP spells. It is important to understand who is at risk for multiple SNAP spells and how local economic conditions affect that risk. Although analysis of higher-order spells can be handled in a straightforward manner by estimating separate models for the first spell and for each higher-order spell, we prefer to pursue an approach that takes into account unobserved individual heterogeneity that persists across spells. Lastly, we intend to explore more fully the employment outcomes of individuals once they exit SNAP.

[37] However, as noted above, controlling for duration dependence non-parametrically (in this case with a monthly step function) is thought to mitigate the problem of unobserved individual heterogeneity in discrete-time hazard models.

References

Autor, D.H., D. Dorn, and G.H. Hanson. 2013. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States," *The American Economic Review* 103(6):2,121-2,168.

Bound, J., and H.J. Holzer. 2000. "Demand Shifts, Population Adjustments, and Labor Market Outcomes During the 1980s," *Journal of Labor Economics* 18(1):20-54.

Card, D. 2001. "Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration," *Journal of Labor Economics* 19(1):22-64.

Chetty, R., N. Hendren, P. Kline, and E. Saez. 2014. "Where Is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States," *The Quarterly Journal of Economics* 129(4):1,553-1,623.

Edwards, M., C. Heflin, P. Mueser, S. Porter, and B. Weber. 2016. "The Great Recession and SNAP Caseloads: A Tale of Two States," *Journal of Poverty* 20(3):261-77

Foote, A., M. Grosz, and A.H. Stevens. 2015. *Locate Your Nearest Exit: Mass Layoffs and Local Labor Market Response.* Available online.

Global Metro Monitor. 2010. *The Path to Economic Recovery*. Metropolitan Policy Program, The Brookings Institution. Available online.

Grieger, L.D. April 2014. *New Versus Return Participation in the Supplemental Nutrition Assistance Program During and Immediately Following the Great Recession*. Presented at the 2014 Annual Meeting of the Population Association of America, Boston, MA.

Hoynes, H.W. 2000. "Local Labor Markets and Welfare Spells: Do Demand Conditions Matter?" *The Review of Economics and Statistics* 82(3):351-68.

Klerman, J.A., and Danielson, C. 2016. "Can the Economy Explain the Explosion in the Supplemental Nutrition Assistance Program Caseload? An Assessment of the Local-level Approach. *American Journal of Agricultural Economics* 98(1):92-112.

Klerman, J.A., and S.J. Haider. 2004. "A Stock-Flow Analysis of the Welfare Caseload," *The Journal of Human Resources* 39(4):865-86.

Lindo, J.M. March 2015. "Aggregation and the Estimated Effects of Economic Conditions on Health," *Journal of Health Economics* 40:83-96.

Meyer, B.D. 1991. "Unemployment Insurance and Unemployment Spells," *Econometrica* 58(4):757-82.

Mills, G.B., T. Vericker, K. Lippold, L. Wheaton, and S. Elkin. September 2014. *Understanding the Rates, Causes, and Costs of Churning in the Supplemental Nutrition Assistance Program (SNAP) – Final Report*, prepared by Urban Institute for U.S. Department of Agriculture, Food and Nutrition Service.

Monte, F., S.J. Redding, and E. Rossi-Hansberg. November 2015. *Commuting, Migration and Local Employment Elasticities*, NBER Working Paper No. 21706. National Bureau of Economic Research. Available online.

Notowidigdo, M.J. 2013. *The Incidence of Local Labor Demand Shocks*, NBER Working Paper Series. National Bureau of Economic Research. Available online.

Office of Forecasting, Research and Analysis. 2016. *Spring 2016 DHS OHA Caseload Forecast*. Oregon Department of Human Services. Available online.

Oregon Employment Department. 2014. *Oregon's Falling Labor Force Participation: A Story of Baby Boomers, Youth, and the Great Recession*. Workforce and Economic Research Division. Available online.

Oregon Office of the Secretary of State. 2017. *The Oregon Blue Book.* Available online.

Perkowski, M. February 2017. "Oregon Has Recovered the Jobs Lost During the 'Great Recession,'" *Herald and News*. Accessed online June 23, 2017.

Pischke, J.S., and J.D. Angrist. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton, NJ: Princeton University Press.

Ribar, D.C., M. Edelhoch, and Q. Liu. 2008. "Watching the Clocks: The Role of Food Stamp Recertification and TANF Time Limits in Caseload Dynamics," *Journal of Human Resources* 43(1):208-38.

Tolbert, C., and M. Sizer. 1996. *U.S. Commuting Zones and Labor Market Areas: A 1990 Update*, AGES-9614, U.S. Department of Agriculture, Economic Research Service.

Tufte, E.R. 2006. *Beautiful Evidence*. Graphics Press.

Wooldridge, J.M. 2010. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

Appendix

Table A1

Hazard models of SNAP exit: quarterly employment by geographical area, year-month fixed effects

	County		CZ		WIA	
Panel A: 2005 cohort						
Log working-age population	0.121	0.136	0.056	0.109	0.009*	0.008*
	(0.145)	(0.169)	(0.122)	(0.264)	(0.017)	(0.016)
Average monthly earnings (100s)	1.024*	1.027*	1.009*	1.011**	1.032**	1.030**
	(0.011)	(0.011)	(0.004)	(0.004)	(0.011)	(0.010)
Log employment						
Total area		1.702		4.501*		4.249*
		(0.593)		(2.948)		(2.718)
Food and accommodation	1.107		1.299		1.817	
	(0.220)		(0.309)		(0.568)	
Retail	1.439		1.311		0.777	
	(0.527)		(0.369)		(0.236)	
Manufacturing	1.128		2.443**		1.950*	
	(0.190)		(0.699)		(0.540)	
Log-likelihood	-89,125	-89,125	-89,156	-89,157	-89,174	-89,176
Panel B: 2009 cohort						
Log working-age population	0.110	0.106	0.008	0.026	0.023	0.093
	(0.190)	(0.175)	(0.022)	(0.056)	(0.064)	(0.248)
Average monthly earnings (100s)	1.011	1.012	1.002	1.004	1.027***	1.026***
	(0.010)	(0.010)	(0.003)	(0.003)	(0.007)	(0.007)
Log employment						
Total area		1.557		5.058**		1.332
		(0.701)		(2.790)		(0.725)
Food and accommodation	1.106		1.738		1.38	
	(0.293)		(0.608)		(0.393)	
Retail	1.28		1.333		1.327	
	(0.294)		(0.507)		(0.485)	
Manufacturing	1.083		1.721		1.209	
	(0.288)		(0.623)		(0.418)	
Log-likelihood	-91,458	-91,458	-91,493	-91,493	-91,512	-91,514
Panel C: full sample						
Log working-age population	0.242	0.261	0.081**	0.047**	0.037**	0.036**
	(0.208)	(0.231)	(0.070)	(0.044)	(0.045)	(0.045)
Average monthly earnings (100s)	1.017	1.018*	1.006*	1.006**	1.027***	1.026***
	(0.009)	(0.009)	(0.002)	(0.002)	(0.007)	(0.007)
Log employment						
Total area		1.572		4.743***		1.922
		(0.370)		(1.469)		(0.790)

—continued

Table A1

Hazard models of SNAP exit: quarterly employment by geographical area,year-month fixed effects—continued

	County		CZ		WIA	
Food and accommodation	1.076		1.465*		1.385*	
	(0.162)		(0.221)		(0.207)	
Retail	1.474		1.493		1.291	
	(0.245)		(0.389)		(0.344)	
Manufacturing	1.087		1.584***		1.223	
	(0.119)		(0.202)		(0.210)	
Duration effects	X	X	X	X	X	X
Year-month fixed effects	X	X	X	X	X	X
Area fixed effects	X	X	X	X	X	X
Area time trend	X	X	X	X	X	X
Probability of exit ≤ 12 months		0.61		0.6		0.6
Marginal effect of +10%Δ		0.016		0.054		0.023
Log-likelihood	-180,997	-180,998	-181,039	-181,040	-181,069	-181,072
Observations	1,085,159	1,085,159	1,085,159	1,085,159	1,085,159	1,085,159

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01, and *** p<0.001. SNAP = Supplemental Nutrition Assistance Program. CZ = commuting zone. WIA = workforce investment area. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading). Under each column heading (County, CZ, and WIA) are two subcolumns. For each column heading, the lefthand subcolumn displays results from a model that includes industry-specific labor market variables, whereas the righthand subcolumn displays results from a model that includes total area labor market variables only and omits industry-specific variables.

Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Table A2

Hazard models of SNAP exit: quarterly employment by geographical area, year fixed effects

	County		CZ		WIA	
Panel A: 2005 cohort						
Log working-age population	0.290	0.204	0.201	0.234	0.253	0.201
	(0.467)	(0.344)	(0.500)	(0.586)	(0.597)	(0.487)
Average monthly earnings (100s)	0.997	0.993	1.00	0.996	1.001	0.980*
	(0.007)	(0.007)	(0.003)	(0.003)	(0.010)	(0.010)
Log employment						
Total area		1.838		2.897**		3.058***
		(0.649)		(0.943)		(0.938)
Food and accommodation	1.643**		1.874**		2.703***	
	(0.265)		(0.402)		(0.647)	
Retail	0.721		0.335***		0.236***	
	(0.285)		(0.082)		(0.081)	
Manufacturing	1.117		2.442***		1.620*	
	(0.190)		(0.609)		(0.321)	
Log-likelihood	-89,179	-89,182	-89,201	-89,211	-89,219	-89,229
Panel B: 2009 cohort						
Log working-age population	0.060	0.038	0.001*	0.002*	0.001*	0.000*
	(0.136)	(0.085)	(0.003)	(0.005)	(0.003)	(0.001)
Average monthly earnings (100s)	1.022**	1.016**	1.005***	1.003**	1.030***	1.018***
	(0.007)	(0.006)	(0.001)	(0.001)	(0.005)	(0.005)
Log employment						
Total area		5.243***		13.243***		8.443***
		(1.288)		(4.391)		(2.996)
Food and accommodation	1.788**		2.176**		2.239**	
	(0.364)		(0.545)		(0.571)	
Retail	1.102		0.863		0.770	
	(0.270)		(0.384)		(0.336)	
Manufacturing	1.559		2.445**		2.044*	
	(0.466)		(0.782)		(0.711)	
Log-likelihood	-91,387	-91,389	-91,413	-91,416	-91,447	-91,455
Panel C: full sample						
Log working-age population	0.275	0.222	0.078***	0.028***	0.060*	0.025**
	(0.250)	(0.221)	(0.057)	(0.024)	(0.082)	(0.032)
Average monthly earnings (100s)	1.010	1.006	1.003*	1.001	1.015**	1.003
	(0.006)	(0.005)	(0.001)	(0.001)	(0.005)	(0.004)
Log employment						
Total area		2.596***		5.260***		4.072***
		(0.579)		(1.166)		(0.903)
Food and accommodation	1.747***		2.237***		2.585***	
	(0.20)		(0.344)		(0.437)	
Retail	1.027		0.59		0.526	

—continued

Table A2

Hazard models of SNAP exit: quarterly employment by geographical area, year fixed effects—continued

	County		CZ		WIA	
	(0.203)		(0.181)		(0.182)	
Manufacturing	1.133		1.850***		1.395	
	(0.152)		(0.250)		(0.242)	
Duration effects	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Area fixed effects	X	X	X	X	X	X
Area time trend	X	X	X	X	X	X
Probability Of exit ≤ 12 months		0.590		0.590		0.590
Marginal effect of +10%Δ		0.032		0.057		0.049
Log-likelihood	-181,003	-181,009	-181,030	-181,044	-181,076	-181,094
Observations	1,084,401	1,084,401	1,084,401	1,084,401	1,084,401	1,084,401

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01, and *** p<0.001. SNAP = Supplemental Nutrition Assistance Program. CZ = commuting zone. WIA = workforce investment area. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading). Under each column heading (County, CZ, and WIA) are two subcolumns. For each column heading, the lefthand subcolumn displays results from a model that includes industry-specific labor market variables, whereas the righthand subcolumn displays results from a model that includes total area labor market variables only and omits industry-specific variables.

Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Table A3

Hazard models of SNAP exit: new hires by geographical area, year-month fixed effects

	County		CZ		WIA	
Panel A: 2005 cohort						
Log working-age population	0.486	0.348	1.037	0.51	0.143	0.094
	(0.615)	(0.476)	(2.157)	(1.066)	(0.311)	(0.195)
Average monthly earnings (100s)	1.013	1.014	0.999	0.999	1.006	1.002
	(0.012)	(0.012)	(0.002)	(0.002)	(0.022)	(0.021)
Log new hires						
Total area		1.114		1.281		1.385*
		(0.122)		(0.204)		(0.199)
Food and accommodation	1.212*		1.264*		1.262*	
	(0.097)		(0.116)		(0.117)	
Retail	1.049		0.996		0.970	
	(0.078)		(0.052)		(0.043)	
Manufacturing	0.956		1.02		0.992	
	(0.046)		(0.064)		(0.050)	
Log-likelihood	-89,103	-89,108	-89,141	-89,143	-89,161	-89,161
Panel B: 2009 cohort						
Log working-age population	0.753	0.469	0.253	0.184	0.432	0.202
	(1.089)	(0.653)	(0.493)	(0.361)	(1.204)	(0.551)

—continued

Table A3
Hazard models of SNAP exit: new hires by geographical area, year-month fixed effects—continued

	County		CZ		WIA	
Average monthly earnings (100s)	0.998	0.998	0.998*	0.999	1.004	1.003
	(0.007)	(0.006)	(0.001)	(0.001)	(0.007)	(0.007)
Log new hires						
Total area		1.212**		1.240**		1.184*
		(0.071)		(0.084)		(0.084)
Food and accommodation	1.039		1.072		1.075	
	(0.053)		(0.066)		(0.086)	
Retail	1.085		0.995		0.98	
	(0.034)		(0.074)		(0.078)	
Manufacturing	1.045		1.064		1.032	
	(0.034)		(0.029)		(0.029)	
Log-likelihood	-91,288	-91,287	-91,327	-91,325	-91,362	-91,361
Panel C: full sample						
Log working-age population	0.496	0.442	0.349	0.221	0.176	0.113*
	(0.380)	(0.354)	(0.332)	(0.209)	(0.186)	(0.125)
Average monthly earnings (100s)	1.002	1.002	0.999	0.999	1.005	1.002
	(0.005)	(0.005)	(0.001)	(0.001)	(0.008)	(0.008)
Log new hires						
Total area		1.193**		1.312***		1.274***
		(0.080)		(0.081)		(0.083)
Food and accommodation	1.122**		1.164***		1.156*	
	(0.046)		(0.052)		(0.069)	
Retail	1.078		1.012		0.983	
	(0.044)		(0.052)		(0.053)	
Manufacturing	1.006		1.064*		1.026	
	(0.022)		(0.027)		(0.025)	
Duration effects	X	X	X	X	X	X
Year-month fixed effects	X	X	X	X	X	X
Area fixed effects	X	X	X	X	X	X
Area time trend	X	X	X	X	X	X
Probability of exit ≤ 12 months		0.610		0.60		0.610
Marginal effect of +10%Δ		0.0061		0.0094		0.0083
Log-likelihood	-180,811	-180,812	-180,860	-180,859	-180,905	-180,902
Observations	1,084,142	1,084,142	1,084,142	1,084,142	1,084,142	1,084,142

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01, and *** p<0.001. SNAP = Supplemental Nutrition Assistance Program. CZ = commuting zone. WIA = workforce investment area. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading). Under each column heading (County, CZ, and WIA) are two subcolumns. For each column heading, the lefthand subcolumn displays results from a model that includes industry-specific labor market variables, whereas the righthand subcolumn displays results from a model that includes total area labor market variables only and omits industry-specific variables.
Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Table A4

Hazard models of SNAP exit: new hires by geographical area, using year fixed effects

	County		CZ		WIA	
Panel A: 2005 cohort						
Log working-age population	0.345	0.33	0.865	0.587	0.382	0.408
	(0.545)	(0.564)	(2.083)	(1.536)	(0.993)	(1.046)
Average monthly earnings (100s)	1.001	1.006	0.999	0.999	0.998	0.992
	(0.007)	(0.007)	(0.001)	(0.001)	(0.008)	(0.008)
Log new hires						
Total area		1.223**		1.322***		1.356***
		(0.078)		(0.078)		(0.087)
Food and accommodation	1.302***		1.307***		1.317***	
	(0.087)		(0.079)		(0.089)	
Retail	0.989		0.978		0.962	
	(0.048)		(0.035)		(0.028)	
Manufacturing	0.959		0.991		0.978	
	(0.042)		(0.045)		(0.042)	
Log-likelihood	-89,159	-89,167	-89,192	-89,197	-89,213	-89,215
Panel B: 2009 cohort						
Log working-age population	0.082	0.110	0.008	0.011	0.004	0.004
	(0.187)	(0.246)	(0.029)	(0.037)	(0.014)	(0.014)
Average monthly earnings (100s)	1.009*	1.014***	1.001*	1.002***	1.016**	1.019***
	(0.004)	(0.003)	(0.001)	(0.001)	(0.005)	(0.005)
Log new hires						
Total area		1.215***		1.245***		1.183***
		(0.041)		(0.043)		(0.042)
Food and accommodation	1.031		1.046		1.04	
	(0.034)		(0.037)		(0.033)	
Retail	1.141***		1.136***		1.096**	
	(0.035)		(0.033)		(0.034)	
Manufacturing	1.041		1.044*		1.024	
	(0.028)		(0.020)		(0.022)	
Log-Likelihood	-91,374	-91,375	-91,415	-91,414	-91,445	-91,443
Panel C: full sample						
Log Working-age population	0.371	0.402	0.146**	0.125**	0.074*	0.059*
	(0.302)	(0.361)	(0.104)	(0.098)	(0.092)	(0.073)
Average monthly Earnings (100s)	1.005*	1.008***	1	1.001	1.009*	1.009**
	(0.002)	(0.002)	(0.001)	(0.000)	(0.004)	(0.003)
Log new hires						
Total area		1.236***		1.295***		1.251***
		(0.046)		(0.033)		(0.031)
Food and accommodation	1.113***		1.109***		1.097**	
	(0.030)		(0.034)		(0.033)	

—continued

Table A4

Hazard models of SNAP exit: new hires by geographical area, year fixed effects—continued

	County		CZ		WIA	
Retail	1.101**		1.088**		1.055	
	(0.041)		(0.034)		(0.033)	
Manufacturing	1.016		1.057*		1.041	
	(0.021)		(0.023)		(0.027)	
Duration effects	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Area fixed effects	X	X	X	X	X	X
Area time trend	X	X	X	X	X	X
Probability of exit ≤ 12 months		0.590		0.590		0.590
Marginal effect of +10%Δ		0.0073		0.0089		0.0077
Log-likelihood	-180,971	-180,970	-181,022	-181,017	-181,064	-181,057
Observations	1,084,401	1,084,401	1,084,401	1,084,401	1,084,401	1,084,401

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01, and *** p<0.001. SNAP = Supplemental Nutrition Assistance Program. CZ = commuting zone. WIA = workforce investment area. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading). Under each column heading (County, CZ, and WIA) are two subcolumns. For each column heading, the lefthand subcolumn displays results from a model that includes industry-specific labor market variables, whereas the righthand subcolumn displays results from a model that includes total area labor market variables only and omits industry-specific variables.

Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Table A5

Hazard models of SNAP exit: quarterly employment by geographical area, omitting time trends

	County		CZ		WIA	
Panel A: 2005 cohort						
Log working-age population	0.221*	0.168*	0.049***	0.029***	0.037**	0.022***
	(0.157)	(0.121)	(0.039)	(0.024)	(0.039)	(0.025)
Average monthly earnings (100s)	1.029**	1.031**	1.007**	1.009***	1.033**	1.033**
	(0.010)	(0.011)	(0.002)	(0.002)	(0.010)	(0.011)
Log employment						
Total area		2.098		4.239**		4.706**
Total area		(0.802)		(2.290)		(2.601)
Food and accommodation	1.117		1.418		1.879*	
	(0.209)		(0.322)		(0.555)	
Retail	1.271		1.189		0.813	
	(0.332)		(0.359)		(0.336)	
Manufacturing	1.138		1.621		1.633*	
	(0.169)		(0.427)		(0.367)	
Log-likelihood	-89,173	-89,171	-89,192	-89,191	-89,206	-89,207
Panel B: 2009 cohort						
Log working-age population	0.861	1.007	0.322	0.237	0.22	0.462
	(0.609)	(0.829)	(0.443)	(0.302)	(0.173)	(0.486)
Average monthly earnings (100s)	1.010	1.010	1.002	1.002	1.026***	1.025***
	(0.009)	(0.009)	(0.002)	(0.002)	(0.007)	(0.007)
Log employment						
Total area		1.302		4.771**		1.009
		(0.615)		(2.360)		(0.586)
Food and accommodation	1.112		1.873*		1.204	
	(0.269)		(0.501)		(0.224)	
Retail	1.458		1.295		1.574	
	(0.312)		(0.448)		(0.494)	
Manufacturing	1.036		1.328		1.164	
	(0.218)		(0.337)		(0.379)	
Log-likelihood	-91,533	-91,535	-91,559	-91,560	-91,569	-91,571
Panel C: full sample						
Log working-age population	0.758	0.708	0.186*	0.274	0.180*	0.239*
	(0.306)	(0.293)	(0.134)	(0.183)	(0.122)	(0.172)
Average monthly earnings (100s)	1.016*	1.016*	1.006***	1.005***	1.029***	1.030***
	(0.008)	(0.008)	(0.001)	(0.001)	(0.007)	(0.007)
Log employment						
Total area		1.265		2.392**		1.637
		(0.317)		(0.704)		(0.672)
Food and accommodation	1.029		1.571**		1.306	
	(0.157)		(0.262)		(0.205)	

—continued

Table A5

Hazard models of SNAP exit: quarterly employment by geographical area, omitting time trends—continued

	County		CZ		WIA	
Retail	1.328		1.257		1.498	
	(0.249)		(0.336)		(0.387)	
Manufacturing	0.969		1.028		1.052	
	(0.047)		(0.041)		(0.096)	
Duration effects	X	X	X	X	X	X
Year-quarter fixed effects	X	X	X	X	X	X
Area fixed effects	X	X	X	X	X	X
Area time trend						
Log-likelihood	-181,116	-181,117	-181,143	-181,144	-181,164	-181,168
Observations	1,085,418	1,085,418	1,085,418	1,085,418	1,085,418	1,085,418

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01, and *** p<0.001. SNAP = Supplemental Nutrition Assistance Program. CZ = commuting zone. WIA = workforce investment area. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading). Under each column heading (County, CZ, and WIA) are two subcolumns. For each column heading, the lefthand subcolumn displays results from a model that includes industry-specific labor market variables, whereas the righthand subcolumn displays results from a model that includes total area labor market variables only and omits industry-specific variables.

Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Table A6

Hazard models of SNAP exit: new hires by geographical area, omitting time trends

	County		CZ		WIA	
Panel A: 2005 cohort*						
Log working-age population	0.369	0.396	0.222	0.272	0.181	0.200*
	(0.195)	(0.224)	(0.135)	(0.181)	(0.130)	(0.154)
Average monthly earnings (100s)	1.014	1.015	1	0.999	1.013	1.008
	(0.010)	(0.011)	(0.002)	(0.002)	(0.020)	(0.020)
Log new hires						
Total area		1.151		1.355		1.417*
		(0.132)		(0.211)		(0.193)
Food and accommodation	1.234*		1.301**		1.284**	
	(0.104)		(0.116)		(0.113)	
Retail	1.064		1.004		0.970	
	(0.082)		(0.049)		(0.046)	
Manufacturing	0.959		1.04		1.004	
	(0.041)		(0.061)		(0.048)	
Log-likelihood	-89,150	-89,156	-89,175	-89,178	-89,193	-89,192
Panel B: 2009 cohort						

—continued

Table A6

Hazard models of SNAP exit: new hires by geographical area, omitting time trends

	County		CZ		WIA	
Log working-age population	1.869	1.519	3.816	2.741	0.951	0.754
	(1.380)	(1.048)	(3.576)	(2.543)	(0.750)	(0.570)
Average monthly earnings (100s)	0.994	0.994	0.998	0.999	1.001	1.001
	(0.006)	(0.006)	(0.001)	(0.001)	(0.007)	(0.007)
Log new hires						
Total area		1.217***		1.262**		1.197*
		(0.071)		(0.089)		(0.085)
Food and accommodation	1.040		1.093		1.086	
	(0.049)		(0.067)		(0.084)	
Retail	1.097**		1.002		0.981	
	(0.035)		(0.072)		(0.079)	
Manufacturing	1.042		1.062		1.038	
	(0.035)		(0.034)		(0.036)	
Log-likelihood	-91,365	-91,364	-91,394	-91,393	-91,420	-91,419
Panel C: full sample						
Log working-age population	0.795	0.887	1.062	1.299	0.516	0.608
	(0.262)	(0.278)	(0.559)	(0.676)	(0.223)	(0.263)
Average monthly earnings (100s)	1.006	1.005	0.999	1	1.01	1.009
	(0.005)	(0.005)	(0.001)	(0.001)	(0.007)	(0.007)
Log new hires						
Total area		1.198**		1.351***		1.263**
		(0.082)		(0.088)		(0.095)
Food and accommodation	1.144**		1.186***		1.191**	
	(0.050)		(0.057)		(0.067)	
Retail	1.077		1.02		0.984	
	(0.043)		(0.054)		(0.053)	
Manufacturing	0.997		1.070*		1.032	
	(0.020)		(0.028)		(0.027)	
Duration effects	X	X	X	X	X	X
Year-quarter fixed effects	X	X	X	X	X	X
Area fixed effects	X	X	X	X	X	X
Area time trend						
Log-likelihood	-180,935	-180,937	-180,969	-180,968	-180,999	-180,999
Observations	1,084,401	1,084,401	1,084,401	1,084,401	1,084,401	1,084,401

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01, and *** p<0.001. SNAP = Supplemental Nutrition Assistance Program. CZ = commuting zone. WIA = workforce investment area. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading). Under each column heading (County, CZ, and WIA) are two subcolumns. For each column heading, the lefthand subcolumn displays results from a model that includes industry-specific labor market variables, whereas the righthand subcolumn displays results from a model that includes total area labor market variables only and omits industry-specific variables.

Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Table A7

Hazard models of SNAP exit: county-level quarterly employment, sequential estimation

	-1	-2	-3	-4
Panel A: 2005 cohort				
Log working-age population	0.197	0.304	0.356	0.224
	(0.329)	(0.502)	(0.606)	(0.361)
Average monthly earnings (100s)	0.993	0.995	0.992	0.993
	(0.007)	(0.007)	(0.007)	(0.007)
Log employment				
Total area	1.828			
	(0.644)			
Food and accommodation		1.557**		
		(0.215)		
Retail			1.172	
			(0.512)	
Manufacturing				1.221
				(0.178)
Log-likelihood	-89,201	-89,199	-89,204	-89,203
Panel B: 2009 cohort				
Log working-age population	0.014	0.038	0.067	0.023
	(0.035)	(0.102)	(0.167)	(0.053)
Average monthly earnings (100s)	1.016**	1.022**	1.019**	1.022**
	(0.006)	(0.007)	(0.007)	(0.007)
Log employment				
Total area	5.029***			
	(1.227)			
Food and accommodation		2.125***		
		(0.387)		
Retail			2.064**	
			(0.562)	
Manufacturing				1.978*
				(0.640)
Log-likelihood	-91,552	-91,553	-91,564	-91,557
Panel C: full sample				
Log working-age population	0.175	0.257	0.231	0.244
	(0.174)	(0.202)	(0.207)	(0.234)
Average monthly earnings (100s)	1.008	1.012*	1.009	1.011*
	(0.005)	(0.005)	(0.006)	(0.006)
Log employment				
Total area	3.032***			
	(0.706)			
Food and accommodation		2.010***		
		(0.209)		

—continued

Table A7

Hazard models of SNAP exit: county-level quarterly employment, sequential estimation—continued

	-1	-2	-3	-4
Retail			1.903*	
			(0.529)	
Manufacturing				1.387*
				(0.181)
Duration effects	X	X	X	X
Year fixed effects	X	X	X	X
Area fixed effects	X	X	X	X
Area time trend	X	X	X	X
Log-likelihood	-181,203	-181,196	-181,217	-181,216
Observations	1,085,418	1,085,418	1,085,418	1,085,418

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01, and *** p<0.001. SNAP = Supplemental Nutrition Assistance Program. CZ = commuting zone. WIA = workforce investment area. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading).

Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Table A8

Hazard models of SNAP exit: CZ-level quarterly employment, sequential estimation

	(1)	(2)	(3)	(4)
Panel A: 2005 cohort				
Log working-age population	0.219	0.759	0.989	0.063
	(0.540)	(1.901)	(2.477)	(0.155)
Average monthly earnings (100s)	0.996	0.998	0.997	0.997
	(0.003)	(0.002)	(0.003)	(0.003)
Log employment				
Total area	2.880**			
	(0.935)			
Food and accommodation		1.789***		
		(0.292)		
Retail			1.005	
			(0.415)	
Manufacturing				2.633***
				(0.458)
Log-likelihood	-89,230	-89,229	-89,236	-89,227
Panel B: 2009 cohort				
Log working-age population	0.001*	0.002	0.003	0.000**
	(0.002)	(0.008)	(0.011)	(0.000)
Average monthly earnings (100s)	1.003**	1.005***	1.004***	1.004***
	(0.001)	(0.001)	(0.001)	(0.001)

—continued

Table A8

Hazard models of SNAP exit: CZ-level quarterly employment, sequential estimation—continued

	(1)	(2)	(3)	(4)
Log employment				
Total area	12.994***			
	(4.296)			
Food and accommodation		2.852***		
		(0.529)		
Retail			2.572**	
			(0.892)	
Manufacturing				4.157***
				-1.071
Log-likelihood	-91,578	-91,581	-91,599	-91,583
Panel C: full sample				
Log working-age population	0.018***	0.087**	0.059***	0.044***
	(0.015)	(0.065)	(0.048)	(0.036)
Average monthly earnings (100s)	1.001	1.003***	1.002**	1.003*
	(0.001)	(0.001)	(0.001)	(0.001)
Log employment				
Total area	6.417***			
	(1.432)			
Food and accommodation		2.604***		
		(0.269)		
Retail			2.134*	
			(0.649)	
Manufacturing				2.343***
				(0.501)
Duration effects	X	X	X	X
Year fixed effects	X	X	X	X
Area fixed effects	X	X	X	X
Area time trend	X	X	X	X
Log-likelihood	-181,233	-181,229	-181,265	-181,244
Observations	1,085,418	1,085,418	1,085,418	1,085,418

Notes: Models include additional control variables described in the text. Coefficients are exponentiated. Significance levels: * p<0.05, ** p<0.01, and *** p<0.001. SNAP = Supplemental Nutrition Assistance Program. A blank cell indicates that a particular variable or fixed effect (row label) was not included a given specification (column heading). An X indicates that a particular fixed effect (row label) was included in a given specification (column heading).

Source: Administrative Records from Oregon, Quarterly Census of Employment and Wages, Quarterly Workforce Indicators, and Local Area Unemployment Statistics.

Table A9

Shares of SNAP units in Oregon with different recertification periods: 2005-11

	Jan-05	Jan-09	Jan-11
SNAP units with earners			
Percent with 1-3 month RP	1.2	0.0	0.0
Percent with 4-6 month RPs	33.0	12.3	0.4
Percent with 7-12 month RPs	65.7	87.7	99.6
Percent with 13+ month RPs	0.0	0.0	0.0
Nonearning, nonelderly SNAP units			
Percent with 1-3 month RPs	3.5	0.3	0.0
Percent with 4-6 month RPs	41.5	12	0.0
Percent with 7-12 month RPs	54.2	87.7	99.5
Percent with 13+ month RPs	0.7	0.0	0.5

Note: SNAP = Supplemental Nutrition Assistance Program. RP = recertification period.

Source: Authors' tabulations using USDA, Food and Nutrition Service SNAP Quality Control Data.

Table A10

Proportion of person-months sample members were employed in select industries, 2003-14

Industry	2005 cohort	2009 cohort
Retail trade	16.6	17.3
Accommodation and food services	15	16
Health care social assistance	13.5	12.4
Administrative and support and waste management and remediation services	12.5	11.6
Manufacturing	10.3	10.4
Construction	5.9	6.3
Person-months	1,964,752	2,071,298

Source: Authors' tabulations using Oregon administrative unemployment insurance (UI) wage records.

Notes: The data used for these calculations are UI wage records of sample members and other members in the Supplemental Nutrition Assistance Program case unit (but not necessarily in the final analysis sample), covering the period of the third quarter of 2003 to the fourth quarter of 2014. The table displays the six largest employers of current, former and past SNAP recipients in Oregon for the two SNAP entry cohorts considered in this report. The numbers represent the proportion of time (months) individuals worked in a given industry. Industries are defined by 2-digit NAICS codes.