

2016

A Pilot Benefit and Cost Analysis Study of Sponsors of Registered Apprenticeships in Maine

Jonathan R. Payne PhD

University of Southern Maine, Muskie School of Public Service

Follow this and additional works at: <https://digitalcommons.usm.maine.edu/etd>

 Part of the [Public Policy Commons](#)

Recommended Citation

Payne, Jonathan R. PhD, "A Pilot Benefit and Cost Analysis Study of Sponsors of Registered Apprenticeships in Maine" (2016). *All Theses & Dissertations*. 300.
<https://digitalcommons.usm.maine.edu/etd/300>

This Open Access Dissertation is brought to you for free and open access by the Student Scholarship at USM Digital Commons. It has been accepted for inclusion in All Theses & Dissertations by an authorized administrator of USM Digital Commons. For more information, please contact jessica.c.hovey@maine.edu.

**A PILOT BENEFIT AND COST ANALYSIS STUDY OF SPONSORS OF
REGISTERED APPRENTICESHIPS IN MAINE**

By

Jonathan R. Payne

B.S. University of New Hampshire, 2001

M.S. University of Southern Maine, 2010

A DISSERTATION

Submitted in Partial Fulfillment of the

Requirements of the Degree of

Doctor of Philosophy

In Public Policy

The University of Southern Maine

August 2016

Advisory Committee:

Catherine Fallona, Professor, Education and Human Development,
Advisor

David Silvernail, Professor Emeritus, Educational Leadership

Charles Colgan, Professor Emeritus, Public Policy and Management

© 2016 Jonathan Read Payne

All Rights Reserved

LIBRARY RIGHTS STATEMENT

In presenting this dissertation in partial fulfillment of the requirements for an advanced degree at the University of Southern Maine, I agree that the Library shall make it freely available for inspection. I further agree that permission for "fair use" copying on this thesis for scholarly purposes may be granted by the Librarian. It is understood that any copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Signature:

A handwritten signature in black ink, consisting of a series of loops and a long horizontal stroke extending to the right.

Date:

12/5/16

A BENEFIT AND COST ANALYSIS OF SPONSORING REGISTERED
APPRENTICESHIP FOR BUSINESSES IN MAINE

By

Jonathan R. Payne

B.S. University of New Hampshire, 2001

M.S. University of Southern Maine, 2010

Approved by:



Catherine Fallona, Chair



David Silvernail, member



Charles Colgan, member

**PILOT BENEFIT AND COST ANALYSIS STUDY OF SPONSORS OF
REGISTERED APPRENTICESHIP IN MAINE**

By Jonathan R. Payne

Dissertation Advisor: Dr. Catherine Fallona

AN ABSTRACT OF THE DISSERTATION

Submitted in Partial Fulfillment of the

Requirements of the Degree of

Doctor of Philosophy

in Public Policy

August, 2016

A skills gap exists in Maine because of lack of diversity in educational opportunity offered to students. Preparation for college and career readiness has become conflated. High schools focus primarily on core academic knowledge, often forsaking the knowledge necessary to prepare for jobs that do not require college educations. College is not for everyone, and some students fail to graduate, leaving them without a credential, often in debt, and lacking any skills that would lead to meaningful employment.

In countries across the European Union, the United Kingdom, and Canada those issues are addressed through apprenticeship, and empirical research suggests that sponsoring apprenticeship is beneficial for the apprentices, their employers, and society

at large. The research also suggests, however, that cost plays a significant factor in a business' decision to sponsor apprenticeship. To date, no benefit-cost analysis for sponsors of apprenticeship has been conducted in the United States.

Therefore, this research performs a pilot benefit-cost analysis study for sponsors of Registered Apprenticeship in Maine. To do so, a mixed methodology consisting of an intake interview, accounting framework, and exit interview was conducted with eight sponsors -- three trade unions and five businesses -- of Registered Apprenticeship across southern and central Maine.

This research found that six of the eight sponsors saw monetary benefits as a result of sponsoring an apprentice through Registered Apprenticeship. It is likely that all sponsors would realize a monetary benefit if the non-monetized benefits were to be monetized. That is because the research also found that sponsors see benefits to recruitment, retention, and advancement, as well as in the ability to invest in and shape the training of their employees, which factor was not monetized in this research.

This study also recommends three additional areas of research that would assist policymakers and educators to better prepare the workforce. First, focus on increasing empirical research of the benefits and costs across all sectors. Second, proliferate the new empirical research of the benefits of apprenticeship and increase implementation of Registered Apprenticeships. Third, increase labor union involvement and engagement in establishing and maintaining Registered Apprenticeships.

ACKNOWLEDGEMENTS

I would like to thank my advisor, Dr. Catherine Fallona, for her support and guidance throughout my dissertation. I would like to thank the other two panel members, Dr. David Silvernail, and Dr. Charles Colgan for their expert tutelage. Arron Sturgis of Preservation Timber Framing hired me years ago as an apprentice, and introduced me to the trades. For that he also has my thanks.

I would like to thank the representatives of businesses and unions that gave up their valuable time to take part in my sampling process. The institutional knowledge of those individuals helped to shape my methodology. Joan Dolan at the Maine Department of Labor is due thanks for her help in facilitating my ability to contact members of the sample, and for her willingness to give me her valuable time as well.

I would like to thank my friends for their continued support and understanding of my absence over the last four years. Specifically, I would like to thank Ken Pittman for his time as one of my original readers.

Lastly, I need to thank my family. My mother, Mary, and father, George, gave their support throughout this process, and through my life writ large. As an only child, I have no doubt of where they think the sun rises and sets. My step-daughter Caylie, kept me going by saying, “You can do it, Jonny” at the perfect time every time. And finally, to the love of my life, my wife, Stacie, my anchor, who keeps me safe through every storm.

Table of Contents

LIST OF TABLES	ix
LIST OF FIGURES	xi
LIST OF EQUATIONS	xi
CHAPTER ONE: INTRODUCTION	1
Introduction	1
Statement of Problem	7
Purpose of the Study	10
Significance of the Study	11
Limitations and Delimitations	13
CHAPTER 2: LITERATURE REVIEW	15
Introduction	15
The Path of Education in the United States	15
Engagement of Labor Unions in Apprenticeship in the United States	22
The Dual-System Countries: Australia, Austria, Germany, and Switzerland	25
Introduction to Economic Analysis	29
Cost-Benefit Analysis of Apprenticeship in Europe	32
Cost-Benefit Analysis of Apprenticeship in the United Kingdom	35
Cost-Benefit Analysis of Apprenticeship in Canada	46

Cost-Benefit Analysis of Apprenticeship in the United States	51
Summary	52
CHAPTER THREE: THEORETICAL FOUNDATIONS	59
Introduction	59
The Special Case of Unions	63
CHAPTER FOUR: METHODOLOGY	69
Introduction to the study	69
Methodological Overview	71
Research Context.....	72
Data Collection.....	73
Data Analysis	74
CHAPTER FIVE: RESULTS	78
Introduction	78
Labor Unions.....	78
Union A	79
Union B.....	86
Union C.....	93
Summary of Union Results	101
Construction	102

Business A	102
Health and Social Services	109
Business B	110
Business C	117
Business D	123
Manufacturing	130
Business E.....	130
Summary of Business Results	135
CHAPTER SIX: CONCLUSIONS	137
Benefits.....	137
Monetary Benefits	137
Non-monetized Benefits	141
Other Findings.....	145
Limitations of the Study	146
Future Research.....	147
Policy Implications.....	151
REFERENCES	154
APPENDIX A: DEFINITIONS	161
APPENDIX B: APPRENTICESHIP SECTORS.....	162

(Maine Department of Labor, 2014)	162
APPENDIX C: INTAKE INTERVIEW	164
APPENDIX D: EXIT INTERVIEW	165
APPENDIX E: INITIAL CONTACT LETTER.....	166
BIOGRAPHY OF THE AUTHOR.....	167

LIST OF TABLES

Table 2-1: Outline of accounting framework of the costs and benefits of training	38
Table 2-2: Variables and Definitions.....	41
Table 2-3: Net Costs by Sector	42
Table 2-4: Benefit-cost Spreadsheet	45
Table 3-1: Summary of Costs and Benefits for Unions and Businesses.....	67
Table 5-1: Annual Cost Incurred by a Business for Sponsoring an Apprentice from Union A.....	83
Table 5-2: Annual Revenue per Apprentice from Union A.....	84
Table 5-3: Annual Revenue Realized by a Business for Sponsoring an Apprentice from Union A.....	84
Table 5-4: Net Present Value Realized by a Business for Sponsoring an Apprentice from Union A.....	85
Table 5-5: Annual Costs Incurred by a Business for Sponsoring an Apprentice from Union B.....	90
Table 5-6: Annual Revenue per Apprentice from Union B.....	91
Table 5-7: Annual Revenue Realized by a Business for Sponsoring an Apprentice from Union B.....	91
Table 5-8: Net Present Value of Sponsoring an Apprentice for Union B	92

Table 5-9: Annual Costs Incurred by a Business for Sponsoring an Apprentice from Union C.....	97
Table 5-10: Annual Revenue per Apprentice from Union C.....	98
Table 5-11: Annual Revenue Realized by a Business for Sponsoring an Apprentice from Union C.....	99
Table 5-12: Net Present Value of Sponsoring an Apprentice for Union C	99
Table 5-13: Summary of the Sector and Net Present Value	101
Table 5-14: Annual Cost of Sponsoring an Apprentice for Business A.....	105
Table 5-15: Annual Revenue per Apprentice for Business A.....	107
Table 5-16: Annual Revenue of Sponsoring an Apprentice for Business A	107
Table 5-17: Net Present Value of Sponsoring an Apprentice for Business A.....	107
Table 5-18: Annual Cost of Sponsoring Apprenticeship for Business B	112
Table 5-19: Annual Revenue per Apprentice for Business B.....	114
Table 5-20: Annual Revenue of Sponsoring an Apprentice for Business B.....	115
Table 5-21: Net Present Value of Sponsoring an Apprentice for Business B	116
Table 5-22: Annual Costs for Sponsoring an Apprentice for Business C	119
Table 5-23: Annual Revenue per Apprentice for Business C.....	120
Table 5-24: Annual Revenue of Sponsoring an Apprentice for Business C.....	121
Table 5-25: Net Present Value of Sponsoring an Apprentice for Business C	122

Table 5-26: Annual Costs for Sponsoring an Apprentice for Business D	125
Table 5-27: Annual Revenue per Apprentice for Business D.....	127
Table 5-28: Annual Revenue of Sponsoring an Apprentice for Business D	128
Table 5-29: Net Present Value of Sponsoring an Apprentice for Business D	128
Table 5-30: Annual Cost of Sponsoring an Apprentice for Business E	132
Table 5-31: Annual Revenue per Apprentice for Business E	134
Table 5-32: Annual Revenue of Sponsoring an Apprentice for Business E	134
Table 5-33: Net Present Value of Sponsoring an Apprentice for Business E	135
Table 5-34: Summary of Sector and Net Present Value	135

LIST OF FIGURES

Figure 2-1: Stylized Model of Apprenticeship Training.....	50
--	----

LIST OF EQUATIONS

Equation 2-1: Net Cost of Apprenticeship by Dionisius et al. (2008)	33
Equation 2-2: Cost of Apprenticeship by Dionisius et al. (2008).....	33
Equation 2-3: Benefit of Apprenticeship by Dionisius et al. (2008)	34
Equation 2-4: Total Cost of Apprenticeship by Gamin, Hasluck and Hogarth (2010).....	40
Equation 2-5: Total Benefit of Apprenticeship by Gambin, Hasluck, and Hogarth (2010)	40

Equation 2-6: Net Cost of Apprenticeship by Gambin, Hasluck, and Hogarth (2010)	40
Equation 2-7: Net Present Value of Apprenticeship by Gambin, Hasluck, and Hogarth (2010)	43
Equation 4-1: Annual Costs to a Sponsor of RA in Maine	75
Equation 4-2: Annual Revenues to a Sponsor of RA in Maine as Calculated by Marginal Product Value Generated by the Apprentice	75
Equation 4-3: Annual Revenue to a Sponsor of RA in Maine as Calculated by Marginal Productivity of the Apprentice	76
Equation 4-4: Present Revenue Received by an RA Sponsor	77
Equation 4-5: Present Cost Incurred by an RA Sponsor	77
Equation 4-6: Net Present Value Realized by an RA Sponsor	77
Equation 6-1: Simplified Cost Equation	147

CHAPTER ONE: INTRODUCTION

Introduction

According to a Deloitte University Press publication, Manufacturing Opportunity (Giffi, 2012), there were 600,000 unfilled manufacturing jobs in the United States because "...employers can't find people with the right skills." Along with those unfilled positions, seventy-four percent of manufacturers indicated that employee shortages or inadequate talent were limiting the businesses' ability to expand, and to increase productivity. Furthermore, Giffi estimated that filling those 600,000 jobs, along with 500,000 new jobs from manufacturing growth and the 2.75 million new jobs in related industries overall unemployment could be reduced by a total of 3.85 million workers (Giffi, 2012).

The Boston Consulting Group (BCG) "...estimates that the shortage of high skill manufacturing workers could worsen to approximately 875,000 machinists, welders, industrial machinery mechanics, and industrial engineers by 2020" (Olinsky & Ayers, 2013, p. 6). According to a RAND Corporation analysis, the decline of the U.S. machine-tool industry was in part due to the firms' disinvestment in worker training and "...the collapse of the apprenticeship system that was the main source of skilled labor" (Olinsky & Ayers, 2013, p. 6).

That disinvestment in the American workforce was seen in Manpower Group's Talent Shortage Survey (2011-2014) in which the research revealed that approximately one-half of U.S. employers have had difficulty filling jobs, compared to approximately

one-third of global employers seeking to fill the same positions (ManpowerGroup, 2014). In 2009, the Business Roundtable surveyed employers, and found that sixty-one percent had difficulty filling vacancies for skilled workers. Finally, two-thirds of American manufacturers surveyed by the Manufacturing Institute reported they were experiencing a shortage of qualified workers (Morrison, et al., 2011). Moreover, the hardest jobs to fill were in skilled trades, which show the existence of skills mismatches, especially for many technical jobs requiring mastery of specific occupational tasks (Smith & Kemmis, 2013).

Those same skills gaps that are evident on a national level also exist in Maine. According to the National Skills Coalition (NSC), “middle-skill jobs, which require education beyond high school but not a four-year degree, make up the largest part of America’s and Maine’s labor market” (National Skills Coalition, 2014). Fifty-three percent of all jobs in Maine required some additional post-secondary training, but not a four-year college degree, and forty-nine percent of the positions generated between 2010-2020 will fall within that middle-skill area. But only forty-eight percent of the workers being trained in Maine are being aimed at those mid-skill jobs. Thus, less than half those educated in Maine today will meet the skills needs for seventy-five percent of the jobs that will exist in the state in 2020. Apprenticeship represents a promising training alternative to fulfill both the current and projected middle-skill training deficit.

Apprenticeship offers an alternative secondary and post-secondary pathway in education in Europe and plays a major role in education and training. In Europe

apprenticeship also offers a path to good paying middle class jobs, and helps to establish robust economies. Countries like Austria, Germany, and Switzerland have long traditions of apprenticeship embedded in their cultures and reflected in their countries educational systems. Apprenticeship is so much a part of the fabric of the educational systems that is known as the Dual Education System where apprenticeship with a company and vocational education at school exist within the same program. In addition, countries like France, Denmark, the Netherlands, and the United Kingdom have sizable apprenticeship systems, and are currently working to expand them. In the United States, however, “few high school students and graduates are aware that...they can achieve a long-term career and a substantial wage premium without a four-year degree... apprenticeships should be an appealing avenue into the workforce for the one in three high school graduates today who do not immediately go on to seek a four-year degree” (Olinsky & Ayers, p. 20). The educational system in the United States continues to rely almost entirely on academic institutions that focus on policies to increase academic attainment, especially through college (Smith & Kemmis, 2013).

Apprenticeships are drastically underutilized as a standard part of the development and training of the American workforce. “The United States has only 358,000 registered apprentices... [With] only 21,000 unique programs nationwide. By comparison, Germany has 1.8 million apprentices [with] 500,000 sponsoring companies despite having a population less than one-third of that of the United States” (Olinsky & Ayers, 2013, p. 16). In England during the 2011-2012 academic year, more than half million new entrants were registered for apprenticeships. Were that ratio applied to the

United States population, it would mean 2.5 million U.S. entrants. As such, the total of 104,332 U.S. entrants seems woefully inadequate (Olinsky & Ayers, 2013, p. 16).

There are some underlying challenges with the implementation, adoption, and proliferation of apprenticeship programs globally as well as within the United States. These issues have been identified by Olinsky & Ayers (2013) and the Organisation for Economic Co-operation and Development (OECD) (2012), as:

- poor understanding of apprenticeships based on social perceptions of vocational education being for the unintelligent or as a selection-by-failure
- occupations limited to traditional sectors, such as construction and manufacturing, which are largely male dominated
- insufficient positions supplied for the number of applicants
- disjointed communication between government labor and education administrations
- inconsistent certification standards or lack of certification upon completion
- lack of coordination with the educational system
- reduced unionization in the United States and a lack of cooperation between employers and trade unions
- perceived costs for sponsors
- lack of research

Those factors are echoed in studies conducted throughout the European Union in countries like Austria, Germany, Switzerland, the Netherlands, the UK, and in Canada.

Researchers in those countries have sought to analyze the costs and benefits of apprenticeship to the apprentices, employers, and society. Specifically, empirical research conducted in Switzerland showed that employers' engagement in apprenticeships was significantly influenced by the net cost of the programs, through the direct or indirect costs of training (Dionisius, et al., 2008).

While there are similar facets in both economic and educational structures in the aforementioned EU countries to those of the US, it is likely more *dissimilarity* exist. Therefore, the economic contexts can likely be too easily dismissed, so further research in the U.S. is required. For example, in many of the dual-system countries apprenticeship positions are supplied to meet the demand for positions by enrolling apprentices. If employer-provided positions become saturated, apprentices are placed in government-funded training schools until positions in the private sector become available. In the United States, providing Registered Apprenticeship (RA) programs is voluntary; companies will supply positions only as long as they see a benefit from doing so. That benefit could be the marginal productivity in each new apprenticeship position created. It could also be non-monetized benefits such as increased retention, increased promotion pool, increased workplace safety, increased work quality, increased customer satisfaction or increased workplace diversity.

According to the Chartered Institute of Personnel and Development (2012) the key benefits of apprenticeship as found by the National Apprenticeship Service are:

- a more engaged workforce
- a more motivated and satisfied workforce
- lower staff turnover
- fewer skills-related vacancies
- lower recruitment costs
- a more productive workplace
- a better sponsor-reputation
- greater customer satisfaction

Such benefits clearly extend beyond the apprentice/sponsor relationship and impact the consumer as well. Ultimately, the financial benefits of all those factors can lead to increased income for the sponsor and the apprentice, which translates to higher tax revenues for society, and subsequently a net benefit to society as a whole in the increased ability to provide social goods and services. They also work to eliminate the potential drain on social resources which occurs because of under-skilled and under-employed workers.

Because of those cumulative benefits the Chartered Institute of Personnel and Development (2012) suggests apprenticeship be thought of as a long-term solution to workforce growth and development by ensuring that skill needs are met now and in the future. The report points out that forty-one percent of employers state that apprentices

make valuable contributions to organizations during their training periods, sometimes as early in the training period as the first weeks. In fact, in *Why Companies Invest in “Grow Your Own” Talent Development Models*, Corporate Voices for Working Families found that companies believe “...the *intangible* benefits are as nearly or fully important as the *tangible* ones...” (Corporate Voices for Working Families, 2011)

In light of the findings of Dionisius, et al. that the non-monetized benefits to recruitment, retention, advancement, customer satisfaction, employee happiness, increased productivity, and improved workplace safety can be difficult to measure and/or to monetize, they often remain an uncertainty. As such, sponsors often look to justify apprenticeship through simple benefit-cost analysis, research data which is currently lacking in the United States. Voids in information regarding employer’s perceived costs and benefit-cost ratio for sponsoring apprenticeship may be preventing U.S. companies from sponsoring Registered Apprenticeships. That is likely especially true for small businesses whose profit margins are smaller, and which are subsequently less tolerant of potential negative economic consequences of sponsoring apprenticeships.

Statement of Problem

As yet there has been only one comprehensive study of the Registered Apprentice system in the United States. Conducted by Mathematica Policy Research, *An effectiveness assessment and cost-benefit analysis of Registered Apprenticeship in 10 states* (Reed, et al., 2012) sought to answer four essential research questions:

- Is Registered Apprenticeship effective in raising the annual earnings and employment of participants?
- Do the total social benefits of Registered Apprenticeship outweigh the total social costs?
- What are the experiences of women in Registered Apprenticeship and what can be done to further promote their success in the program?
- Are there differences between the Registered Apprenticeship programs of states administered by the Office of Apprenticeship and states administered by State Apprenticeship Agencies?

To answer these questions Reed, et al. used a purposive sampling technique to select 10 states with “...vary[ing] program features and labor market characteristics, including program size, region, the degree of union representation in the state, administrative type (federal or state), and the degree to which RA is concentrated in a few occupations” (p. xiii). Florida, Georgia, Iowa, Kentucky, Maryland, Missouri, New Jersey, Ohio, Pennsylvania, and Texas were selected. The researchers examined programmatic effectiveness by “...the association between RA and employment and earnings over a period of up to nine years following entrance into the RA program” (p. 7). The cost-benefit analysis was done using the measurement of costs and benefits over that same nine-year period, and those data were extrapolated to form career-long estimates. Along with the two quantitative pieces, qualitative data was also collected using semi-structured telephone interviews with state level apprenticeship directors.

The Mathematica research found that Registered Apprenticeship participants made more than non-participants, and that overall the costs of apprenticeship were outweighed by the benefits. These findings are largely supported in previous research conducted worldwide. What was most interesting about the research was that in the calculation of social benefits, only worker productivity and reduced social dependence were included as benefits, while only the governmental cost of administering RA programs and the cost of off-the-job training were included as costs. The employer was left completely out of the calculation of social benefit because, as the researchers state, "...we assumed that employers' net benefits are zero. We made this assumption because we do not have measures of costs and benefits for employers" (p. xvii). They go on to say that they expect employers to have a net positive benefit because of the employers' voluntary participation in RA, and that if the net positive benefit was in fact the case, then the net social benefit would also be higher.

To date there has been no data collected regarding the benefit-cost ratio for apprenticeship sponsors in Maine. The only analysis of apprenticeship in the state is conducted by The Maine Apprenticeship Program which produces an annual report detailing important aspects of the program statewide such as participant demographics, completion rates and statewide fiscal implications. The financial analysis component of *The Maine Apprenticeship Program Report* pertains to general funds dollars used in support of the program, the increased income for apprentices, and the subsequent increased tax revenue for the state. According to the Maine Department of Labor (2014), individuals who completed their programs saw an average of sixty-five percent increase

in wages from the program start to end. The program spent \$398,746 from the statewide general fund. From those monies, as a result of increased training and pursuant increased wages, the state leveraged \$73,431,915 dollars of additional tax revenue, or a return on investment of \$183 per \$1 of general fund dollars leveraged. The average annual wage of the 1,737 apprentices was \$41,870, which yielded \$5,781,946 in state income-tax revenue.

What the Maine Apprenticeship report fails to determine is the benefit-cost ratio or the non-monetized benefits for *sponsors*. Given the research findings of Dionisius, et al. (2008) indicating employers' engagement in apprenticeship was significantly influenced by the net cost of the programs, there is the potential for the lack of benefit-cost data to impact the positions offered. Therefore, the goal of this research was to perform a pilot benefit and cost analysis study for sponsors of Registered Apprenticeship in Maine.

Purpose of the Study

The purpose of this study was to perform a pilot benefit and costs analysis study for sponsors of Registered Apprenticeship in Maine. Thus a mixed methodology study collecting quantitative benefit and cost data and qualitative data pertaining to non-monetized benefits to recruitment, retention, and advancement was performed on eight sponsors in southern Maine. As part of this study the costs and benefit information was used to determine a net cost/benefit, and both intake and exit interviews were conducted

to uncover the non-monetized benefits, and to verify the findings of the benefit-cost analysis (BCA).

Significance of the Study

Apprenticeships in other countries are proven to be a win-win-win endeavor, benefiting the apprentice, the sponsor, and society. While apprenticeships in the United States continues to be “underutilized due to lack of awareness, misconceptions, or similar barriers...their return on investment should be a compelling reason for us to take a look at whether we can easily expand their use and our investment in them” (Olinsky & Ayers, 2013, p. 14). Apprentices can expect to gain future earnings and career prospects; sponsors can expect to gain a larger supply of skilled labor; and the economy can expect to gain increased productivity through more rapid innovation, lower product prices, and a more educated and knowledgeable society (International Labour Organization, 2012).

This benefit was seen by The European Commission, which states that,

Companies that engage apprentices are likely to benefit from a net profit on their investment, either during the apprenticeship or soon after by employing a fully trained worker. At the same time, [Vocational Education and Training] VET students and apprentices will be able to learn valuable workplace skills in a professional environment, ensuring a greater degree of future employability. In the long run, such schemes are likely to contribute to increased tax revenue, less welfare payments, and great levels of social inclusion for all (European Commission, 2014).

Olinsky & Ayers add to the European Commission findings by identifying further benefits of apprenticeship to society as a whole.

Estimates show that the social benefits of apprenticeships are overwhelmingly larger than social costs. In a comprehensive study on the effectiveness of apprenticeships in 10 diverse states, research found that the net social benefits were \$59,000 on average in the medium term and \$124,000 over a worker's career (p. 13).

Though not part of the Mathematica (2009) research, Washington State conducts its own review of workforce training. Apprenticeship was found to have the highest benefit-cost ratio of all the employee training programs studied. The estimated lifetime net benefit to taxpayers, after accounting for public costs, was more than \$85,000 per participant, for a return of \$23 for every public dollar invested (p. 14). Furthermore, Reed, et al. found that those who completed RA programs earned on average \$240,037 more over the course of a career than individuals in the same career who had not participated in Registered Apprenticeship, and that the estimated social benefit of the programs exceeds the cost by more than \$49,000. Not only are apprentice's wages higher upon graduation, they also earn while they learn. For example, site engineers at a D.C. International Union of Operating Engineers program earn between \$60,000 and \$80,000 per year, which translates to an apprenticeship starting pay in excess of \$30,000, "a pay level you can't earn handing out towels at the college rec center" (Kurtzleben, 2013).

Apprentices benefit as a direct result of the market-driven training provided by their sponsors.

Apprenticeships match the supply of skills with the demand from employers much more efficiently than is possible with a system of school-based full-time vocational education. They develop high level skills identified by employers as necessary for growth and increased productivity. To the extent that skills developed in apprenticeships promote higher value-added economic activity they are good for growth and for general welfare. The higher earnings associated with higher productivity provide higher tax revenue which governments can use for health, education and other general welfare measures (International Labour Organization, 2012, p. 9).

Overall, studies conducted both globally and in the U.S. have pointed towards positive benefits for the apprentices and for society. The research conducted in the EU that has examined the benefit for employers has found that at the very worst the costs are recouped within three to four years.

Limitations and Delimitations

This study was limited to the analysis of the cost-benefit analysis for sponsors of RA programs in Maine. The list of those sponsors was submitted to the Maine Department of Labor's Office of Apprenticeship in March 2014 and 2015 as part of the 2013 and 2014 Annual Reports from the Maine Department of Labor State Apprenticeship Agency.

The sample size (n=8) in this research was also a limitation. A larger sample would provide for more reliability in the cost-benefit analysis. Also, while attempts were made to try to select a sample representative of sponsors across the state, this research did not seek to disaggregate the experience for sponsors based on location, size, or demographic, and did not specifically differentiate between sponsors that are “shop based” and those that are “site based”.

The sample organizations represent only three of the six Apprenticeship Sectors identified in the Maine Department of Labor Maine Apprenticeship Program Report (2014) (See Appendix B): Health and Social Services, Construction Trades, and Manufacturing. No respondents from Administration, Public and Retail Services, Education, or Shipbuilding were willing/able to take part in the research or to provide the information requisite for participation.

The term “apprenticeship” has been associated with a variety of different meanings and ideas depending on context. This study deals specifically with apprenticeships that have been accepted by the RA program in the state of Maine, and did not include informal apprenticeships, internships, or traineeships.

This research did not seek to monetize cost savings such as decreased turnover, decreased recruitment costs, increased productivity, or decreased training costs. Neither did it seek to analyze the cost-benefit ratio nor net benefits of sponsors outside the state of Maine.

CHAPTER 2: LITERATURE REVIEW

Introduction

The purpose of this study was to perform a pilot benefit and costs analysis study for sponsors of Registered Apprenticeships in Maine, and this review of the literature has two sections. The first is a general overview of the current educational system in the United States, and a comparison of the U.S. system (which is ostensibly a single pathway) to that of the dual-system countries. That was done to provide a contextual setting for the second section of the review, which deals with financial analysis models in general and specifically with the cost-benefit analysis (CBA) that has been conducted both abroad and domestically. The second section focuses on economic analysis models (CBA,) and specifically research conducted over the past two decades, beginning with the oldest research in Germany and Switzerland, and continuing through the gradually more similar educational and social systems of the U.K. and Canada, and finishing with the Mathematica study, the only CBA conducted to date in the United States.

The Path of Education in the United States

The educational system in the United States today has firmly espoused the idea that all public school students need largely the same basic requirements. From the inception of formal education in the United States, the majority of students take the same, or similar, courses K-12 with only a small amount of variation in grades 10 through 12. As a result of *A Nation at Risk* in 1983, that has meant the New Basics curriculum. More recently those standards have been replaced by the Common Core State Standards

(CCSS), developed by the National Governor’s Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO). The ultimate goal of CCSS is to ensure that all students are “college and career ready” upon graduation from high school. Thus there is a great deal of literature around what it means to be “college and career ready.”

According to *What is “Career Ready?”* by the Association for Career and Technical Education, career readiness has three major elements. The first is the *core academic* skills typically acquired through formal classroom instruction. The second is *employability skills* such as critical thinking and responsibility that are again typically part of formal classroom instruction and acquired through the status quo K-12 academic context. The third element is *technical, job-specific skills* which relate to a specific career but which are completely absent from regular K-12 instruction in the United States, and thus must be acquired outside the regular school day (Association for Career and Technical Education, 2010).

However, there is little diversity to the pedagogical and political discussions surrounding college and career readiness, and in essence the discussion is almost exclusively about only one topic: college preparedness. While many students have the opportunity to take vocational educational classes during high school, vocational training curriculum constitutes an increasingly smaller portion of overall curriculum (U.S. Department of Education, 2004). Hence, there is a population of students whose interests are unheeded, resulting in policy decisions and pedagogical choices that are debated, and

often instituted, without consideration of the needs or desires of that population. Because the focus of high school instruction is primarily on compelling students to attend post-secondary education, there is little emphasis on the skills, knowledge, and abilities required to be work-ready.

In *Education Pays 2010: The Benefits of Higher Education for Individuals and Society* (2010), Baum, Ma, and Payea found that nationally, of the first-time, full-time students who began a bachelor's degree program at a four-year institution in 2002, only 57 percent completed this degree within *six years* from said institution. "Completion rates averaged 65% at private not-for-profit, 55% at public four-year, and 22% at private for-profit institutions" (p. 5).

The current data show that many of students that begin college do not earn a degree. The average annual cost after grants for the eight public universities in Maine was \$13,209; that cost almost doubles for the 11 private not-for-profit institutions whose average annual costs for students was \$23,159 (Trust, 2016). According to Nguyen (2012), "Those who dropped out [of college] had higher unemployment rates and made less money than those who graduated. Borrowers who dropped out were more than four times more likely to default on their loans" (p. 1). Of the 37 million borrowers in the first quarter of 2012, 14 percent have at least one past due payment, and of the almost one trillion dollars in student loan debt, \$85 million was past due (Brown, Haughwout, Lee, Mabutas, & van der Klaauw, 2012). Furthermore, from 2004 to 2009, 33 percent of undergraduate federal student loan borrowers who left without a credential became

delinquent without defaulting, and 26 percent defaulted. Essentially, that means that students who leave college without a credential have a less than a five percent chance of staying current on their student loans.

In a recent article in the Wall Street Journal, *College Grads Earn Nearly Three Times More Than High School Dropouts*, Shah states that while college graduates will statistically earn more "...new research suggests that the job opportunities of college-educated Americans may not improve much even when the economy rebounds...[leaving] young people, especially those with jobs that don't require their education...stuck between a rock and a hard place in the economy" (Shah, 2013). Consider that in 1973, just 28 percent of jobs required post-secondary education. That number jumped to 59 percent in 2008 and is predicted to reach 65 percent in 2020. To be clear, those jobs are not just for graduates of four-year colleges. It is projected that one-third of jobs will not require a four-year bachelor's degree but will require some level of postsecondary education or training, such as an associate's degree, technical certificate, or industry credential—exactly what can be offered through apprenticeship (Olinsky & Ayers, 2013, p. 4).

The fiscal results of the student loan debt crisis are felt directly by borrowers who are unable to repay their student loan debts, and indirectly by borrowers who *are* able to repay their debts but have higher interest rates as a result of others default. The social results of those educational policies, increased high-school and college dropout rates, and lack of educational specialization manifests in the seemingly ubiquitous gap that exists

between the skills and knowledge being supplied by education and those being demanded by employers and colleges. Apprenticeship offers an alternative secondary and post-secondary pathway in education, and plays a major role in education and training in Europe.

Olinsky and Ayers (2013) suggest that, "...apprenticeships should be an appealing avenue into the workforce for the one in three high school graduates today who do not immediately go on to seek a four-year degree" (p. 20). Yet, the educational system in the United States continues to rely almost entirely on academic institutions that continue to focus on policies that increase academic attainment, especially through college (Smith & Kemmis, 2013).

Apprenticeships are underutilized as a means of building human capital in the American workforce. Countries like Austria, Germany, and Switzerland have such long traditions of apprenticeship that they are known as dual-system countries. In addition, countries like France, Denmark, the Netherlands, and the United Kingdom (U.K.) also have robust apprenticeship systems they continue to bolster.

Today only about 20 percent of apprentices in the United States are under age 25 and the average age is closer to 30. At the same time there are currently close to 4 million youth under the age of 25 with a high school diploma who cannot find full-time work, many of whom could benefit from an apprenticeship... Youth unemployment poses a long-term threat to America's economy, as it has been shown to reduce workers' wages, decrease revenues, and increase the cost to

government of health care, crime, and social assistance (Olinsky & Ayers, 2013, p. 17).

According to the National Association for Colleges and Employers (NACE), *Job Outlook 2011* reports that “employers across industries seek similar skills in job applicants; yet employers often report finding these desired skills lacking in new hires” (p. 8) and only 5.3 percent of employers surveyed in 2011 reported that work experience does *not* typically factor into the hiring decisions. The skills the NACE report found most important were written and verbal communication skills and work ethic: skills that are best “...developed in the ‘real life’ situations in the programmes of workplace learning provided in apprenticeship; moreover, many young people flourish in the more adult atmosphere of the workplace and benefit from learning away from a classroom atmosphere” (Steedman, Gospel, & Ryan, 1998, p. 7).

The United States had 358,000 active registered apprentices in 2012, only seven percent of the number of apprentices in England when adjusting for population size (Olinsky & Ayers, 2013, pp. 1-2). Yet by 2020, The United States is projected to experience a shortage of three million workers with associate’s degrees or higher, and five million workers with technical certificates and credentials. Compounding our inadequate workforce development system, research shows that employers are now spending less on training than they have in the past. At the same time, industry surveys show that a lack of qualified workers was a top concern for many employers (Olinsky & Ayers, 2013, p. 2). That leaves a market gap that could be filled by high school and

college dropouts if the U.S. offered a more robust apprenticeship program. So while 40 percent of adults today have a high school diploma or no credential at all, only 36 percent of jobs in 2020 will be available to them (Olinsky & Ayers, 2013, p. 7). Clearly, there is a need for formal instruction beyond high school that is not a four-year college education.

In the United States, true “apprenticeships”, those in which students receive paid on-the-job training, and targeted off-the-job classroom instruction, that result in a nationally recognized credential, are called Registered Apprenticeships (RA) and are regulated by the United States Department of Labor through the Office of Apprenticeship (OA). The OA has authorized 25 states, including Maine, to regulate their Registered Apprenticeships through state apprenticeship agencies (SAAs). Since the 1937 National Apprenticeship Act set the precedent for contractual status, wages, and training hours, apprenticeship in the United States has evolved into Registered Apprenticeships that mobilize “America's workforce with structured, on-the-job learning in traditional industries such as construction and manufacturing, as well as new emerging industries such as health care, information technology, energy, telecommunications and more. Registered apprenticeship connects job seekers looking to learn new skills with employers looking for qualified workers, resulting in a workforce with industry-driven training and employers with a competitive edge” (United States Department of Labor, 2014).. Collectively there are approximately 29,000 sponsors representing more than 250,000 employers who provide apprenticeships for over 375,000 apprentices nationwide. Those apprenticeships range from one to six years (with the majority being four-year programs) during which the average apprentice receives 2,000 hours of on-the-

job training and 144 hours of related classroom instruction. In Fiscal Year 2013, approximately 164,000 apprentices entered the RA system, and about 52,000 participants graduated. Of those, only 135 were from Maine (United States Department of Labor, 2014). As part of a Registered Apprenticeship, participants earn wages which increase with time and qualifications, and earn a nationally recognized certification upon graduation.

Engagement of Labor Unions in Apprenticeship in the United States

Throughout the past century unions in the United States have functioned in a principal-agent relationship connecting apprentices with employers. “[T]he Organisation for Economic Co-operation and Development point[s] out that countries with strong apprenticeship systems often have a ‘close and active involvement of both of the social partners representing employers and the trade unions.’ ... Additionally, research has shown that joint programs with union participation have ... significantly better performance as measured by attrition and completion rates” (Olinsky & Ayers, 2013, p. 33).

The passage of the Smith-Hughes law in 1917 provided federal aid for vocational education, and cemented a relationship among labor, business and social services in the United States. Since Smith-Hughes, unions have played a role, in varying degrees, in the training and inculcation of apprentices, and were able to join in formal agreements with apprentices and employers nationwide to provide training. That was especially true throughout the 1920s in the traditionally unionized building trades, which were

represented by the American Federation of Labor (AFL). However, many larger factories established their own in-house training programs. These employers did not require federal money for operation, and ostensibly wanted to diminish and discourage the organization of their labor force (Jacoby, 2016).

During the Great Depression of the 1930s, training of new employees came almost entirely to a halt as the nation struggled to rebuild the economy. During the recovery following the Great Depression labor also shifted from an agrarian base to a largely industrialized base. With that transition came a shift in power from the AFL to the Congress of Industrial Organizations (CIO). By the late 1930s, the nation was recovering, and the shortage of skilled labor that resulted from the lack of training in the preceding years was felt across the United States. That led to the creation of the Fitzgerald Act (1937) which formalized the indentures that existed between apprentices and employers or trade unions by standardizing the type and amount of training provided by an employer to an apprentice (Jacoby, 2016).

During the 1940s and 1950s, the Fitzgerald Act continued to support the relationship of unions, businesses and apprentices, and in 1955 the AFL and CIO merged to become the AFL-CIO, creating the largest federation of unions in United States, representing some 20 million members at its peak in the late 1970s. But the organized began to encounter difficulties in the late 1960s, when civil rights organizations claimed racial and gender discrimination were preventing access to already limited apprenticeship opportunities (Jacoby, 2016). During the same time period, Gary Becker published his

work on human capital theory which suggested that formal old-style, long-term indentures would enable employers to protect their investment in their skilled workers by preventing apprentices from “...absconding with the capital employers had invested in them” (Jacoby, 2016).

More recently, faced with yet another skills shortage forecasted to increase in the future, the American Recovery and Reinvestment Act (2009) provided \$3.9 billion to public workforce development, especially for workforce partnerships with union involvement. That is important because, “[u]nions can be instrumental in the identification of worker’s training needs. With their direct access to workers, they can provide workforce partnerships that inform on the skills and competencies needed to keep workers and business competitive” (Wagner, 2010). Currently, unions invest significant resources to develop apprenticeship programs through joint committees and “each year, building trades unions and their partner contractors invest more than \$1 billion in apprentice and journey-level training, tens of millions of dollars more in construction training plants and equipment, and \$10 billion in apprentice wages and benefits” (Olinsky & Ayers, 2013, p. 2). However, as union membership declines, so too does their ability to establish, manage and fund apprenticeships in collaboration with business partners across the country (Olinsky & Ayers, 2013).

While joint union-management programs now only account for about one-fourth of sponsors in the United States, they continue to account for a large number of apprentices. Not surprisingly, as union membership has declined over the past

decades, so has the number of apprenticeships in the country. Indeed, our analysis shows an extremely strong positive correlation (0.87) between active apprenticeship programs and union membership rates going back to 2001 (Olinsky & Ayers, 2013, p. 33).

The Dual-System Countries: Australia, Austria, Germany, and Switzerland

Countries such as Australia, Austria, Germany, and Switzerland have a long tradition of apprenticeships woven into the cultural and educational fabric of their society. Apprentice learning takes place in both privately run worksites and publicly run vocational schools. Those countries are termed “dual-system countries because their apprenticeship programs have two specific and separate components: on-the-job apprenticeship training; and off-the-job classroom instruction geared specifically toward the apprenticeship (International Labour Organization, 2012).

In *The State of Apprenticeship in 2010*, Steedman conducted another analysis of the apprenticeship systems in Australia, Austria, England, France, Germany, Ireland, Sweden, and Switzerland. The report confirmed her previous research findings that participation in apprenticeship is highest among the dual-system countries (Austria, Germany, and Switzerland) and Australia in which more than half of all young people enter apprenticeship. In those countries, apprenticeships play a major role in helping to provide the skill needs for the public and private sectors to work closely together to ensure fecundity. According to Steedman, “...in 2010, nearly two thirds (61%) of German apprentices were taken on as full-time employees in their apprentice firm”

(International Labour Organization, 2012, p. 7). Steedman goes on to point out that the transferable skills and knowledge apprentices acquire as part of participation in the dual-system programs contribute to employability and mobility in the job market (International Labour Organization, 2012).

Steedman states that in 2009 England had the lowest percentage of firms which offered apprenticeship at nine percent, while 25 percent of the employers in the dual-system countries, and nearly a third of the employers in Australia offer apprenticeship positions. In Germany the majority of very large firms, those with 500 employees or more, offer apprenticeship, compared to just 30 percent in England. England was also the only country found in this literature review that does not offer government payments to employers to help stimulate demand.

One of the largest issues identified across Organisation for Economic Cooperation and Development (OECD) countries is the lack of adequate positions to meet the demands of apprentices. That leads to a greater difficulty in bridging the school to work transition, and to higher youth unemployment rates. In general, the study found that there was an inverse relationship between countries with strong apprenticeships and youth unemployment. For example, in Germany if would-be apprentices cannot find an apprenticeship position they can take part in a government-sponsored program that provides them with training and a stipend to assist them in finding a full-time apprenticeship. Therefore, youth unemployment in Germany was very low (Organisation for Economic Co-operation and Development , 2010).

The study also found that among all OECD countries, the percentage of U.S. students who engage in apprenticeship as part of their upper-secondary (high school) education was almost zero, compared with the dual-system countries like Austria, Netherlands, Switzerland, Australia, and Germany, which all have over half of their upper-secondary population engaging in apprenticeship (Organisation for Economic Co-operation and Development , 2010).

Benefits of apprentices to *businesses* have been cited by Olinsky & Ayers (2013) and the Chartered Institute of Personnel and Development (2013). Through apprenticeships, employers can:

- build a pipeline of skilled workers who are able to advance through a company
- save money on recruitment
- increase job safety
- increase job satisfaction, commitment and motivation for their employees
- increase productivity and quality of products and services

Apprenticeship presents a benefit to apprentices, employer/sponsors, and to society as a whole. It is a time-honored means of building human capital, bridging skills gaps, and addressing market needs. While there is a great deal of research to support that in other countries, only some research has been conducted in the United States, and even that fails to consider the experience of sponsors of apprenticeship.

Because there is a lack of research regarding the return on investment for sponsors of apprenticeship, better research regarding the net-cost may help inform employers and policymakers alike. The current research that exists regarding apprenticeship is all based on benefit-cost analysis methodology, ostensibly because the research seeks to monetize both the costs and benefits over a longer timeframe. In the existing body of research, the benefits of apprenticeship to society, and to the apprentices and employers, as well as the costs associated with sponsoring apprenticeship, have all been determined and considered in part or as a whole. However, the majority of that literature is based in educational and economic settings abroad, disparate from those found in the United States, or Maine specifically and therefore is likely to be easily dismissed. Nevertheless, key authors and researchers such as Dionisius (2008) and Muehlemann (2013) in Germany and Switzerland, Steedman (1998) and (2011), Hasluck, Hogarth (2008) and (2010) and Gambin, Hasluck, and Hogarth (2010) in the U.K., and Bruce, et al. (2009) in Canada have all contributed to the body of knowledge regarding CBA. Along with these researchers, institutions such as the OECD, the European Commission and the Institute for Employment Research have also contributed to the body of knowledge regarding the financial viability and programmatic integrity of apprenticeship. In the United States, only Mathematica has contributed to the body of research, and only Olinsky and Ayers have contributed to policy.

Again, the benefits of apprentices to *business* have been cited by Olinsky & Ayers (2013) and the Chartered Institute of Personnel and Development (2013). According to them employers can;

- build a pipeline of skilled workers who are able to advance through the company;
- save money on recruitment;
- increase job safety;
- increase job satisfaction, commitment and motivation;
- increase productivity and quality of products and services

Apprenticeships also provide new connections to schools and to communities with recruitment of young people in school, the unemployed or underemployed, thus creating lasting mutually beneficial relationships. Apprenticeship presents a benefit to the apprentice, the employer/sponsor, and to society as a whole, and is a time-honored means of building human capital, bridging skills gaps, and addressing market needs. Because the return on educational investment is realized in the long term, better research regarding the net benefits may help inform employers and policymakers alike.

Introduction to Economic Analysis

The Institute for Employment Research (2012) cites Shury et al. and City & Guilds (C&G) stating, “the costs of providing apprenticeships discourage employers from doing so. The costs considered by employers include administrative burden, apprentices’ time away from the workplace and time spent by other employees on supervising apprentices in the workplace (*e.g.* C&G, 2011). Cost factors have been found to be a reason for not participating more commonly reported by smaller employers than larger ones (Shury et al., 2011)” (pp. iii - iv). Along with the issue of cost, some sponsors also

fail to see the relevance of apprenticeship for their specific business or industry, or may feel their business does not require the high level of skills delivered by apprenticeship.

Among the most common types of economic analysis models are cost analysis, fiscal impact analysis, risk-benefit ratio, cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis, benefit-cost analysis, and return on investment. As part of determining the costs for any of the methodologies seeking to do so, the direct costs, indirect costs, start-up and one-time costs, future costs, and capital costs must be considered.

The simplest of the methods is cost analysis which simply seeks to determine the cost information for any given project or policy by accounting for only the costs. The major limitation to a costs analysis is that it does not seek to determine any of the benefits for a project or policy. A fiscal impact analysis is often used by governments to examine the net change in a government's revenues and expenditures. To do that, it accounts for all sources of revenue, expenditure and savings, and is often attached to pieces of legislation to help policymakers determine policy decisions. The limitation of that methodology though is that it does not account for efficiency, or effect size, of a policy, and simply looks at the bottom line.

On the other hand, cost-effectiveness analysis and cost-utility analysis, both used widely in the medical industries, do look at the efficiency of the policy or project at hand, but do not necessarily attempt to monetize the benefits. Instead the two economic analysis models seek to create a ratio of the expense associated with the implementation,

and the non-monetized measures of outcomes for any action. Because the benefits and utility are often difficult to monetize, the outcomes are a ratio of cost to benefit/utility rather than a singular value. Conversely, risk-benefit ratio predominantly used in social, economic and behavioral analyses, typically seeks to monetize benefits, but does not seek to monetize risks. Because the risks associated with apprenticeship are almost entirely monetary, those models are inappropriate for this research.

Lastly, cost-benefit, or benefit-cost analysis and return on investment, are all similar methodologies used to compare the costs and benefits of a program, policy, or project by monetizing both the costs and the benefits. They are widely used in both government and private sector businesses to determine the viability of a decision, policy or program. Because both the costs and benefits are monetized, the result of any of the three is a net benefit. That net benefit value can be reported as either a dollar amount, or as a ratio, and therefore, specific attention must be paid to the actual format being referenced. For a cost-benefit analysis, a positive dollar value or ratio greater than 1.0 would indicate a *net cost*. For benefit-cost analysis and return on investment a positive dollar value, or a ratio greater than 1.0 would indicate a *net benefit* or *net return*.

The current research that exists regarding apprenticeship is all based on benefit-cost analysis methodology, ostensibly because the research seeks to monetize both the costs and benefits over a longer timeframe. In the existing body of research the benefits of apprenticeship to society, and to apprentices and employers, as well as the costs associated with sponsoring apprenticeship have all been determined and considered in

part or as a whole. However, the majority of the literature is based abroad in educational and economic settings disparate from those found in the United States, or Maine specifically and therefore is likely to be easily dismissed. Nevertheless, key authors and researchers such as Dionisius (2008) and Muehlemann (2013) in Germany and Switzerland, Steedman (1998) and (2011), Hasluck, Hogarth (2008) and (2010) and Gambin, Hasluck, and Hogarth (2010) in the U.K., and Bruce, et al. (2009) in Canada have all contributed to the body of knowledge regarding cost-benefit analysis. Along with those researchers, institutions such as the OECD, the European Commission and the Institute for Employment Research have also contributed to the body of knowledge regarding the financial viability and programmatic integrity of apprenticeship. In the United States, only Mathematica has contributed to the body of research, and only Olinsky and Ayers have contributed to policy.

Cost-Benefit Analysis of Apprenticeship in Europe

Apprenticeship in Switzerland has a history of being profitable for the firms that host them; while apprenticeship in Germany firms typically incur a substantial net cost. Research conducted by Dionisius, et al. (2008) utilized a matched method of two surveys conducted simultaneously in 1825 firms in Germany and 1471 firms in Switzerland, to examine the differences between the two countries in training professions, industry structure, firm size, and relative wages. They found the differences in outcomes in the two countries were a result of the tasks to which apprentices were assigned. In Switzerland, apprentices were assigned higher skilled tasks earlier in their training, while at the same time being paid marginally lower wages relative to their German

counterparts. As such the marginal return on a Swiss apprentice is greater sooner in the term of the apprenticeship.

To establish the net cost (C) of apprenticeship Dionisius, et al. considered the cost of training (c_i) and the benefit to the firm (b_i) were considered.

Equation 2-1: Net Cost of Apprenticeship by Dionisius et al. (2008)

$$C = c_i - b_i$$

The cost of training (c_i) comprised three components: the wage of the apprentices (w_a); the wage of the training personnel (w_t); and the costs for materials, infrastructure, recruitment and administration of apprenticeships (X).

Equation 2-2: Cost of Apprenticeship by Dionisius et al. (2008)

$$c_i = w_{ai} + w_{ti} + X_i$$

The benefit is based on both the type of work in which the apprentice engaged and the division of the work. Apprentices spend a portion (α) of their time at work (h) engaged in work which could otherwise be done by unskilled workers, while the other portion of their time is used to perform skilled work $(1-\alpha)h$. It is assumed that the work done should carry the same wage rate as the corresponding skill level, so unskilled labor (w_u) and skilled labor (w_s) have correspondingly different valuation. The understanding that apprentices are inherently less productive than journeymen (with regard to skilled tasks) when they begin, but become increasingly more efficient as they progress through

their apprenticeship forms the basis for relative productivity. That relative productivity measure (γ) is therefore applied only to the time spent on skilled labor.

Equation 2-3: Benefit of Apprenticeship by Dionisius et al. (2008)

$$b_i = [\alpha w_{ui} + (1 - \alpha)\gamma w_{si}]h$$

Drawing heavily on the research conducted in *Cost and benefit of apprenticeship training: A comparison of Germany and Switzerland* by Dionisius, et al. (2008), Muehlemann and Wolter (2013) point out that between 2000 and 2007 net training costs in Germany have decreased by 36 percent, ostensibly as a result of apprentices engaging in more productive work earlier in the apprenticeship period. As a result, the researchers indicate that 30 percent of all apprenticeships in Germany are profitable. In Switzerland, 60 percent of firms offering apprenticeship do so at a net benefit. As a result, Swiss firms are generally more eager to offer apprenticeship opportunities, and the concerns surrounding poaching that exist in many other European countries are not as widely held in Switzerland. The lack of concern regarding poaching is seemingly manifest in the high mobility rate among Swiss apprentices, of which 60 percent leave their training firm within one year of completion, but again because Swiss firms profit *during* the apprenticeship term this workforce mobility is not seen as a major drawback. Based on older research conducted by Lassnigg and Steiner (1997), Muehlemann and Wolter indicate that about 35 percent of Austrian firms see a net benefit from sponsoring apprenticeship.

Cost-Benefit Analysis of Apprenticeship in the United Kingdom

Modern Apprenticeship (MA), the U.K. apprenticeship program, is larger in scope and more fully developed than its U.S. equivalent, Registered Apprenticeship. The International Network of Innovative Apprenticeship (INAP) emphasizes that apprenticeship systems must be collaborations between the labor market and economic policies and educational policies, and that they require high-level cooperation between educational institutions and employers. That high degree of collaboration and cooperation is one of the factors that make the implementation of any vocational education training system different from general education (INAP, 2012).

There are two different levels of MA in the United Kingdom: Foundation Modern Apprenticeship (FMA) and Advanced Modern Apprenticeship (AMA). The average training period for an apprentice in the FMA system is one to two years, while the average training period of an apprentice in AMA is three to four years (Hogarth & Hasluck, 2003). During that time, instruction can take place in three different versions, or combinations, of on- and off-the-job training. The first is a one-phase (integrated) duality apprenticeship in which an apprentice's workplace and classroom instruction alternate at short intervals. The second is an alternating duality with long periods of full-time school-based vocational education followed by equal periods of on-the-job training, and finally, the informal duality, which is unregulated and primarily excludes classroom training. Of the three, the one-phased duality is preferred because while classroom instruction is essential to a successful apprenticeship, long periods in the classroom remove the practical application of skills and knowledge, and also prevent consistent reflection about

work practices, while the third phase omits critical classroom instruction necessary to build depth and breadth of knowledge.

During their training, apprentices in the MA program receive a salary which is based on their input-output ratio so that as apprentices increase their productivity, their wages also increase. “Research on the costs and benefits of apprenticeship training show that a three-to-four-year training programme can be organized in such a way as to cover an apprentice’s costs when the apprentice training allowance is about one third of a skilled worker’s wages...the tendency is that the benefit of training is increasing with the training quality. It is upon this condition that in-company dual training can be self-financing” (INAP, p. 11)

Since 1994, there have been three studies of apprenticeship in the U.K. The first two studies were before the implementation of the MA program, and therefore pertained to a broader spectrum of on-the-job training than the final piece, *Net cost of Modern Apprenticeship training to employers* (Hogarth & Hasluck, 2003). To provide a detailed cost breakdown of MA, the researchers conducted approximately 40 case studies of establishments across five different industries:

- Engineering (AMA only)
- Construction (AMA only)
- Retail (FMA and/or AMA)
- Business Administration (FMA and/or AMA)
- Hospitality (FMA and/or AMA)

The data for the study were processed using an accounting framework of the costs and benefits of training (Table 2.1) and delimiting the training cost and benefit to a three-year period. This delimitation was conceived to account for the discrepancy in data that would be caused by graduates that complete the AMA in three and a half years while others do so in the full four-year span. There data are presented in the following table.

Table 2-1: Outline of accounting framework of the costs and benefits of training

	Year 1	Year 2	Year 3	Total
Average wage of apprentice (wage paid either by employee or training provider in each year of the apprenticeship)				
Productive contribution of apprentice (percentage of the tasks of the journeymen that apprentice can undertake)				
Journeyman's wage				
Employer Costs				
Wage costs (total wage costs of apprentice)				
National insurance contributions (Employer NI contributions)				
Supervisory costs (Amount of time spent supervising the apprentice, such as providing on-the-job training)				
Training manager (Amount of time spent by Training Manager or equivalent either delivering training, organizing off-the-job training, plus administrative activities related to AMA or MA)				
Production line staff (Amount of time staff in departments spend assisting apprentices)				
Other staff (Other staff costs reported by respondents)				
Training costs (Expenditure on training whether on the job or off-the-job)				
Other costs (Other costs reported by respondents e.g. tools, books, etc.)				
Employer benefits				
Productive contribution (percentage of journeymen tasks the apprentice can complete multiplied by journeymen's wage)				
Other income (Funding provided for training of apprentices supplied by training providers or Local Learning and Skills Council)				
Benefit-cost (Total costs minus all benefits)				
Total (excluding MA funding)				
Total (including MA funding)				

From those data Hogarth and Hasluck (2003) found that not only were there differences in the net costs between industries, but also differences between the AMA and FMA groups within the same industry. Engineering and construction showed relatively high costs incurred early in the training process, which were only partially

offset by government funding. On the other hand, employers in retail and business administration broke even during the course of apprenticeship training.

One of the most interesting components of the Hogarth and Hasluck (2003) research is the way in which the productive contribution of apprentices is calculated. It may be difficult, or perhaps even impossible, to actually monetize all of the positive contributions made by an apprentice to the employer on a *per part* basis in some fields. However, it is probably much easier for an employer to look at an apprentice's time spent at work and see how much of that time is used in productive work (work from which an employer will see a financial benefit) vs. unskilled work (where an employer sees neither a benefit nor a cost) vs. training (where an employer will see 100 percent cost), and base that against the assumption that journeymen will be 100 percent efficient.

Based on a continued public policy interest in England, and in the U.K. in general, to expand apprenticeship in light of the "...voluntarist training system...allied to a relatively flexible labour market..." and because of the high cost of sponsoring apprenticeship in the U.K., employers there are keenly aware of the dangers presented by poaching apprentices. Therefore, the researchers Gambin, Hasluck, and Hogarth sought to determine the timeframe required for firms sponsoring apprenticeship to recoup the costs associated therein. To do that the researchers conducted in-depth case studies of 42 employers across five different sectors; 11 in engineering, eight in hospitality, eight in retail, six in business administration, and eight in construction.

Using the data collected from the case studies, the benefit-cost ratio for sponsorship was found using a detailed mathematical model. Using the variables found in Table 2.2, the researchers constructed equations for the net cost (NC_{app}), total benefit (TB_{app}), and total cost (TC_{app}) as follows;

Equation 2-4: Total Cost of Apprenticeship by Gamin, Hasluck and Hogarth (2010)

$$TC_{app} = R + C + w_{app} + NIC_{app} + Admin + \sum_{i=TM,LM,SP} [S_i(W_i + NIC_i)]$$

Equation 2-5: Total Benefit of Apprenticeship by Gambin, Hasluck, and Hogarth (2010)

$$TB_{app} = p_{app} \times w_{exp} + I_{app}$$

Equation 2-6: Net Cost of Apprenticeship by Gambin, Hasluck, and Hogarth (2010)

$$NC_{app} = TC_{app} - TB_{app}$$

Table 2-2: Variables and Definitions

Variable	Definition	Unit of Measure
A	Total number of apprentices	
W_{app}	Wage to apprentice	£ per year
P_{app}	The employer's estimate of the apprentice's productivity (in the workplace)	Percentage of journeymen's tasks that apprentice can complete - adjusted for the fact that the apprentice may spend time outside the workplace whilst training over which time period their productive contribution will be zero
W_{exp}	Wage to journeyman	£ per year
S_i	Supervision by Training Manager (TM), Line Manager (LM) or Supervisor (SP)	Percentage of i's time used to supervise apprentice
W_i	Salary paid to TM, LM or SP	£ per year
R	Cost of recruiting the apprentice	£
C	Course fees	£
NIC_i	National Insurance Contributions per Apprentice (app), Training Manager (TM), Line Manager (LM), Supervisor (SP)	£
Admin	Administrative costs	£
I_{app}	Income associated with apprentice	£

(Gambin, Hasluck, & Hogarth, Recouping the costs of apprenticeship training: Employer case study evidence from England, 2010, pp. 134-135)

Gambin, Hasluck and Hogarth (2010) found that the ranges of net costs by sector were as follows:

Table 2-3: Net Costs by Sector

Sector	Number of case study firms	Max. net cost (£)	Min. net cost (£)
Engineering	11	39,351	18,784
Hospitality	8	10,966	1,221
Retail	8	4,917	275
Business Administration	6	20,883	-7,492
Construction	8	22,640	21,491

Looking at the aforementioned data it becomes clear that almost all businesses in the study saw net costs during the term of the apprenticeship, with the exception of business administration, which saw a minimum net cost of -£7,492, which actually represents a net revenue. It is likely that the benefits begin to accrue in the time beyond the end of apprenticeship, as apprentices become journeymen, so long as the apprentice remains an employee of the training firm. To that end, Gambin, Hasluck, and Hogarth (2010) found that employers reported the lowest turnover amongst former apprentices. To determine those extended benefits (especially for firms that incur net costs during apprenticeship) of sponsoring apprenticeship or an apprentice, Gambin, Hasluck and Hogarth collected data for each year of training, and combined the net benefit data from each year into an aggregate net present value (NPV). The NPV is calculated by adding the benefits derived from the business by the continued employment of an apprentice (S) and then subtracting the total net costs of training the apprentice (NC_{total}). Because the

benefits occur in the future they must be scaled by a discount rate (r), which Gambin, Hasluck, and Hogarth set roughly equivalent to the interest at the time, to present value.

Equation 2-7: Net Present Value of Apprenticeship by Gambin, Hasluck, and Hogarth (2010)

$$NPV_{app} = \sum_{t=1}^n (S_n / (1 + r)^n) - NC_{total}$$

The payback period (in years) was calculated using the aforementioned model and found to be relatively short in all five sectors, ranging from one to two years for hospitality, retail, and business administration, and two to three years for engineering and construction. So, despite the high costs of training in engineering and construction, the correspondingly high increase in marginal productivity resulted in a firm's ability to recoup investment quickly.

The mathematical model is predicated on the research findings of Dearden, Reed and Van Reenen (2000, 2005) which found that training tended to raise the wage of experienced workers by about half the increase in their marginal productivity (Gambin, Hasluck & Hogarth, 2010). For example, training results in a £2 increase in the marginal productivity of a worker earning £20: the worker would see wages increase £1 and the business would see profits increase £1. Put another way, firms essentially split the increased benefit from training with employees such that "...the total return to Apprenticeships would be equal to twice the difference between the wages of an untrained/unskilled worker and that of a fully trained/skilled worker" (Gambin, Hasluck & Hogarth, 2010, p.136).

One of the major limitations of the study was that the small sample size (42 case studies with as few as six in a sector) does not necessarily constitute a representative sample, and hinders the generalizability to all firms. In addition, the lack of a control group of benefits in non-training firms means that the findings are corollary instead of causal. Despite those limitations, the quantitative findings of the research in conjunction with the qualitative findings of the case study reflect:

- journeymen who trained as apprentices with a company are more steeped in company values
- former apprentices are often the cadre from which supervisors and managers are recruited
- former apprentices tend to stay with a company longer (reduced labor turnover)
- apprentices can sometimes be a source of new ideas and innovation

In an effort to increase the transferability of their research, Hogarth, et al. (2012) conducted a larger study from May 2011 to July 2011 of 79 employers across eight different sectors. Five of these sectors are the same as those in *Net cost of Modern Apprenticeship training to employers* (Hogarth & Hasluck, 2003): engineering, construction, retail, hospitality, and business administration, with the addition of three new sectors, transportation and logistics, financial service, and social care.

Using the accounting framework found in Table 2.3 that is very similar to the framework used in their previous research, the costs and benefits of apprenticeship were estimated. Costs were based on the cost of training:

- apprentice wages
- supervisor wages including trainer and staff wages (measured as time spent training multiplied by their respective wage cost)
- Other costs of training (materials, recruitment costs, etc.)

The benefits of training were measured by the portion of a journeyman's capacity that an apprentice could accomplish on average in any given year multiplied by the wage of journeyman as reported by the employer. The framework is shown in Table 2-4.

Table 2-4: Benefit-cost Spreadsheet

	Year 1	Year 2	Year <i>n</i>	Total
Total number of apprentices or trainees				
Number of apprentices or trainees who drop-out without completing				
Apprentice or trainee salary				
Salary of Fully Experienced Worker				
Trainee productivity (% of skilled workers)				
Supervision (per apprentices or trainee)				
% of Training Manager's time spent training				
% of Line Manager's time spent training				
% of Supervisor's time spent training				
Training Manager's Salary				
Line Manager's Salary				
Supervisor's Salary				
Total training costs per apprentices or trainee				
Costs of recruiting the apprentice or trainee				
Course fees				
Supervision costs				
Apprentice or trainee salary				

Employer's NI (insurance) contributions				
Administrative costs				
Total Costs				
Total training benefit per apprentice or trainee				
Apprentice or trainee product				
Other income				
Total benefit per apprentice or trainee				
Net cost per apprentice or trainee				
Net Cost including drop-out				
State funding for Framework (from BIS data)				
% of total cost met by Employer				

As is evident the 2003 and 2012 accounting frameworks are very similar. One major difference is the ability to account for the entire duration of an apprenticeship in the 2012 framework, as opposed to the cutoff after three years in the framework used in 2003. Combined with a more robust sample, that helps increase the reliability of the 2012 data. From that Hogarth et al. (2012) found that during the apprenticeship or training period employers incurred net costs which they were typically able to recoup within one to two years after an apprentice had completed training.

Cost-Benefit Analysis of Apprenticeship in Canada

A 2004 Canadian apprenticeship forum, Forum Canadien sur l'apprentissage (CFA-FCA) indicated that the perceived cost of sponsoring apprenticeship was one of the major barriers to firms' engagement in training. As a result, the CFA-FAC working group (Bruce, et al., 2009) conducted a 2006 and 2008 study to determine if a financial return

on investment could be calculated and if the investment would support the employer's bottom line. The researchers conducted a survey of more than 1000 employers in the following 16 trades to find the costs and benefits of apprenticeship training.

From that it was found that “For every \$1 spent on apprenticeship training, an employer receives a benefit, on average, of \$1.47 or a net return of \$0.47” (Bruce, et al., 2009, p. 3). Over the four-year period of an apprenticeship, the net benefit found by the researchers ranged from the lowest net benefits \$39,524 for a cook, to \$148,985 for construction millwrights, to \$173,122 for automotive service technicians, and the largest net benefits of \$245,264 for heavy-duty equipment mechanics. Employers also estimated that their apprenticeship graduates were on average 29 percent more productive than fully trained employees who had not undergone apprenticeship (Bruce, et al., 2009).

Those results were found using a benefit-cost model in which the net benefits and costs were calculated on a per-apprentice per-year basis. The cost components for the survey were:

- **Wages and Benefits:** base pay, compulsory and non-compulsory benefits such as workers compensation, employment insurance, and Canadian Pension Plan.
- **Opportunity Costs:** costs related to the resources drawn by apprentices that could be otherwise used elsewhere. The journeyman time used for training, wastage (the material costs associated with loss as a result of apprentice mistakes), and the time required to correct apprentice mistakes.

- Disbursements: costs related to the training of apprentices including tuitions and registration fees for off-the-job training.
- Administration: costs associated with the administration of apprenticeships including clerical expenses of program logistics.

The researchers found that, on average, 71 percent of the total cost of sponsoring apprenticeship was represented by wages and benefits, 23 percent of the cost was represented by a journeyman's time in training, 3 percent for wastage, 2 percent for disbursements, and 1 percent for administrative costs (Bruce, et al., 2009).

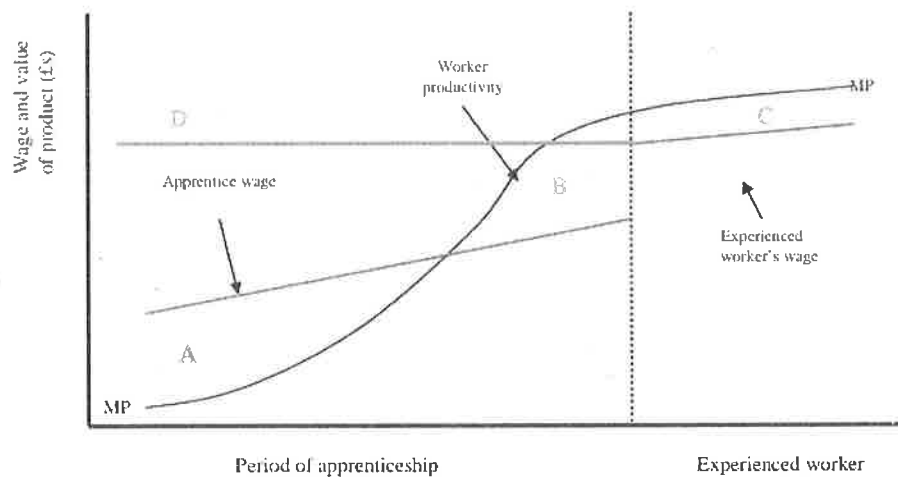
The benefit component for the survey used employer-supplied data on either “charge-out,” the amount the employer was able to bill for the actual work conducted by the apprentice, or by “mark-up.” “For example, among employers of Cooks and Parts persons (*sic*), employers were unable to provide an estimate of the charge-out rates of the apprentices. For those trades, the consultant utilized a “mark-up” rate based on the journeypersons wage rate” (Bruce, et al., 2009, p. 8). The mark-up used was 100 percent of a journeyman’s wage, essentially that assumes that the marginal productivity of the apprentice yields the employer a benefit equal to the hourly cost of a journeyman.

The most interesting aspect of the research is the use of opportunity cost. In the CBA research conducted throughout Europe and the U.K., an apprentice’s marginal productivity is thought of as a portion of the marginal productivity of a journeyman. However, in the CBA research conducted in Canada, an opportunity-cost model is used. The model assumes that apprentices have the same marginal productivity as journeymen,

except that they make mistakes, which reduce their marginal benefit to the employer. For example, if a journeyman is capable of making 10 widgets an hour and works for eight hours then the total output is 80 widgets. In the U.K. model an apprentice's marginal productivity would be estimated at, for the sake of example, 50 percent, meaning that the apprentice would make on average five widgets per hour or 40 total widgets in a day. In the Canadian model it would be assumed that the apprentice would make 10 widgets per hour but, for the sake of example, might mess up five of these each hour, and as a result have only 40 total marketable widgets at the end of each day. The models are essentially different ways of estimating an apprentice's productivity.

Mark-up is another interesting aspect of the CBA model used in the research. The mark-up, equal to 100 percent of a journeyman's wage, is somewhat parallel to the underlying assumptions used by Gambino, Hasluck, and Hogarth (2010) and Hasluck and Hogarth (2010). Predicated on the idea that training is an investment in human capital, firms engage in training because its cost is outweighed by its long-term benefits. Hogarth and Hasluck created a stylized graph (Figure 2-1) that helps represent the balance between wage and time in relation to the marginal product of employment.

Figure 2-1: Stylized Model of Apprenticeship Training (Hasluck and Hogarth, 2010) with added line (D)



In the figure, the (marginal) product of a recruit to an apprenticeship is represented by the curve MP-MP. That is likely to be low at the outset but to increase as the apprentice acquires competence eventually mirroring the productivity of journeymen. Over much of the apprenticeship period the apprentice wage exceeds the apprentice product (especially where training is full-time and off the job). The level of apprentice wage is likely to reflect the employment alternatives open to young people (such as unskilled work) as well as institutional factors such as the national minimum wage, and the benefit regime. Once the apprenticeship is completed, the apprentice will commence work as a journeyman at a higher wage. The experienced worker's wage will reflect his or her marginal product, but be set by the employer at a level that leaves a sufficient difference (or markup) to provide the employer with a return on the cost of training the apprentice in the first place.

The approach taken to determine the net benefit to the employer amounts to estimating the net costs during the apprenticeship period (Areas A and B in Figure 2.1 together with the cost of supervision and direct training costs such as course fees). The potential returns to employers following the completion of the apprenticeship are found in Area C in the figure (the return to investment in apprenticeships). (p. 16-17)

Line D has been inserted to represent the “mark-up” used by Bruce, et al., for industries that had difficulty calculating the marginal benefit. The surplus between the apprentice wage (A) and the mark-up (D) would represent the actual marginal benefit to the company.

Cost-Benefit Analysis of Apprenticeship in the United States

In the most comprehensive research of the Registered Apprenticeship program to date, Reed et al. (2012) sought to assess the effectiveness and perform a benefit-cost analysis of Registered Apprenticeships in 10 states for the United States Department of Labor’s Employment and Training Administration. Specifically, the four research questions asked were:

- Is Registered Apprenticeship effective in raising the annual earnings and employment of participants?
- Do the total social benefits of Registered Apprenticeship outweigh the total social costs?
- What are the experiences of women in Registered Apprenticeship and what can be done to further promote their success in the program?

- Are there differences between the Registered Apprenticeship programs in states administered by the federal office of apprenticeship verses those of administered by state apprenticeship agencies?

Of those four questions, only the first two pertain to the benefit-cost for the apprentice. Unfortunately, the research is missing the employer, the major link between the apprentice and society. Admittedly, the researchers state, "...we assumed that employers' net benefits are zero. We made this assumption because we do not have measures of costs and benefits for employers. However, we expect that the employers have net positive benefits because they participate voluntarily in the program. If employers' net benefits are positive, inclusion of these benefits would increase the net social benefits..." (p. xvii).

This research sought to fill that gap in knowledge, particularly as it exists in Maine, with the hopes that by determining the net cost of sponsoring Registered Apprenticeship in Maine, the methodology could then be applied in other states, thus furthering Registered Apprenticeship as a viable alternative pathway for post-secondary instruction in the US.

Summary

Dionisius, et al. (2008) was a seminal piece of research completed examining the cost and benefits of sponsoring apprenticeship. While the sample size is substantial and lends to generalizability to countries with similar social infrastructures, it is impossible to replicate without the mobilization of manpower and the substantial allocation of funds.

One of the few issues with the methodology used in their research is the discrepancy between data collection techniques used in Germany, where data was collected during personal interviews, and Switzerland, where surveys were completed by mail. Another issue is the way in which the CBA externalities were calculated when the data were originally collected, in that the costs in Germany did not include part-time training personnel. That factor was included in subsequent recalculations, and was included in the Swiss calculation.

The research conducted by Hogarth and Hasluck (2003) used a case study methodology to uncover the financial impact of sponsoring apprenticeship in the U.K, as well as examining the systemic beliefs of the program. The methodology adds to the depth of understanding of the situations in each of the businesses in the sample, but because of that depth, the sample size ($n=42$) is substantially smaller than that of the Dionisius, et al. research. Though the sample is smaller and subsequent generalizability is lower, the transferability of the qualitative data is relatively high because clear institutional trends across businesses in the sample emerge. Another strength of the research is that the sample was treated both as a whole and broken down for analysis by sectors. That also increases the transferability of the findings: a business would be better able to compare themselves with businesses in the sample of the same sector. The research also needed to consider two different levels of qualifications (AMA and FMA) which completed in different term lengths, similar to the United States, which has Registered Apprenticeship terms of 2,000 to 10,00 hours. Rather than attempt to delineate the terms into multiple increments, however, Hogarth and Hasluck drew the line for

determining costs at the end of three years, the point at which most apprenticeships have completed. That does introduce the potential for inaccuracy in their financial assessment, but given that the costs for apprenticeship primarily occur in the beginning of the term and the benefits accrue progressively as the term progresses, any bias introduced would likely err on the side of cost rather than of benefit.

In 2010 Hogarth, Hasluck and Gambin revisited the same methodology as the 2003 study but also included a final piece of quantitative analysis aimed at projecting the time required to recoupe the capital investment in apprenticeship. That required the assumption that apprentices become journeyman who remain in the employ of the business that provided the training. That assumption *is* based on evidence that employers reported the lowest turnover among former apprentices. Another assumption required was a discount rate. Hogarth, Hasluck and Gambin set their discount rate approximately equal to the rate of inflation. That assumes that the rate of inflation during the forecast period is roughly constant, and also assumes the bare minimum in terms of returns. Ostensibly, having an r equal to the rate of inflation assumes any capital invested in apprenticeship would have simply been “kept under the mattress” and not otherwise invested. That likely downplays the opportunity costs, and has the potential to bias the results towards shorter recoup times.

Hogarth et al. (2012) used the same case study methodology as in 2010, but expanded the sample size of the previous research to 79 businesses. Again, the samples were broken down into the same five sectors previously defined by Hogarth and Hasluck

(2003). The larger sample size of the research lends to both the generalizability of the quantitative financial analysis, and the transferability of the qualitative findings. The larger sample also requires more time, manpower, and funding to complete.

The research of Bruce et al. (2009) employed a large sample size ($n=1013$) over 16 different trades nationwide to calculate the costs and benefits of apprenticeship in Canada. Again, the size of the study is a strength in terms of the generalizability of the data, but a weakness in terms of the requirements to replicate it. Similar to the research of Dionisius et al. the results of the research are based on averages across all employers, and so are not necessarily reflective of the experience of every employer. Despite the large sample size, some of the trades had less than the sector sample size ($n=20$) and so for those sectors the generalizability of the data is low.

The most significant difference between the Bruce et al. research and that performed throughout Europe is the calculation of the benefit and the inclusion of an opportunity cost. While the research conducted in Europe uses a partial productivity metric which requires employers to estimate the marginal productivity of an apprentice relative to a journeyman incrementally throughout their term to calculate benefit, the research of Bruce et al. uses “charge-out” or “mark-up.” The employers supplied data on “charge-out” (the amount the employer was able to bill for the actual work conducted by the apprentice) or “mark-up” (100 percent of the journeyman’s wage) for trades in which it is difficult or impossible to disaggregate the apprentice’s piecework.

While charge-out and mark-up are factors affecting the benefits to employers, the opportunity costs effects the costs side of the equation. The opportunity costs used by Bruce et al. assumes that apprentices are 100 percent as productive as journeymen, rather than partially productive, but that they make mistakes which increase the costs, as opposed to reducing the benefit. As partial productivity in the research conducted in Europe requires an estimate of productivity to be made by the employer, and omits the material costs associated with mistakes made by the apprentice, the opportunity cost accounts for the material costs in mistake, but omits the fact that apprentices are likely slower, and hence less productive, than journeymen. Either methodology relies on estimates made by the employers.

The cost-benefit analysis Mathematica performed in the United States did not seek to monetize the benefits to apprenticeships, but instead assumed the net benefit to sponsors of apprenticeship was zero. That assumption was predicated on the idea that in an educational and economic system in which sponsoring apprenticeship is voluntary, businesses must see benefits, monetized or not, so setting the benefit at zero would only underestimate the true benefit. The issue with that assumption is that the results are easily overlooked by businesses, and therefore the impact of the research is diminished.

From the benefit-cost models examined in the literature review, with particular attention to Hogarth and Hasluck (2003) and Gambin, Hogarth and Hasluck (2010), clear trends emerge in the methodologies used to determine the benefit-cost analysis for employers sponsoring apprenticeship. Generically costs have been established to be:

- Wages paid to apprentices
- Other costs associated with employing apprentices
 - health insurance
 - life insurance
 - workers compensation insurance
 - disability insurance
 - FICA (Social Security and Medicare)
 - federal and state income tax
 - retirement/pension contributions
- Training costs associated with employing apprentices
 - supervisor's time (on-the-job instruction)
 - co-worker's time (on-the-job instruction and mistake correction)
 - trainer's time (off-the-job instruction or tuition costs)
 - administrative time (program logistics)
 - wastage (material costs associated with apprentice mistakes)
 - ancillary instructional supplies (books and materials required for training)

The generic benefits can be slightly more difficult to monetize, but fall into three categories: marginal product value; marginal productivity; and full productivity, opportunity cost. Total value is simply the revenue of the piece work conducted by an apprentice (e.g. profit per widget times number of widgets produced). That methodology is quite simple but is applicable only to apprenticeships that generate a real product, and can be directly connected to an individual. Another methodology is to estimate the

percent productivity or percent efficiency of an apprentice relative to a fully trained journeyman. That methodology was used by Gambin, Hasluck and Hogarth (2010) and Hogarth, et al. (2012) and is based on employer estimates of the percent productivity of apprentices, which increases over time until they complete their apprenticeships and become journeymen. As indicated by Bruce, et al. (2009) assessing the actual value of a product produced by an apprentice or the productivity of that apprentice can be difficult to ascertain. In those cases, an opportunity-cost subtraction methodology can be implemented which assumes an apprentice is as effective per unit-time as a journeyman, then deducts the material costs and experienced-worker costs associated with mistakes made by that apprentice during working time. As such, any instrument must collect the information to calculate the benefit using any, and all, of the aforementioned methods.

From the review of the literature it seems that previous research into the benefits of apprenticeship has been conducted using a mixed-methodology. That methodology has been used to collect both quantitative data, to consider costs and benefits, as well as qualitative data, to examine the non-monetized benefits to recruitment, retention, and advancement of apprentices. In addition, some form of accounting framework has been used to organize the quantitative data collection. Those key components were used to inform the methodology detailed in Chapter Four.

CHAPTER THREE: THEORETICAL FOUNDATIONS

Introduction

The research findings of the benefits, both monetary and non-monetized, described in the previous chapter, show that for many businesses sponsoring an apprentice is beneficial during the term of the apprenticeship and will, at worst, result in full return on investment within three to four years after completion. However, misconceptions surrounding the cost of apprenticeship still exist as indicated by the Institute for Employment Research which states, "...the costs of providing apprenticeships discourage employers from doing so" (Institute for Employment Research, 2012, p. iii). When those cost misconceptions are compounded with the fact that some businesses also fail to see the relevance of apprenticeship for their specific business or industry, or may feel their business does not require the higher level of skills delivered by apprenticeship, the stage is set for the underutilization of apprenticeship as a viable means for building human capital.

While benefit-cost analyses conducted in other countries have shown the financial viability of sponsoring apprenticeship, to date there has been no benefit-cost analysis conducted in the United States that addresses the benefits and costs incurred by sponsors. Because of the lack of benefit-cost analysis research, employers' perceptions of cost, and a failure to recognize the relevance and non-monetized benefits, may be preventing them from sponsoring apprenticeship. Thus employers in the United States need to know if

sponsoring Registered Apprenticeships is a good investment. The answer lies in the theoretical foundations of business investment.

For many employers, maximizing profits is the driving concept, and therefore business owners and managers see only the labor-cost outlay in regard to their employees. Such labor-cost outlay is the amount an employer pays to an employee per unit-time to perform work, whether it is for the production of widgets on the factory floor, or an annual number of architectural drawings completed by a firm. Businesses seeking to maximize profit adjust their labor-cost outlays to ensure they have exactly the right supply of labor to meet the demand of their particular markets by adding or subtracting shifts, asking current employees to work more or fewer hours, and/or reducing or increasing fully trained staff who are able to be fully productive from their dates of hire. Those are examples of short-run decisions because labor requirements are a variable input while other major capital investments like machinery and facilities remain fixed inputs (Mankiw, 2007). That is important because it means that business managers are not necessarily looking at their labor-cost outlay as an investment that will pay dividends in the long-run. Instead, they are simply viewing their labor-cost outlay as an input which directly changes the marginal productivity output in the short run.

Sponsoring an apprentice does not immediately contribute to a sponsor's outputs in the same capacity as the aforementioned short-run labor solutions. Because an apprentice is not a fully trained and fully skilled employee his or her marginal production is lower, and it will take time and training to increase necessary skills and knowledge.

Sponsoring an apprentice, therefore, is not a matter of short-run labor-cost outlay, but instead represents a long-run investment in human capital. Sponsors engage in apprenticeships because human resources are one of the four essential factors (land, labor, capital, and entrepreneurship) of production (Mankiw, 2007). In this benefit-cost analysis study only the variable costs associated with human resources have been considered, while the other costs associated with land, capital, and entrepreneurship have been held constant. This has been done because the businesses and unions in this sample already existed before they began sponsoring apprenticeship and so those costs were already established. It is also assumed that businesses did not have to expand or engage in any other form of capital investment to sponsor an apprentice. Ostensibly, the assumption is that the conditions required to support the apprenticeship existed in totality at the onset of the term.

Investments in human capital allow businesses to increase their production and thus increase their overall revenues at some time in the future, but because of the delay, there is also an inherent degree of risk: if for some reason an apprentice does not successfully complete training, or completes their training and leaves the firm, there is the potential for a loss on the investment. To gauge the success of an investment, businesses will look to see if they earned a net profit. In business, a profit is earned when the total revenues (outputs) are greater than the total costs (inputs). While the revenues are often much more straightforward to determine, the total costs are often slightly more difficult. That is because the total costs of an investment must take into account not only the explicit costs associated with production, but also the implicit opportunity costs, or

the ability to utilize those funds in the next best option (Mankiw, 2007). Sponsoring an apprentice bears with it an opportunity cost, which is an implicit cost of financial capital invested in the business.

Because the investment in an apprentice will not return an immediate profit, a firm must determine if such an investment is a good one, based on the duration of the investment and the degree of risk involved. Those two variables are accounted for using the discount rate to calculate the present value of the investment. Determining the net present value allows businesses to compare present investment with expected future returns and possible future returns at the discount rate. To determine the net present value (PV) the formula $PV = FV/(1+r)^n$ is used. In the formula the future value (FV) is discounted by the discount rate (r) over a period of time (n). The discount rate used is based on the premise of a comparable alternative investment in the next best option, such as an investment in a five-year Treasury bond. Therefore, the discount rate for any investment is based on similar market risks and terms. For example, a short-term low-risk investment would expect to see lower returns than a high-risk short-term investment. Similarly, in a benefit-cost analysis, a shorter-term, and lower-risk investment would have a lower discount rate while a higher-risk investment would require a higher discount-rate (Mankiw, 2007).

Because the average apprenticeship completion rate in Maine was more than 80 percent it was assumed that the risk for sponsoring an apprentice was low to moderate (Maine Department of Labor, 2014); and, because the terms of apprenticeships are

between one and five years and apprenticeship represents an investment which theoretically only pays out upon completion, bonds rates, rather than traditional savings account rates, were used as a comparison. That is because money in a traditional savings can be immediately withdrawn at any point while money invested in a bond is “locked in.” The benchmarks used for establishing the discount rate were five year terms to keep them consistent with the longest possible apprenticeship term. The five -year U.S. Treasury bond, which is very low risk/low yield (about one percent annual return) was used to set the lowest possible discount rate and the five-year high-yield bond (which might see a maximum return of 10 percent) was used for the highest possible discount rate. Therefore, for the calculation of net present value in this research a discount rate of five percent was established because it is roughly average with regard to returns on investment in similar term lengths. Using that discount rate, the net present value of sponsoring apprenticeships can be calculated for individual businesses.

The Special Case of Unions

A special case exists within the labor market as it pertains to the establishment and sponsorship of Registered Apprenticeship between unions, which act as agents, to connect apprentices, who act as principals, with businesses. Unions have engaged in sponsoring apprenticeship for several reasons, “in particular, unions are well situated to identify and codify the occupational skills requirements necessary for registering an occupation as apprenticeship” (Olinsky & Ayers, 2013, p. 33). Furthermore, unions are also responsible for developing certifications and determining competencies for certification. Lastly, unions have an existential interest in fostering apprenticeships

because a union exists to bargain on behalf of its members and because bargaining ability increases in proportion to membership, it holds true that the more apprentices a union can place, the more dues-paying members it will have, and the more bargaining power it will have on behalf of its members. Also, because unions are not for-profit entities, they need only to cover their costs of existence in the provision of services to its members, meaning that unions can inherently keep their costs low.

Those factors are most important in industrial unions such as those of autoworkers, steelworkers, and the construction, rather than with those of public employees. Industrial unions, specifically in the construction trades, actively participate in the placement/employment and training of apprentices while public-employee unions function less in the placement and training and more on collective bargaining (Arnold, 2005). Because a union is functioning as the agent in those labor relations some of the costs of the apprentice/sponsor relationship are different than when an apprentice acts as his or her own agent. For example, since a labor union is providing the off-the-job training, the entire training cost is not incurred by the business that contracts the apprentice because said employer is not paying. In such cases, unions fund apprenticeship training through a surcharge added to the contractually negotiated wage rate. Thus, while a business electing to sponsor an apprentice independently might incur \$2000 a year in off-the-job training expenses, an employer who contracts an apprentice through a union for one hundred hours of work might only pay \$100, assuming approximately a \$1.00 per hour surcharge for training (which is the average surcharge found in this benefit-cost analysis research). In that example the same apprentice would leave one hundred hours

with the first company, and subsequently be contracted by another company and perform work there. That could happen several more times, spreading the entire cost of sponsorship over several companies. It is also possible that a company with a sufficient amount of work could contract an apprentice through a union for the entire term of the apprenticeship, and assume the entire cost for off-the-job training (again, paid as a surcharge which is added to the wage rate).

Therefore, the costs means that the calculation of benefits and costs when unions act as agents in the establishment of the apprentice/sponsor relationship is slightly more complicated because of the involvement of a third party with some fiduciary interest. While that does slightly complicate the understanding of who incurs the costs and benefits, the majority of the financial benefits (in the form of billable work conducted by the apprentice) are still realized by the business that does the contracting. And, because the training and administrative requirements of the apprenticeship are paid for by surcharges added to the cost of training, the collection of businesses contracting apprentices through a union, in fact, pay for the cost of training as well. Therefore, businesses who contract apprentices through labor unions likely assume lower individual risk than in an apprenticeship sponsored by a business alone, because they are not indentured to the apprentice for the entire term of the apprenticeship.

Along with the reduced risk involved for businesses that contract through a labor union, there are several other factors that would motivate contractors to engage with unions to sponsor apprenticeship. First, it can be assumed that contractors are seeking to

maximize profits and second, that because of the fluidity of their workforce, contractors view their employees as a labor cost. Thus the contractors are not necessarily interested in a long-run human-capital investment, but rather in short-run marginal productivity. Because unions function as agents in a principal-agent capacity for their apprentices and the employers, unions are actually perfectly suited to meet that demand. Unions have negotiated salaries based on qualifications and competencies with labor commissions, and therefore it is possible for a business to contact with a union for exactly the labor required to meet the demand of any job. For example, an electrical contractor would know that he has a job which will require certain workers with certain skills, and could then contact a labor union and request exactly the right number of workers with exactly the right skills, thereby maximizing each worker's marginal product.

Thus, the cost-benefit data collected from unions must be analyzed differently than the data collected directly from private employers, because it must be assumed that employers are looking to maximize profits and care only about the labor cost outlay in the short-run while unions are looking at the human capital investment in their membership in the long-run. That means that for businesses that contract through unions, the costs incurred by unions for supervisor training, administration, and recruitment, which are paid for with union dues, can be set aside because they do not impact the benefit-cost analysis for those businesses. The businesses in this sample that contract apprentices through the three labor unions do pay the apprentices' wages and FICA, as well as journeyman training, retirement and insurance as a surcharge on the wage rate paid to the union, which provides off-the-job training, and is the insurance and retirement

subscriber. Those, then, are the major cost centers businesses might incur. The monetary benefits that are considered in this study are essentially all incurred by a business because the existential benefits realized by a union are considered to have been met through the apprenticeship. While unions do have their own benefit-cost analysis problems ensuring that they take in enough revenue in member dues to cover their costs of operation, it was assumed for the sake of this research that it was, in fact, the case, because the unions in this sample have existed for decades.

Table 3-1: Summary of Costs and Benefits for Unions and Businesses

	Unions	Businesses
Costs	<ul style="list-style-type: none"> • Recruitment • Administration • Existential costs 	<ul style="list-style-type: none"> • Wages and benefits • FICA • Training (journeyman wages and off-the-job) • Retirement
Benefits	<ul style="list-style-type: none"> • Continue membership • Continue trade 	<ul style="list-style-type: none"> • Billable work conducted by apprentice • Maximized marginal productivity • Reduced risk of investment in apprenticeship

The long-run vs. short-run investment, and the impact of labor unions, are both significant factors in determining the financial viability of sponsoring apprenticeships. Because of the reduced risk and ability to maximize marginal productivity, it is possible that collaboration with a trade union allows businesses to maximize the benefits of apprenticeship. Because of the episodic nature of industries such as the construction

trades in New England, it is also possible that contracting apprentices through a trade union is actually the best possible option for businesses: the alternative would be to try to carry extra labor costs during the slow winter season or potentially loose the investment in training made during the busy spring, summer and fall.

That understanding of the theoretical foundations presented in this chapter, including the consideration of investment risk and term, as well as the special circumstances presented by the involvement of labor unions functioning as agents for apprentices, along with the literature review in Chapter Two were used to create the methodology and data analysis procedures that follow in Chapters Four and Five.

CHAPTER FOUR: METHODOLOGY

From the literature review it can be seen that there were two different methodology types. The first methodology used by Dionisius, et al. and Bruce, et al. was a quantitative survey administered to a very large sample; the second variety used by Hasluck and Hogarth, and Gambin, Hasluck, and Hogarth was a case study which combined the collection of quantitative and qualitative data from a smaller sample in order to triangulate both the monetary and non-monetized benefits. Given the limitations of time and material, the methodology of this benefit-cost analysis research of Registered Apprenticeship in Maine was primarily informed by the smaller sample size case studies conducted. The methodology of this research was designed to answer the research questions, “What are the benefits and costs for sponsors of Registered Apprenticeship in Maine?”

Introduction to the study

The benefits of apprenticeship for apprentices have been largely supported in the research conducted worldwide, as have the societal benefits. What is most interesting about that research is the way the social benefits were calculated. Worker productivity and reduced social dependence were included as benefits, and federal and state administration of Registered Apprenticeship and the cost of off-the-job instruction, were considered as costs: employers were left completely out of the calculation of social benefit. The Mathematica researchers state, “we assumed that employers’ net benefits are zero. We made this assumption because we do not have measures of costs and benefits for employers” (p. xvii). They go on to say that they expect employers to have a net

positive benefit because of their voluntary participation in Registered Apprenticeship, and that if that net positive benefit is, in fact the case, then the net social benefit would also increase.

To date there has been no data collected regarding the benefit-cost ratio for apprenticeship sponsors in Maine. The only analysis of apprenticeship in the state is conducted by The Maine Apprenticeship Program which produces an annual report detailing important aspects of the state's program. According to the report, the state of Maine had 1,737 apprentices being served at the close of 2013. Of those, 211 apprentices were finishing programs, and 169 apprenticeships were cancelled prior to completion, for an overall completion rate of 55.5 percent.

The financial analysis component of The Maine Apprenticeship Program Report pertains to General Fund dollars used in support of the program, the increased income for apprentices, and the subsequent increased tax revenue for the state. Individuals who completed their programs saw an average of 65 percent increase in wages from their programs' start to end. The total cost to taxpayers for the program was \$398,746, with a return on investment of \$183 per \$1 of General Fund dollars leveraged. The average annual wage of the 1,737 apprentices was \$41,870 which yielded \$5,781,946 in state income tax revenue (Maine Department of Labor, 2014).

What the Maine Apprenticeship Program Report fails to report, or even seeks to determine, is the benefit-cost ratio for *sponsors* in the state. Therefore, the goal of this research was to perform a pilot benefit and costs analysis for sponsors Registered

Apprenticeship in Maine, with the hopes that the model can be used for further study to provide sponsors with quantitative figures which will incentivize increased sponsorship and assuage concerns regarding the cost of sponsoring apprenticeship, thus benefiting apprentices, sponsors, and society as a whole.

This research sought to help fill the lack of research pertaining to the costs and benefits associated with sponsoring apprenticeship in Maine by asking the research question: what are the benefits and costs for sponsors of Registered Apprenticeship in Maine?

Methodological Overview

To perform a pilot benefit and costs analysis study for sponsors of Registered Apprenticeship in Maine, a mixed methodology comprising qualitative intake and exit interviews and a quantitative analysis of costs and benefits was conducted. The intake interview was intended to establish key demographic information about a sponsor, to uncover any institutional predispositions about sponsoring apprenticeship, and to uncover preconceived perceptions of costs and benefits. The quantitative analysis was designed to determine the costs incurred, and the benefits received, by sponsors during the term of the apprenticeship. The exit interview was intended as a member check of the quantitative analysis results, and a means to uncover sponsors' perceptions of the accuracy of the results, as well as any notable limitations. Lastly, the exit interview was intended to see how the results might affect the sponsors' perceptions of their choices to sponsor

apprenticeship, and how sponsors might advise future organizations seeking to engage in sponsoring apprenticeship.

Research Context

At the inception of the research approximately one hundred sponsors (provided by the Maine Apprenticeship Program at the Maine Department of Labor) were sent an initial contact letter (Appendix E), and were called the week following the mailing. The researcher reached approximately one-half (approximately 50) of those by phone to discuss the project. One-half (approximately 25) of that number declined to participate for a variety of reasons: e.g., lack of records; not enough time. Other recipients of the letter did not return voicemail messages. Twelve sponsors were ultimately willing to participate in the research. All of these sponsors were called in the week that followed. Of this 12, one was unwilling to provide any CBA data and three were unable to provide CBA data complete enough to conduct a benefit-cost analysis with any degree of accuracy. That meant the final sample for this research therefore is a convenience sample comprising eight organizations across central and southern Maine.

The eight organizations represent three of the six Apprenticeship Sectors identified in the Maine Department of Labor Maine Apprenticeship Program Report (2014) (See Appendix B): Health and Social Services, Construction Trades, and Manufacturing. No respondents from Administration, Public and Retail Services, Education, or Shipbuilding were willing/able to take part in the research or to provide the information requisite for participation.

Because of the small sample size ($n=8$) in this study, sponsors were not named and geographic region descriptors were deliberately left general. That was done in an effort to prevent any identifiable data for any individual sponsor being disclosed.

As compensation for their time, each of the sponsors that completed the case study received a detailed analysis of their costs and benefits, along with their cost-benefit analysis and estimated time of payoff on their investments in apprenticeship.

Data Collection

For this study, data collection began by contacting sponsors through an initial contact letter (Appendix E) sent by email to establish willingness and ability to participate in the research through. The director of apprentice ship at the SSA provided those email addresses, and phone numbers of the contacts as well. Sponsors were then contacted via phone within two weeks of the initial email. Those to whom the researcher spoke were able to ask questions and/or express concerns about participating. Once a sponsor agreed to take part, the researcher set a time frame and schedule with that firm. Sponsors were also given the opportunity to conduct the research in one two- to three-hour session, or two one and a half hour sessions. They were also provided all the information required for the accounting-framework component of the study.

To understand the sponsors' demographics and to uncover the impact of apprentices on the recruitment, retention, and advancement of personnel, the intake interview questions (See Appendix C) were asked during the first half of the two to three-hour full interview timeframe. The Accounting Framework was completed directly

following the intake interview to calculate benefit-cost analysis. If the second half of the interview process was to follow immediately, then the BCA was calculated at that time, otherwise the date and time for the second half of the interview was established.

During the second half of the interview, a member check of the results of the accounting framework was conducted for accuracy, and the exit interview (See Appendix D) was completed.

Data Analysis

For each of the respondents, the total costs and annual revenues were calculated (when enough data were present) using modified versions of the equations derived from Gambin, Hasluck, & Hogarth (2010). The equations were modified to reflect the different insurance and taxations structures in the United States versus the United Kingdom. National Insurance has been replaced with health/dental insurance, life insurance, disability insurance, and workers compensation insurance. Additionally, Federal Insurance Contribution Act (FICA), which combines Social Security and Medicare, were also added to the equation.

The annual cost to a sponsor of Registered Apprenticeship in Maine, Equation 4.1, was used for each member of the sample to calculate the overall annual costs incurred by the employer during the term of the apprenticeship. In the equation T is one year, W_T^{App} refers to the wages paid to the apprentice, W_T^{Sup} refers to the wages paid to the supervisor and W_T^{jour} refers to the wages paid to the journeyman for the time they were actively engaged in training the apprentice. Those represent the major cost centers

for sponsors of Registered Apprenticeship. Aside from those major costs I_T^{app} refers to the total insurance premiums paid by the employer on behalf of the apprentice. $FICA_T^{app}$ refers to the employer's share of FICA. Ret_T^{app} refers to any retirement contributions made by the employer on behalf of an apprentice. The other costs refer to off-the-job training, waste generated by mistakes made by an apprentice, miscellaneous costs incurred by the company (e.g., uniforms), administrative costs related to establishing or maintaining the apprenticeship, and costs of recruiting an apprentice.

Equation 4-1: Annual Costs to a Sponsor of RA in Maine

$$C_T^{app} = W_T^{app} + I_T^{app} + FICA_T^{app} + Ret_T^{app} + W_T^{Sup} + W_T^{jour} + C_T^{otj} + C_T^{waste} + C_T^{misc} + C_T^{Admin} + C_T^{Rec}$$

The calculation of the annual revenues realized by a sponsor over the term of an apprenticeship was calculated using one of two possible methods predicated on how the sponsor valued, or billed, for their products or services. Method A, which can be seen in annual revenues to a sponsor of Registered Apprenticeship as calculated by marginal product value generated by the apprentice (Equation 4.2), used the actual market value of the product generated or the billable work conducted on behalf of the employer. In the equation, T is equal to one year. Q represents that total quantity of billable output generated by the apprentice which is multiplied by P , the market price for said output. All other potential revenues a firm might realize as a result of sponsoring apprenticeship are represented in R_{other} .

Equation 4-2: Annual Revenues to a Sponsor of RA in Maine as Calculated by Marginal Product Value Generated by the Apprentice

$$R_T^{app} = (Q_T^{app} * P_T) + R_{other}^{app}$$

Method A works well for an industry that produce discrete goods, pieces, parts, or services, but is difficult to use in situations where the marginal product is more continuous than discrete.

In those situations Method B, the marginal productivity of apprentice relative to journeyman was used. The annual revenues to a sponsor of Registered Apprenticeship in Maine as calculated by a marginal productivity of the apprentice (Equation 4.3) uses the average productivity of the apprentice as estimated by the employer. In the equation, T is one year. Q represents the total amount of billable output conducted by the apprentice which is multiplied by the billable output rate of the journeyman. P represents that marginal productivity of the apprentice relative to the journeyman and as such $P < 1.0$. Again, all other potential revenues the firm might realize as a result of sponsoring apprenticeship are represented in R_{other} .

Equation 4-3: Annual Revenue to a Sponsor of RA in Maine as Calculated by Marginal Productivity of the Apprentice

$$R_T^{app} = (Q_T^{app} * R_T^{jour}) * P + R_{other}^{app}$$

In an effort to account for the opportunity cost and risk of the potential investment in sponsoring an apprentice versus the next best option, the present revenues (Equation 4.4) and present costs (Equation 4.5) were calculated and based on a standard discount rate (r). The discount rate was set at five percent because of the relatively short term (a maximum of five years) of the investment and the relatively low risk (more risk than U.S. 5-year bonds but lower risk than high-yield bonds) involved.

Equation 4-4: Present Revenue Received by an RA Sponsor

$$R_{Pres}^{app} = \sum_{i=1}^n \frac{R_T^{app}}{(1+r)^n}$$

Equation 4-5: Present Cost Incurred by an RA Sponsor

$$C_{Pres}^{app} = \sum_{i=1}^n \frac{C_T^{app}}{(1+r)^n}$$

Using the sum of the present value revenues and sum of the present value costs the Net Present Value of the investment in sponsoring Registered Apprenticeship was calculated using Equation 4.6

Equation 4-6: Net Present Value Realized by an RA Sponsor

$$NPV = R_{Pres}^{app} - C_{Pres}^{app}$$

The Net Present Value was then used to determine if the sponsor realized an overall cost or benefit as a result of sponsoring an apprentice and subsequently if it was a worthwhile investment. A positive net present value results from revenues that are greater than the costs, which indicates a profitable investment, while a negative net present value results from revenues that are less than the costs, and indicates a net loss on investment.

CHAPTER FIVE: RESULTS

Introduction

Using the aforementioned methodology, a total of five businesses and three labor unions functioning as agents in a principal-agent relationship with apprentices and businesses across southern and central Maine were interviewed and data analyzed to answer the research question: “What are the benefits and costs for sponsors of Registered Apprenticeship in Maine?”

The five businesses and three labor unions were from the Construction, Health and Social Services, and Manufacturing sectors, three of the six Apprenticeship Sectors identified by the Maine Department of Labor with Education, Ship Building and Maintenance, and Administrative, Public and Retail Services not represented in the sample. The findings of these case studies are disaggregated into the three unions and five businesses and then further by apprenticeship sector and presented as a narrative.

Labor Unions

Unions act as agents to connect apprentices, who act as principals, with businesses. Unions have engaged in sponsoring apprenticeship since the early 1900s and at their peak in the mid-1950s more than twenty-five percent of the American workforce was comprised of union workers. Unions “... are well situated to identify and codify the occupational skills requirements necessary for registering an occupation as apprenticeshipable” (Olinsky & Ayers, 2013, p. 33). They are also responsible for developing certifications and determining competencies for certification. Unions also have an

existential interest in fostering apprenticeships because the union exists because of their members and as their membership grows the union gains bargaining power on behalf of its members.

Union A

Intake Interview

Union A is a labor union of electrical workers that supplies union electricians and electrician's apprentices. It is located in central Maine and does business in central and eastern coastal Maine. It currently has about 150 journeyman members, and deals with five fairly large contractors on a regular basis. The union has been sponsoring Registered Apprenticeship since 1957, and has had approximately 600 to 700 apprentices. The union believes that apprenticeships provide the best training, including monitored off-the-job training attendance, monitored on-the-job attendance, and monitoring of academic performance. That means that along with the obvious existential benefit the union realizes as a result of its involvement with RA "the benefit to contractors is they know whoever they hire [the union member] is interested in the trade...not just a job".

The union currently has 45 apprentices, and in most years it takes on an average of about 10 to 2 new apprentices, who aim to earn certifications as either journeymen inside wireman, a high-voltage certification, or installer technicians, a low-voltage certification. Most of the apprentices are currently pursuing the journeymen inside wireman certification, which requires 8000 hours of on-the-job training and 900 hours of classroom training over five years. Those that pursue the installer technician certification

are required to complete 4800 hours of on-the-job training and 540 hours of in-class training over a three-year period. The training director states that apprentices have about a 70 percent completion rate, with the classroom training component being the biggest obstacle for those that do not conclude the program. Some apprentices struggle with two three-hour classes each week on top of a 40-hour work week and the travel between the work site and the training facility. He also states that the apprentices who drop out typically do so early on in the apprenticeship, though some fail to complete at the very end of their terms because they are unable to pass the written exam.

The union is currently expecting “quite a few” of its employees to retire within the next 10 years as 55 percent of their journeymen members are 50 years old or older. That will allow the field of apprentices and young journeymen to move into roles in the hierarchy of construction projects: apprentice to journeymen to foreman to general foreman to superintendent to project manager. Twenty to twenty-five percent of those positions will ultimately be filled by apprentices from within the union, though there is the potential for “companies to hire off the street” to fill positions that emphasize management and deemphasize technical skills and knowledge.

Accounting Framework

Because Union A is a labor union it functions as an agent in a principal-agent relationship with apprentices. Its pay scales are based on the collective bargaining agreement it negotiated with the regional contractors’ associations and apply to all contractors and all union members, including apprentices. That makes the cost

calculations quite easy, and also means that they should be almost identical for any apprentice currently in the program because the salary and employee benefits package are contractually predetermined. As such, the calculations are representative of any theoretical apprentice, not to a specific apprentice. Also, for the sake of this analysis it was assumed that an apprentice was contracted through the union by a single employer for the duration of the term of the apprenticeship. It would also be possible to consider these costs and benefits as being distributed across all, or a portion, of the businesses that contracted the apprentice because it is equally as likely that the apprentice was contracted by multiple businesses throughout the term. However, rather than attempting to disaggregate the benefits and costs across the myriad businesses that contracted an apprentice during the term, it is easier to analyze the benefits and costs for a hypothetical single contracting business, and subsequently frame said benefits and costs couched in the understanding that those benefits and costs are potentially spread out across multiple businesses.

Apprentices in Union A are paid wages and benefits depending on what portion of their terms they are in, and in what field work they are engaged pursuant to the collective bargaining agreement. The range for wages is \$11.18 per hour for an apprentice doing field work in residential wiring in the first 1000 hours of the term to \$24.16 per hour for an apprentice doing field work in industrial wiring in the term between 6501 and 8000 hours. Those wages are based upon percentages of the journeymen wage which range from \$19.30 per hour to \$28.50 per hour. Apprentices receive their benefits through the union as well; contractors pay a flat rate per work-hour towards them regardless of an

apprentice's time in the term. For example, contractors pay \$6.00 per hour for health and welfare insurance, and \$0.64 per hour for disability; pensions range from \$1.00 to \$5.25 per hour depending on how far an employee is into his or her term. The training benefit (used to fund a portion of off-the-job training) paid by contractors are also determined by the type of field work, and paid as a flat rate per work-hour. In the case of Union A, the costs for supervisor training, administrative costs associated with establishing and maintaining the apprenticeship and the recruitment of new apprentices are all costs incurred by the union, and supported by local dues, and have therefore been excluded from the cost calculations. Because of seasonal variations in the work calendar apprentices have five years to complete 8000 hours, which is equivalent to four years at 40 hours per week for 50 weeks. Therefore, the calculations for cost and benefit have been compressed into four years.

A benefit-cost analysis was calculated based on the contractually agreed upon wage and compensation package that applies to all apprentices, journeymen, and foremen. For this example, the 8000 hour journeyman inside wireman certification was considered. Table 5.1 shows the annual costs incurred by a business for sponsoring an apprentice from Union A. The annual costs range from \$118,898 in the first year to \$74,083 in the last.

Table 5-1: Annual Cost Incurred by a Business for Sponsoring an Apprentice from Union A

	Apprentice Wages	Insurance	FICA	Retirement	Journeyman Training	Off-the-job Training	Annual Cost	Present Cost
1	\$31,400	\$13,280	\$2,402	\$10,500	\$51,300	\$1,920	\$110,802	\$105,526
2	\$35,380	\$13,280	\$2,707	\$10,500	\$34,200	\$1,920	\$97,987	\$88,877
3	\$40,150	\$13,280	\$3,071	\$10,500	\$28,500	\$1,920	\$97,421	\$84,156
4	\$46,960	\$13,280	\$3,592	\$10,500	\$5,700	\$1,920	\$81,952	\$67,422
								\$345,981

The apprentice's wages were \$15.00 per hour in the first 1000 hours and increased to a final wage rate of \$24.16 in the last 1500 hours. Contractors pay \$6.64 per hour for health and welfare and disability insurance and \$5.25 per hour towards the apprentice's pension. The journeyman training expenses were derived from the time in training estimates made by the training director of 36 hours per week in the first quarter, 24 hours per week in the second, 20 hours in the third, and four hours in the last. Off-the-job training is paid for at \$0.96 per work-hour by the contractor. The training director felt that the amount of wastage generated by apprentices would likely be negligible because they have so much oversight and training when they are learning new tasks.

Table 5.2 shows the annual revenue per apprentice from Union A which is realized by the contracting business as a result of the 40 hour billable workweek at a rate of \$75 per hour, which is the rate the training supervisor indicated would be representative of the rate billed for that type of work in the area, for 50 weeks (or 2000 hours) a year. Apprentices' vacation time is not paid for by a contracting business.

Table 5-2: Annual Revenue per Apprentice from Union A

Hours per week	Number of weeks	Billable rate / employee / hour	Total revenue / employee / year
40	50	\$75	\$150,000

Neither companies nor the union receive additional revenue as a result of sponsoring an apprentice. Therefore, Table 5.3 shows the annual revenue realized by a business for sponsoring an apprentice from Union A for years one through four of the apprenticeship is \$150,000 each year. All the years have the same total because the source of revenue from the apprentice is consistent throughout the duration of the term.

Table 5-3: Annual Revenue Realized by a Business for Sponsoring an Apprentice from Union A

Year	Value of Product/Billed Hours	Other sources of Revenue	Annual Revenue	Present Revenue (5% discount rate)
1	\$150,000	\$ -	\$150,000	\$142,857
2	\$150,000	\$ -	\$150,000	\$136,054
3	\$150,000	\$ -	\$150,000	\$129,576
4	\$150,000	\$ -	\$150,000	\$123,405
				\$531,893

As shown, the net present value realized by a business for sponsoring an apprentice from Union A (Table 5.4) shows that given a five percent discount rate, the present cost of capital invested in apprenticeship is \$374,688, and the present revenue is \$531,893. Therefore the net present value realized by a business as a result of sponsoring an apprentice from Union A is \$185,911.

Table 5-4: Net Present Value Realized by a Business for Sponsoring an Apprentice from Union A

Net Present Value	Present Revenue	Present Cost
\$185,911	\$531,893	\$345,981

Exit Interview

During the exit interview the training director was shown the totals for annual costs and annual revenues (present cost and present revenue adjustments were made after the fact during the final data analysis portion) and stated, "Being a graduate of the program [I remember] how often I was with a journeyman over the course of the five years. If anything it might be conservative, apprentices are really expected to produce right away". Based on that the training director also felt that the model was "extremely thorough" and could think of nothing that was missing or extraneous.

Lastly, the training director stated that another beneficial factor of sponsoring apprenticeship was that "it forces commitment from both parties" because under the typical entry level employer/employee relationship neither party has "much skin in the game." When asked what advice he might have for businesses interested in sponsoring apprenticeship he suggested contacting the Maine Registered Apprenticeship program at the Maine Department of Labor because as a member of the Apprenticeship Council he states, "the [ME DOL Registered Apprenticeship Council] is willing to make [Registered Apprenticeship] fit for a business." Furthermore, the training director wanted to dispel what he felt was a misconception about apprenticeships being linked strictly to unions, adding that despite the fact that he represented a union that there were apprenticeships

across the state that are non-union. And finally, the training director stated that for businesses struggling to find talented help "it goes a long way in curing the skills shortage".

Union B

Intake Interview

Union B is a union of electrical workers doing business in southern, western, and northern Maine in the construction trades sector. The union represents approximately 300 employees, though not all of the members came through the apprenticeship program, and has been conducting apprenticeship since its 1869 founding, and formally conducting Registered Apprenticeships since the 1940s. Currently the union has 42 apprentices in different stages of the program. On average, it sponsors ten new apprentices each year and so it is likely it has sponsored approximately 750 registered apprentices. Apprentices complete 10,000 hours of training over a five-year term though the state requires only 8,000 hours, and apprentices end with a state of Maine certification in inside electrical work. The union does that "to make sure that [it] is meeting the market demand for skilled labor. [The] business partners pay top dollar and expect a level of skills".

Expert skill is one of the reasons the union sponsors apprenticeship, "...it's a cohesive means of training a qualified workforce..." There were several other benefits indicated by the training supervisor such as job placement, increased workplace safety, and advancement. The union works closely with the contractors' association to ensure that it takes in only the number of apprentices needed, ensuring that it trains only enough

apprentices for the labor market to bear, thus keeping their members are working. “We have 42 apprentices right now and only seven of them are out of work and that’s really good for construction mid-winter.” (Construction trades in Maine typically see a significant dip during the winter months because of shorter days and colder temperatures) Furthermore, the training supervisor stated, “When we train, we train for skills and safety,” and explained that apprentices get additional safety training during the terms of their apprenticeships. That additional training also ensures that apprentices are ready to advance in their field. “We cover everything they need to advance from apprentice to journeymen to master and then on to project management. Over 70 percent of our journeymen have taken additional training. We currently have several project managers that were apprentices.”

The ability to advance apprentices in the field after training is likely to be a major benefit as the training supervisor stated; “In the next five years we will see close to 15-20 percent, so possibly 60 people...” leave the field. That means that “advancement is really limited only to the desire of the apprentice. I’m seeing a lot more of those young people get promoted. Twenty-five percent of those that graduate to journeymen will advance beyond that to a higher level.” To ensure they have enough candidates to fill the apprenticeship placements they offer, the union recruits year-round and has begun reaching out to local Career and Technical Education schools and high schools. “What we’ve found is that guidance counselors don’t even know about apprenticeship.” As previously mentioned, the union sponsors about 10 apprentices every year, this year they “...had a class of 12 and we have 8 left. One of the individuals couldn’t handle the

academic load...the other three didn't even show up." Typically the union sees the most attrition in the first year, and rarely loses anyone thereafter; on average the training supervisor estimates they will lose approximately 10 percent of their apprentice class in the first year.

Accounting Framework

Because Union B is a labor union, it functions as an agent in a principal-agent relationship with apprentices. Pay scales are based on the collective bargaining agreement negotiated between the union and the regional contractors' associations, and apply to all contractors and all union members, including apprentices. That makes the cost calculations quite easy, and also means that they should be almost identical for any apprentice currently in the program because the salary and employee benefits package are contractually predetermined. Thus, the calculations are representative of any theoretical apprentice as opposed to a specific apprentice. Also, for the sake of this analysis it was assumed that the apprentice was contracted through the union by a single employer for the duration of the term of their apprenticeship. It would also be possible to consider the costs and benefits as being distributed across all, or a portion, of the businesses that contracted the apprentice, because it is equally as likely that the apprentice was contracted by multiple businesses throughout the term. However, rather than attempting to disaggregate the benefits and costs across the myriad businesses that contracted an apprentice during his or her term, it is easier to analyze the benefits and costs for a hypothetical single contracting business, and subsequently frame said benefits and costs

couched in the understanding that those benefits and costs are potentially spread out across multiple businesses.

In this case, the wage rate paid by the contracting employer did not go straight to the apprentice, instead the funds traveled through the union first. That means that the wage rate paid by the employer is high because it is a bundled package that includes the apprentices' wages, insurance packages, retirement, off-the-job training funds, and administrative costs. Therefore, the base apprentice wage rate is \$26.95 per hour and goes up incrementally through a total of 10 periods, or steps, over the term of the apprenticeship to \$43.06 per hour.

The hiring contractors do not pay any additional training costs; training is provided by the union and paid for with union dues. Likewise, the contractors do not pay for recruitment: that, too, is a union function and covered by dues. Apprentices make very few mistakes on the job because they receive the appropriate off-the-job training before they are asked to do something in the field, which means that contractors also see very little wastage costs.

Table 5-5: Annual Costs Incurred by a Business for Sponsoring an Apprentice from Union B

Year	Apprentice Wages	FICA	Journeyman Training	Annual Cost	Present Cost (5% discount rate)
1	\$53,900	\$4,123	\$74,618	\$132,641	\$126,325
2	\$57,480	\$4,397	\$49,745	\$111,622	\$101,245
3	\$67,260	\$5,145	\$37,309	\$109,714	\$94,775
4	\$71,970	\$5,506	\$24,873	\$102,348	\$84,202
5	\$82,970	\$6,347	\$12,436	\$101,753	\$79,727
					\$486,273

As may be seen in the table, annual costs incurred by a business for sponsoring an apprentice from Union B ranged from \$132,641 in year one to \$101,753 in year five. The journeyman training costs were calculated based on the training supervisor's estimate that a journeyman would spend approximately 30, 20, 15, 10, and 5 percent of a 40-hour work week engaged in training in each of the five years of the apprentice's term, respectively at a wage rate of \$46.21 + FICA.

The annual revenue per apprentice from Union B (Table 5.6) is realized by the hiring company as a result of the billable workweek of 40 hours per week at a rate of \$70 per hour, which is the rate the training supervisor indicated would be representative of the rate billed for the type of work in the area, for 50 weeks (or 2000 hours) a year: again, apprentices receive two weeks of unpaid vacation.

Table 5-6: Annual Revenue per Apprentice from Union B

Hours per week	Number of weeks	Billable rate / apprentice / hour	Total revenue / apprentice / year
40	50	\$70	\$140,000

The company receives no additional revenue as a result of sponsoring Registered Apprenticeship. Therefore, the annual revenue realized by a business for sponsoring an apprentice from Union B (Table 5.7) shows annual revenue for years one through five of the apprenticeship of \$140,000 each. All of the years have the same total because the only source of revenue from the apprentice is consistent throughout the duration of the term.

Table 5-7: Annual Revenue Realized by a Business for Sponsoring an Apprentice from Union B

Year	Value of Product/Billed Hours	Other sources of Revenue	Annual Revenue	Present Revenue (5% discount rate)
1	\$140,000	\$ -	\$140,000	\$133,333
2	\$140,000	\$ -	\$140,000	\$126,984
3	\$140,000	\$ -	\$140,000	\$120,937
4	\$140,000	\$ -	\$140,000	\$115,178
5	\$140,000	\$ -	\$140,000	\$109,694
				\$606,127

As such, the net present value realized by a business for sponsoring an apprentice from Union B (Table 5.8) shows that given a 5 percent discount rate, the present cost of capital invested in apprenticeship is \$486,273 and the present revenue is \$606,127. This

means that the net present value realized by a business as a result of sponsoring an apprentice from Union B is \$119,853.

Table 5-8: Net Present Value of Sponsoring an Apprentice for Union B

Net Present Value	Present Revenue	Present Cost
\$119,853	\$606,127	\$486,273

Exit Interview

During the exit interview the training director was shown the totals for annual costs and annual revenues (present cost and present revenue adjustments were made after the fact during the final data analysis portion) and stated that the results of the benefit-cost analysis were accurate. He reaffirmed the estimates made with regard to the marginal productivity of the apprentices because they are a contractually agreed upon amount generated by a group of stakeholders, and are also representative of what the market will bear. Furthermore, the journeyman proficiencies are based on a 10-year union study and so represent more than a simple hunch. In all, the training director also felt that the methodology was thorough and accurate. When asked about advice he might give to businesses interested in sponsoring apprenticeship he stated, “as a labor group we stand for the non-monetized benefits...we are losing industries (paper mills and manufacturing) in this state...employers complain about a lack of skilled workers and apprenticeship would provide them a direct source of training...why aren’t [businesses] stepping up to fill the gap?”

Union C

Intake Interview

Union C is a labor union representing 350 active and 150 retired plumbers, pipefitters, welders and HVAC technicians in a traveling local (a shop that sends its members throughout the country and the world.) The local has been sponsoring apprenticeship in Maine since the 1940s and sponsoring Registered Apprenticeship since they were established. Currently the union has 26 apprentices in the four fields, all of which are five-year, 8000 hour terms at 1600 hours per year, with 240 hours of off-the-job academic training annually. Of those 26, 15 apprentices are enrolled in the HVAC technician certification apprenticeship, which is the union's fastest growing sector "...because of its predictability...HVAC guys will work 9-5." For individuals seeking a regular schedule that is very appealing. The union sponsors about 15 new apprentices every year, of which about ten will make it through the first five years. Throughout the next four years the rate of failure is almost none. Those who do fail do so for two reasons: the first is because, "...the work is too hard for them. It's hard work and it's nonstop. They haven't learned life balance yet...so they don't know how to balance things out..." Substance abuse is the second reason for failure, presumably because the significant population of apprentices comprises armed-forces veterans, who often struggle with PTSD and other emotional hardships.

The training director of the union is clearly very passionate and knowledgeable about apprenticeship, and has a depth and breadth of knowledge both within and without the union and state. He states that the union is vested in Registered Apprenticeship

because “We have to build the workforce the way we want it...If we don’t have apprentices we don’t have a retirement...It’s a way to build our future...”. In fact, all of the members of the union pay dues into the apprenticeship fund to ensure its future. Combined with the fact that the union has “...actually mapped that out...over the next five years, 50 or more journeymen will be eligible for retirement; and almost 100 [additional] will be eligible in the five years that follow that...”, apprenticeship is a definite part of the planning for the future.

Along with planning for the future of the union, comes ensuring the skills of its members, which is evidenced by the training director’s statements including, “You can’t learn welding out of the book, you have to be on the job...school [classroom instruction] gives you the foundations, vocab and basic knowledge...but you master your craft on the job.” The training director went on to explain that “...students do better academically when they are under pressure, working and learning at the same time...” ostensibly because they have less downtime, and therefore must focus on the tasks at hand, or because they see the day-to-day reward of their work. On and off the job training is also not limited simply limited to the skills and knowledge needed to fulfill the work at hand, “The last year of their training focuses on leadership...we give them foreman certification”.

With regard to recruitment, the union has a definitive process and set of requirements for incoming apprentices. “If people are brought in without a clear pathway they won’t succeed.” The union “...want[s] people to succeed and to be successful

individuals,” and there are limited resources available for apprentices. The training supervisor takes pride of ownership for all the apprentices that come through the union, including those that do not complete the program: “once they are under my umbrella they are my people and I will help them...and I often do.” Every potential apprentice must attend an orientation held by the union in conjunction with the Maine Department of Labor, as well as veterans’ representatives because “we see a lot of veterans...they don’t always succeed because of their backgrounds...but the best apprentices we have are veterans.” Of the approximately 200 potential apprentices that attend orientation, roughly 20 will complete the extensive application process. All of those receive an interview with a six-member selection panel: three from the union; three representing contractors. Everyone receiving a high score is selected.

The deliberate recruitment process used, combined with on- and off-the-job training, results in a very favorable advancement picture for apprentices after they complete their training. Along with foreman certification during their apprenticeships, the union sends their “...star students to the National Apprenticeship Contest...they will be the ones that we pass the torch to...by doing so they realize their name is out there.” Once an apprentice’s name is out there he or she is poised “...to take a union leadership role or become a training coordinator...” In fact “...95 percent of our foremen were apprentices...most union leadership and trainers are [or were] journeymen...[because] they know how to supervise and they understand the importance of training”. As a result, 50 percent or more of the apprentices that complete training to become journeymen will

advance to foremen, or further to supervisors, and ultimately even on to management.

“The contractors are cherry picking our program because we are training leaders.”

Accounting Framework

Because Union C is a labor union it functions as an agent in a principal-agent relationship with apprentices. The pay scales are based on the collective bargaining agreement negotiated between the union and the regional contractors' associations and apply to all contractors and all union members, including apprentices. Therefore the cost calculations quite easy, and also means that they should be almost identical for any apprentice currently in the program because the salary and employee benefits package are contractually predetermined. Therefore, the calculations are representative of any theoretical apprentice as opposed to a specific apprentice. Also, for the sake of this analysis it was assumed that an apprentice was contracted through the union by a single employer for the duration of the term of their apprenticeship. It would also be possible to consider those costs and benefits as being distributed across all, or a portion, of the businesses that contracted the apprentice because it is equally as likely that an apprentice was contracted by multiple businesses throughout the term. However, rather than attempting to disaggregate the benefits and costs across the myriad businesses that contracted an apprentice during their term, it is easier to analyze the benefits and costs for a hypothetical single contracting business and subsequently frame said benefits and costs couched in the understanding that the benefits and costs are potentially spread out across multiple businesses.

In this case, the wage rate paid by the contracting employer did not go straight to the apprentice, instead the funds traveled through the union first. The wage rate paid by the employer is high because it is a bundled package that includes the apprentices' wages, insurance packages, retirement, off-the-job training funds, and administrative costs. The base apprentice wage rate is \$21.50 per hour and goes up incrementally through eight steps over the term of the apprenticeship, to \$41.15 per hour. The apprentice wages shown in Table are based on 40 hours a week, 50 weeks a year.

The hiring contractors do not pay any additional training costs, as this training is provided by the union and paid for with union dues. Likewise, the contractors do not pay for recruitment, because this too is a union function and covered by dues. Apprentices make very few mistakes on-the-job because they receive the appropriate off-the-job training before they are asked to do something in the field, this means that contractors also see very little wastage costs.

Table 5-9: Annual Costs Incurred by a Business for Sponsoring an Apprentice from Union C

Year	Apprentice Wages	FICA	Journeyman Training	Annual Cost	Present Cost (5% discount rate)
1	\$44,900	\$3,435	\$19,898	\$68,233	\$64,984
2	\$55,740	\$4,264	\$14,924	\$74,928	\$67,962
3	\$70,464	\$5,390	\$9,949	\$85,804	\$74,120
4	\$80,200	\$6,135	\$4,975	\$91,310	\$75,121
					\$282,186

As may be seen in the annual costs incurred by a business for sponsoring an apprentice from Union C ranged from \$68,233 in year one to \$91,310 in year four. The journeyman training costs were calculated based on the training supervisor's estimate that a journeyman would respectively spend approximately 20 percent, 15 percent, 10 percent, and 5 percent of their time engaged in training in each of the four years of the apprentice's term at a wage rate of \$46.21 + FICA an hour, assuming 40-hour work weeks of 50 weeks per year.

The annual revenue per apprentice from Union C (Table 5.10) is realized by the hiring company as a result of the billable workweek of 40 hours per week at a rate of \$50 per hour, which is the rate the training supervisor indicated would be representative of the rate billed for the type of work in the area, for 50 weeks (or 2000 hours) a year, for 50 weeks (or 2000 hours) a year; apprentices receive two weeks of unpaid vacation.

Table 5-10: Annual Revenue per Apprentice from Union C

Hours per week	Number of weeks	Billable rate / apprentice / hour	Total revenue / apprentice / year
40	50	\$50	\$100,000

The company receives no additional revenue as a result of sponsoring Registered Apprenticeship. Therefore, the annual revenue realized by a business for sponsoring an apprentice from Union C (Table 5.11) shows annual revenue for years one through five of the apprenticeship of \$100,000. The years have the same total because the only source of revenue from an apprentice is consistent throughout the duration of the term.

Table 5-11: Annual Revenue Realized by a Business for Sponsoring an Apprentice from Union C

Year	Value of Product/Billed Hours	Other sources of Revenue	Annual Revenue	Present Revenue (5% discount rate)
1	\$100,000	\$ -	\$100,000	\$ 95,238
2	\$100,000	\$ -	\$100,000	\$ 90,703
3	\$100,000	\$ -	\$100,000	\$ 86,384
4	\$100,000	\$ -	\$100,000	\$ 82,270
				\$ 354,595

The net present value realized by a business for sponsoring an apprentice from Union C (Table 5.12) shows that given a 5-percent discount rate, the present cost of capital invested in apprenticeship is \$282,186 and the present revenue is \$354,595. Therefore the net present value realized by a business as a result of sponsoring an apprentice from Union C is \$187,950

Table 5-12: Net Present Value of Sponsoring an Apprentice for Union C

Net Present Value	Present Revenue	Present Cost
\$72,409	\$354,595	\$282,186

Exit Interview

During the exit interview the training director was shown the totals for annual costs and annual revenues (present cost and present revenue adjustments were made after the fact during the final data analysis portion) and stated, “The results look accurate; I think the contractors would agree.” Given the transparency that exists with regard to wages, and the ease of calculating the benefit based on the state billable wages it seems that the benefit-cost analysis information in this case is likely reliable. The major source

of uncertainty lies with the estimation of the billable wage, as that could vary from contractor to contract and job to job, but \$50 per hour is a low estimate, and as such would server to diminish rather than inflate the benefits.

The training director had quite a bit to say for businesses interested in pursuing sponsoring Registered Apprenticeships.

“Apprenticeship is a programmatic overlay of a partnership with many contractors. They could fix so many of Maine’s problems if they used Registered Apprenticeship as an overlay to a career pathway...Registered Apprenticeship offers flexibility and the ability to change and the ability to figure out if a career is for you...Registered Apprenticeship gives apprentices and businesses the black and white way to succeed...I think people want control and the mechanism for that comes from Registered Apprenticeship, for both employers and apprentices...Everything is clearly spelled out.”

The training director states businesses should: “Start by having an informed [internal] conversation, make a list of skills [and knowledge], know wages from low to high, and then bring that to the DOL and let the DOL do the work.”

The training director went on to add that if businesses are concerned about the cost of sponsoring, “It’s not about paying people good wages. It’s about paying them good wages while you’re training them the way you want, for your company’s future...” this is why the pay in the first probationary year of apprenticeship is so low. Once wages begin to increase “...it creates a mutual feeling of respect...” as apprentices start earning

more because of the training they have received on the job. Lastly, the training director suggested that if businesses were really concerned with losing apprentices they had trained they could “have apprentices sign a non-compete contract...this makes your investment real.”

Summary of Union Results

The results of the benefit-costs analysis of the unions in the sample showed an overall positive net present value indicating a return on investment and an overall benefit for businesses that contracted apprentices through labor unions. This indicates that these businesses realized a monetary benefit as a result of sponsoring Registered Apprenticeship with variability in the overall extent of that benefit.

Table 5-13: Summary of the Sector and Net Present Value

Organization	Sector	Net Present Value
Union A	Construction	\$185,911
Union B	Construction	\$119,853
Union C	Construction	\$72,409

With regard to the non-monetized benefits, there are two clearly emerging themes. The first is the desire of trade unions to continue the trades and ensure the future of their workforces. The second is the ability of trade unions to train their future workforces in a manner that ensures the productiveness of their apprentices and their

apprentices' abilities to meet the needs of contracting businesses. Those sentiments were echoed across all of the trade union training directors interviewed.

Businesses

The five businesses in the sample were comprised of one in the construction trades sector, three in the health and social services sector, and one in the manufacturing sector. These businesses range from very small, with less than three full-time employees including the apprentice, to larger businesses with several hundred employees.

Construction

The construction trades sector comprises fields such as carpenter, crane operator, electrician, metal fabricator, plumber, pipefitter, and welder.

Business A

Intake Interview

Business A is a mechanical contracting business that operates on major construction projects throughout Maine and New Hampshire. The training supervisor states the company participates in Registered Apprenticeships because “we get to hand pick the people we want,” typically individuals in their mid-20s or younger, with the ability to communicate professionally on paper and digitally. The company values those traits because it is trying to generate “...people that can take our place,” and as a result the company tries “...to teach...a whole professional way of life” based on the motivations of the apprentices. The training supervisor states that the company does not

view apprenticeship as having a cost because the company bills out for apprentices at a rate greater than that which is paid.

Business A has approximately 185 to 200 full-time employees, and currently has two registered apprentices. It began sponsoring construction-trades apprenticeships in 2000 and has had “at least 30, and probably more” apprentices complete both the plumbing and pipefitting certifications, both of which require a 4000-hour term. The training supervisor also stated the company was currently looking at taking on apprentice welders as well.

The company predicts that of its current employees “50 percent will retire in the next 10 years,” and that 80 percent of the 30 or more apprentices complete their training. Currently, the company fills about 20 entry level positions every year, and of those approximately five are registered apprentices, and 15 are simple laborers, or those entering the less-intensive, in-house apprenticeship program (Because the “in-house” training program does not meet the requirements of Registered Apprenticeship it was not considered for the benefit-cost analysis). The training supervisor states that the apprentices that complete their training are less likely to leave the company than their non-apprentice counterparts because “they owe us because we’re paying them and training them.”

The training supervisor states that of those that do not make it, the major reason is an inability to keep up with the demands of the program. “One of the things that needs to be changed at the state level is...the off-the-job training...the three-hour modules are too

long...it's too much during the work week.” The training supervisor states many of his apprentices struggle to maintain the full-time work, two nights a week of classroom training, and family commitments, and that those individuals typically know within the first few weeks whether they will be able to complete the program. Recently the company has begun using an online training program that has alleviated some of the travel burden from their in-house apprentices.

Since the economic decline of 2008, the company has had more difficulty sponsoring Registered Apprenticeship and had been switching to an in-house apprenticeship training model. This in-house training model offers more virtual learning and requires less travel of the apprentices to attend off-the-job training, but because the program is not a Registered Apprenticeship, there is no guarantee that those who complete the training will have a nationally recognized certification.

Another issue the training supervisor indicated was a lack of business knowledge “...that would be a great thing to include in...apprenticeship programs”. The company is looking for that business acumen in the apprentices because of the last two large groups of registered apprentices in 2000-2004 and 2004-2008 almost all of the journeymen produced have been promoted within the company. The training supervisor also stated that the company does not engage in poaching from other companies, and so those external candidates that are hired to fill positions above journeymen are filled through recommendations from the top foreman in the company.

The calculations that follow are representative of one theoretical apprentice over the 4000-hour term spanning two years. That was done because the training supervisor did not have access to the specific payroll records of any one specific apprentice, but rather had the holistic knowledge of the general wages and compensation and training for any apprentice. The training supervisor was also generally knowledgeable with regard to the potential revenue stream generated by any apprentice, rather than having access to records for any specific apprentice. The apprentice is assumed to work a standard 40-hour work week (38.5 hours of billable work on-the-job and 1.5 hours of paid off-the-job training). The apprentice is also assumed to receive two weeks of unpaid vacation during the apprenticeship, and does not represent any one specific apprentice, but rather an ideal apprentice.

Accounting Framework

The annual cost of sponsoring an apprentice for Business A (Table 18) shows a cost during year one of \$40,455 and the cost during year two as \$51,220.

Table 5-14: Annual Cost of Sponsoring an Apprentice for Business A

Year	Apprentice Wages	Insurance		Supervision	Journeyman Training	Admin	Annual Cost	Present Cost (5% discount rate)
1	\$28,000	\$4,938	\$2,142	\$1,500	\$1,500	\$875	\$40,455	\$35,529
2	\$38,000	\$4,938	\$2,907	\$1,500	\$1,500	\$875	\$51,220	\$46,458
								\$84,987

The major difference between years one and two was the wages paid to the apprentice. The apprentice made \$13 per hour in the first 1000 hours, \$15 per hour in the

second 1000 hours, then \$18 per hour and finally \$20 per hour for the last 1000-hour increment based on the apprenticeship agreement established with Registered Apprenticeship. The FICA expense is also higher in year two than in year one since it is calculated based on the total wages paid. Other than those two columns, all of the other expenses are the same in each category. The training director indicated that both supervisors and journeymen make approximately \$60,000 per year. The training director stated that supervisors would spend about two hours each week, for 50 weeks, for the duration of the apprenticeship engaged in training. Journeymen would spend one hour in training each week for the duration of the apprenticeship. The company does not provide paid vacation which is why a work year is 2000 hours (50 weeks at 40 hours per week). The company also does not provide its apprentices with a retirement account until they have completed training and become a journeyman. The company spends no money on recruitment; all job training is done and paid for in-house so there is no off-the-job training expense, and the company considers wastage a cost of doing business and so does not maintain detailed records.

The annual revenue per apprentice for Business A (Table 5.15) is that of the billable workweek of 38.5 hours (though apprentices work a 40-hour work week they have one and a half hours of off-the-job training with the employer for which the employer cannot bill a client) per week at a rate of \$45 per hour for 50 weeks (or 2000 hours) a year: again apprentices receive two weeks of unpaid vacation.

Table 5-15: Annual Revenue per Apprentice for Business A

Hours per week	Number of weeks	Billable rate / apprentice / hour	Total revenue / apprentice / year
38.5	50	\$45	\$86,625

The company receives no additional revenue as a result of sponsoring Registered Apprenticeship. Therefore, the annual revenue of sponsoring an apprentice for Business A (Table 5.16) shows annual revenue for years one and two of the apprenticeship of \$86,625 each. Both of those years have the same total because the only source of revenue from the apprentice is consistent throughout the duration of the term.

Table 5-16: Annual Revenue of Sponsoring an Apprentice for Business A

Year	Other sources of Revenue	Value of Product/Billed Hours	Annual Revenue	Present Revenue (5% discount rate)
1	\$ -	\$86,625	\$86,625	\$82,500
2	\$ -	\$86,625	\$86,625	\$78,571
				\$161,071

As such, the net present value of sponsoring an apprentice for Business A (Table 5.17) shows that given a 5-percent discount rate, the present cost of capital invested in apprenticeship is \$84,987 and the present revenue is \$161,071. Therefore the net present value realized by Business A as a result of sponsoring an apprentice is \$76,084.

Table 5-17: Net Present Value of Sponsoring an Apprentice for Business A

Net Present Value	Present Revenue	Present Cost
\$76,084	\$161,071	\$84,987

Exit Interview

During the exit interview the training supervisor was shown the totals for annual costs and annual revenues (present cost and present revenue adjustments were made after the fact during the final data analysis portion) and stated, “[The annual cost and revenue data] look very accurate” though “trying to get everything broken down was difficult,” and there were fields such as wastage and recruitment for which the company did not have any records. The accuracy of the results for Business A is likely due in large part to the reasonably simple business-accounting for the firm. In terms of the total cost calculation the major cost-center is direct compensation to the apprentice and the major benefit was calculated in terms of billable hours worked by the apprentice. In general, the business seems to incur very little in training costs in light of the fact that “most of the craftsman we work with have a basic mechanical ability” so they don’t need much training.

Because of the size of Business A, the training supervisor was unable to provide all of the information required to complete the accounting framework during the initial meeting so in this case the framework was left with the training supervisor for completion with the business’ accounting team. When asked about ways to increase the accuracy of the benefit-cost model the training supervisor stated that the format of the accounting framework was good and that it was quite easy to follow, indicating that the framework may be able to be completed independent of the researcher.

Aside from the financial benefits seen by the company during the term of an apprenticeship, the training supervisor also indicated the non-monetized benefits of sponsoring apprenticeship as:

- “To continue the trades...[because]...we are having a hard time filling positions...”
- To “...keep the company running past the current administration...” by promoting employees from within the company, ostensibly those that have completed the apprenticeship program.

With regard to advice proffered to companies interested in sponsoring apprenticeship the training supervisor suggested that it was important for companies to screen their applicants to ensure they have some of the skills necessary to be successful. Furthermore, he suggested that success was not limited solely to work completion, but that leadership skills and habits of mind were also essential to ensure an apprentice would be able to progress in the company. The training supervisor specified that people that were inquisitive and interested in understanding the entire job, rather than just doing work, were the most successful stating, “It’s not for dummies...you have to be a pretty sharp individual to run a large project.”

Health and Social Services

The health and social services sector comprises fields such as critical care nurse, emergency nurse, and float nurse, along with funeral director and practitioner, human services assistant, ocularist, pharmacy technician, and veterinary technician.

Business B*Intake Interview*

Business B is a funeral home located in southern Maine, with a second larger location in southern New Hampshire. The company has four full-time, fully certified funeral directors, including the two owners (one of whom completed Registered Apprenticeship with the business) and two other employees (both of whom completed RA with the business). The company has been sponsoring Registered Apprenticeship since 1987 because “they will learn the business as [the owner] was taught it.” Specifically the business emphasizes customer service and customer satisfaction and has “never looked at [apprenticeship] as a cost... [It] has always sponsored because [it] have a spot for one” and would “prefer that they stay with [the business].” The owner states that by sponsoring apprenticeship the business gets to ensure apprentices learn what the business wants and “weeds out those that aren’t cut out for it” which benefits both the business and the apprentices.

Since it began sponsoring RA in 1987, the company has had a total of seven registered apprentices in the funeral director certification. The apprenticeship term is 2000 hours and is completed after an apprentice earns an associate’s degree in mortuary science, and passes state and national testing, as well as an embalming practicum. The business is currently sponsoring one apprentice who is due to complete her certification soon. The business is expecting to take on another apprentice at that time, and is actively seeking a certified funeral director and has been for the past 10 months.

The owner states that the business takes on one new apprentice every three years on average. Registered apprenticeship is the only way to earn certification as a funeral director or funeral practitioner in the state of Maine. That is because of several of the certification requirements, including post-mortem services such as embalming, can only be learned on the job. Thus all of the employees the business has, or has had, have either come to the business fully certified having completed their apprenticeship with another firm, or have gone through apprenticeship with the business. Apprenticeship *is* the entry level position and only registered apprentices are able to fill openings.

Of the seven apprentices the business has sponsored, four have become full time employees, one has completed training and taken employment at another company, and two did not complete their training. Of those two, the owner states: "one found it just was not for him...he got a job in a completely different field," while the other went on to focus on grief counseling. Since the term of the apprenticeship is 2000 hours or approximately one year, both of those apprentices left within that first year of employment. Other than those two, the business manager states that there is very little turnover in the field.

The apprentice selected for use in the accounting framework was training to become a funeral director. The term for a funeral director apprenticeship is 2000 hours, or roughly one year at 40 hours each work week for 50 weeks of the year.

Accounting Framework

As can be seen from the annual cost of sponsoring apprenticeship for Business B (Table 22) the annual cost for sponsoring the apprentice was \$64,983 over the 2000-hour term with wages paid to the apprentice and wages paid to the journeyman as the highest two costs.

Table 5-18: Annual Cost of Sponsoring Apprenticeship for Business B

Year	Apprentice Wages	FICA	Supervisor Training	Journeyman Training	Admin	Recruitment	Annual Cost	Present Cost (5% discount rate)
1	\$28,000	\$2,142	\$9,226	\$25,235	\$80	\$300	\$64,983	\$61,889

The apprentice's wage began at \$13 per hour during the first half of the apprenticeship and increased to \$15 per hour in the second. The business offers apprentices health and dental coverage, but the apprentice in this study did not need the employer-provided benefit. Health and dental insurance coverage would normally cost the company \$512 per month, or \$3.07 per hour. Assuming a nominal 40-hour work week those costs might come into play given a different apprentice.

FICA contributions made by the sponsor are equal to those made by the apprentice. Business B does not contribute to any retirement programs for its apprentices. The owner estimated that the supervisor's wage during the time of the apprenticeship was \$80,000 per year + 7.65% FICA + \$3.07 per hour for benefits, which equate to \$46.13 per hour and that the supervisor spent on average four hours each week during the duration of the apprenticeship engaged in training. The business manager stated that the

wages for the journeymen engaged in training was between \$22 and \$30 per hour and so the average of \$26 per hour was used for the calculations + 7.65% FICA + \$3.07 for benefits totaling \$31.06 per hour. The business owner stated the company had no expenses for off-the-job training, wastage and the associated repairs/fixes, and only \$80 in annual administrative costs directly related to sponsoring the apprenticeship. In addition, the business spent \$300 on an ad in a national journal to recruit either a fully trained funeral director or an apprentice.

The annual revenue per apprenticeship for Business B (Table 23) was calculated using the partial marginal productivity gained by sponsoring the apprentice. In this case, the apprentice's marginal productivity was stated by the owner to be 25 percent that of a journeyman during the first quarter of the apprenticeship, 35 percent during the second quarter, 50 percent during the third, and 85 percent during the last. Based on that, the average marginal productivity of the apprentice is 48.75 percent that of a journeyman. According to the owner the funeral home does approximately 45 "calls" each year and that those 45 calls can be attended by a single funeral director. The owner stated that, in Maine, statistically 65 percent of those calls are for cremation rather than burial. The owner states that the 65 percent is disaggregated into 35 percent direct cremation, and 25 percent cremation with some extra services and 5 percent cremation after embalming, and that for these services the billable work conducted by the funeral director is \$2,295, \$3,200, and \$3,770 respectively. Thirty-five percent of the calls were for embalming and burial which on average yields about \$4100 of billable work. Using those percentages, it was determined that on average, the funeral home conducts 16 direct cremations, 11

cremations with some additional services, 2 full embalming services followed by cremation, and 16 embalming and burial services annually.

Table 5-19: Annual Revenue per Apprentice for Business B

Annual work	Billable rate	Marginal productivity of apprentice	Marginal annual revenue generated by the apprentice
35% Direct Cremation= 16 calls 25% Direct + other services = 11 calls 5% Cremation after Embalming = 2 Calls 35% Burial = 16 Calls	16 Calls @ \$2,295 each = \$36,720 11 Calls @ \$3,200 each = \$35,200 2 Calls @ \$3,770 = \$7,540 16 Calls @ \$65,600	1 full-time fully-trained employee @ 100% efficiency 1 apprentice @ 48.75% Average Marginal Productivity	1.4875 employees = \$145,060
45 Calls total	Total Revenue = \$145,060	1.4875 employees	Annual Revenue generated by the apprentice \$47,541

Using the call breakdown in conjunction with the billable rates it was determined that the full billable value of the work conducted at the funeral home in one year was \$145,060. That work was performed by one full-time, fully trained employee (Marginal Productivity = 1) along with the apprentice (Average Marginal Productivity = 0.4875) it was determined that the apprentice contributed \$47,541 of the total revenue.

The company receives no additional revenue as a result of sponsoring Registered Apprenticeship. Therefore, the annual revenue of sponsoring an apprentice for Business B was \$47,451.

Table 5-20: Annual Revenue of Sponsoring an Apprentice for Business B

Year	Value of Product/Billed Hours	Other sources of Revenue	Annual Revenue	Present Revenue (5% discount rate)
1	\$47,451	\$ -	\$47,451	\$45,277

As such, the net present value of sponsoring an apprentice for Business B (Table 5.21) shows that given a 5-percent discount rate, the present cost of capital invested in apprenticeship is \$61,889 and the present revenue is \$45,277. Therefore the net present value realized by Business B as a result of sponsoring an apprentice is \$-16,612. That negative net present value would be recouped in less than one year assuming no changes in the apprentice's compensation package, and that the apprentice, now journeyman, had a marginal productivity of 90 percent.

The major reason the net present value for Business B is negative is because of the average marginal productivity of the apprentice over the course of the year is low. That average marginal productivity is based on the employer's estimation, and therefore does represent a potential source of error. If the apprentice's average marginal productivity was 63.5 percent, then the net present revenue would be equal to the net present cost during the year of the apprenticeship. As a means of perspective, if the apprentice's marginal productivity was estimated to increase in a linear fashion from 25 percent in the first quarter to 100 percent in the last, the average marginal productivity would be 62.5 percent.

Table 5-21: Net Present Value of Sponsoring an Apprentice for Business B

Net Present Value	Present Revenue	Present Cost
\$(16,612)	\$45,277	\$61,889

Exit Interview

During the exit interview the owner identified an issue with the initial annual cost and annual revenue results. Because the estimates given by the business owner for benefit calculation were overly simplified, there was a compound error, making the annual revenues noticeably and erroneously high. At that point the researcher and the business owner reevaluated the businesses benefit together, taking into consideration the total number of funerals performed annually, the services rendered at said funerals, and the income generated as a result. The apprentice's average marginal productivity was then used to calculate the new benefit listed in the previous tables, 5-18 through 5-21.

When given the new annual cost and annual benefit data the business owner stated, "Yes, that's better...once I saw those [old] numbers, I knew they just weren't right...that's the way that [our business] goes," indicating that the final total benefit seemed reasonable in light of both the number of annual calls the funeral home had and the statistical frequencies of cremation vs. burial. When asked about the accuracy of the marginal productivity, the business owner reflected on her own apprenticeship stating, "There's so much to learn in this business...at the end of my apprenticeship I still didn't know 100 percent, I don't think that just a year gets you to 100 percent...after the first quarter you get to 25 percent...and by the end you get to know all the aspects, you get to know embalming and funeral directions and you might be better at one than the other."

When asked about the accuracy of the model the business owner stated, "I don't know that I would know...I'm just answering your questions" and that the "...emails and discussion opened up things [both she and the researcher] didn't originally think about."

The owner also stated that the business has just hired another apprentice, and when asked what factors aside from cost would influence participation in Registered Apprenticeship she stated: "It was never about cost or benefit; it was about getting young people into the business." Based on those perceptions, she stated that she would specifically advise funeral home businesses interested in sponsoring apprenticeship that "...if someone is serious and [the business] has room, I would strongly suggest they take on someone because there isn't a lot of interest." In general the owner indicated that sponsoring apprenticeship was a good way to get young people involved in the business and "give them a chance to do it...with an apprentice if it doesn't work out [the apprentice] can move on". The owner also stated that apprenticeship was a great way to "...make them feel like they are a part of something, they can contribute, and they are important".

Business C

Intake Interview

Business C is a funeral home that employs three full-time fully certified funeral practitioners (a variation of the funeral director certification) and one apprentice, now journeyman, who completed his training in July. They have been operating in southern and central Maine since the late 1800s. Ownership of the business has passed from one

family to another over the past 100 years, but it has always been a family owned and operated establishment. The current owner completed his apprenticeship in 1990 with the business, became a full time employee, then and purchased it from the previous owner (who is still employed by the business) in 1999.

The current business owner believes he is the first person to have completed a Registered Apprenticeship with the business. He was the only apprentice sponsored by the previous owner, and since taking ownership of the company, he has sponsored two additional apprentices. One of those completed training 11 years ago, and since has been promoted to business manager, and the other just recently completed training. All three completed their 2000 hour/one-year funeral practitioner certification.

The owner states that he sees the benefits of apprenticeship in all of the three major aspects of employment: recruitment, retention, and advancement.

“The biggest thing is the mentoring...bringing young people into a field that’s rewarding...then having a long lasting career on the other end...it were done for me and now I get to do it again...it’s a big part of succession planning.”

The business clearly has a long history of sponsoring targeted apprenticeship as a means of ensuring its future. The business owner believes that all three of the current funeral practitioners will retire in the next ten years, which means there is the potential for the apprentice who just completed training to advance to business manager, and the potential, too, for that apprentice to buy the company.

Accounting Framework

The annual cost for sponsoring an apprentice for Business C shows the annual cost incurred was \$135,772.

Table 5-22: Annual Costs for Sponsoring an Apprentice for Business C

Year	Apprentice Wages	Insurance	FICA	Supervisor Training	Journeyman Training	Off-the-job Training	Wastage	Annual Cost	Present Cost (5% discount rate)
1	\$42,647	\$4,914	\$3,262	\$69,948	N/A	\$12,000	\$3,000	\$135,772	\$ 129,306
									\$ 129,306

The major costs centers are wages paid to the apprentice, wages paid to the training supervisors and off-the-job educational expenses. The business owner was able to provide the total salary paid to the apprentice during the term of apprenticeship in the form of payroll documents. Those showed the regular hourly work plus any overtime pay, thus the figure is very accurate. The business owner was also able to provide the annual total salary paid to the three funeral practitioners who conducted the training. All three of those were considered supervisors for the sake of organizing the data. Along with the supervisors' gross annual pay, the owner was also able to provide the approximate percentage of time each individual likely spent engaged in training. The last major cost sector, off-the-job training, is a stated educational expense from the business owner. The wastage amount comprises "write-offs," mistakes made in the quoting or billing process by the apprentice, for which there was no recourse of correction; the business simply absorbed those errors.

The annual revenue per apprentice for Business C was calculated using the marginal productivity of the apprentice. That was conducted in a similar fashion to Business B with the exception that Business I was able to provide the total bottom line for the company for the year in question.

Table 5-23: Annual Revenue per Apprentice for Business C

Total Annual Revenue	Marginal productivity of apprentice	Marginal annual revenue generated by the apprentice
\$371,527	3 full-time fully trained employee @ 100% efficiency 1 apprentice @ 46.25% Average Marginal Productivity	3.4625 employees = \$371,527
	3.4625 employees	Annual Revenue generated by the apprentice \$49,626

To determine what percentage of this net income was produced by the apprentice the apprentice's marginal productivity was calculated based on stated values of 15 percent in his first quarter, 35 percent, 50 percent, and 85 percent in each of the following quarters respectively, thus giving an average of 46.25 percent. From that, it was assumed that the other three fully trained funeral practitioners were each 100-percent productive, and that each contributed equally to the net income of the company. As such the total net income of the company was divided by 3.4625. That gives the total contribution for one full time, fully trained, 100-percent productive employee, which share was then multiplied by the apprentice's average marginal productivity over the term. That provides a total production value of \$49,626 to the company as a result of sponsoring said apprentice.

The company receives no additional revenue as a result of sponsoring Registered Apprenticeship. Therefore,

The annual revenue of sponsoring an apprentice for Business C is \$49,626.

Table 5-24: Annual Revenue of Sponsoring an Apprentice for Business C

Year	Value of Product/Billed Hours	Other sources of Revenue	Annual Revenue	Present Revenue (5% discount rate)
1	\$49,626.36	\$ -	\$49,626	\$47,263
				\$47,263

As such, the net present value of sponsoring an apprentice for Business C (Table 5.25) shows that given a 5-percent discount rate, the present cost of capital invested in apprenticeship is \$129,306 and the present revenue is \$49,626. Therefore the net present value realized by Business C as a result of sponsoring an apprentice is \$-79,680. That negative net present value would be recouped in approximately three years assuming no changes in the apprentice's compensation package and that the apprentice, now journeyman, had a marginal productivity of 90 percent in the second year of employment and a 100 percent marginal productivity in the third.

The major reason the net present value for Business C is negative is that the average marginal productivity of the apprentice over the course of the year, which was estimated by the employer, was estimated as low. That average marginal productivity is based on the employer's estimation, and therefore does represent a potential source of error. If the apprentice's average marginal productivity was higher the net present

revenue would increase, thus lessening the overall negative net present value during the term of the apprenticeship, and decreasing the overall time required to recoup the investment. As a means of perspective, if the apprentice's marginal productivity was estimated to increase in a linear fashion from 25 percent in the first quarter to 100 percent in the last, the average marginal productivity would be 62.5 percent. At that rate of marginal productivity, the company would recoup its investment at the end of one year.

Table 5-25: Net Present Value of Sponsoring an Apprentice for Business C

Net Present Value	Present Revenue	Present Cost
\$(79,680)	\$49,626	\$129,306

Exit Interview

During the exit interview, the business owner was shown the totals for annual costs and annual revenues (present cost and present revenue adjustments were made after the fact during the final data analysis). The owner stated: "That's quite amazing!" Having previously never calculated the costs or benefits for the company as they specifically pertain to the apprentices, the business owner was surprised by the costs. When asked about his perceptions of the accuracy of the annual costs and revenues the business owner stated, "I think the results are accurate, we've had to pay for his training...it takes him longer to do things...the numbers all make sense".

The business owner was quite confident with his estimation of the marginal productivity of the apprentice. As a former apprentice himself the business owner stated "I remember the previous owner told me it takes 10 years to handle every case that comes through the door on your own and to do it the first year there's just no way".

Lastly, with regard to advice for companies interested in sponsoring Registered Apprenticeship the business owner stated, "...everything is becoming a lost art...I feel it is important to give back to young people...". He would also encourage businesses to "do if for the right reasons" which included "being patient...giving back knowledge...and mentoring. All are important."

Business D

Intake Interview

Business D is a medical prosthetics company operating in central Maine, and doing business across the state, as far south as Massachusetts in this country, and attracting customers from around the world. Operating in the health and human services sector, Business D has one apprentice working towards an ocularist certification. The president and owner is the only full-time employee of Business D. There is also a three-quarter time secretary and bookkeeper, who is also the vice-president, as well as a part-time laboratory technician who is a former apprentice.

The company has been sponsoring Registered Apprenticeships since 1997 because it is interested in training staff replacements, and because of a sense of duty to their existing customers and to those that will require their services in the future. The owner states, we "train them the way we want them" and is "...thrilled we are doing this...there are so few sources to learn this...it's absolutely about passing on a knowledge base". Business D sponsors apprenticeships in light of its calculations that it costs more than \$100,000 per year and that it "has to learn how to teach an apprentice" which is

“stressful.” Much of that effort is likely overshadowed by the need to train their replacements in light of the fact that both the president and vice president are interested in retiring as soon as they can train an apprentice to take over the business, at which point they would be retained simply as consultants.

Since the company began sponsoring Registered Apprenticeship in 1997, it has had four apprentices, including the current one who is in the third year of apprenticeship. The certification for clinical ocularist and anaplastarist requires 10,000 hours of training completed over a five-year period. Of the three previous apprentices the business has sponsored, one did not finish the apprenticeship, but later became a laboratory technician at the company. The other two apprentices did not complete their training because one was “incompetent” and unable to learn the skills necessary, and the other could not accept the timeline for training and wanted to complete training sooner. All three of the apprentices that did not complete left after having completed 1000 to 6000 hours.

Because of the size of the company and because of the very specific nature of its craft they have very low recruitment and turnover. Since it began sponsoring apprenticeship in 1997, it has had an apprentice almost continuously. The owner states, “I had another apprentice when the current apprentice sought me out. So [the person] called me within a day or so of the previous apprentice washing out.” Based on the specificity of the skills and knowledge required to complete the work the owner would hire someone that was not an apprentice, but the person would also require a great deal of training and so she has always simply hired apprentices. The business also has very low turnover, the

The apprentice wages were agreed upon at the start of the apprenticeship and were based on percentages from 73.3 percent to 100 percent of the journeymen wage, \$15.00 per hour, over the course of five years. The supervisor training was based on a range of time spent in training from 30 hours per week in the first year of training down to four hours a week in the final year. The business-manager training did not start until the second year, and even then was only a small portion of the on-the-job training. The business manager speculated the apprentice had five hours per week of training in the second year, 10 in the third, and 15 in the fourth, after which the apprentice had all of the skills and knowledge required and would require only approximately one hour each week of checking in. The off-the-job training cost was calculated based on annual dues to a professional journal (\$250) and travel and annual attendance to professional conferences (\$2500). The business also provides the apprentice with an apartment for which the business covers heat, hot water, electricity, and security valued at \$3600 annually. Lastly, the owner estimated about \$1200 in waste generated during teaching and training each year over the course of the five-year term.

As seen in Table 5.27, the portion of revenue generated by the apprentice ranges from \$0 in year one to \$215,000 in year five. That is because only the owner and apprentice generate billable work for the company, minus the small amount that is conducted by the lab tech. As the apprentice takes over, the owner steps back and the income stream is born increasingly by the efforts of the apprentice. The businesses total annual income is approximately \$225,000 (based on a three-year snapshot), and it was estimated that the lab technician produced about \$10,000 of annual work toward that

product. Therefore, it was determined that the annual income generated by the owner/apprentice is \$215,000. In year one that was 100 percent the owner, in year two the apprentice contributed 25 percent of the total, in the current year the apprentice has taken on 65 percent of the total work of the owner, and in the next two years the owner speculates she will retire (retaining ownership of the business and consulting on specialty cases) and the apprentice will take on 100 percent of the work.

Table 5-27: Annual Revenue per Apprentice for Business D

Year	Average Annual Revenue	Marginal Productivity of Apprentice	Portion of Revenue Generated by Apprentice
1	\$215,000	0%	\$ -
2	\$215,000	25%	\$53,750
3	\$215,000	65%	\$139,750
4	\$215,000	82.5%	\$177,375
5	\$215,000	100%	\$215,000

The company also receives additional revenue as a result of sponsoring RA in the form of reimbursements from the state for one half (\$1375) of the total (\$2750) dues and conferences the apprentice attends as part of off-the-job training. Therefore, the annual revenue of sponsoring an apprentice for Business D ranges from \$1,310 to \$169,535 from the first through the fifth year.

Table 5-28: Annual Revenue of Sponsoring an Apprentice for Business D

Year	Value of Product/Billed Hours	Other sources of Revenue	Annual Revenue	Present Revenue (5% discount rate)
1	\$ -	\$1,375	\$1,375	\$1,310
2	\$53,750	\$1,375	\$55,125	\$50,000
3	\$139,750	\$1,375	\$141,125	\$121,909
4	\$177,375	\$1,375	\$178,750	\$147,058
5	\$215,000	\$1,375	\$216,375	\$169,535
				\$489,812

The net present value of sponsoring an apprentice for Business D shows that given a five-percent discount rate, the present cost of capital invested in apprenticeship is \$327,191 and the present revenue is \$489,812. Therefore the net present value realized by Business D as a result of sponsoring an apprentice is \$162,621.

Table 5-29: Net Present Value of Sponsoring an Apprentice for Business D

Net Present Value	Present Revenue	Present Cost
\$162,621	\$489,812	\$327,191

Exit Interview

During the exit interview the owner was shown the totals for annual costs and annual revenues (present cost and present revenue adjustments were made after the fact during the final data analysis) and stated she felt the results "make sense...[because]...I can see in a year where she will be carrying us." The business has had experiences with apprentices in the past that have not worked out and the owner indicated that she was

much more confident that the current apprentice would not only complete the training, but would also be able to take over the business.

When pressed to support her estimates of the apprentice's marginal productivity the business owner stated, "Because at first it was a kid coming in and watching what you're doing...she just had to watch, listen, learn, meet patients...she can't *work* with patients until she knows what she's doing. And then [her productivity] doubles because she knows the basics...[now] there are still things that she asks me for help...[but]...she's at the point where she wants to be doing instead of asking". The business owner emphasized the necessity of a connection with the patients as one of the major early indicators as well as milestones that an apprentice would be successful.

The business manager stated the model "seemed thorough...and efficient" and "...gave the business a better understanding of what is going on in [their] business". When asked about other factors that would influence involvement in Registered Apprenticeship, the business owner stated "You get to train them the way you want them" and "...can be more selective..." with her apprentices because there are only two states that have ocularist apprenticeships. The owner also expressed her sense of duty to her current customers and to the people of Maine because there are so few businesses that provide services like hers. "You benefit from passing your craft along...you don't want to just say -- I'm retiring. You want someone to take care of your [patients]...I think that's important, very important, that there's someone to do that in Maine."

When asked what advice she might have for businesses interested in sponsoring Registered Apprenticeship in the future the owner indicated that it takes a great deal of work to set up, and potential sponsors should be sure they understand why they want to do it. "It's a commitment...a student/teacher relationship."

Manufacturing

The manufacturing sector comprises fields such as cabinet maker, CNC tool operator, electrical designer, laminator, materials engineer, and waterworks technician.

Business E

Intake Interview

Business E is located in southern Maine, specializing in HVAC installation and servicing. It does business in Maine, New Hampshire, and Massachusetts. The company has eight full-time employees: two office staff, the owner/salesman, and five technicians. The company has been sponsoring Registered Apprenticeship since 2005 because "[we] get to train them the way [we] want them" despite the costs associated with sponsoring apprentices including the costs of employment, benefits, insurances, and personal time off, as well as business apparel and a clothing allowance.

The company has had a total of four registered apprentices, none of whom have completed the process. Three of the four, however, are currently employed by the company as full-time, fully trained workers. The business manager states the lack of completion is "because [employees] didn't follow through with the paperwork," but that employees did complete the term hours required by the Registered Apprenticeship, and

also completed the necessary training. “That’s the hardest part of being a small business, we don’t have a person who is just payroll, so those things fall through the cracks. It gets put on the back burner and nobody thinks of it.” The business manager also indicated that the Maine Department of Labor takes a fairly hands-off approach to Registered Apprenticeship in that “...once [apprentices] filed their paperwork we never heard from [Maine DOL] again...no letters, phone calls, nothing.” In the exit interview, the business manager stated it would be helpful “if the state sent out emails once a month asking apprentices to report their hours.”

Accounting Framework

Of these four apprentices the one “...that did the most work did so because he was also applying for GI benefits” but left the company before completing his training. Currently, the company has two employees they consider “apprentices,” although they individuals are not currently engaged in formal RA. Therefore the employee selected for use in the accounting framework is the one who completed the most paperwork, but who ultimately left before completing his term. The individual was chosen for two reasons: his data were the most complete, and he likely had the highest costs and lowest benefits.

The apprentice selected was training to become an HVAC technician, which falls under the manufacturing apprenticeship sector, though the business manager stated that the company more closely aligned with the construction trades sector because its work was performed exclusively on-site. The term for an HVAC technician apprenticeship is 6000 hours, or roughly three years at 40 hours each work week for 50 weeks of the year.

The apprentice in this survey completed a total of 4932.25 hours of training (4571 regular hours and 361.25 hours of overtime) during 122 work weeks from January 2005 to June 2007 at which point he left the company.

As seen in Table 5.30, the annual cost for sponsoring the apprentice was \$95,587 in the first year, \$95,285 in the second, and \$28,206 for the portion of the third year during which the apprentice was still with the company.

Table 5-30: Annual Cost of Sponsoring an Apprentice for Business E

Year	Apprentice Wages	Insurance	FICA	Supervisor Training	Journeyman Training	Recruitment	Misc. Cost	Annual Cost	Present Cost (5% discount rate)
1	\$38,223	\$3,559	\$2,921	\$4,844	\$45,465	\$150	\$425	\$95,587	\$91,035
2	\$49,303	\$6,714	\$3,689	\$4,844	\$30,310	\$ -	\$425	\$95,285	\$86,426
3	\$11,182	\$6,977	\$822	\$2,131	\$6,668	\$ -	\$425	\$28,206	\$24,365
									\$201,827

In this case, the payroll sheets provided by the employer including the gross pay, insurance, and FICA were provided by the employer. The apprentice's wage began at \$17.50 per hour for regular hours during the year and a half of the apprenticeship, and increased to \$19.00 per hour in the second year and a half of the apprenticeship. The apprentice received time and half for over time and double time on Sunday. The total insurances paid by the employer contains health insurance premiums after the company began providing health insurance for their employees in April 2006, workers compensation insurance, liability insurance and unemployment insurance. All other insurance coverages were paid for by the apprentice, with the exception of workers

compensation insurance. (Workers compensation and liability is paid by employers but is not disaggregated by employee so no accurate estimate could be made.)

FICA contributions made by the sponsor are equal to those made by the apprentice. Business E does not contribute to any retirement programs for its employees. The business manager estimated that the supervisor's wage during the time of the apprenticeship was \$900 per week + 7.65% FICA which equates to \$24.22 per hour, and that the supervisor spent approximately four hours each week for the entire duration of the apprenticeship engaged in training. The business manager stated that the wages for the journeymen engaged in training during the aforementioned window was \$27 per hour + 7.65% FICA + health insurance (for simplicity it was assumed that journeymen received health benefits for the entire duration of the apprenticeship despite the fact that they did so only for the second half) totaling \$30.31 per hour. Because the apprenticeship used in this analysis took place between eight and ten years ago the business manager was unable to recall with any degree of accuracy any expenses that were spent for off-the-job training, wastage and the associated repairs/fixes, or administrative costs incurred directly related to sponsoring the apprenticeship, though she did remember posting a newspaper ad for recruitment that cost \$150.

The annual revenue per apprentice for Business E is that of a billable work-week of 38.5 hours (although apprentices work a 40-hour work week they have one and a half hours of off-the-job training with the employer for which the employer cannot bill a

client) per week at a rate of \$45 per hour for 50 weeks (or 2000 hours) a year: again, apprentices receive two weeks of unpaid vacation.

Table 5-31: Annual Revenue per Apprentice for Business E

Year	Hours per week	Number or weeks	Billable rate / apprentice / hour	Total revenue / apprentice / year
1	40	50	\$60	\$120,000
2	40	50	\$70	\$140,000
3	40	22	\$80	\$74,560

The company receives no additional revenue as a result of sponsoring Registered Apprenticeship. Therefore, as shown in Table 5.32, the annual revenue of sponsoring an apprenticeship for years one and two is \$86,625 each year. The years have the same total because the only source of revenue from the apprentice is consistent throughout the duration of the term.

Table 5-32: Annual Revenue of Sponsoring an Apprentice for Business E

Year	Value of Product/Billed Hours	Other sources of Revenue	Annual Revenue	Present Revenue (5% discount rate)
1	\$ 120,000	\$ -	\$ 120,000	\$ 114,286
2	\$ 140,000	\$ -	\$ 140,000	\$ 126,984
3	\$ 74,560	\$ -	\$ 74,560	\$ 64,408
				\$ 305,678

Therefore, the net present value of sponsoring an apprentice for Business E shows that given a five-percent discount rate, the present cost of capital invested in apprenticeship is \$201,827 and the present revenue is \$305,678. That means the net present value realized by Business E as a result of sponsoring an apprentice is \$103,851.

Table 5-33: Net Present Value of Sponsoring an Apprentice for Business E

Net Present Value	Present Revenue	Present Cost
\$103,851	\$305,678	\$201,827

Exit Interview

While Business E confirmed that the results of the accounting framework seemed accurate, no one in the business had to time necessary to complete the entire exit interview process.

Summary of Business Results

The table below shows a summary of the net present value in the business examined in this research.

Table 5-34: Summary of Sector and Net Present Value

Organization	Sector	Net Present Value
Business A	Construction	\$76,084
Business B	Health and Social Service	- \$16,612
Business C	Health and Social Services	- \$79,680
Business D	Health and Social Service	\$162,621
Business E	Manufacturing	\$103,851

The results of the benefit-costs analysis showed an overall positive present value indicating a return on their investment and an overall benefit for three of the five businesses, while two businesses realized a negative net present value indicating an overall cost. Thus the majority of the sample realized a monetary benefit as a result of sponsoring Registered Apprenticeship, though there is variability among the sample as to the extent of the benefit, as well as variability among sectors.

With regard to the non-monetized benefits, there are two clearly emerging themes. The first is the desire of businesses to continue the trades and ensure the future of their workforces. The second is the ability of businesses to train their future workforces in a manner that meets their needs and ensures the productivity of their apprentices. Those sentiments were echoed across many, if not all, of the businesses interviewed.

CHAPTER SIX: CONCLUSIONS

The purpose of this study was to examine the research question: “What are the benefits and costs for sponsors of Registered Apprenticeship in Maine?” The question was answered using a mixed methodology that consisted of intake interviews, accounting frameworks, and exit interviews. The conclusions made from those results are reported in this chapter and have been broken into sections. The first section pertains to the benefits of the study as they relate to the sponsors’ monetary outcomes and/or non-monetized gains as a result of sponsoring Registered Apprenticeship. The second section pertains to potential correlations found in the data; the third to the limitations of the study; the fourth to potential future research; and the fifth section contains some policy implications of this research.

Benefits

Monetary Benefits

Tables 5-13 and 5-34 show the summary of sector and overall benefit/cost of the three labor unions acting as agents for apprentices and the five businesses surveyed in the sample. Of the eight sponsors, all but two realized a net present value greater than zero, which indicates an overall benefit to a company during the term of an apprenticeship.

Those benefits ranged from a low net present value of \$72,409 over the course of four years, realized by businesses that contract apprentices through Union C, to a high net present value of \$185,911 again over the course of four years, realized by businesses that contract apprentices through Union A. The average net present value realized by all

sponsors in the sample is \$78,055 over the various terms of their respective apprenticeships; that average includes the negative net present value incurred by Business B and Business C. The average net present value for businesses that contract apprentices through the three trade unions is \$126,059 over the four- to five-year terms of the apprenticeship. And the average net present value across the businesses in the sample is \$49,253 during their terms of apprenticeship, again including the negative net present value incurred by Businesses B and C. The average net present value realized in the construction sector was \$113,646, or between twenty and thirty thousand dollars per-year per-apprentice when averaged across the four- to five-year terms of the apprenticeships. The average net present value in the health and social services sector was more than \$22,000, despite the negative net present value by two of the three businesses. Those positive net present value averages reflect an overall *net benefit*, or a preferential investment.

Each of the five businesses and three labor unions functioning as agents were asked to provide their impressions of the accuracy of their annual revenue and annual costs. All of the businesses made statements similar to those of Business C, “seemed thorough...and efficient” and “...gave the business a better understanding of what is going on in [the] business.” Union A: “If anything, it might be conservative; apprentices are really expected to produce right away.” Business B was the one exception to that stating, “I don't know that I would know [if the costs and benefits were accurate] ...I'm just answering your questions.”

One of the factors that became apparent during this research was that the calculation of benefits was difficult for businesses that do not bill for their work at an hourly rate. For the businesses that had a definitive hourly rate for apprentices, such as Business A, the calculation of benefit was simple, and for those that had a definite labor rate for journeymen, such as all of the labor unions, the calculation was only slightly more difficult using the marginal productivity model. The calculation of benefit became markedly more difficult for sponsors, such as funeral homes, that bill based on services rendered, not on time taken to render said services. In those examples, the calculation of the benefit was much more heavily reliant upon collaboration between the researcher and the respondent. Unfortunately, that means that the data are based more on speculation than hard numbers. The potential for error, therefore, increases in those situations, and to a great extent the data can be influenced by biases, known or unknown, on the part of the respondent. The two businesses that saw a negative net present value were just those types of businesses, funeral homes, indicating that both those businesses might have realized a benefit which was overshadowed by overestimates of costs and/or other biases in the responses. It is also worth mentioning that to become a certified funeral director or funeral practitioner in Maine, an individual must complete a certain number of embalmings, which can obviously be done only on the job. Therefore, if an individual is interested in becoming a funeral director or funeral practitioner, he or she must complete an apprenticeship. Likewise, if businesses want to bring a new employee onboard to become a funeral director or funeral practitioner, they must sponsor them as apprentices.

That externality was not monetized in this research but definitely influences the benefits to those businesses.

Overall, there is an inherent amount of speculation involved in several aspects of the cost as well. In some cases, sponsors lacked concrete records for factors such as time spent on training, amount spent on workers' compensation, costs of liability and unemployment insurances, cost of wastage, and cost of recruitment. In instances where sponsors lacked such concrete data, they were asked to make estimations of those amounts. Many sponsors considered the cost of insurances and wastage as simply "costs of doing business" since they pay for insurances as lump sums, and even their journeymen make mistakes generating waste. In either case, those costs, along with recruitment costs are trivial in comparison to the major costs of wages paid to apprentices and wages paid to trainers, for which sponsors do keep detailed records.

Sponsors typically maintain excellent records for what they pay their apprentices, and as that was the largest cost center for all of the eight sponsors, it helps to establish a general trend towards benefits or cost. Sponsors also have accurate records regarding the compensation for trainers, but the uncertainty in that cost center stems from inaccuracies surrounding the amount of time spent by trainers engaged in training. Some of the sponsors, the labor unions, for example, had defined times that apprentices spent engaged in off-the-job training with supervisors. Several of the sponsors, including both funeral homes and two of the three labor unions, had training supervisors and owners who had also completed the apprenticeship program. As a result, those estimates were couched in

those individual's personal experiences, in addition to their experiences as supervisors. Being both an apprentice and a supervisor likely provided those training supervisors with a more in-depth insight into the apprenticeship experience.

It is likely that another confounding factor actually forces an overestimation of this cost. With regard to the costs of training, there is likely an overestimation (specifically for sponsors that bill their clients hourly) because it is assumed that while a journeyman is engaged in training, his or her marginal productivity is zero. However, that is not the case. Because journeymen do not "clock out" to engage in training as an apprentice does, they are still providing a constant revenue stream, which in fact means the cost center for journeyman training could potentially be eliminated.

Non-monetized Benefits

Despite the difficulties with the calculations of benefit, it still seems that for the small sample in this research, the accounting framework for the benefit-cost calculation comes to reasonable approximations of the net present value realized by apprenticeship sponsors. Furthermore, it seems that for many, if not all, of the respondents, there were other non-monetized benefits that were equally, if not more, important. Those non-monetized benefits comprised those to the three phases of employment: recruitment, retention, and advancement.

The businesses in this study indicated that sponsoring apprenticeship had a minimal impact on their recruitment of new employees. As an example, Business A filled only approximately 25 percent of its openings through apprenticeship. The labor unions

were on the opposite end of the spectrum, however, and filled the majority of their openings through apprenticeship. The key question is: do sponsors realize a *benefit* from sponsoring apprenticeship? That would be indicated by a positive change in their recruitment patterns in comparison to the time before the company began sponsoring apprenticeship. Because apprenticeship is already used extensively in recruitment in labor unions, and because of licensure requirements for certification to work in funeral homes, it is difficult to determine any increased recruitment. Therefore, further targeted research would be required to examine the impact of apprenticeship on recruitment.

Apprenticeship seemed to have a greater impact on retention. Businesses A and B, and Union B, indicated at least in part that apprenticeship played a role in keeping employees once they were hired and trained. The training supervisor at Business A indicated that he felt apprentices were less likely to leave the company than employees who were not apprentices. Business B stated there was very little turnover in the funeral director field, but three of their seven apprentices have left the company, which might indicate a difference between perception and reality. Union B has very low turnover in general because it seeks only to enroll the number of apprentices the market will bear, but the approximately ten percent of apprentices that do leave will do so mostly within the first year.

The advancement of an apprentice to journeyman and on was clearly the phase of employment on which apprenticeship had the most significant effect. Seven of the eight sponsors in the sample indicated that sponsoring apprenticeship had a significant impact

on their abilities to promote from within. All three of the labor unions indicated that apprentices who become journeymen were likely to become job foremen or project managers, or to take on leadership roles within the union itself, whether of the apprentice's own accord or because they had been actively scouted for leadership roles. The majority of sponsors indicated that a significant portion of their workforces would be retiring in the next ten years, leaving gaps that apprentices would likely fill. In fact, Business C and D were both looking to train their replacements to take control of the company in the next five to ten years so that the owners could retire.

Along with the perceived benefits to advancement realized by sponsors, there were several other non-monetized benefits of note indicated during the interview process. Both Business B and C indicated that cost was an insignificant factor for their decisions to sponsor apprenticeship. There is the potential that sentiment influenced the over-exaggeration of costs, and resulted in both Business B and C estimating a net loss. That could also be the result of the requirement for a number of embalming procedures required to be performed for licensure. Businesses B and C, and Union C, all indicated that apprenticeship was essential to making apprentices feel valued and given a sense of belonging within the company, which would likely play a further role in ensuring their retention. Along those same lines, the majority of the sponsors indicated that one of the major benefits from sponsoring apprenticeship was the commitment from both parties: again a factor likely to increase retention.

There were two distinct and related benefits of which sponsors were acutely aware with regard to sponsoring Registered Apprenticeship. The first was the commitment from employers to continue the trades and pass on their knowledge to their successors. Businesses A, B, C, and D and Unions A and B all indicated that was an important, or essential, part of the program. That is evident in statements like: “The biggest thing is the mentoring...bringing young people into a field that’s rewarding...then having a long lasting career on the other end...it was done for me and now I get to do it again...it’s a big part of succession planning” from Business C, or “You benefit from passing your craft along...you don't want to just say -- I'm retiring. You want someone to take care of your [patients]...I think that's important, very important, that there's someone to do that in Maine” made by Business D.

The second and most widely espoused benefit as a result of apprenticeship is that sponsors are in control of the training (though the training had to meet strict certification requirements for it to be a Registered Apprenticeship). All of the sponsors in the sample indicated that the ability to deliver the training to apprentices in a manner that suited the company, the apprentices, and the market need was an essential non-monetized benefit. The Union C representative succinctly captured the essence of all of the sponsors’ sentiment by stating: “We have to build the workforce the way we want it...If we don’t have apprentices we don’t have a retirement fund [because apprentices become journeymen and journeymen continue the workforce and continue paying into the retirement program]... It’s a way to build our future...” Union B stated: “As a labor group we stand for the non-monetized benefits...we are losing industries [paper mills and

manufacturing] in this state...employers complain about a lack of skilled workers and apprenticeship would provide them a direct source of training...why aren't [businesses] stepping up to fill the gap?"

From those perceptions it seems clear that for the respondents in this sample the non-monetized benefits of sponsoring Registered Apprenticeship, specifically the benefits to retention and advancement, are very real, are important to their way of doing business, and are essential for the future of their companies and their industries. Given that, if the previously non-monetized benefits were to be monetized in future studies it is likely that sponsors who already experienced positive net present values would realize even more substantial positive net present values, and businesses that realized a negative net present value would actually realize a positive net present value.

Other Findings

There is the potential for correlation between sponsor sector and monetary benefit because all of the sponsors in the construction and manufacturing sectors saw a definite benefit while two of the three sponsors in the health and social services sector saw negative net present values. There are two potential explanations: first, three of the four sponsors in the construction sector were trade unions, not single-entity employers. The difference may occur because the compensation rates that exist between the labor unions and the contractors' association are negotiated and contractually agreed upon in such a manner that they are mutually beneficial. Second, the estimates of billable rates provided by the union training directors for each union could have been overestimated. Of those

two, it seems more likely that having mutual agreed-upon wage rates that ensure mutual benefit is the cause for the high return on investment when labor unions act as agents, as opposed to the possibility that three separate training managers made three similar overestimations during three separate interviews.

Limitations of the Study

One of the major limitations to the generalizability of the quantitative accounting framework portion of this research is the sample size. There was one respondent in the manufacturing sector, one business and three labor unions in the construction sector, and three sponsors in the health and human services sector. So only eight sponsors completed the accounting framework. There are not enough data to establish a generalizable trend across any demographics with regard to sector, size, or region, or even to say that businesses that sponsor apprenticeships see a net benefit.

Another limitation of this study is that the accounting framework sought to examine the benefits and costs based on a single apprentice, not across the host of apprentices a sponsor had ever seen. In the cases of small businesses, that might have been a feasible task given the small number of apprentices each business has sponsored. In the cases of the larger businesses and labor unions, however, it would have been impossible to consider every single apprentice ever sponsored. It would be possible, however, to use the percent-completion rate as a proxy for the overall experience of each sponsor.

This research did not seek to monetize cost savings such as decreased turnover, decreased recruitment costs, increased productivity, or decreased training costs. Because those benefits were largely reported as positive, however, if they were monetized it is likely that the even the businesses in this study which realized a negative net present value would instead realize a positive net present benefit. This research also did not seek to analyze the benefit-cost ratio or net benefits of businesses outside the state of Maine, though the methodology used should be transferrable to any other state in the country because costs from state to state should be fairly constant.

Future Research

In looking forward at ways this model could be improved there are a few recommendations. First, it seems prudent to eliminate workers compensation, liability, and unemployment insurance. The sponsors in this sample by and large did not have that information disaggregated. At the same time, it also seems reasonable to eliminate wastage. In this sample there were only two sponsors that had any record of it, and even those amounts were small relative to the major cost centers. Along those same lines, it seems reasonable to eliminate recruitment costs as well. All of those costs could be brought into the “miscellaneous costs” category if sponsors had substantial enough records to include them. That would result in a simpler costs equation, as shown below:

Equation 6-1: Simplified Cost Equation

$$C_T^{app} = W_T^{app} + FICA_T^{app} + I_T^{app} + Ret_T^{app} + W_T^{Sup} + W_T^{jour} + C_T^{otj} + C_T^{misc}$$

Eliminating those cost categories would also allow for deeper study of the administrative/training costs within a similar timeframe. In that case it seems that two questions should be asked of sponsors at the beginning of the accounting framework; “How do you bill your clients?” and “Are your employees off the clock when they are engaged in training?” Asking those two questions would help to prescribe the next steps in the benefit-cost analysis accounting framework, because it would dictate the methodology for determining benefit, and whether costs associated with journeyman and supervisor wages for time spent training were even a factor. As previously mentioned, if businesses bill their clients hourly then the calculation is simple; if businesses bill hourly AND their trainers are on the clock while training, then the only real cost incurred by the business are an apprentice’s wages and benefits. If those businesses are also billing for hours completed by their apprentices, then it is almost certain that they are seeing a monetary benefit during the term of the apprenticeship because they are billing more for the apprentice per hour than they are paying. If businesses are billing clients per service rendered, or on a fixed bid, then the calculations must be slightly more deliberate. In that case, it is possible that trainers are operating at a loss (given the labor margins built into the bid or service). In situations like those, the marginal productivity model must be applied. It is also possible that further research into the amount of time spent engaged in training might add clarity to the calculations by providing more data to the existing data set.

Six of the eight businesses in the sample realized a positive net present value despite the sampling specification limitations. Given businesses’ responses of benefits on

the factors in the study which were not monetized such as recruitment, retainment, advancement and even succession planning and goodwill, it is likely that if those factors were monetized in future research that the benefit realized by all of the businesses in the sample would be positive for the businesses that experienced a negative net present value in this study and, overwhelmingly positive for businesses that were already shown to experience a net present value.

Continued research on a larger scale into the benefits and costs with the addition of the monetization of the non-monetized benefits in this research could help confirm the results of this study, and help assuage the fears of businesses surrounding costs or sponsorship that may be dissuading them from sponsoring apprenticeship.

What this research was not able to discern is why there is a lack of implementation of Registered Apprenticeship. Future research is needed to answer the following questions:

- Are businesses aware of Registered Apprenticeship and the potential benefits?
- Do businesses actually harbor misconceptions about the costs of sponsoring Registered Apprenticeship?
- Are high school guidance counselors aware of Registered Apprenticeship and the potential benefits thereof as a post-secondary training option for their graduates?

Further research into the first two of those questions would help understand if businesses are simply not aware that the opportunity exists; or if businesses are interested

in sponsoring apprenticeship but are harboring misconceptions about the costs. Such research would help contribute to the limited body of knowledge that exists regarding apprenticeship in the United States, and could help to advise future policies aimed at bolstering Registered Apprenticeship.

Further research into the third question would help determine the level of awareness of Registered Apprenticeship among secondary guidance counselors. If guidance counselors across Maine, and the country, are unaware that the Registered Apprenticeship program exists, which is likely given the disjointed administration of apprenticeship between the United States Department of Education (which controls education K-12) and the United States Department of Labor (which controls apprenticeship as post-secondary pathway), then there is no market demand being created for apprenticeship positions. Further research into the statement, “what we’ve found is that guidance counselors don’t even know about apprenticeship” made by Union B, could be a very simple and potentially informative topic for future research that would add to this research, and potentially help advise policy in Maine and throughout the United States.

Despite the limited sample size of this research, the sponsors in the sample all indicated that the accounting framework produced thorough and accurate results. With a more broadly applied sampling it is possible to achieve more generalizable results and correlations. That would facilitate the expanded knowledge and understanding of Registered Apprenticeship for sponsors that could potentially benefit.

The researcher is hopeful that this pilot research will lead to further study and a greater understanding and awareness of the benefits and costs of Registered Apprenticeship for apprentices and sponsors across Maine, and in the United States writ large.

Policy Implications

This research would indicate that sponsors benefit as a result of sponsoring an apprentice through Registered Apprenticeship. That would be even more likely if the non-monetized benefits were monetized, because the research also found that sponsors see benefits in the ability to invest in and shape the training of their employees, the ability to build a qualified applicant pool to promote from within, and the decreased turn-over rates seen amongst apprentices, factors which were not monetized in this research. Despite the benefits, Registered Apprenticeship is underutilized, which would indicate a gap in general awareness of the program and its benefits.

Olinsky and Ayers (2013, p. 18) state:

“The biggest challenge is a lack of awareness and misperceptions of apprenticeships among workers and businesses alike who may not consider them when considering training or career options. Few employers or workers are aware of their tremendous benefits and return on investment. Some companies may mistakenly believe that apprenticeships only exist for unionized workers. Despite efforts by the Department of Labor to expand the reach of apprenticeships, they are still largely limited to traditional, male-dominated occupations such as

construction. Moreover, there is no targeted federal funding to help businesses offset the costs of sponsoring an apprentice, nor is there a national marketing effort to make businesses aware of the benefits of hiring apprentices. Finally, a disjointed system of administration prevents us from collecting important data and establishing consistent certification standards across the country. And, while the United States once relied heavily on unions to overcome many of these challenges, declining union membership means businesses seeking to establish apprenticeship programs have less assistance.”

Three policy implications would be the result of the future research proposed in this section. First would be a focus on increasing empirical research of the benefits and costs across all sectors. In an effort to increase the empirical research of the benefits and costs across all sectors in the state, the methodology used in this pilot study could function as the foundation on which the previously non-monetized benefits could be monetized for a large-scale study conducted by the Maine State Department of Labor Office of Apprenticeship. The results of that study could be used to inform the decisions of potential sponsors, as well as inform the general discussion of apprenticeship as a financially viable post-secondary alternative throughout the state.

Second, new empirical research on the benefits of apprenticeship should increase implementation of RA programs. Because of the return of \$183 to every \$1 of General Funds dollars invested in Registered Apprenticeship realized by, it seems worthwhile for Maine to continue investing General Funds dollars. Additional funding could be used to

conduct a statewide information campaign. Such a campaign could target businesses to ensure they understand the benefits of sponsoring apprenticeship.

Third, and perhaps most importantly in light of the results of this research, additional research could increase labor-union involvement and engagement in establishing and maintaining Registered Apprenticeships. “The historical declines in union membership rates have likely taken a significant toll on apprenticeships here in the United States. Given the crucial role unions play in establishing and maintaining strong apprenticeship programs, any effort to expand apprenticeships in the United States would benefit greatly from increasing union membership and boosting apprenticeships among nonunionized workforces” (Olinsky & Ayers, 2013, p. 34).

Those three efforts would help to increase the availability for apprenticeship as a viable post-secondary pathway to a well-paid job. As with other efforts taking place in public policy today to help combat the lack of post-secondary opportunities available for the youth of the United States, informed policy decisions cannot be made to assuage the lack of awareness and address the misconceptions about apprenticeships without guidance from proper research. Groups like Mathematica and researchers like Olinsky and Ayers, and Lerman have already begun working to inform federal policymakers’ decisions. This research was designed to pilot a methodology that could be used to fill the gap that exists in the current body of knowledge as it pertains to benefit-cost analysis experiences for businesses and for businesses that contract apprentices through labor unions acting as agents for Registered Apprenticeships.

REFERENCES

- Alliance for Excellent Education. (2011). *The High Cost of High School Dropouts: What the Nation Pays for Inadequate High Schools*. Washington, D.C.
- Arnold, R. A. (2005). *Economics*. Mason: Thomson.
- Association for Career and Technical Education. (2010). *What is "Career Ready"?* Alexandria.
- Brown, M., Haughwout, A., Lee, D., Mabutas, M., & van der Klaauw, W. (2012, March 5). *Liberty Street Economics: Grading Student Loans*. Retrieved from Federal Reserve Bank of New York:
http://libertystreeteconomics.newyorkfed.org/2012/03/grading-student-loans.html#.Vu7kU_krLGE
- Bruce, A., Cottingham, C., Kirby, B., Marins, R., Sandwell, T., Zagorac, M., . . . Rougeau, A. (2009). *It pays to hire an apprentice: Calculating the return on training investment for skilled trades employers in Canada*. Ottawa: The Canadian Apprenticeship Forum - Forum canadien sur l'apprentissage (CAF-FCA).
- Business Roundtable. (2009). *Getting Ahead - Staying Ahead: Helping America's Workforce Succeed in the 21st Century*.
- Center for Workforce Research and Information. (2015). *Industry Employment and Wages*. Retrieved from Maine.gov:

<http://www.maine.gov/labor/cwri/data/qcew/QCEW-Employers-Size-Maine-March.xls>

Chartered Institute of Personnel and Development. (2012). *Apprenticeships that work*. London: UK Commisision on Employment and Skills.

Chronicle of Higher Education. (2015, 3 6). *Maine public colleges (4-year)*. Retrieved from College Completion: Who graduates from college, who doesn't, and why it matters.: http://collegecompletion.chronicle.com/state/#state=me§or=public_four

CollegeBoard Advocacy & Policy Center. (2010). *Education Pays 2010*. CollegeBoard Advocacy & Policy Center.

Corporate Voices for Working Families. (2011). *Why Companies Invest in "Grow Your Own" Talent Development Models*. Washington, DC: Corporate Voices for Working Families.

Cunningham, A. F., & Kienzl, G. S. (2011). *Delinquency: The Untold Storey of Student Loan Borrowing*. Washington, D.C.: Institue for Higher Education Policy.

Dionisius, R., Muehlemann, S., Pfeifer, H., Walden, G., Wenzelmann, F., & Wolter, S. C. (2008). *Cost and benefit of apprenticeship training: A comparison of Germany and Switzerland*. Bonn: The Intitute for the Study of Labor (IZA).

Dolan, J. (2015, 12 1). Registered Apprenticeship in Maine. (J. Payne, Interviewer)

European Commission. (2014). *European alliance for apprenticeships*.

Floria, M., Maffii, S., Atkinson, G., De Rus, G., Evans, D., Ponti, M., . . . Sartori, D. (2008). *Guide to cost-benefit analysis of investment projects*. European Commission.

Gambin, L., Hasluck, C., & Hogarth, T. (2010). Recouping the costs of apprenticeship training: Employer case study evidence from England. *Empirical Research in Vocational Education and Training*, 2(2), 127-146.

Gambin, L., Hogarth, T., & Brown, A. (2012). *Review of apprenticeship research: A summary of research published since 2010*. Coventry: Warwick Institute for Employment Research.

Giffi, C. A. (2012). *Manufacturing Opportunity: A Deloitte series on making America stronger*. Deloitte University Press.

Hasluck, C., & Hogarth, T. (2010). The net benefits to employers' investment in apprenticeship: Case study evidence from the UK. *The Canadian Apprenticeship Journal*, 2, 1-28.

Hasluck, C., Hogarth, T., Adam, D., Baldauf, B., & Briscoe, G. (2008). *The Net Benefits to Employer Investment in Apprenticeship Training*. University of Warwick. Coventry: Institute for Employment Research.

- Hogarth, T., & Hasluck, C. (2003). *Net costs of Modern Apprenticeship training to employers*. Coventry: Institute for Employment Research.
- Hogarth, T., Gambin, L., Winterbotham, M., Baldauf, B., Briscoe, G., Gunstone, B., . . . Taylor, C. (2012). *Employer investment in apprenticeships and workplace learning: The fifth net benefits of training employers study*. London: Department for Business Innovation & Skills.
- Institute for Employment Research. (2012). *Review of apprenticeship research: A summary of research published since 2010*. Coventry: Warwick Institute for Employment Research.
- International Labour Organization. (2012). *Overview of apprenticeship system and issues*.
- International Network on Innovative Apprenticeship (INAP). (2012). *An architecture for Modern Apprenticeship*. International Network for Innovative Apprenticeship.
- Jacoby, D. (2016, 6 29). *Apprenticeship in the United States*. Retrieved from EH.net: <https://eh.net/encyclopedia/apprenticeship-in-the-united-states/>
- Kurtzleben, D. (2013, January 13). Apprenticeships a little-traveled path to jobs. *US News*.
- Labor, United States Department of. (2014, May 30). *Employment and Training Administration*. Retrieved from Registered Apprenticeship: <http://www.doleta.gov/oa/>

- Lerman, R. (2012). *Can the United States Expand Apprenticeship? Lessons from Experience*. American University, Urban Institute, and IZA.
- Maine Department of Education. (2014, 02 14). *High School Graduation & Dropout Rates*. Retrieved from Maine.gov:
<http://www.maine.gov/education/gradrates/gradrates.html>
- Maine Department of Labor. (2014). *Maine apprenticeship program*.
- Mankiw, N. G. (2007). *Principles of Economics*. Mason: Thomson South-Western.
- ManpowerGroup. (2014). *The Talent Shortage Continues*.
- Morrison, T., DeRocco, E. S., Maciejewski, B., McNelly, J., Giffi, C., & Carrick, G. (2011). *Boiling Point? The skills gap in U.S. manufacturing*. Deloitte Development.
- Muehlemann, S., & Wolter, S. C. (2013). *Return on investment apprenticeship systems for enterprises: Evidence from cost-benefit analyses*. Bern: European Expert Network on Economics of Education.
- National Association of Colleges and Employers. (2011). *Job outlook 2011*. National Association of Colleges and Employers.
- National Skills Coalition. (2014, August 27). *Maine Middle-Skill Jobs Fact Sheet*. Retrieved from National Skills Coalition:

<http://www.nationalskillscoalition.org/resources/publications/file/middle-skill-fact-sheets-2014/NSC-Maine-MiddleSkillFS-2014.pdf>

Nguyen, M. (2012). *Degreeless in Debt: What happens to borrowers who drop out.* Education Sector.

Olinsky, B., & Ayers, S. (2013). *Training for success.* Center for American Progress.

Oliver Brown, et al. v. Board of Education of Topeka, et. al., 347 U.S. 483 (United States Supreme Court May 17, 1954).

Organisation for Economic Co-operation and Development . (2010). *Learning for jobs: Summary and policy messages.*

Organization for Economic Co-operation and Development. (2012). *OECD note on "Quality Apprenticeships" for the G20 task force on employment.*

Quintini, G., Martin, J. P., & Martin, S. (2007). *The changing nature of school-to-work transition process in OECD countries.* Bonn: The Institute for the Study of Labor.

Reed, D., Yung-Hsu Liu, A., Kleinman, R., Matri, A., Reed, D., Sattar, . . . Ziegler, J. (2012). *An effectiveness assessment and cost-benefit analysis of Registered Apprenticeship in 10 states.* Oakland: Mathematica Policy Research.

Shah, N. (2013). College Grads Earn Nearly Three Times More Than High School Dropouts. *The Wall Street Journal.*

- Smith, E., & Kemmis, R. B. (2013). *Towards a model apprenticeship framework: A comparative analysis of national apprenticeship systems*. New Delhi: International Labour Organization.
- Steedman, H. (2005). *Apprenticeship in Europe: 'fading' or flourishing?* London: Centre for Economic Performance.
- Steedman, H., & Vaitilingam, R. (2011). *Apprenticeship policy in England: Increasing skills versus boosting young people's job prospects*. Centre for Economic Performance.
- Steedman, H., Gospel, H., & Ryan, P. (1998). *Apprenticeship: A strategy for growth*. London: Centre for Economic Performance.
- Trust, T. E. (2016). *College Results Online*. Retrieved from The Education Trust: <http://collegeresults.org/search2d.aspx?so=ME&sec=1,2&y=2013>
- Wagner, S. (2010). *Unions as Partners: Expanding the Role of Organized Labor in Workforce Development*. National Fund for Workforce Solutions.

APPENDIX A: DEFINITIONS

Apprenticeship: a contract between an employer and a young person combining on-the-job training, formal learning and productive work. Once entered into, the agreement places upon both employer and the young person a set of reciprocal rights and duties. The employer agrees to ensure that the apprentice follows the stipulated program of vocational education and training which will be based on national standards formally recognized by the sector concerned. A non-negotiable part of the agreement will be that on-the-job training will be complemented by off-the-job training in an educational institution. In return, the apprentice agrees to conscientiously pursue the stipulated program of education and training, to undertake productive work related to his/her course of training within the company and to accept a training wage appropriate for his/her age and stage of his/her apprenticeship training (Steedman, Gospel, & Ryan, Apprenticeship: A strategy for growth, 1998, p. 17)

Journeyman: an individual that is a fully trained employee either after having completed an apprenticeship program or having been hired by any company as a fully trained employee.

Percent productivity of apprentice: the benefit of an apprentice's work as a percentage of his or her productivity relative to that of a journeyman for each quarter is averaged and multiplied by the journeyman's wage, assuming that the value of the marginal product generated by the journeyman and the apprentice are equivalent to the company).

APPENDIX B: APPRENTICESHIP SECTORS

(Maine Department of Labor, 2014)

- Administrative, Public and Retail Services
 - Accountant
 - Administrative Assistant
 - Automobile Mechanic
 - Auto Service Mechanic
 - Business Manager
 - Cosmetology/Hair Replacement
 - Crew Manager
 - Dispatcher/Telecommunications
 - Fire Fighter
 - Office Manager
 - Police Officer
- Education
 - Child Development Specialist
 - Education Technician II, III
 - Head Start Teacher I, II, III, IV
 - Home Day Care Educator
 - Home Start Coordinator
 - Program Manager
 - Special Education Technician
- Health and Social Services
 - Critical Care Nurse
 - Emergency Care Nurse
 - Float Nurse
 - Funeral Director
 - Funeral Practitioner
 - Human Services Assistant
 - Ocularist
 - Pharmacy Technician
 - Veterinary Technician
- Construction Trades
 - Architectural Drafter
 - Carpenter
 - Construction Craft Laborer
 - Crane Operator
 - Electrician
 - Foundation Layer
 - Heavy Equipment Mechanic
 - Heavy Equipment Operator
 - Inside Wireman
 - Lineworker
 - Maintenance Technician
 - Metal Fabricator
 - Millwright
 - Painter
 - Plumber
 - Pipefitter
 - Rigger
 - Sheet Metal Worker

- Telecommunicatio
ns Technician
- Tele-data
Technician
- Welder
- Manufacturing
 - Cabinet Maker
 - CNC Tool
Operator
 - Electrical
Designer
 - HVAC
Technician
 - Laminator
 - Machinist
 - Manufacturing
Technician
 - Materials
Engineer
 - Production
Laborer
 - Waterworks
Technician
- Ship Building and
Maintenance
 - Canvas Worker
 - Carpenter
 - Electrical
Designer
 - Electrician
 - Electronics
Mechanic
- Hull Outfit
Designer
- HVAC Designer
- HVAC
Installation &
Service
- Insulation Worker
- Machinist
- Maintenance
Mechanic
- Marine Electrician
- Marine Joiner
- Marine Service
Foreman
- Non-Destructive
Tester
- Outside Machinist
- Painter
- Pipefitter
- Piping Designer
- Plastics Fabricator
- Rigger
- Sheet Metal
Worker
- Shipfitter
- Shipwright
- Structural
Designer
- Tinsmith
- Welder

APPENDIX C: INTAKE INTERVIEW

1. General
 - a. What do you perceive as the benefits to sponsoring apprenticeship?
2. Demographics
 - a. With which Apprenticeship Sector (Maine Department of Labor, 2014) does your company best align?
 - b. How long has your company been sponsoring Registered Apprenticeship?
 - c. What is the apprentice's certification field?
 - d. What is the term for this certification type?
3. Recruitment
 - a. How many FTE employees does your company have?
 - b. How many of your employees do you foresee retiring within the next year? Five years? 10 years?
 - c. How many apprentices does your company currently have?
 - d. How has apprenticeship affected your recruitment of new employees?
4. Advancement
 - a. How many apprentices have been promoted within your business since you began hosting apprenticeship?
 - b. How has apprenticeship affected your advancement of employees?
5. Retention
 - a. How many apprentices has your company had previously, including those that did not complete?
 - b. How many apprentices has your company had that have not completed training?
 - c. Why do you think those apprentices not make it?
 - d. How long did it take those apprentices to "drop-out"?
 - e. How has apprenticeship affected your retention of employees?

APPENDIX D: EXIT INTERVIEW

1. Do the results of the benefit-cost analysis seem accurate to you? Why or Why not?
2. Do you still feel your estimates of Marginal/Percent Productivity are accurate? Why or Why not?
3. What suggestions do you have about ways to increase the accuracy of the benefit-cost model?
4. What factors, aside from cost, might influence your company's participation in Registered Apprenticeship?
5. What advice might you give to companies interested in getting involved in Registered Apprenticeship?

APPENDIX E: INITIAL CONTACT LETTER

Dear [Business Manager],

My name is Jonathan Payne and I am a doctoral candidate in Public Policy at the University of Southern Maine. I am conducting my doctoral research to examine the net benefits of sponsoring Registered Apprenticeship for businesses in Maine. Surprisingly, this research has *never* been done in the United States and I am very excited to be doing it. I obtained your company's name from the Maine Department of Labor Apprenticeship Report and found that your company may fit my criteria for this study

Your participation in this study would require approximately 3-4 hours of time total over two days with minimal intrusion into your business operations to complete an intake and an exit interview and an Accounting Framework used to calculate your company's Benefit-Cost ratio from sponsoring apprenticeship. I understand that your time is valuable and I will do everything I can to make our meeting times efficient and effective.

As compensation for your time I would be happy to provide you with a copy of the Benefit-Cost results for your company. Aside from these results, I can offer no further compensation except the knowledge that your business is helping with pioneer research that may have the potential to shape apprenticeship in the future. . I will be calling you shortly to give you more details, to answer any questions you may have, and to inquire whether or not you would be interested in taking part in my study. I genuinely appreciate your time and consideration and sincerely hope you choose to participate in my research.

Sincerely,

Jonathan R. Payne, A.B.D.

BIOGRAPHY OF THE AUTHOR

Jonathan Payne was born in Keene, New Hampshire, and graduated from Keene High School in 1997. He earned a Bachelor of Science degree in marine and freshwater biology in 2001 from the University of New Hampshire. He taught for a year at Franklin High School in Franklin, NH, was a field biologist for Normandeau Associates, then became a preservation and restoration carpenter with Preservation Timber Framing. In 2005, he enrolled at the University of Southern Maine's extended teacher education program, from which he graduated in 2006. He became a chemistry and engineering teacher at Noble High School in Maine, where he is currently the school's technology integrator. In 2010, he completed a master of science in teaching and learning at the University of Southern Maine, where he is currently a candidate for a Ph.D. in public policy with a concentration in educational leadership.