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USDA's Value-Added Producer Grant Program and Its Effect on Business Survival and Growth

Anil Rupasingha, John Pender, and Seth Wiggins

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USDA's Value-Added Producer Grant Program and Its Effect on Business Survival and Growth

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Abstract

The USDA's Rural Development mission area (RD) implements several loan and grant programs to support businesses in rural areas, including the Value-Added Producer Grant (VAPG) program. This report examines the impacts of the VAPG program on business survival and growth. The VAPG program provides financial assistance for agricultural producers to enter into value-added activities related to processing and/ or marketing of value-added products. The study was conducted by combining data on the VAPG program obtained from RD with establishment-level data from the National Establishment Time-Series (NETS), and comparing business survival and employment growth outcomes of VAPG recipients to the outcomes of businesses having similar observable characteristics and employment growth histories that did not receive VAPGs. The results show that VAPGs enable recipient businesses to reduce the risk of failing and to provide more jobs than the comparison group.
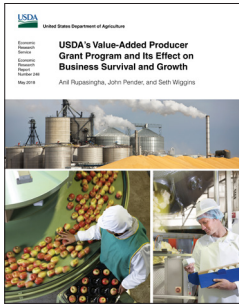
Keywords: Value-Added Producer Grant program, USDA-Rural Development, program impact assessment, access to capital, business survival and growth

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What Is the Issue?

USDA's Value-Added Producer Grant (VAPG) program provides grants to enable agricultural producers to enter into value-added activities related to the processing and/or marketing of value-added products. Generating new products, creating and expanding marketing opportunities, increasing producer income, and contributing to community economic development (save jobs and create new jobs, increase earnings) are the goals of this program. The program provided 2,345 grants with a total value of $318 million (about $136,000 per grant) to farmers and ranchers between 2001 and 2015. Even though the VAPG program has been active since 2001, little information is available on the outcomes of the program. This report assesses the impact of the VAPG program on the survival and growth of recipient businesses, the outcomes of which are related to the goals of saving and creating jobs. To this end, survival of VAPG recipient businesses and their employment growth since the receipt of a VAPG are compared to the survival and growth of a comparable group of businesses that never received a VAPG. Because business size (number of employees) was needed to identify the comparison groups, the analysis excluded startups with no employment history. On average, recipient and nonrecipient businesses had about 14 employees and had been in business about 7 years old at the time of receiving a VAPG.

What Did the Study Find?

Businesses that received VAPGs were less likely to fail. VAPG recipients were 89 percent less likely to fail 2 years after the grant than the group of similar nonrecipients. That is, the predicted likelihood of failure for VAPG recipient businesses 2 years after receiving a grant was about 0.23 business out of 1,000 VAPG recipient businesses, versus the likelihood that 2.04 of 1,000 nonrecipient businesses of the same age and other characteristics would fail. The effect of VAPG on survival dropped with time: VAPG recipients were 71 percent less likely to fail than similar nonrecipients 4 years after receiving a VAPG and 57 percent less likely to fail than nonrecipients after 6 years. For the 6-year time period, this implies that 18.5 out of 1,000 VAPG recipient businesses were likely to fail, compared with about 42.3 likely failed businesses per 1,000 nonrecipients.

Greater VAPG funding decreased the risk of failing for recipient businesses. In examining the *size* of a grant rather than simply whether an establishment received a grant or not, the risk of failing decreased significantly with increasing grant size. For example, increasing the

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average size of a VAPG from the current $136,000 to $236,000 is associated with a 47-percent decrease in the likelihood of failure for a recipient business 2 years after the grant.

VAPG recipient businesses provide more jobs than the comparison group. There is no significant difference in average employment levels between grant recipients and nonrecipients before the grants are received (see chart, up to year 0). However, grant recipients employed five to six more workers, on average, than nonrecipients 1 to 5 years after the grant was received. This job increase represents an increase of about 40 percent in average employment for recipient businesses.

Summary figure
Difference in average employment growth between VAPG and non-VAPG recipients
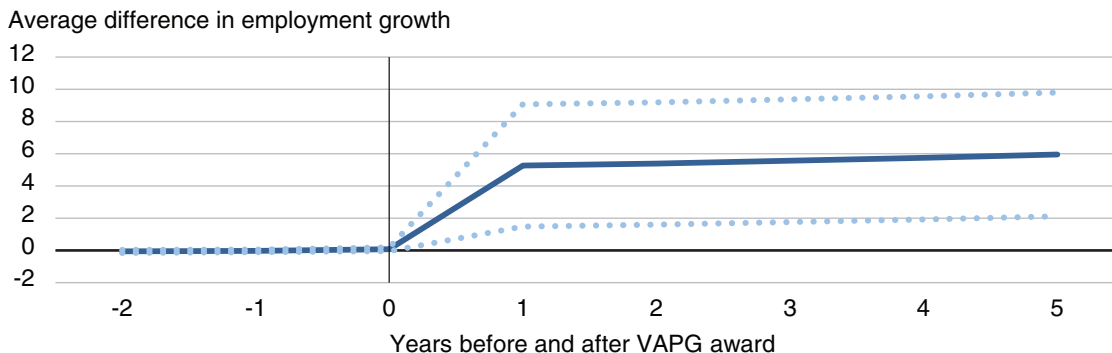
Average difference in employment growth

Years before and after VAPG award

Notes: This chart is based on multiple regression analysis that—in addition to VAPGs—accounts for differences in establishment characteristics that could also affect employment growth in businesses that did and did not receive grants. The dotted lines are the bounds of the 95-percent confidence interval, based on standard errors. "0" in the chart is the grant year, "-2" is 2 years before grant, and "5" is the fifth year after grant. VAPG = Value-Added Producer Grant.
Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service and National Establishment Time-Series.

Greater VAPG funding creates more jobs. A separate analysis that examined the impact of the size of a grant, rather than simply whether an establishment received a grant or not, showed that larger grants had greater employment impacts: An increase of the average size of a grant by $100,000 increases employment, on average, by about four jobs for recipients over the 2- to 4-year periods considered after the grants. Given that a $100,000 increase in VAPG funding increases employment by about four jobs and assuming that the cost of the program includes only VAPGs (and not administrative costs), the cost of the VAPG program to taxpayers is around $25,000 per job created. Although not grant programs, the cost of Federal guaranteed loan programs per job may provide some interesting comparisons. Based on a recent study of the impact of Small Business Administration (SBA) loans on employment growth, rough calculations of the cost of SBA loans to taxpayers per created job ranged from $21,580 to $25,450—similar to what is estimated as the cost per job for VAPGs.

How Was the Study Conducted?

To estimate the impacts of the VAPG program on rural business survival and growth, administrative data on the VAPG program from USDA's Rural Business-Cooperative Service (RBS) were combined with establishment-level data from the National Establishment Time-Series (NETS). The report compares business survival and employment growth outcomes of VAPG recipients to the outcomes of businesses having similar observable characteristics and employment growth histories that did not receive VAPGs.

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Introduction

The Value-Added Producer Grant (VAPG) program is one of the rural development business programs operated by the Rural Business-Cooperative Service (RBS), with annual funding of approximately $15 million in fiscal year (FY) 2015, $11 million in FY 2016 (USDA, 2016), and additional mandatory funding of $63 million provided by the Agricultural Act of 2014 through FY 2018 (P.L. 113-79).[1] The VAPG program provides grants to agricultural producers to enter into value-added activities related to processing and/or marketing of value-added agricultural products (see box, "What Are Value-Added Agricultural products?"). Value-added activities are a means of expanding the consumer base and increasing producers' share of the revenues from sales of food and agricultural products. Promotion of value-added agriculture has been seen by some researchers and policymakers as a strategy to promote increased rural employment and income (Barkema and Drabenstott, 1996; Coltrain et al., 2000; Kilkenny and Schluter, 2001).[2] Evidence of such positive rural development impacts is lacking, however (Rupasingha, 2009). Even though the VAPG program has been active since 2001, little information is available on the outcomes of the program.

The objective of this study is to assess the impact of the VAPG on the survival and growth of recipient businesses. To this end, survival of VAPG recipient businesses and their employment growth since the receipt of a VAPG are compared to the survival and growth of a comparable group of businesses that never received a VAPG. Data on the program provided by the Rural Business-Cooperative Service (RBS) are linked to establishment-level data from the National Establishment Time-Series (NETS). This research is inspired to some extent by Brown et al. (2015), who studied the impact of a Small Business Administration (SBA) loan program on employment growth by linking program administrative data with census data. Both that study and this are examples of how research to support evidence-based policymaking can be achieved by linking program administrative data to other existing data sources.

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[1]Rural Business Development Grants (FY 2015 program level $24 million), another discretionary program, had a greater program level than the VAPG program. Rural Energy for America Grants (FY 2015 program level $37 million) is a mandatory program authorized by the Agricultural Act of 2014, also with a greater program funding than VAPG. See table 1 for a list of RBS programs and their funding levels.

[2]For example, Kilkenny and Schluter (2001) pointed out that every State had at least one value-added agricultural program, with over $280 million budgeted for these State programs, during 1998-99.

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USDA Rural Development Programs for Business Development[3]

The primary goal of USDA's Rural Development (RD) mission area is to help rural communities create prosperity. To achieve this goal, RD offers grants, direct loans, loan guarantees, and technical assistance for development of rural business and industry in general and for development of renewable energy (provided by USDA's Rural Business-Cooperative Service); rural housing and community facilities (USDA's Rural Housing Service); and rural water, waste disposal, electric, and telecommunications infrastructure (USDA's Rural Utilities Service). Most of the RD programs for rural businesses are administered by RBS. RBS programs are designed to provide capital, technical support, educational opportunities, and entrepreneurial skills to rural residents to start and grow businesses or access jobs in agricultural markets and in the bio-based economy (see table 1). Access to capital programs is mainly implemented in partnership with private-sector lenders and community-based organizations; the capital may be in the form of loan guarantees, direct loans, or grants to individuals, rural businesses, cooperatives, farmers/ranchers, public bodies, nonprofit corporations, Native American Tribes, and private companies.

Table 1

USDA Rural Business-Cooperative Service programs and funding levels, FY 2011-FY 2016 ($ million)

Program	2011	2012	2013	2014	2015	2016
Appropriate Technology Transfer to Rural Areas			2	2	2	2
Biorefinery Assistance Guaranteed Loans					71	
Bioenergy for Advanced Biofuels					14	
Business and Industry Guaranteed Loans	1046	811	776	958	920	920
Delta Regional Authority Grants	3	3	3	3	3	3
Intermediary Relending Program	22	18	19	19	19	19
Rural Business Development Grants	41	26	26	25	24	24
Rural Cooperative Development Grants*	7.40	5.80	6.50	5.80	5.80	5.80
Rural Economic Development Direct Loans and Grants	43	43	43	43	43	45
Rural Energy for America Guaranteed Loans and Grants	62	8	9	13	88	88
Rural Microentrepreneur Assistance Loans and Grants	15	0	0	0	8	8
Small, Socially Disadvantaged Producers Grants*	3	3	3	3	3	3
Value-Added Producer Grants*	18.87	12.50	10.00	15.00	15.001	10.754

Source: USDA (2012, 2013, 2014, 2015, 2016, 2017). Funding estimates are based on amounts provided by the Continuing Appropriations Resolution. * These numbers were revised based on feedback received from USDA's Rural Business-Cooperative Service.

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[3]This box is based on the information available at the USDA-Rural Development website and the USDA Budget Summary for fiscal years 2012, 2013, 2014, 2015, 2016, and 2017.

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What Are Value-Added Agricultural Products?

The VAPG program defines a value-added agricultural product as an agricultural commodity that meets at least one of the following five criteria: (i) has undergone a change in physical state (e.g., processing berries into jam, meat into sausage, wheat into flour, or corn into ethanol); (ii) was produced in a manner that enhances its value (e.g., organic production); (iii) is physically segregated in a manner that enhances its value (e.g., an identity preservation system for a particular variety of grain or traceability of hormone-free livestock); (iv) is a source of farm- or ranch-based renewable energy (e.g., converting methane from animal waste to generate energy); or (v) is aggregated and marketed as a locally produced food product. The program also requires that these activities expand the customer base for the commodity and increase producers' share of the revenue from the commodity.

Background

Access to readily available capital is a key to rural small businesses' success. While there is a general lack of empirical data on rural businesses' access to credit, a few existing data sources such as small business loans reported under the Community Reinvestment Act (CRA)[4] indicate that the supply of credit is lower in rural areas than in urban areas. For example, Figure 1 shows that per capita values of small business loans between 2000 and 2015 were smaller in rural than urban counties.[5] In 2000, the per capita loan amount for urban counties was $1,006, compared to $760 for rural counties. Loan amounts generally increased for urban counties until 2007, with a downward tick in 2005—before declining in 2009 to the lowest reported levels during that period. Loan amounts for rural counties followed a similar pattern, but per capita loan amounts lagged the urban amounts and continued to stagnate after the Great Recession.

Some studies suggest that farm and rural small business owners may have had a credit advantage over urban small business owners. For example, one study—using data from the USDA 2005 Agricultural Resource Management Survey (ARMS) on farm households and the Federal Reserve Bank System 2003 Survey of Small Business Finances on rural/urban households and small businesses—found that rural farm and rural small business owners were able to access credit more freely than their urban counterparts (Briggeman and Akers, 2010).

Figure 1
Amount of small business loans (per capita) at origination, 2000-15

Loan amounts per capita (2015 dollars)
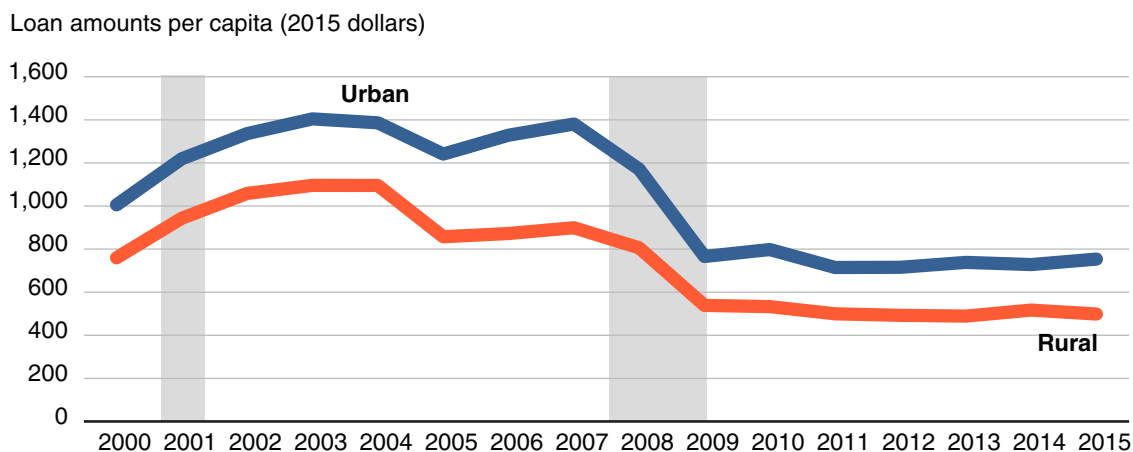
Note: Shaded areas indicate periods of recession. Data are expressed in constant (inflation-adjusted) 2015 dollars.
Source: USDA, Economic Research Service calculations using Community Reinvestment Act (CRA) data from the Federal Financial Insitutions Examination Council.

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[4]The Community Reinvestment Act (CRA) of 1977 encourages commercial banks and savings institutions to help meet the credit needs of the communities they are chartered to serve. The banks covered by the CRA data-reporting requirements disclose information on the number and dollar amount of small business and small farm loans and community development loans. For small businesses, the maximum loan size is $1 million and for small farms, $500,000. The small business and small farm loan data are grouped into three loan-size categories. These are $100,000 or less, $100,001 to $250,000, and more than $250,000 up to the respective maximum for each loan type. These loans may include loans given by financial institutions under Federal guaranteed loan programs.

[5]In this report, we use the terms "urban" and "rural" counties as synonyms for "metropolitan" and "nonmetropolitan" counties, as defined by the Office of Management and Budget. See "What Is Rural" under the Rural Economy & Population topic on the ERS website for more explanation.

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Several papers studied the effects of credit constraints on small business viability. Briggeman et al. (2009) found that the production impacts of being denied credit were significantly lower for credit-constrained farm and nonfarm proprietorships. More specifically, the drop in the production was 3 percent and 13 percent of total value of production for farm and nonfarm sole proprietorships, respectively (Briggeman et al., 2009). Another study found that the small business loans reported under the CRA have a significant positive effect on small business growth in rural areas of the United States (Rupasingha and Wang, 2017).

Several existing studies argue in favor of Federal policy or public-sector support in enhancing rural capital access. For example, Rubin (2010; 2011) argued that the Federal Government or public sector must take the lead in creating an environment conducive to private investment such as by providing subsidies to offset higher costs of investing in rural areas or creating mandates requiring financial institutions to invest. Drabenstott (1995), focusing on rural credit needs, emphasized the role of the Federal Government in enhancing competition and enlarging access to broader capital markets for rural nonfarm business. However, studies that investigate local and State government support for private enterprises in rural areas find evidence of no effect or even a negative effect of these policies on job creation in rural areas (Patrick, 2014; 2016).

The Federal Government uses various policies to influence the allocation of credit in the U.S. economy, including regulation of financial institutions, tax policies, bankruptcy laws, support for secondary markets, and direct and indirect financial assistance programs. For example, the Congress passed the Community Reinvestment Act of 1977 to regulate financial institutions based on their credit supply to underserved and rural areas in the United States. Numerous Federal direct and indirect financial assistance programs have been implemented, including those provided by USDA's Rural Development mission area to support businesses in rural areas. While some of these financial assistance programs are direct loans and grants, others such as guaranteed loan programs are indirect in the form of incentives to lenders. This report focuses on the VAPG program.

The Value-Added Producer Grant (VAPG) Program[6]

The VAPG program was first authorized as part of the Agriculture Risk Protection Act of 2000 (P.L. 106-224), and was provided initially with $20 million in mandatory funding. The program was reauthorized by the Farm Security and Rural Investment Act of 2002 (P.L. 107-171, the 2002 "Farm Bill"). The program was reauthorized by subsequent farm bills in 2008 and 2014, with mandatory funding of $15 million provided by the Food, Conservation, and Energy Act of 2008 (P.L. 110-246) and $63 million provided by the Agricultural Act of 2014 (P.L. 113-79). In addition to the mandatory funding provided by several farm bills, the program is also funded by discretionary funds from annual appropriations bills.

The VAPG program provides grants to assist farmers and ranchers to create greater value for agricultural commodities and helps producers enter into activities related to the processing and/or marketing of value-added products. Generating new products, creating and expanding marketing opportunities, increasing producer income, and contributing to community economic development (create new jobs, increase earnings) are the goals of this program. An applicant may receive priority if s/he is a beginning or socially disadvantaged farmer or rancher, operates a small or medium-sized farm or ranch structured as a family farm, is part of a farmer/rancher cooperative, or is proposing a mid-tier value chain.[7] Grants are awarded through a national competition. Grantees are required to contribute at least $1 of matching funds or eligible in-kind contributions for every $1 in grant funds. Grant and matching funds can be used for planning activities or for working capital expenses directly related to producing and marketing a value-added agricultural product. Conducting feasibility studies and developing business plans for processing and marketing the proposed value-added product are examples of planning activities. Processing costs, marketing and advertising expenses, and some inventory and salary expenses are examples of working capital expenses.

RBS reviews applications for eligibility, scores eligible applications, and then ranks applications based on responses to several criteria: nature of the proposed project, qualifications of project personnel, commitments and support, work plan and budget, and priority points (*Federal Register* 82 FR 40987). The components in the nature of the proposed project criteria are technological feasibility, operational efficiency, profitability, and overall economic sustainability. Under the qualifications of project personnel criteria, applicants are expected to document credentials and/or experience

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[6]The information in this section is derived largely from the USDA Rural Development website, which details VAPG eligibility requirements and other program information.

[7]According to 7 CFR 4284.902 definitions, a *beginning farmer or rancher* is an individual independent producer that has operated a farm or ranch for no more than 10 years. A *socially disadvantaged farmer or rancher* is a farmer or rancher who belongs to a "Socially-Disadvantaged Group," a group whose members have been subjected to racial, ethnic, or gender prejudice because of their identity as members of a group without regard to their individual qualities. A small farm or ranch that is structured as a <u>family farm</u> has averaged $500,000 or less in annual gross sales of <u>agricultural products</u> in the previous 3 years. A medium-sized farm or ranch structured as a family farm has averaged $500,001 to $1,000,000 in annual gross sales of agricultural commodities in the previous 3 years. A *farmer or rancher cooperative* is a business owned and controlled by independent producers that is incorporated, or otherwise identified by the State in which it operates, as a cooperatively operated business. A *mid-tier value chain* is a local or regional supply network that links independent producers with businesses and cooperatives that market value-added agricultural products in a manner that (1) targets and strengthens the profitability and competitiveness of small and medium-sized farms and ranches that are structured as a family farm; and (2) obtains agreement from an eligible Agricultural Producer Group, Farmer or Rancher Cooperative, or Majority-Controlled Producer-Based Business Venture that is engaged in the value chain on a marketing strategy. According to the program's most recent Notice of Funds, 10 percent of annual funds are reserved for "mid-tier" value-chain projects and another 10 percent is reserved for beginning or socially disadvantaged farmers and ranchers, regardless of funding amounts.

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of all project staff. The commitments and support criteria are evaluated based on the number of independent producers involved in the project and the nature, level, and quality of their contributions, including matching contributions. End-user and third-party commitments are also considered under these criteria. The work plan and budget criteria are scored based on specific and detailed descriptions of the tasks and the key project personnel. A detailed breakdown of all estimated costs of project activities and allocation of those costs among the listed tasks are expected. The priority points are based on eligibility criteria discussed in footnote 8 above.

The amount of VAPG money obligated and the number of grants have fluctuated significantly since the program began in 2001 (fig. 2).[8] A total of 2,345 grants were provided during this period.

Figure 2
Number of VAPGs and obligated total funding amount, 2001-15
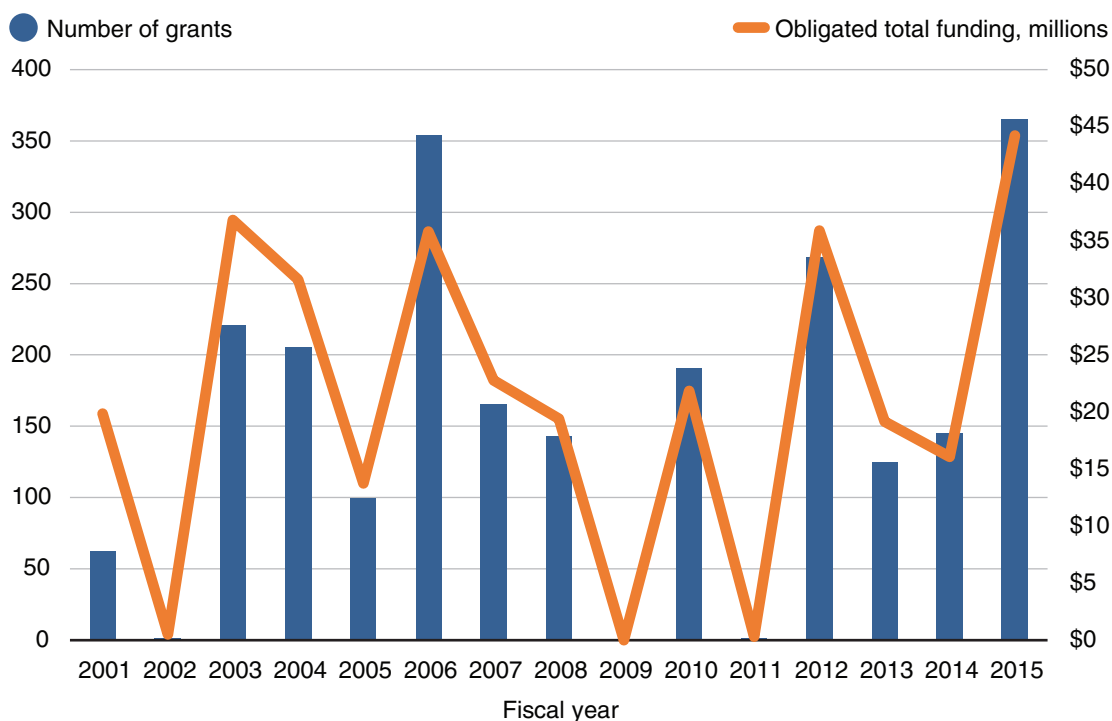
Note: These obligations do not reflect Value-Added Producer Grant (VAPG) cycles, which often roll over into another fiscal year. VAPG funds appropriated each year are "no year funds," which means they do not expire but rather roll over to the next fiscal year. As such, in many cases a fiscal year will include obligations for two VAPG cycles. Or in the case of 2002 and 2009, there were no obligations due to combining fiscal years for one VAPG cycle.
Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service and National Establishment Time-Series.

[8]These obligations do not reflect VAPG cycles, which often roll over into another fiscal year. VAPG funds appropriated each year are "no-year funds," which means they do not expire but rather roll over to the next fiscal year. As such, in many cases a fiscal year will include obligations for two VAPG cycles. Or in the case of 2002 and 2009, there were virtually no obligations due to combining fiscal years for one VAPG cycle. A grant may also be obligated after a cycle has been completed due to agency errors or an appeal. As for the FY 2011 program, USDA was not allowed to run the program until the agency promulgated a regulation that incorporated the 2008 Farm Bill changes to the program. Consequently, there was no VAPG program implemented in FY 2010, and funds made available for FY 2010 were combined with FY 2011 appropriated funds under a single notice. The FY 2011 notice covered both FY 2010 plus FY 2011. While RBS ran a VAPG program in FY 2011, awards from that program cycle were not made until January 2012. As a result, RBS data do not show any awards/obligations for FY 2011, and the 2011 awards show up as obligations made in 2012. Reserved funding expires on June 30 of each year (personal communication with VAPG administrators).

Figure 3 displays county-level variation of the dollar amount distribution of the VAPG for the 2001-15 time period. These grants are concentrated mainly in the north-central, western, and north-eastern regions of the country. The north-central States of Iowa, Wisconsin, Missouri, Nebraska, and Minnesota received a combined 28 percent of all grants from 2001 to 2015. While a little over 50 percent of grantees were in nonmetro counties, the rest were located in metro counties.[9]

Figure 3
Value-Added Producer Grant dollars, distribution by counties, 2001-15
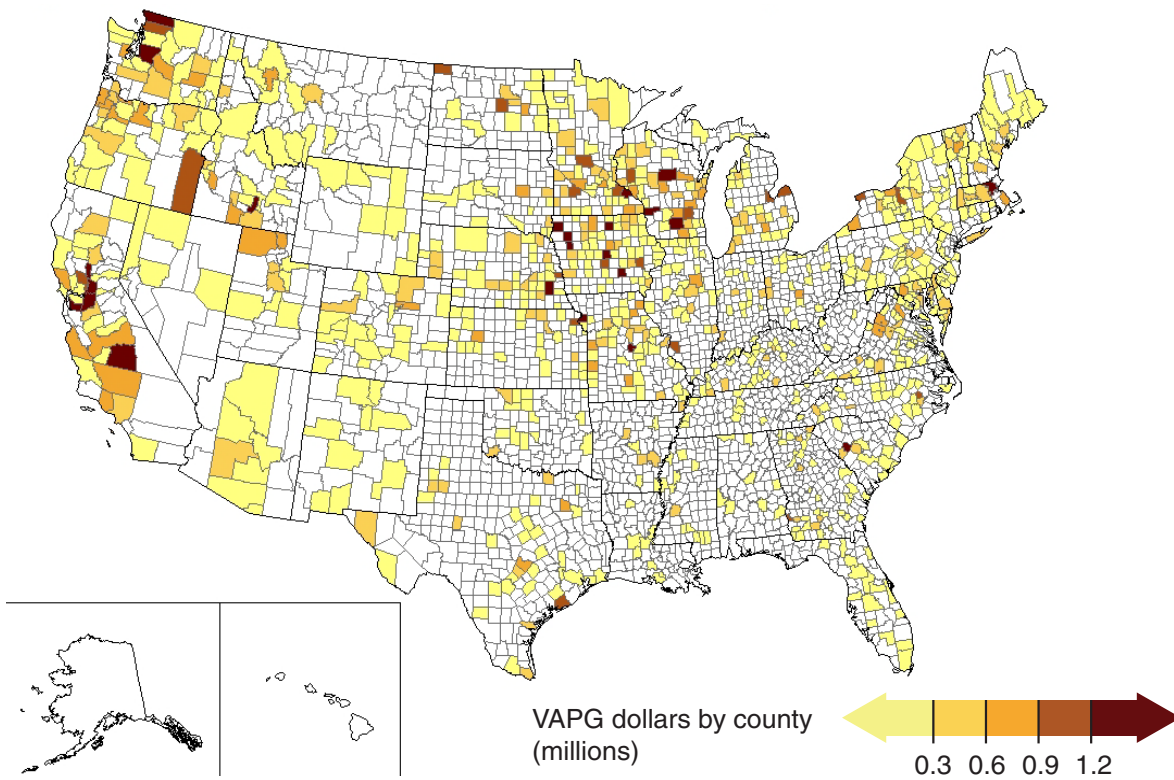
VAPG dollars by county (millions)

0.3 0.6 0.9 1.2

Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service.

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[9]There is no requirement in the program that beneficiaries be located in nonmetro areas.

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Previous Studies of the Value-Added Producer Grant Program

Three previous studies have investigated impacts of the VAPG program. The only published study out of these three was by Boland, and colleagues (2009). They identified determinants of success among VAPG program recipients using a nine-step scale of business development by VAPG recipients (ranges from "Creation of idea" to "Product or service is sold"), and found that the grant's size had significant impacts on a VAPG recipient being successful in reaching step nine of the nine-step business process. In the second study, updating Boland and colleagues (2009), Schenheit (2013) also found that the grant size had significant impacts on a VAPG recipient reaching step nine. The third, an unpublished thesis by Stevenson (2016), studied the impact of VAPGs on business survival. It used data on VAPG recipients from 2001 to 2011 in Iowa and North Carolina and National Establishment Time-Series (NETS) data from 1990 to 2011 to conduct a survival analysis. Stevenson found that VAPG recipients had a better chance of survival, compared to the comparison group, but that the size of the grant had no impact on the survival. McFadden and colleagues (2009) profiled a case study of a successful value-added agricultural enterprise and how the company utilized a VAPG to obtain technical assistance from Colorado State University to conduct market analysis in developing a strategic marketing plan before the producer explored further expansion of the business.

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Estimation Approach and Data

Evaluating the effectiveness of Government programs such as VAPG presents substantial challenges. Even though it is possible to follow VAPG recipient businesses and gauge whether they survived or how they have grown after receiving a VAPG, that information does not indicate whether the businesses' survival or how much of that growth is due to the program. The main challenge in estimating the impact of the VAPG is to determine the survival rate of a business or the number of jobs the VAPG recipient would have created if it had *not* received the VAPG. This hypothetical outcome (counterfactual) is not observable in the data and has to be estimated. To do this, we identify a group of businesses that did not receive a VAPG that is comparable to those that received a VAPG. Ideally, this comparison should be based on the factors that may affect the outcomes that we are trying to measure. To create a comparison group and conduct the statistical analysis, we combine the administrative data on the VAPG program provided by RBS with National Establishment Time Series (NETS) data. The NETS is a business registry database that has information on business entry, exit, and growth information over time.

Data Linking and Matching

We attempted to link administrative data[10] on every VAPG recipient during 2001 to 2013 to the NETS data. A total of 1,394 businesses received at least 1 VAPG between 2001 and 2013 (we limited the treated sample to businesses receiving their first VAPG).[11] We linked these VAPG businesses to the NETS data using DUNS (Data Universal Numbering System) numbers and business names and addresses.[12] We were able to link about 73 percent of the VAPG recipients to the NETS, giving us a linked sample of 1,020 VAPG recipient businesses.

Biases can result in the analysis from the fact that not all grant recipients are found in the NETS, since the linked sample may not be representative of all VAPG recipients. We do not have enough information to gauge the potential and size of this bias due to unavailability or incompleteness of RBS data for variables such as business age, employment, and earnings, which are needed to investigate the potential bias. The only variable available in the RBS data for all VAPG recipients is the size of the grant. The average grant amount is $124,479 for the linked group and $142,324 for the nonlinked group. The difference in average grant size between these groups is statistically signifi-

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[10]This analysis is based on an earlier version of administrative data on VAPG, provided to us by USDA's Rural Business-Cooperative Service (RBS). The data in figure 2 were provided by the RBS during the final clearing process of this report. There were 192 more grants (11 percent more) and about $34 million more in total grant value (15 percent more) reported in figure 2 between 2001 and 2013 (the time period of the analysis) than the number of grants and dollar amounts in the original data we received. However, the differences in the number of grants and dollar amounts between our final analysis dataset and the current RBS dataset should be smaller, since we restricted our sample to the businesses that could be linked to the NETS data and that had an employment history prior to receiving a grant. It is difficult to determine whether the use of the smaller data set that RBS provided caused any bias in our results. However, the fact that the percentage difference between our analysis dataset and the summary data reported in figure 2 in the value of grants (15 percent) was greater than the percentage difference between the two data sets in the number of grants (11 percent) indicates that the grants missing from our analysis were larger in average value than the grants in our analysis dataset. Since we found that larger grants had larger impacts on businesses' probability of survival and employment growth, this suggests that any bias in our estimates of VAPG program impacts is downward.

[11]Subsequent grant receipt may be influenced by the outcome of the first one (Brown and Earle, 2017), and such a scenario will hamper our attempt to uncover the causal relationship between VAPG and business outcomes.
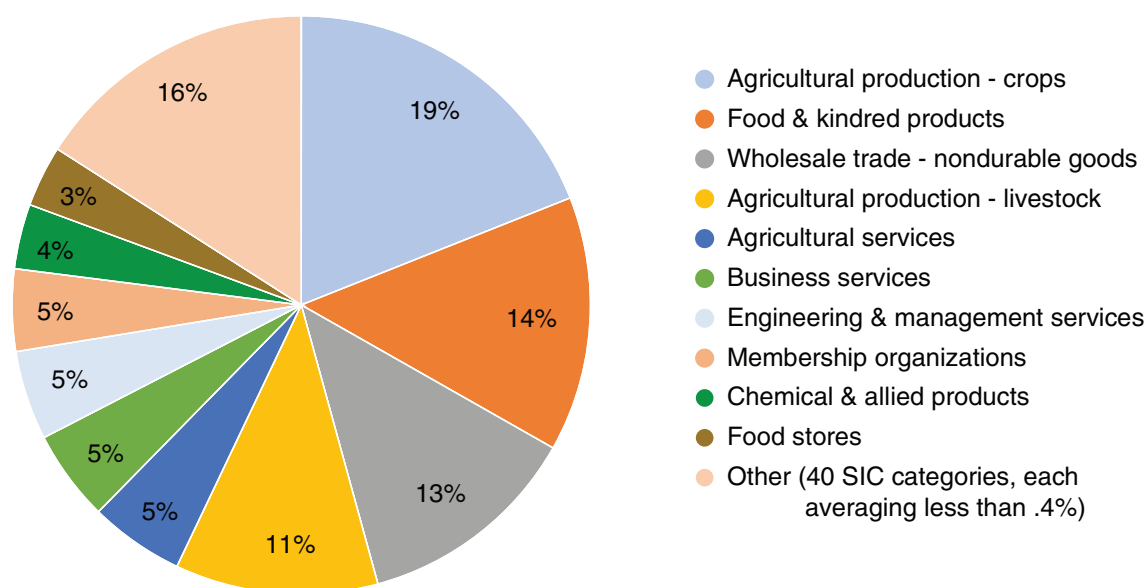
[12]After linking using addresses only, some addresses resulted in multiple DUNS in the same location. These were also removed from the analysis.

cant, indicating that the grants included in our analysis (i.e., the linked group) are not fully representative of all VAPGs. Hence, our impact estimates may not be representative of the average impact of all VAPGs, and may be an underestimate of survival and growth (since the grants excluded from our analysis are larger on average than the grants included in the analysis).[13]

Figure 4 illustrates the distribution of these linked 1,020 businesses in terms of their industry classification and shows that nearly 30 percent of the VAPG recipient businesses are primarily crop and livestock producers.[14] While manufacturers of food and kindred products have received 14 percent of the grants, businesses in the nondurable wholesale trade sector received 13 percent of the grants. This sector includes many agricultural products, including groceries and related products; farm-product raw materials; beer, wine, and distilled alcoholic beverages; farm supplies; and tobacco/tobacco products. An additional 13 percent of the grants were distributed among 38 different industry sectors, each sector accounting for an average of less than 0.3 percent of grants. The vast majority (93 percent) of these 1020 businesses were independent establishments.

Figure 4
Two-digit industry classification for linked businesses

Legend:
- Agricultural production - crops
- Food & kindred products
- Wholesale trade - nondurable goods
- Agricultural production - livestock
- Agricultural services
- Business services
- Engineering & management services
- Membership organizations
- Chemical & allied products
- Food stores
- Other (40 SIC categories, each averaging less than .4%)

Note: Data represent the 1,020 businesses that received VAPGs over 2001-2013. SIC = Standard Industrial Code.
Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service and the National Establishment Time Series.

[13]This interpretation may not hold, however, if some factors responsible for our inability to link some businesses to the NETS data are associated with the potential for survival and growth of those businesses. For example, if businesses are in the nonlinked group because the business owner or manager was careless in filling out the grant application, and if such carelessness is a more general characteristic that is associated with poor performance of those businesses, then the expected survival and growth of the nonlinked businesses could be less than that of the linked businesses.

[14]This classification uses the primary Standard Industrial Classification (SIC) code for the last year that a recipient business is reported in the NETS database and may or may not be applicable to the SIC code of the business at the time the VAPG is received. The SIC codes are also reflective of a particular project or facility and may not reflect the primary business of the recipient at the time of application. An applicant has to be a crop or livestock producer to receive priority but can also be proposing a mid-tier value chain.

Out of 1,020 establishments linked to NETS, 836 establishments had employment records prior to receiving a VAPG, which is a requirement (for reasons explained below) for the matching techniques that we used to find a control group of nonrecipient establishments. The vast majority of these 836 businesses were small businesses that had 19 or fewer employees at the time of the grant receipt. Compared to the businesses that had prior employment records, the excluded establishments tended to have received smaller grants.[15]

The 836 "treated" VAPG recipients were matched to the whole universe of NETS data sans establishments that received VAPG. In the matching, we required treated and control businesses to be in the same State, have the same 2-digit Standard Industrial Classification (SIC) code, same firm type (whether the business is an independent establishment or an entity of a multi-unit firm), same locale (rural or urban county), same age category at the time of the grant, same employment size for 3 years prior to the grant, and same start year (of the business). We were unable to find exact matches for 195 treated businesses, reducing our sample of treated businesses to 641 matched observations. Unmatched establishments tended to be larger employers and receive larger grants.[16] A total of 295,334 exact-matched control businesses were identified from this exercise. Following Ho et al. (2007), we use all matched controls for each treated establishment created by exact matching in our econometric estimation.[17]

Figure 5 shows the average employment trends for treated and control establishments in a randomly selected one-to-one matched sample for each year before and after VAPG receipt. "0" in the chart is the grant year, "-5" is 5 years before grant, and "5" is the fifth year after grant. The close alignment of control establishments with the treated establishments prior to the grant year provides evidence of the success of our matching.[18] The chart also shows very noticeable divergence of average employment of surviving businesses between treated and control establishments after the treatment, suggesting a positive effect of VAPG on employment growth of treated businesses (among those that survive). This descriptive evidence of employment change after the VAPG should not be construed as statistically significant evidence of the impact of the program.

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[15]The mean difference in grant size between establishments that had prior employment records ($128,579) and those that did not have prior employment records ($105,850) was statistically significant at less than the 1-percent level. This suggests that a majority of the grantees that did not have employment records before the grants may have received planning grants (for proposed new projects or businesses). Planning grants tend to be smaller than working capital grants. According to the RBS website, the maximum planning grant is $75,000, and the maximum amount for a working capital grant is $250,000.

[16]The mean differences for grant amount and employment size between these two groups were statistically significant at less than the 1-percent level.

[17]More details on use of matched controls are presented in the Appendix.

[18]The decline in employment prior to treatment is mainly due to a changing sample size and the nature of the sample (being dominated by older firms at -5, then adding younger and younger firms in each subsequent year). Limiting the establishments to age 2 or more (years) at the time of the grant receipt produced a more stable pre-grant employment (not declining) but similar divergence in employment after the grant. Average rising employment in the control group after year 0 is also mainly due to the longer average survival of larger establishments.

Figure 5
Mean employment per business by year before and after a Value-Added Producer Grant

Average employment per establishment

Years before and after VAPG
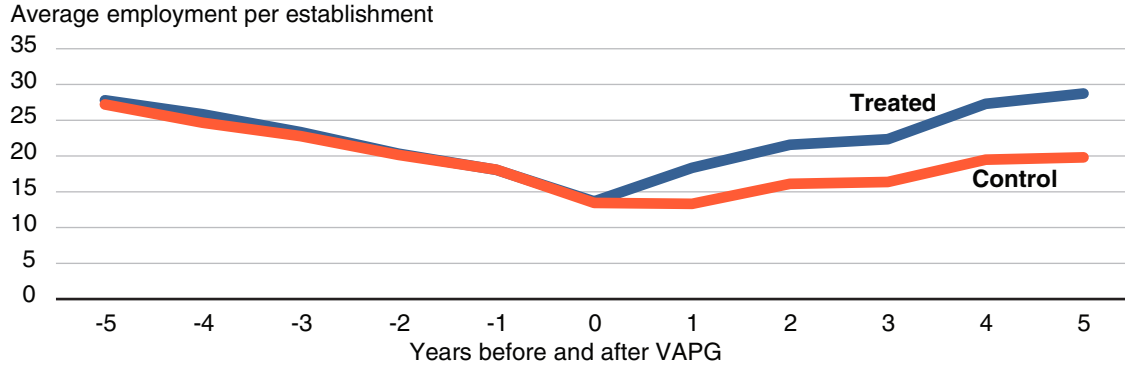
Note: Figure shows the average employment trends for treated and control establishments in a randomly selected one-to-one matched sample for each year before and after VAPG receipt. "0" in the chart is the grant year, "-5" is 5 years before grant, and "5" is the fifth year after the grant. The close alignment of control establishments with treated establishments prior to the grant year indicates successful matching.
Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service and the National Establishment Time-Series.

Figure 6 shows employment differences before and after the treatment more rigorously using multiple regression analysis. There is no significant difference in average employment levels between grant recipients and nonrecipients *before* the grants were received, as evidenced by the line hugging 0 until the grant. Average employment grew more rapidly for VAPG recipients than nonrecipients after receipt of the VAPGs.

Figure 6
Difference in average employment growth between Value-Added Producer Grant and non-VAPG recipients
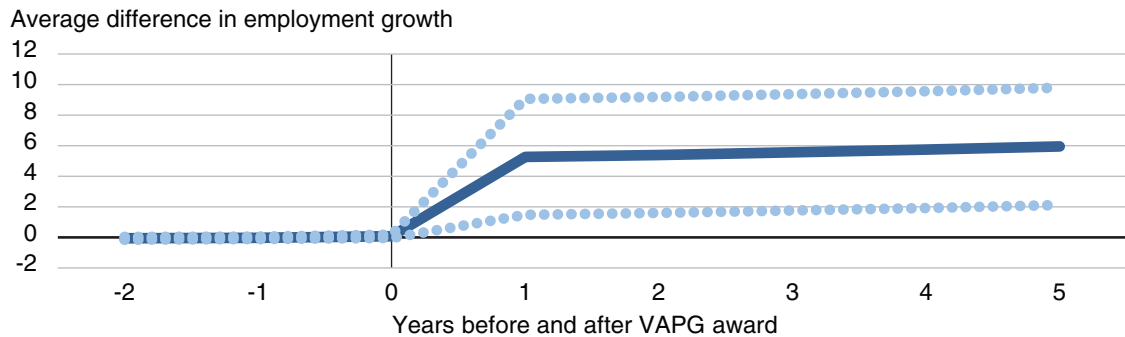
Average difference in employment growth

Years before and after VAPG award

Notes: This chart is based on multiple regression analysis that, in addition to VAPGs, accounts for differences in establishment characteristics that could also affect employment growth in businesses that did and did not receive grants. The dotted lines are the bounds of the 95-percent confidence interval, based on standard errors. "0" in the chart is the grant year, "-2" is 2 years before the grant, and "5" is the fifth year after the grant. The post-grant change in average employment for each year is the change in average employment during the 2 years before the grant plus the grant year (year 0) to employment in year 1, average employment in years 1 and 2 (for 2 years after the grant), average employment in years 1, 2 and 3 (for 3 years after the grant), etc. Pre-grant employment for year 0 was the employment in that year minus the average employment in years 0 to -2. Pre-grant employment for year -1 was the average employment in year 0 and year -1 minus the average employment in years 0 to -2. Pre-grant employment for year -2 was the average employment in year -1 and year -2 minus the average employment in years 0 to -2.
Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service and the National Establishment Time-Series.

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Estimation Methods

The first question we examine is whether being a VAPG recipient decreases the risk of failing compared to a business in the control group using survival analysis.[19] We calculate how long (in years) an establishment survived after grant receipt and estimate whether being a VAPG recipient or the grant amount had any effect on the risk of failing. We calculate the survival duration using the length of time from the grant year until an establishment ceases to exist or until the end of the period considered. The total time period that we consider in the analysis spans from 2001 to 2013. Since the VAPG program also spans this whole time period, an analysis focusing on a 13-year time period will subject the early grant recipients to longer time periods and later recipients to shorter time periods. In order to avoid this and treat all grant recipients on an equal footing, following Brown et al. (2015), we constrain the timeframe around which we calculate survival time since the grant receipt to focus on the short- and medium-term effects of the grants. This ensures that all of the grant cohorts count equally rather than having longer time series for early cohorts and shorter series for later ones. We calculate three time periods: (1) survival of 2 years, (2) 4 years, and (3) 6 years since the grant receipt. The analysis used here investigates the question: If an establishment has survived until a particular point in time, what is the probability that it will exit in the next year (known as the hazard rate)?

In addition to whether a business received a VAPG or not and the size of the grant, the survival and growth of a business can be associated with other business-related characteristics. In order to isolate the effect of VAPG on business survival, we incorporate other characteristics into the estimation model. Based on previous studies (Audretsch and Mahmood, 1994; Christie and Sjoquist, 2012) and the availability of these characteristics in our data, we include several factors that are associated with business survival (and that were also used in the matching) in the survival and growth analysis. These factors include the age and the size of the business and whether the business is independent or an establishment of a multi-unit business firm. Previous studies (Audretsch and Mahmood, 1994; Christie and Sjoquist, 2012) have found that older and larger establishments are expected to survive longer and that the establishments with multi-unit firms would be expected to survive longer than independent businesses. Age is an important factor because new entrants are more likely to exit sooner, and the risk of exit declines over time for survivors. Employment size of a business matters because larger businesses may have a better chance of survival. Existing studies on businesses survival and growth find diminishing effects of age and size factors, and this is usually modeled by including both linear and squared values of these variables; we adopt the same approach in our analysis.

The establishments that belong to multi-unit firms are expected to survive longer than independent businesses because the learning curve is less steep for multi-unit establishments (Audretsch and Mahmood, 1994). Multi-unit establishments may also have greater access to financial capital, greater ability to recruit skilled workers and managers, and greater name recognition with consumers that will help such establishments survive longer. On the other hand, multi-unit firms may have more flexibility to close an individual branch and consolidate resources into other branches than an independent establishment (Reynolds, 1988; Christie and Sjoquist, 2012). Moreover, a local independent business may be less likely to close because consumers may have a preference for buying from local independent businesses rather than from a chain, or because they are less footloose and more

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[19]Please see the Appendix for technical details of the survival analysis.

committed to the community, and/or because the salvage value of their assets is less than that of a unit of a larger firm (Low and Brown, 2017).

We also include several county-level control variables for local growth or financial capital availability, following the approach of Brown and Earle (2017). They are per capita real small business loan amounts recorded under the Community Reinvestment Act, per capita real total bank deposit amounts, employment growth in the industry sector that an establishment belongs to (using 2-digit SIC codes), and growth of total employment.[20] Although our matching and survival estimations control statistically for the effects of observed factors that could confound our estimates of VAPG impacts, there could still be unobserved sources of differences that are not readily captured by the variables incorporated in the model. To take this factor into account, we also estimated the survival model using an econometric technique that is robust to unobserved heterogeneity (see Appendix for an explanation).

Next, we use multiple regression analysis to show how the VAPG program affects change in employment in the business establishments. This analysis highlights the strength of the relationship between change in employment (the dependent variable) and a set of other variables (independent variables) including the VAPG program. We calculate employment growth as the change in average employment from 2 years before the grant plus grant year to average employment 2 years, 3 years, and 4 years after the grant, following Brown and Earle (2017). Our variable of interest in the set of independent variables is whether a business received a VAPG and/or the size of the VAPG. The other independent variables in the growth analysis are the same as the variables used in the survival analysis. Previous studies find that business growth tends to decrease with business age and size. Larger employment size at the beginning means slower growth, and younger businesses grow faster than older ones (Persson, 2004).

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[20]Five-year growth for both industry and total employment was calculated using NETS data.

Effects of VAPG on Establishment Survival

Table 2 presents the results of the survival analysis.[21] Our statistical tests show that the model incorporating unobserved heterogeneity is superior to the model without it. Results presented and discussed are based on the estimation with unobserved heterogeneity. Results shown in row 2 of table 2 indicate that the VAPG recipients were 89 percent less likely to fail 2 years after the grant than were the group of similar nonrecipients. That is, the predicted likelihood of failure within the next year for VAPG recipient businesses 2 years after receiving a grant was about 0.23 businesses out of 1,000 VAPG recipient businesses, compared to a likelihood of failure of about 2.04 per 1,000 nonrecipient businesses of the same age and other characteristics. The effect of VAPG on survival dropped with time: VAPG recipients were 71 percent less likely to fail than similar nonrecipients 4 years after receiving a VAPG and 57 percent less likely to fail than nonrecipients after 6 years. For the 6-year time period, this implies that 18.5 out of 1,000 VAPG recipient businesses were likely to fail, compared to a likelihood of about 42.3 failures per 1,000 nonrecipients. These results show that the VAPG program had a positive impact on the survival of recipient businesses, even 6 years later.

One shortcoming of the comparison between VAPG-recipient businesses and nonrecipient businesses is that it treats VAPG recipients as if all of them received the same size grant. The impacts of a program may be larger for recipients that received greater funding (Pender and Reeder, 2011). The results reported on row 3 of table 2 show how the survival of a business changes with the size of the VAPG. The program funding received by the control group, which was included in the analysis, is zero. These results show that the risk of failing decreased significantly for businesses that received larger grants compared to those that received smaller grants, including the ones that received no grants. For example, increasing the average size of a business grant from the current $136,000 to $236,000 is associated with a 47-percent decrease in the likelihood of failure for a recipient business 2 years after the grant. As with the impact of the grant receipt alone, the positive impact of the *size* of the grant tends to decrease over time. In summary, a business that received a VAPG is less likely to fail than a business that did not receive a VAPG, and businesses that received larger grants are less likely to fail than those that received smaller grants or no grants.

With respect to other variables in the survival analysis, both establishment age and size are shown to decrease the risk of failing, but these effects are reversed after about 15–16 years of age and 100–149 employees. Results of the analysis suggest that independent establishments are less likely to fail than establishments of a multi-unit firm. For example, independent businesses are 99 percent less likely to fail than multi-unit businesses 2 years after receiving a grant. This result is counter to the earlier findings that if an establishment is part of a multi-unit firm, it tends to survive longer (Audretsch and Mahmood, 1994) and more in line with recent findings that establishments that belong to multi-unit firms have a greater likelihood of failure compared to independent businesses (Christie and Sjoquist, 2012; Low and Brown, 2017).

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[21]The full survival analysis results are presented in table A1 in the Appendix.

Table 2
Survival analysis results

Factor	2-year survival	4-year survival	6-year survival
Receipt of VAPG	89% less likely to fail (than nonrecipients)	71% less likely to fail	57% less likely to fail
Amount of VAPG (effect of additional $100,000)	47% less likely to fail than those that did not receive the increase	31% less likely to fail than those that did not receive the increase	28% less likely to fail than those that did not receive the increase
Business age	Older establishments less likely to fail, but effect is reversed after some threshold age	Older establishments less likely to fail, but effect is reversed after some threshold age	Older establishments less likely to fail, but effect is reversed after some threshold age
Business size	Larger establishments less likely to fail, but effect is reversed after some threshold size	Larger establishments less likely to fail, but effect is reversed after some threshold size	Larger establishments less likely to fail, but effect is reversed after some threshold size
Independent business (vs. unit of a larger firm)	Independent establishments less likely to fail	Independent establishments less likely to fail	Independent establishments less likely to fail

Note: These extracted results are drawn from results presented in Appendix table A1.
Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service and the National Establishment Time-Series.

Effects of VAPG on an Establishment's Employment Growth

Table 3 presents results of a multiple regression analysis that estimates the employment effects of the VAPG program. The three columns of results are the estimated employment effects of VAPG within 2 years, 3 years, and 4 years of receiving a grant. Grant recipients employ five more workers, on average, than do nonrecipients in all three growth periods considered. We also study the effect of grant size on employment growth and find that larger grants had greater employment impacts. A $100,000 increase in the average size of a grant increases employment for recipients by about four jobs, on average, within 4 years of the grant. These employment impacts are substantial, considering that the average employment of businesses in the analysis was 14 at the time of the grant.

Table 3

Regression analysis results on the effects of a Value-Added Producer Grant on employment growth

Factor	2 years after grant	3 years after grant	4 years after grant
Receipt of VAPG	Recipients employ about 5 more workers on average than nonrecipients	Recipients employ about 6 more workers on average than nonrecipients	Recipients employ about 6 more workers on average than nonrecipients
Amount of VAPG (effect of $100,000 increase)	A $100,000 increase in VAPG increases employment by 4 jobs	A $100,000 increase in VAPG increases employment by 4 jobs	A $100,000 increase in VAPG increases employment by 4 jobs
Business age	Older businesses at the time of the grant grow faster, but effect is reversed after some threshold age	Older businesses at the time of the grant grow faster, but effect is reversed after some threshold age	Older businesses at the time of the grant grow faster, but effect is reversed after some threshold age
Business size	Larger businesses grow faster, but effect is not statistically significant	Larger businesses grow faster, but effect is reversed after some threshold size	Larger businesses grow faster, but effect is reversed after some threshold size
Independent business (vs. unit of a larger firm)	Effect not statistically significant	Effect not statistically significant	Effect not statistically significant

Note: These extracted results are drawn from Appendix table A2.
Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service and National Establishment Time-Series.

As in the survival analysis, these regressions also include businesses' age and size, whether a business is independent or an entity of a multi-unit business, and county-level covariates. These results show that older businesses at the time of the grant grow faster, but this effect is reversed after about 12 years of age. The effect of employment size is positive, indicating that larger size at the beginning of the grants creates more jobs, but this effect reversed after about 10–14 employees.

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Conclusion

We find that receipt of a VAPG decreases the risk of failing for recipient businesses compared to similar businesses that did not receive a VAPG, and that larger VAPGs have a larger impact on business survival. Although not directly comparable due to differences in sample sizes and in matching and estimation techniques, our results are in line with general findings in Stevenson (2016), although she did not find statistically significant effects of grant size on survival.[22] We also find a positive impact of VAPG receipt and size on employment growth, but Stevenson (2016) did not study the impact of the VAPG on employment growth.

The evidence on employment impacts of other Federal grant programs is limited. Two studies analyzed impacts of the Small Business Innovation Research (SBIR) program.[23] Lerner (2000) studied the impact of SBIR awards on business sales and employment and found that an SBIR award alone had little impact on employment and sales overall but found a positive impact (83-percent increase in employment over a 10-year period) when interacting the SBIR indicator with measures of venture activity. Wallsten (2000) also found no employment effect of SBIR grants.

Although not grant programs, the impact of Federal guaranteed loan programs on employment growth of businesses may provide some interesting comparisons. For example, Brown and Earle (2017) explored the effects of SBA loans on employment growth in recipient businesses and estimate three additional jobs per $1 million of SBA loans during the first 3 post-loan years and five to seven jobs during the first 5 post-loan years. Based on results reported in this study, it seems that the VAPG program has a much larger employment impact per dollar provided—roughly 40 jobs per $1 million of VAPGs, 13 times as large an impact per dollar during the first several years after the grant. However, it is important to note that here we are comparing the impacts of Government grants to the impacts of Government-guaranteed loans. Although the VAPG program requires matching funds, the fact that grants are not repaid may lead to larger impacts on recipient businesses per dollar provided. That does not mean that these grants have larger impacts per dollar appropriated for the program than the SBA loans; that comparison depends on what fraction of SBA loans are repaid and any interest subsidy involved in the SBA loan programs. Brown and Earle (2017) provide rough calculations of the costs per created job that are attributable to SBA loans[24] and calculated that a cost per job created ranged from $21,580 to $25,450. Given that a $100,000 increase in VAPG funding increases employment by about four jobs and assuming that the cost of the program includes only VAPGs (and not administrative costs), the cost of the VAPG program to the taxpayer (around $25,000 per job created) is close to what Brown and Earle (2017) estimated in their study of SBA loans.

This report has demonstrated the potential to combine program administrative data with other data sources to provide rigorous evidence on the impacts of a rural business development program. Insights from the findings of this research may be relevant to academics and policymakers interested in understanding how Federal business grant and loan programs affect the dynamics of individual

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[22]The smaller sample size of Stevenson's study may have been partly the reason for this statistically insignificant result.

[23]Federal Government grants are rarely available to small businesses. To the best of our knowledge, the only other grant program that is available to private businesses is the Small Business Innovation Research (SBIR) program, under which grants are provided to small businesses engaged in scientific research and development. The program is overseen by the Small Business Administration (with participation from other agencies) and awards grants to stimulate high-tech innovations.

[24]The main costs of the SBA loan programs include default and administration costs (Brown and Earle, 2017).

businesses. Further research on the economic impacts of this and other Federal programs, and how those impacts vary across programs, types of recipients, and geographic contexts, could increase the ability of the Federal Government to pursue evidence-based policies to promote economic development.

Our findings are subject to several caveats. As mentioned above, biases can result in the analysis from the fact that not all grant recipients are found in the NETS database. We found that these unlinked recipients had received a higher grant amount, on average, suggesting that our findings may be a conservative estimate of a VAPG's impact (since larger grants were found to have greater impacts on business survival and growth). However, we are unable to be sure of the magnitude of this bias. We excluded startup businesses that received a VAPG in order to consider pre-grant growth trends of the businesses in selecting the control group. However, the effects of VAPGs on startups are also of interest, and they could be investigated in future research.

Although we have used the best available methods and data to control for other factors that may affect business survival and employment growth, it is possible that treated firms were able to obtain additional financial capital for the same reasons they were able to secure funding from the VAPG program. For example, the VAPG recipients who have initial success with their value-added activities may be encouraged to seek additional financial help from formal lenders, the equity market, or Government to further their businesses—and they may be more likely to receive such help. Thus, we cannot claim that the increased growth of VAPG recipients' businesses resulted solely from receipt of a VAPG. Even in that case, however, the VAPGs may have played a catalytic role in leveraging other sources of financial capital. Further research is needed to investigate this and other possible mechanisms by which these positive impacts of the VAPG could have occurred.

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Appendix: Data, Methods, and Results

Identification Strategy

Many evaluation methods do not differentiate the effect of a program on outcomes from the effect of historical outcome patterns, firm-level and industry-level characteristics, or the wider economy, or more generally do not measure the counterfactual of what measured outcomes would have been in the absence of the program (Gu et al., 2008; Pender and Reeder, 2011). For example, businesses that receive a VAPG may be inclined to grow faster or slower than the businesses that did not receive any VAPG, regardless of whether they received program funding. This difference between the businesses that received program funding (treated) and the businesses that did not receive program funding (control) could arise due to unobserved differences across businesses, leading to overestimates or underestimates of the effect of a program (O'Keefe, 2004).

The standard approach to address this issue is to construct counterfactuals using the outcomes of never-treated businesses. The exact matching technique that we use in this report, combined with difference-in-difference (DID) estimation, is designed to mitigate the potential biases and eliminate confounding effects in a way similar to what randomization does. Unobserved variables that affect business survival and growth may differ between the VAPG recipients and matched control businesses, potentially biasing our results. However, only differences between VAPG recipients (treated) and matched control businesses that vary over time and that occur after the treated firms receive a grant are likely to confound our results since, as shown in figure 5, the treated and control businesses have very similar average employment trends prior to receiving a grant. Only after the treated businesses received a grant do we observe a divergence in mean employment outcomes for the treated and control businesses. This suggests that only very particular unobserved factors, with differences between treated and control businesses that appear and grow only after the treated businesses receive a grant, are likely to confound our results. While the presence of such confounding factors cannot be definitively ruled out, we are not aware of any obvious examples of such factors. Relatively fixed factors, such as the ability of the business' managers, do not seem able to account for the employment patterns shown in figure 6. Time-varying factors, such as general macroeconomic trends or the trends affecting a particular industry, are addressed by our matching and DID estimation approach, since the matched control firms are selected from the same industry as the treated firms, are the same age, and are observed for the same calendar years as the treated firms.

We combine two datasets to conduct statistical analysis. The administrative data on the VAPG program provided by RBS include annual data from the inception of the program (2001) to 2015. These data included information such as the Data Universal Numbering System (DUNS) number and the addresses of grant recipients, the grant year, and the obligated amount. However, these data do not contain information on nonrecipient businesses, so we cannot use these data alone to construct a control group. Furthermore, the RBS data do not contain other information necessary for the evaluation, even for VAPG recipients, such as changes in employment over time. To overcome these shortcomings, we combined VAPG data with data from the National Establishment Time-Series (NETS), a business registry database that has information on business entry, exit, and growth over time.

NETS is a longitudinal establishment database constructed by Walls & Associates and uses business-level data from Dun & Bradstreet (D&B) Dun's Market Identifier (DMI) files. Walls & Associates linked the cross-section establishment data using the unique DUNS number and claims to cover nearly every U.S. business unit that has operated in the United States over the past two

decades, including sole proprietors, small privately owned firms, farms, nonprofit organizations, and public-sector establishments such as post offices and public schools. ERS has acquired these data for the period from 1990 to 2013; the dataset contains over 54 million observations.[25]

In this research, we are interested in the effects of the VAPG program on business survival and growth. For illustration purposes, we denote outcome (survival or employment growth) in business i as Y_i.[26] Let $(Y_{1i} \mid VAPG_i=1)$ indicate outcome of a business if it were to receive a VAPG, and let $(Y_{0i} \mid VAPG_i=1)$ be outcome in the same business if it did not receive a VAPG. The treatment effect of receiving a VAPG in this context can be expressed as $(Y_1 \mid VAPG_i=1) - (Y_0 \mid VAPG_i=1)$. We can define the average treatment effect on the treated (ATET) as $E[Y_{1i} - Y_{0i} \mid VAPG_i=1] = E[Y_1 \mid VAPG_i=1] - E[Y_0 \mid VAPG_i=1]$, where $E[]$ denotes the expectation operator. The first component of the ATET is the average outcome in the population of VAPG recipients, a quantity that can be observed in the present context. The second component is the average outcome of VAPG recipients had they not received a VAPG. The value of the second component (the counterfactual) is not observable and must be estimated. We estimate this value using the outcome of businesses that did not receive a VAPG, and that are similar in observable characteristics to the businesses that did receive a VAPG. We use matching techniques to select a comparison group of similar businesses. Once a matched sample has been formed, one can estimate employment growth regressions and survival functions using an appropriate estimator.

We used exact matching methods to select controls that have, for each control business, observed characteristics similar to those of the treated businesses. The panel structure of our data allows us to compare changes in employment between the pre-VAPG period and the post-VAPG period for the treated versus controls (i.e., difference-in-difference (DID) estimation). The DID estimator removes the effects of unobserved permanent differences between treated and control units, as long as such permanent differences have an additive effect on the outcome measure. In addition, since we are able to match treated and control businesses in terms of their pre-VAPG employment trends, we are able to assure that the treated and control groups are comparable not only in their characteristics at the time of the VAPG, but also in their pre-treatment trends in the outcome variable. This combination of matching and DID estimation helps to assure that the treatment and control groups would have experienced similar employment trends had the VAPG recipients not received VAPGs.[27]

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[25]Several criticisms have been made regarding the use of data based on D&B for research in the past (see Davis et al., 1998): that the data based on commercial datasets are unfit for analysis; that the D&B data underreport births and younger/smaller businesses and that there are discrepancies in the total U.S. employment figures between DMI files and data published by the U.S. Bureau of Labor Statistics. These criticisms were mainly targeted toward the use of early D&B DMI files, especially the data developed by David Birch in his research on small business and employment in the early 1980s. There have been significant improvements in the methodology used to gather, screen, and clean data since Birch's dataset was developed (Kolko and Neumark, 2007). Acs and colleagues (2008) argue that D&B has a strong incentive to ensure data accuracy, as inaccuracies would jeopardize D&B's core business. The NETS data set has become increasingly popular among researchers, and numerous top-tier economics journals have published papers that use NETS data.

[26]For simplicity of exposition, we suppress time subscripts. Generally, we are discussing employment in a particular year (t).

[27]This assumption is called the "parallel trends assumption" and is a critical assumption for identification of an impact using the DD estimator (Abadie 2005). Research has shown that "conditional difference-in-difference estimation," combining matching with DD estimation, yields more valid results than applying either simple matching or simple DD estimation (Heckman et al., 1998).

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Matching

After linking the VAPG recipients with the NETS database, we have millions of nontreated (control) businesses from which to choose a control group of businesses. The idea is to limit the analysis to those businesses in the control group that are most comparable to treated businesses in terms of their observable characteristics, especially characteristics expected to influence business survival and growth. We used exact matching on selected variables to select the control group.[28]

We made several sample restrictions before matching. To be a candidate in the control group, an establishment can never have received a VAPG between 2001 and 2013. Both control and treated establishments must have had positive employment in the year that a treated firm received a grant and at least 1 year prior to receiving a grant. We also limited the treated sample to businesses receiving their first VAPG.[29]

In the matching, we required treated and control businesses to be in the same State, have the same 2-digit Standard Industrial Classification (SIC) code,[30] same firm type (whether the business is an independent establishment or an entity of a multi-unit firm), whether the businesses are in a rural or urban county, same age category[31] at the time of the grant, same employment size for 3 years prior to the grant receipt by the treated establishment, and same start year of the business.[32] All of these are characteristics hypothesized in the literature to affect the likelihood of survival and the growth of businesses (Brown and Earl, 2017; Brown et al., 2015; Christie and Sjoquist, 2012; Audretsch and Mahmood, 1994).

For various reasons, control and treatment group establishments can have divergent pre-program growth trends. For example, Brown and Earl (2017) point out that program recipients of SBA loans, unlike other firms, may tend to grow before they are treated. Therefore, the matching process should take into consideration the preprogram growth trends of the matched control and treated businesses so that the two groups display similar trends before treatment (Brown and Earl, 2017). To address this issue, we controlled for prior employment size categories[33] up to 3 years before an establishment received a VAPG. In order to control for the macroeconomic circumstances businesses face,

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[28]When there is a relatively small number of potential control observations, or a large number of variables or continuous variables are used for the matching, exact matching is often not feasible. Because of the difficulty of obtaining exact matches, alternative approaches such as propensity score matching or Mahalanobis metric matching are commonly used. In our case, we have a very large pool of potential controls, and we are using few variables and no continuous variables for the matching, so exact matching is feasible in our case. Even so, we still lose some observations because of a lack of available matches, as noted below.

[29]This includes firms that received more than one grant, but we include only the first grant year and the amount obligated in that year in the analysis, since subsequent grants may be a result of the success a business had with the first grant. However, the measured impacts due to subsequent grants may depend on the timing of the subsequent grants.

[30]"Standard Industrial Classification (SIC) codes are two- to eight-digit numerical codes assigned by the U.S. Government to business establishments to identify the primary business of the establishment. The classification was developed to facilitate the collection, presentation, and analysis of data; and to promote uniformity and comparability in the presentation of statistical data collected by various agencies of the Federal Government, State agencies and private organizations," Two-digit SIC codes are aggregations of four-digit code categories.

[31]Age categories used were: less than 3 years old, 3 to 5 years old, 6 to 10 years old, and over 10 years old by the time an establishment received a grant.

[32]By including the start year and the age at the time of grant receipt, we make sure that a control is picked for a particular treated firm not only in the same age category but also in the same start year.

[33]Size categories used based on number of employees in an establishment are: 1; 2-4; 5-9; 10-14; 15-19; 20-29; 30-49; 50-74; 75-99; 100-149; 150-249; 250-499; 500-999; and 1,000 or more.

we restricted the matched treated and control businesses to have started in the same year. Due to within-State and same-industry matching using up to two SIC codes (to address the fact that many businesses are involved in multiple industries), unobserved industry- and State-specific differences are taken into account. We also matched based on rural/urban county, taking into account rural-urban differences, such as access to markets and agglomeration effects, which differ between urban and rural economies.

The exact matching creates a situation where some treated businesses have more control observations than other treated businesses. Following a recommendation by Ho et al. (2007), we use all matched controls (up to 295,334) for each treated establishment (variable ratio matching) in our estimation.[34] As pointed out by Ho et al. (2007), this procedure reduces variance without any increase in bias and dominates other restricted sampling frames such as one-to-one and one-to-two (or one-to-n) matching. Weights need to be incorporated when using variable ratio matching since the number of matched controls for each treated observation varies (Ho et al., 2007; Stuart, 2010). Control observations are given a weight that is inversely proportional to the number of controls matched to a particular treated business (Stuart, 2010). For example, if one treated establishment is matched with only one control, that control receives a weight of 1. If another treated establishment is matched with five controls, each of those controls receives a weight of 1/5.

Using a methodology similar to that of the present study, Stevenson (2016) found a positive and significant impact of VAPG on business survival. The Stevenson (2016) study investigated the impact of VAPG on business survival in Iowa and North Carolina. It used data on VAPG recipients from 2001 to 2011 in Iowa and North Carolina and National Establishment Time-Series (NETS) data from 1990 to 2011 to conduct a survival analysis. The grant recipients were matched with a group of nonrecipient businesses by constraining them to be in the same State, have the same start year, and be in the same industry. The study found that VAPG recipients had a better chance of survival, compared to the comparison group, but that the size of the grant had no impact on survival.

Our study differs from the Stevenson (2016) study in several ways. While Stevenson (2016) studied only survival, we study both survival and employment growth of recipient businesses. Stevenson (2016) limited the analysis to two States but our study encompasses the entire country. Furthermore, we used a broader set of criteria to select a comparison group of businesses: in addition to the three categories used in Stevenson (2016), we used same establishment type category (independent establishment versus branch or headquarters of a multi-establishment firm), located in the same metro or nonmetro type of county, same age group prior to receiving a grant, and same employment size in 3 years prior to the loan receipt. Matching using pre-grant age and growth variables is critical to ensure that the two types of businesses being compared had similar age and growth trends prior to receiving a grant, since these factors are important determinants of business survival.

Estimation Methods

Survival analysis

The first question we analyze is whether being a VAPG recipient increases the probability of survival. We calculate the survival time using the length of time that passes from the grant receipt

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[34]We thank an anonymous reviewer for leading us to take this direction as opposed to one to n (one-to-one, one-to-two, etc.) matching scenarios.

year for a particular establishment until it ceases to exist or until the end of the period considered: 2 years, 4 years, and 6 years after the grant in the present case. This exercise results not only in the number of years an establishment has survived but, for those establishments that continue to survive after the end of the period considered, the minimum years an establishment has survived. In other words, it is the length of time the establishment was exposed to the risk of "failure." The censored nature of survival data leads to an important question: If an establishment has survived until a particular point in time, then what is the probability that it will exit in the next short interval of time? The literature defines this aspect of the probability function of survival as the hazard rate.

The application of a hazard model (Cox, 1972) for likelihood of firm survival has become a routine method for survival data used in the empirical literature since Audretsch and Mahmood (1994). In this paper, we estimate the probability of exit using a discrete-time proportional hazard model, which is more effective in handling right-censored duration data that are observed in discrete (yearly) rather than continuous-time (Cameron and Trivedi, 2005; Jenkins, 2005). Using Jenkins' (1995) notation (see also Zucchelli et al., 2010), $t = \tau$ represents the treatment year, $t = 1$ is the first year at which an individual is at risk of exit after treatment. At the end of the time period, some establishments will have exited ($\delta_i = 1$) and some will still be in business (censored, $\delta_i = 0$). $t = \tau + s_i$ is the year in which an establishment exits if $\delta_i = 1$ and the final year of our data period if $\delta_i = 0$. The probability of exit at each t provides information on the duration distribution and the discrete-time hazard rate is:

(1) $\qquad h_i(t) = \Pr(T_i = t \mid T_i \geq t; X_{it})$

where T_i is a discrete random variable representing the time at which establishment exit is observed, t is a specific value of T, and X_{it} is a vector of co-variates. The conditional probability of observing the event history of an establishment with an uncompleted spell at next year is:

(2) $\qquad \Pr\left(T_i > t \mid T_i > \tau - 1; X_{it}\right) = \prod_{t=\tau}^{\tau+s}(1 - h_{it})$

The conditional probability of observing the event history of an establishment completing a spell between τ and next time period is:

(3) $\qquad \Pr\left(T_i > t \mid T_i > \tau - 1; X_{it}\right) = \left(\dfrac{h_{i\,\tau+si}}{1 - h_{i\,\tau+si}}\right) \prod_{t=\tau}^{t=s}(1 - h_{it})$

The corresponding log-likelihood of observing the event history data for the whole sample is:

(4) $\qquad logL = \sum_{i=1}^{n} \delta i\, log\left(\dfrac{h_{i\,\tau+si}}{1 - h_{i\,\tau+si}}\right) + \sum_{i=1}^{n}\sum_{t=\tau}^{\tau+si} log(1 - h_i)$

Empirically, we use a complementary log–log specification to accommodate the underlying discrete time when a survival spell of an establishment ends. The specification for the hazard rate is (Jenkins, 1995):

(5) $\qquad h_i(t) = 1 - \exp\left\{-\exp\left[\theta(t) + \beta' X_i\right]\right\}$

where $\theta(t)$ is the baseline hazard modeled using dummy variables to represent each year at risk. Rather than specifying a specific functional form, we perform a nonparametric estimation of the

baseline hazard by including duration-interval-specific dummy variables for each year an establishment is at risk of going out of business.

Duration (time) is treated as a discrete variable because the data are available on a yearly basis. The estimation method allows for a fully nonparametric estimation of the baseline hazard. The baseline hazard is specified using a nonparametric approach by specifying the duration-dependent terms representing the establishment age after receipt of the VAPG, which enter into the estimation as dummy variables, one for each spell year at risk. Even though we used matching and control for several business-level observable characteristics, the hazard rates of businesses may still differ from each other due to unobserved heterogeneity that can result in inaccurate results (Jenkins, 2005). An estimation without considering unobserved heterogeneity may result in overestimation of the negative duration dependence or an underestimation of the effect of the explanatory variables on the hazard (van den Berg, 2001, cited in Zucchelli et al., 2010). In the estimation, we incorporate unobserved heterogeneity in a discrete-time duration framework and apply a nonparametric approach to test if unobserved heterogeneity is a factor and report the results accordingly.[35]

Growth regressions

We estimate the effect of VAPG on establishment-level employment growth using ordinary least squares regressions. The regressions provide estimates of the impact of VAPG, while controlling statistically for several other firm-level characteristics. Our estimation focuses on the impact of whether a business received a VAPG as well as the impact of the size of the grant. As in the survival analysis, we limit the time intervals around which we calculate employment growth to focus on several years after the grant receipt. More specifically, we focus on the change in employment in a particular establishment for 2 years, 3 years, and 4 years after a grant.

Following Brown and Earl (2017), the following regression equation is used to estimate the effects of the VAPG program on employment growth:

$$\Delta y_{it1} = \alpha_t + X_{it0}\beta + VAPG_{it0} Y + \lambda_j + u_{it1},$$

where Δy_{it1} is the change in the number of employees over a specified period. For example, the 2-year growth is calculated as $\Delta y_{it2} = (y_{it1} + y_{it2})/2 - (y_{it0} + y_{it-1} + y_{it-2})/3$; i indexes firms from 1 to I, t_0 indexes the year of grant receipt for grant recipients (or for nonrecipients, the year the matched grant recipient received a grant) and t_1 indexes the years after the grant; α_t is a vector of year dummies for grant cohorts, X_{it0} is a set of covariates in the year of the grant receipt, and β is the vector of related parameters; $VAPG_{it0}$ is either an indicator variable for receipt of a VAPG in year t_0 or the amount of the VAPG (which equals 0 for control firms); Y is the grant effect of interest; λ_j is a fixed effect for each treated businesses and its matched controls; and u_{it1} is an idiosyncratic error term. Most studies that use matching and regression analysis (Boehmer et al., 2013; O'Keefe, 2004; Fryer, 2014; Brown and Earle, 2017) include matched-pair fixed effects in the regression. This essentially removes any idiosyncratic differences between the matched establishments.

Specifically, we consider in separate regressions t_1 to be 2 years, 3 years, or 4 years after the grant receipt (t_0). We use a similar procedure to that of Brown and Earle (2017) to calculate the dependent

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[35]While unobserved heterogeneity must be taken into account, the choice of exact specification is less important. Studies have used Gamma distribution and normal distribution when estimating discrete-time duration models with unobserved heterogeneity (Zucchelli et al., 2010). We assume a normal distribution in the models that address unobserved heterogeneity.

variable for three growth periods mentioned above: change in employment after 2 years, 3 years, and 4 years of a grant. More specifically, the dependent variable is calculated as the change in average employment from 3 years before the treatment to average of 2 years, 3 years and 4 years after the treatment.

The econometric analysis of employment growth after receipt of a VAPG can be complicated by the fact that we only observe growth rates for continuing establishments and not for establishments that have exited. This leads to the question of how the processes of exit and growth are connected (Oberhofer, 2012, Hölzl, 2014). To address this issue, following Brown and Earle (2017), we imputed zero employment for the year that an establishment exited and for subsequent years, and included those businesses in the analysis.

Survival and growth analysis results

Duration models were estimated in STATA using the xtcloglog command (Jenkins, 2005), which assumes normally distributed unobserved heterogeneity.[36] We created duration-interval-specific dummy variables, one for each spell year at risk after the treatment. The exponentiated coefficients reported in the tables are called hazard ratios, which reflect the relative hazard rates (or the chances of making a transition out of the current State at each time period conditional on survival up to that point) (Jenkins, 2005). For example, the hazard ratio of 0.111 for VAPG receipt in the 2-year survival column of table A1 can be interpreted as the ratio of the hazard rate for VAPG-recipient businesses that survived at least 2 years after receiving a VAPG to the hazard rate for comparable non-VAPG-recipient businesses. A value of 0.111 means that the hazard rate for VAPG recipients was about 89 percent less than the hazard rate for comparable non-VAPG recipients.

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[36]A STATA program explained by S. Jenkins that implements the cloglog model with nonparametric unobserved heterogeneity is available inside STATA, typing ssc install hshaz.

Table A1

Hazard analysis after the VAPG: (1) 2 years, (2) 4 years, and (3) 6 years

Variable	VAPG participation			VAPG amount		
	2-year survival	4-year survival	6-year survival	2-year survival	4-year survival	6-year survival
VAPG receipt (1,0)	0.111***	0.289***	0.433***			
Real VAPG amount				0.532***	0.694***	0.720***
Independent establishment (1,0)	0.003***	0.064***	0.118***	0.004***	0.046***	0.146***
Establishment age	0.662***	0.764***	0.814***	0.668***	0.766***	0.895***
Age squared	1.014**	1.009**	1.006**	1.013**	1.008**	1.001***
Establishment size	0.258***	0.528***	0.589***	0.279***	0.526***	0.765***
Size squared	1.071***	1.034**	1.026**	1.070***	1.033**	1.006***
CRA loans per capita	1.049	1.290	1.206	1.068	1.266	0.915***
Bank deposits per capita	0.997	0.997	0.994	0.999	0.996	1.001***
Industry employment growth	0.990	1.002	1.004	0.990	1.002	0.989***
Total employment growth	0.970	1.011	1.008	0.967	1.007	1.002*
No. of observations	275,517	275,517	275,517	275,517	275,517	275,517
LR test	121.8***	34.82***	13.97***	115.5***	32.09***	57.81***

Notes: This table presents hazard analysis with unobserved heterogeneity, using one to all controls matching. Since the number of matched controls for each treated observation varies, control groups were given a weight that is inversely proportional to the number of controls matched to their treated business. The likelihood ratio test suggests statistically significant heterogeneity, rejecting the model without unobserved heterogeneity. ***indicates significance at the 0.01 level, ** indicates significance at the 0.05 level, and * indicates significance at the 0.10 level. Reported coefficients in the table are hazard ratios (exponentiated coefficients): A hazard ratio in the present case explains how often an establishment exits in one group of establishments compared to how often it happens in another group of establishments, over time. A hazard ratio less (greater) than 1 implies a decrease (increase) in the risk of exit associated with that variable. Reduction in risk of exit is calculated as 1 minus the hazard ratio. A hazard ratio of one means that there is no difference in risk between the two groups. For example, the first column of results in the table shows that with a VAPG, risk of exit of recipients 2 years after the grant decreased by about 90% (i.e., 1-0.111 = 0.889). Similarly, risk of exit decreased by 71% 4 years after the grant, and decreased by 57% 6 years after the grant.
VAPG = Value-Added Producer Grant; CRA = Community Reinvestment Act; LR test = Likelihood-ratio test.
Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service and National Establishment Time-Series.

Table A2
Employment growth regression results

Variables	VAPG participation			VAPG amount		
	Year 2	Year 3	Year 4	Year 2	Year 3	Year 4
VAPG receipt (1,0)	5.393*** (1.936)	5.570*** (1.94)	5.743*** (1.950)			
Real VAPG amount				3.999*** (1.210)	4.073*** (1.216)	4.197*** (1.224)
Establishment age	2.484*** (0.940)	3.299*** (1.149)	3.548*** (1.269)	1.502 (0.947)	2.292** (1.161)	2.510** (1.286)
Age squared	-0.104*** (0.032)	-0.136*** (0.039)	-0.148*** (0.044)	-0.068** (0.031)	-0.099*** (0.039)	-0.11*** (0.044)
Establishment size	38.39 (27.74)	42.34* (25.92)	48.72** (24.14)	38.68 (27.41)	42.64* (25.61)	49.03** (23.83)
Size squared	-5.23* (2.837)	-5.80** (2.623)	-6.56*** (2.408)	-5.31* (2.800)	-5.88** (2.587)	-6.64*** (2.371)
Independent establishment (1,0)	-77.5 (299.4)	-128.9 (290.6)	-187.4 (281.4)	-82.7 (296.2)	-134.2 (287.6)	-192.9 (278.4)
County CRA loans per capita	1.702 (1.571)	1.702 (1.582)	1.421 (1.594)	1.979 (1.588)	1.870 (1.599)	1.708 (1.611)
County bank deposits per capita	0.006 (0.006)	0.006 (0.006)	0.007 (0.006)	0.003 (0.006)	0.004 (0.006)	0.004 (0.006)
County industry employment growth	-0.292* (0.162)	-0.304* (0.163)	-0.317** (0.165)	-0.288* (0.161)	-0.299* (0.163)	-0.312* (0.164)
County total employment growth	0.051 (0.084)	0.058 (0.086)	0.063 (0.088)	0.104 (0.091)	0.111 (0.093)	0.118 (0.096)
Constant	7.626 (273.4)	31.074 (268.7)	75.571 (263.2)	6.417 (270.8)	45.380 (266.2)	90.313 (260.8)
Grant year indicators	Yes	Yes	Yes	Yes	Yes	Yes
Matched FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	275,517	275,517	275,517	275,517	275,517	275,517
R-squared	0.50	0.51	0.52	0.51	0.51	0.52

Notes: The dependent variable, employment change, is calculated as the change in average employment from 3 years before the treatment to average of 2 years, 3 years and 4 years after the treatment. Since the number of matched controls for each treated observation varies, control groups were given a weight that is inversely proportional to the number of controls matched to their treated business. ***indicates significance at the 0.01 level, ** indicates significance at the 0.05 level, and * indicates significance at the 0.10 level. Robust standard errors are in parentheses.

VAPG = Value-Added Producer Grant; CRA = Community Reinvestment Act.

Source: USDA, Economic Research Service using data from USDA's Rural Business-Cooperative Service and National Establishment Time Series.