Teacher Salary and Turnover: A Meta-Analytic Literature Review of Teacher Labor Markets in the US and China

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Term Paper

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Abstract

This comprehensive meta-analysis on the relation between teacher salary and turnover, consisting of 21 studies, seeks to understand contemporary teacher labor markets in the US and China. Background analysis on countries' percentage GDP investment in education reveals that the Chinese government seems to be more determined and consistent in education investment compared to the US government. Effect size estimation results suggest that there is 1) significant negative relation between salary and turnover rate in both countries, and 2) salary is a more sensitive predictor of teacher turnover in China than in the US. Despite the investigation efforts from researchers, this literature review argues that more research using national representative sample data and quantitative methodologies are needed in China. Further, there is a lack of studies to define the healthy threshold standard for teacher turnover rate. A turnover comparison with other similar professions may produce more substantial and in-depth analysis of the relation between salary and turnover rate.

Keywords: meta-analysis, the US, China, teachers' salary and turnover, percentage GDP investment in education.

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1 Introduction

1.1 Objective

This paper seeks to discover the impact of teacher salary on turnover rate. The rising rate of teacher turnover has escalated disruptions in school stability, cross-school collaborations, and student achievement. Investigating the reasons behind this phenomenon can guide future education policy makers to alleviate this issue. Focusing on contemporary US and China, this paper serves to inform and guide education policy makers in these two countries on teacher shortage and quality issues. This study aims to use a two-fold analysis, including individual analysis of each country and comparative analysis between the two countries, to propose more substantial policy suggestions.

1.2 Significance

The transfer and exit of quality teachers, STEM teachers, and teachers teaching in disadvantaged socio-economic districts has adverse repercussions on schools' staffing. This trend is causing school leaders to resort to increasing class size, using unqualified part-time teachers, or hiring new inexperienced teachers. Over the past two decades, the increasing research on the effect of salary on teacher turnover reports mixed results. In order to assist policy makers, a systematic literature review is necessary to sort out the true association between salary and teacher turnover. This study hypothesizes that quality teachers are unsatisfied with their compensation and change jobs due to better offers in industries outside education. This hypothesis is based on Adams' equity theory (Adams, 1963) and Lawler's discrepancy theory (Lawler, 1983). Teacher salary significantly influences teacher incentives, turnover, and quality. According to Hanushek, compared to average teachers, more capable teachers can improve student achievement by an additional grade level in one school year (Hanushek, 1992). Policy makers await robust research on the topic of teacher salary to make adjustments to current salary management. The most recent literature review on teacher turnover in the US was published by Wisconsin researchers (Borman & Dowling, 2008) 11 years ago. This paper aims to fill the gap by reviewing publications after the year 2000.

2 Background

2.1 US-China Comparison

In the US, teacher strikes and protests against low salaries are common newspaper headlines. Last year, teacher strikes were seen in Chicago, West Virginia, and Los Angeles. In China, teachers' strikes are more rare. However, lack of strikes might not be the best indicator of teacher satisfaction. The social, cultural, and political climate in the US and China differs vastly, and the lack of strikes does not mean that teachers' low salary issues are more serious in the US than in China. In fact, the relative teacher-worker salary ratio in Table 1 shows that American teachers are compensated at a much higher relative salary than Chinese teachers. In particular, American teachers enjoy salaries 17% higher than American average salaries while Chinese teachers are compensated merely 3% higher than Chinese average salaries. This salary discrepancy suggests a null hypothesis that Chinese teachers are more dissatisfied towards their salaries and the turnover phenomenon is affected more by salaries compared to their American counterparts. I confirm this hypothesis in this paper, as analyzed in Section 5.

Comparison Criteria	Country	
	US	China
Population (million)	3.2	1390
Annual Average Salary (USD Thousand)	52	12.79
Annual Average Salary for Teachers (USD Thousand)	61	13.2
Ratio of Teacher Salary over Average Salary	117%	103%
Average GDP Investment for Past 8 Years	3.39%	4.17%
Student Teacher Ratio	14.17	14.3
Total Teacher Number for Primary, Middle, and High Schools	3,892,610	7,820,000

Table 1: US-China Background Comparison

**Source: (US Bureau of Labor Statistics, 2019) (World Bank Group, 2019) (National Center for Education Statistics, 2011-2019) (National Bureau of Statistics of China, 2011-2019)*

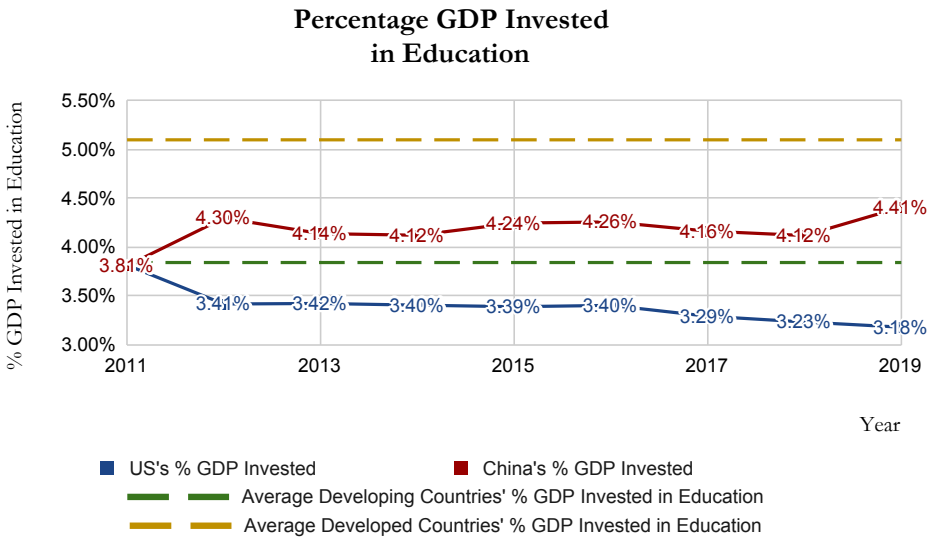

Figure 1: Percentage GDP Invested in Education

**Source: (US Bureau of Labor Statistics, 2019) (World Bank Group, 2019) (National Center for Education Statistics, 2011-2019) (National Bureau of Statistics of China, 2011-2019)*

The average national GDP investment in education is 5.1% for developed nations and 3.84% for developing countries. The US's average GDP invested in education for the past eight years is consistently lower than that of developing countries. On the other hand, China's average GDP investment is approaching the standards of developed nations. Figure 1 shows the sharp contrast between the consecutively declining trend line of the US and the consecutively increasing trend line of China from 2011 to present. Even though they were both 3.81% in 2011, however, in 2019, China is investing 1.23% more than the US. This difference is similar to the developed and developing coutries. In terms of political leaders' vision analysis, it is not hard to see that the 2009-2017 Obama administration maintained a relatively stable investment despite the gradual downward slope. The 2017-present Trump administration has seemed to show less determination to invest in education. In China, whether it was the 2002-2012 Hu Jintao administration or the 2013-present Xi Jinping administration, the Chinese government seems to be demonstrating a consistency in increasing education investment. This investment discrepancy shows that the US is not investing enough into education. Joe

Biden (Biden, 2019) says that any country that out-educates us is going to out-compete us. The US's severe underinvestment in education will have ripple effects in the future well-being of America. The US's low investment in education, in comparison to China, which is percieved as a rising superpower competing to replace America's international leadership, should send out an alarming message to both American education policy makers and the general public.

2.2 Main Reasons for Turnover

In past literature, multiple reasons for teachers exiting the market have been proposed and studied rigorously. In general, there are 6 main categories. The first category is teachers' demographic factors, which include teachers' gender, race, age, marital status, and number of children. A study in the US suggested a U-shape (Kirby & Grissmer, 1993) relationship between age and teacher turnover, with the highest turnover occuring for the youngest and oldest teachers. The higher attrition rate for the young teachers and lower rate for more-experienced teachers can be explained by the survival effect. The retirees' effects also contribute to the U-shape curve. In comparison, a study in China (Liu, 2012) reported lack of evidence on this U-shape distribution. The second category is teachers' qualifications, which include experience, specialty area, and degree. The third category is school characteristics, which include schools' location, size, administrative support, and mentoring program for beginning teachers. Since urban-rural inequality is one of the biggest problems in China, many papers have studied the relationship between the remoteness of schools and teacher quality, resources, and satisfaction. The fourth category is school resources, which includes schools' class-size average, per-pupil spending, student-teacher ratio, and teachers' salaries. The student-teacher ratio is almost the same for the US and China as shown in Table 1. Given various reasons for teachers' turnover, this study mainly focuses on the impact of salary on teachers' turnover.

3 Theoretical Framework

3.1 Labor Economics, Human Resource, and Psychological Theories

Studies on teacher salaries and turnover tend to lean on labor economic concepts to frame arguments (Guarino, Santibanez, & Daley, 2006). In conventional teacher labor markets, demand is defined as the teaching positions offered by educational institutions while supply is defined as willing and capable potential teachers seeking jobs. When wage is set at a point below the market optimal equilibrium wage level, the demand of teachers exceeds the supply of teachers and subsequently creates a teacher shortage. Based on the economic assumption of rational homo-sapiens, teachers who can earn better compensations will quit the teaching profession and pursue other jobs to reach a higher utility level.

Apart from labor economists, theoretical frameworks are also derived from organizational human resource management, as well as job satisfaction psychology. The discrepancy theory (Lawler, 1983) suggests that teachers will experience dissatisfaction if salaries are lower than their expectations. The equity theory (Adams, 1963) implies that teachers are more motivated if their contribution is rewarded fairly through higher salaries. Those two theories together with labor economic theories support the hypothesis that low salary significantly increases teacher turnover.

3.2 Definition of Key Terms

Teacher Salary: Salary is definied as monetary rewards, summer/winter holidays, and teacher aid. It cannot be substituted by school resources, class size, career satisfaction, etc. In this report, salary, compensation, and income are used interchangeably.

Teacher Turnover: There are four categories in the study of teacher mobilities: **retirement turnover, transfer turnover, exit turnover, and non-turnover**. This study uses turnover and attrition interchangeably and both refer to all four categories. Senior teachers who retire naturally are retirees. Teachers who move around schools but still stay

in the teaching profession are movers. Those who quit teaching and join other industries are leavers. Teachers who continue teaching are stayers. While stayers are ideal, retirees are natural, movers are understandable, leavers are the object of study that are mainly responsible for teacher shortages.

4 Methods

4.1 Literature Search Method

The sources for this literature review were compiled using various search keywords in the following computerized reference databases: Google Scholar, JSTOR, ScienceDirect, Scopus, EBSCO, and CNKI. Search keywords included *teacher turnover and salary in the USA, teacher turnover and salary in China, teacher attrition and salary in the USA, teacher attrition and salary in China, teacher turnover and compensation in the USA, and teacher turnover and compensation in China.* After initial article collection, citation and reference chasing methods were used to identify additional articles. The online searching strategies returned more than 1000 articles. The author then examined the abstracts to select articles fulfilling the following criteria: 1) quantitative methodologies, 2) empirical data, 3) samples taken from either the USA or China, 4) teachers from primary, middle, and high schools, 5) use of teacher salary as a direct turnover moderator, 6) published articles, journal reports, and research papers only, 7) no data duplication in another included study, 8) feasibility of using the methodology and information to compute logged odds ratio or effect size, and 9) literature published before year 2000.

Applying the research methods, 60 articles were collected and the abstracts for each piece were closely examined. There are 5 articles that were qualitative and descriptive, 7 articles which did not use salary as a moderator, 5 articles which did not examine the impacts on teachers' turnover, 4 articles that were published from 1997-1999, 3 articles which examined empirical data from the US and some other international countries, 3 articles using repeated data, 6 articles which were not peer-reviewed, 4 articles whose sample also included kindergarten and tertiary education, 1 article having a small sample size of 24, and 1 article using

regression discontinuity. The exclusion of unsuitable literature returned 13 qualified articles for the US and 8 qualified ones for China. The details of those articles will be provided in Table 2.

4.2 Meta-analysis Method

This paper uses meta-analysis to synthesize the literature on the topic of teacher salary and turnover. Initially, through vote-counting method, significant negative association between salary and turnover rate in both the US and China is found. However, the conventional vote-counting method in meta-analysis is considered to be crude, flawed, and worthless (Saroglou, 2002). Vote-counting method has been heavily criticized due to the same weightage given to individual literature regardless of different sample sizes and coefficients of variables. Thus, the results were re-evaluated using the effect size estimation method to yield a more statistically robust conclusion. For studies using regression analysis, the coefficient is taken as logged odds ratio and the effect size for odds ratio is caluculated using the formula

$$ES_{OR} = e^{ES_{LOR}}$$

where ES_{OR} refers to effect size using odds ratio, and ES_{LOR} refers to effect size using logged odds ratio. For studies using hazard models, odds ratio reported are taken directly as effect size measures. The 21 qualified studies have varying sample size ranging from city level size of 269 to national level size of 378,790. Studies using larger sample size naturally have a smaller standard error and are more convincing than others. The conventional method assigns weight to each literature using the formula

$$w_{conventional} = \frac{1}{se^2}$$

where w refers to weight and se refers to reported standard error for the salary coefficient. As for studies that did not report standard error, an estimation was calculated using standard deviation, sample size, and other provided information. However, the conventional method does not account for the quality of published articles. In this paper, the weight assignment is re-factored based on the impact factor of the publication journal. For journals with no impact factor reported, the value 0.09 was taken as the weight (the lowest impact factor -

0.3). Thus, the new weightage formula is

$$w = \frac{1}{se^2} \times impactfactor$$

The formula for average effect size is

$$\hat{ES} = \frac{\sum_{i=1}^{n} (w_i \times ES_i)}{\sum_{i=1}^{n} w_i}$$

Table 2: The 21 studies included

Country	**Year**	**Author**	**Public / Private**	**n of Teachers**	**Data level**	**Odds ratio**	**SE**	**Impact factor**
USA	2001	Ingersoll	Both	6,733	National level	0.99	0.003	NA
USA	2002	Stinebrickner	Both	313	National level (NLS-72)	0.37	0.45	6.53
USA	2004	Smith, Ingersoll	Both	3,235	National level: Beginning Teachers	0.98	0.01	2.46
USA	2011	Gilpin	Both	5000	National level (TFS)	0.08	0.70	1.46
USA	2008	Hancock	Both	1931	National level: Music Teacher	0.62	0.10	0.70
USA	2009	Horng	Both	531	District level: Southern California Crystal Springs	0.91	0.04	2.46
USA	2002	Podgursky, Monroe, Watson	Public	61,889	State level: Missouri College Graduates	-0.02	0.09	1.46
USA	2004	Hanushek, Kavin, Rivkin	Public	378,790	State level: Texas	0.80	0.02	6.53
USA	2005	Imazeki	Public	1,175	State level: Wisconsin New Teachers	0.35	0.13	1.46

(table continues)

Table 2: The 21 studies included(continued)

Country	**Year**	**Author**	**Public / Private**	**n of Teachers**	**Data level**	**Odds ratio**	**SE**	**Impact factor**
USA	2006	Clotfeltera, Glenniea, Ladda, Vigdor	Public	1000	State level: North Carolina	0.83	0.02	1.91
USA	2009	Garcia, Slate, Delgado	Public	300,000	State level: Texas	0.53	0.03	1.18
USA	2004	Kelly	Public	4,761	National level (NCES)	0.99	0.10	1.07
USA	2017	Tran	Public	156	State level: California Principals	0.83	0.08	1.54
China	2012	Liu	Both	510	Province level: 吉林 (Jilin)	0.62	0.074	4.43
China	2005	Sargent, Hannum	Both	1003	Province level: 甘肃 (Gansu)	1.05	0.137	1.82
China	2019	Du, Xie	Both	2643	Province level: 5 provinces	0.75	0.052	NA
China	2019	Xiao	Both	520	Province level: 福建 (Fujian)	0.47	0.264	0.39
China	2019	Li, Ding, Xu	Public	5285	Provincial level: 9 provinces	1.00	0.026	0.99

(table continues)

Table 2: The 21 studies included(continued)

Country	**Year**	**Author**	**Public / Private**	**n of Teachers**	**Data level**	**Odds ratio**	**SE**	**Impact factor**
China	2010	Chen	Both	294	City level: 锦州 (Jinzhou)	0.50	0.467	NA
China	2015	McInerney, Ganotice, King, Marsh, Morin	Both	1060	District level: Hong Kong	0.92	0.130	2.411
China	2014	Loerbroks, Meng, Chen, Herr, Angerer, Li	Both	425	City level: 武汉 (Wuhan)	0.48	0.323	2.196

5 Results

Table 3 reports the results obtained for both the US and China. The 13 papers focusing on the US produced an average effect size of 0.94, meaning that every 1% salary increase decreased the teacher turnover rate by 6%. The 8 papers focusing on China produced an average effect size of 0.87, meaning that every 1% salary increase decreased the teacher turnover rate by 13%. This simple comparison shows that the combined effect size is smaller for China than the US. In other words, salary is a more significant turnover predictor in China than in the US. As both effect sizes are smaller than 1, this result confirms the null hypothesis that salary has a significant negative relationship with teacher turnover in both the US and China. The difference in the combined effect sizes also confirms the hypothesis in Section 2, which predicts that turnover in China is more affected by teachers' dissatisfaction towards low salaries. This confirms another study's conclusion that teachers in developing countries tend to be more influenced by compensation as compared to developed countries (Farrell & Oliveira, 1993). In addition, Chinese teachers are not only unsatisfied with low salary levels but also with bureaucracy. Nealy 50% of rural Chinese teachers report not receiving salaries on time or full (Xuehui, 2018).

Computation	$\sum_{i=1}^{n} w_i$	$\sum_{i=1}^{n} (w_i \times ES_i)$	$\hat{ES}$
US	95,670.52	89,756.01	0.94
China	2,571.98	2,235.68	0.87

Table 3: Average Effect Size Computation for the US and China

Previously in the vote-counting method, the conclusion was that more studies in China listed salary as the utmost essential reason for teacher turnover while most studies in the US agreed that teacher characteristics were better turnover predictors. Compared to the vote-counting method, the effect size estimation confirms the vote-counting finding and quantifies salary's effect on turnover rate in each country.

6 Discussion and Implications

6.1 More Chinese Research Using Representative Sample Size and Quantitative Methodologies is Needed

Previous literature reviews show that there is relatively little research on the topic of teacher turnover outside the US. This study confirms these findings. Although China has the world's largest teacher labor market, the problem of teacher turnover has only been studied on city or province levels with sample sizes ranging from 269 to 5285. Although the sum of American primary, middle, and high school teachers is around half of Chinese primary school teachers, the relationship between salary and teacher turnover is more thoroughly examined in the US on a national level with sample sizes ranging from 531 to 378,790.

During the literature collection procedure, the author had to discard many studies on teacher turnover in China. This is mainly due to the qualitative, descriptive and low-quality nature of those studies. Only 8 papers cleared the stringent criteria of literature selection. The urgent problem of teacher turnover, especially in rural areas, awaits more quality research using first-hand and national level empirical data. The study of salary and tunover has important implications for salary policies in China. The 2009 salary reform in China, changing the single salary system to a merit-pay salary system, intends to motivate teachers to produce better education outcomes. Many studies in recent years have shown the failure of this reform as dissatisfaction grows due to the lack of transparency of the existing merit-pay system.

6.2 More Research on the Healthy Threshold of Teacher Turnover Rates is Needed

Teacher turnover is examined in most literature as a harmful problem that needs to be addressed urgently. Indeed, there are adverse consequences of schools' understaffing and resorting to low quality teachers. However, similar to many other professions which are experiencing a high volume of turnover in this new era, a moderate teaching profession turnover has a healthy nature as well. Lost teachers may quit the market due to their lack

of capability in teaching, disagreement with the mainstream value system in the school, and unhappiness with the nature of teaching. Teacher turnover due to the above reasons can contribute to overall teacher quality, school harmony, and commitment to the teaching profession. Ingersoll (Ingersoll, 2001) emphasized that it is necessary to understand the level and causes of teacher turnover in order to give suitable policy suggestions. There is no consensus on the threshold for a healthy and moderate teachers turnover rate. More literature are needed to compare teaching professions with other professions to conclude a reference point.

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Appendix (refers to the next page)

Table 4: More characteristics of the 21 studies

Country	**Author**	**Published Journal**	**Citation Number**	**Evaluation Method**	**Urban/ Rural**	**School level**
USA	Ingersoll	CPRE Research Reports	3820	SASS Logistic Multiple Regression	Both	All
USA	Stinebrickner	Journal of Human Resources	208	Independent Competing Risks Duration Model	Both	All
USA	Smith, Ingersoll	American Educational Research Journal	2063	Multinomial Logistic Regression	Both	Primary, Middle
USA	Gilpin	Economics of Education Review	57	Probit Estimation	Both	Primary, Middle
USA	Hancock	Journal of Research in Music Education	114	Sequential Logistic Regression	Both	All
USA	Horng	American Educational Research Journal	195	Conjoint Analysis Methodology	Urban	Primary
USA	Podgursky, Monroe, Watson	Economics of Education Review	403	Cox Proportional Exit Hazard Estimates	Both	Primary, Middle
USA	Hanushek, Kavin, Rivkin	Journal of Human Resources	2007	Linear Probability Model	Both	All
USA	Imazeki	Economics of Education Review	376	Competing Risk Model	Both	All
USA	Clotfeltera, Glenniea, Ladda, Vigdor	Journal of Public Economics	357	Hazard Models	Both	Middle
USA	Garcia, Slate, Delgado	International Journal of Educatiuon Policy and Leadership	23	Correlation and ANOVA Analyses	Both	All
USA	Kelly	The Journal of Experimental Education	247	Stratified Cox Proportional Hazard Models	Both	All

(table continues)

Table 4: More characteristics of the 21 studies (continued)

Country	**Author**	**Published Journal**	**Citation Number**	**Evaluation Method**	**Urban/ Rural**	**School level**
USA	Tran	Educational Management Administration & Leadership	25	Structural Equation Modelling	Both	High
China	Liu	Educational Psychology	18	Hierarchical Multiple Regression	Both	Middle
China	Sargent, Hannum	Comparative Education Review	296	Random Effects Logit Models	Rural	Primary
China	Du, Xie	The Journal of East China Normal University (Educational Science Edition)	5	Multivariate Linear Regression	Rural	Primary, Middle
China	Xiao	Journal of Schooling Studies	0	Logistic Regression	Rural	Primary
China	Li, Ding, Xu	Modern Education Management	0	Logistic Regression	Rural	Primary, Middle
China	Chen	Asia Pacific Education Review	31	Exploratory Factor	Urban	Middle
China	McInerney, Ganotice, King, Marsh, Morin	Teaching and Teacher Education	55	Hierarchical Multiple Regression	Urban	Primary, Middle
China	Loerbroks, Meng, Chen, Herr, Angerer, Li	International archives of occupational and environmental health	30	Regression models	Urban	Primary