

令和 5 年 6 月 26 日現在

機関番号：12601  
研究種目：若手研究  
研究期間：2019～2022  
課題番号：19K13715  
研究課題名(和文) Structural Estimation and Counterfactual Analysis in Models of Human Capital Formation  
研究課題名(英文) Structural Estimation and Counterfactual Analysis in Models of Human Capital Formation  
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交付決定額(研究期間全体)：(直接経費) 4,800,000円

研究成果の概要(和文)：私たちは2つのワーキングペーパーを完成させました。1つ目では、パラメータ推定値があり、現在反事実を実行しています。私たちはこのモデルを使用して、1980年から2000年の期間に観察された不平等の増加に、不確実性、職業および場所の経験の「ロックイン」、一般均衡効果がどのように寄与したかを理解します。2番目のプロジェクトは、RCTができなかったため、新型コロナウイルス感染症によって遅れました。予定通りに完了しました。しかし、私たちは昨年最終データセットを受け取り、多くの新しい品質基準を組み込んだモデルの推定に取り組んでいました。

#### 研究成果の学術的意義や社会的意義

技術変化に関する私たちのプロジェクトは基本的に、技術変化の期間中に個人がスキルの習得と場所をどのように調整するかについてのものです。来たるべきAI革命を考慮すると、私たちの研究は、労働者が行う必要がある調整の種類と、これらの変化が不平等にどのようにマッピングされるかを正確に語ることができます。DRCは5歳未満児死亡率が世界で最も高い国の1つであり、私たちのモデルは需要パターンの豊富な特徴を提供するだけでなく、出生前ケアを改善するために設計された反事実的な政策の影響推定値も与えることができます。

研究成果の概要(英文)：We have completed two working papers. For the first we have parameter estimates and are currently running counterfactuals. We will use the model to understand how uncertainty, occupational and location experience "lock in" and general equilibrium effects contributed to increases in observed inequality during the period 1980 - 2000. The second project was delayed by COVID-19 because the RCT could not be completed on schedule. However, we received the final data set last year and have been working to estimate the model, which incorporates many new quality measures.

研究分野：Empirical microeconomics

キーワード：Structural estimation Prenatal care Technological change Migration

## 1 . 研究開始当初の背景(Background at the beginning of the research)

This kaken funded two research projects that I have been working on. The first project "Technological Change and Wage Inequality: The Role of Migration, Occupations, and Human Capital" investigates the effects of technological change on human capital accumulation, migration, occupational choice, and wage inequality. The second project was "Quality of Perinatal Care and Clinic Choice: Evidence from the Democratic Republic of Congo (DRC)".

The background for the first project is the major changes in the wage distribution that have occurred since 1980 in the US (Katz and Murphy, 1992), which is likely caused by "skill-biased" technological change (SBTC) in which the aggregate production technology is biased towards workers with higher levels of skills. This hypothesis has been augmented by more recent evidence around "wage polarization" (Autor and Dorn, 2013) in which technological change seems to have particularly affected individuals in certain "routine" jobs (i.e., jobs in which workers can be easily replaced by computers). A related literature stresses the importance of occupational specific experience in wage determination (Kambourov and Manovskii, 2009), increasing occupational switching over time (Kambourov and Manovskii, 2008), the role of occupational switching over the lifecycle (Neal 1999) and regional differences in wage inequality and occupational mixes (Autor and Dorn, 2013; Diamond, 2016).

The key scientific question of interest is to understand how technological change is interrelated with education, location, occupation and retirement decisions, and the extent to which each of these human capital decisions affect the patterns of wage inequality observed in the data. We answer these questions using a dynamic spatial equilibrium model in which individuals make occupation and location choices and accumulate human capital in an environment in which occupation specific returns are changing through an aggregate production function. Individuals may be slow to adjust to technological changes because of lock-in from previous education, occupation, and location specific human capital decisions. As new cohorts enter the model and begin to make their own human capital decisions, the equilibrium will slowly mitigate the wage differentials across locations and occupations and by education. Understanding why and how this process adjusts may shed light on some empirical difficulties of the SBTC hypothesis (Card and DiNardo, 2002) and on equilibrium differences in the wage structures across regions.

For the second project, I have been working with Dr. Gil Shapira (World Bank) on estimating a flexible demand function for choice of health care clinic for prenatal care in rural DRC. Although the DRC only has approximately 1% of the world's population, it accounts for 7% of the world's maternal deaths and 5% of the under 5 deaths (World Development Indicators 2015). Even more surprisingly the DRC actually has higher use of healthcare services than other African countries with lower mortality rates, which suggests that the DRC likely has lower quality of care. Therefore, it is critical to understand which features of care that households value and specifically how households evaluate trade-offs between price, quality of care, and distance to health facilities.

These issues are especially important given the critical pre- and post-natal periods for child development ("Barker Hypothesis") and wide spread problems of quality and absenteeism that medical consumers face in developing countries (Chaudhury et al., 2006). The DRC in particular is an interesting environment to study because there is substantial variation in both quality and price even within a health care catchment area, a strong gradient between quality of care and household socioeconomic status, interesting geographic variation in the number of facilities available to households, and evidence that households engage in "bypassing" behavior (not attending the closest clinic) suggesting that households do care about some characteristics of facilities including perhaps clinic characteristics that are not productive for children's health.

The key scientific questions of interest are which dimensions of care matter when patients in rural DRC select clinics, how much are they willing to trade off quality for price, how much does distance matter, and how do these trade-offs differ for different types of care choice?

## 2 . 研究の目的(Purpose of research)

The purpose of these two projects is to use the estimated models to understand how policy affects economic outcomes. In the first project, we can understand the various channels through which technological change affects wage inequality: how workers responded to technological change by moving (or not), switching occupations (or not), retiring or not (for older workers), and how younger cohorts change their educational decisions in response to such profound changes in the returns to investments in different sectors and different geographic locations in the economy from 1980 to the present. In order to understand these trends, we will use the estimated model (which will be fit to US data) and we will turn off different channels to understand how each channel independently affected wage inequality. The end result will be a richer characterization of the joint patterns of human capital and technological change. We will also estimate a set of policy proposals such as insurance, training, or moving subsidies that could have been used to mitigate uncertainty in the face of technological change. The design of such policies could be important in the future, for example, given the likely increasing use of robots in place of human workers in certain occupations.

scientific background

For the second project, the most important contribution is to incorporate much more detailed measures of care quality and provider characteristics than any previous paper. For example, we have measures of providers' competency versus their practice behavior (the so-called "know-do" gap), attitudinal measures of doctors towards patients, information about the availability (or not) of medicines at the clinics, the use of unimproved water sources, whether clinics have laboratory services, and measures of provider effort. Having all of these measures simultaneously is unique relative to what has been done in the literature. By using such detailed quality data we hope to understand why households seem to choose clinics that do not seem productive for health outcomes.

## 3 . 研究の方法(method of research)

Both projects involve the use of "structural estimation", which involves estimating statistical models that are consistent with economic theory and give an interpretation of the models through the lens of economic theory. In addition, the models allow the research to do "counterfactual" analysis in which aspects of the economic environment within the model are changed and those changes are then mapped into changes in outcomes. If the model is credible, then these types of counterfactual analyses can be used to inform policymakers about the impacts of policy changes.

Our first model builds upon the framework developed in Margiotta and Miller (2000) and Gayle, Golan and Miller (2015), which allows for a tractable method to incorporate risk aversion and savings into a dynamic discrete choice model. This allows our model to have risk aversion, which may be an important channel to explain migration decisions given substantial cross region wage differentials. This will be an improvement on the existing literature (Kennan and Walker, 2008) that assumes a model linear in consumption and subsequently estimates large moving costs, which are needed to rationalize the data.

We also build on top of existing occupational choice models with technological change (Heckman, Lochner and Taber, 1998; Johnson and Keane, 2013) by adding spatial and migration decisions, which is another channel through which individuals can respond to technological change. This allows our work to connect the literature on wage polarization and wage inequality in cities more clearly to the literature on skill biased technological change. We expect that this will resolve

several puzzles in the current literature and provide a more comprehensive explanation of these human capital patterns.

The second project estimates a flexible demand system to understand the determinants of prenatal choice in the DRC. We will describe the trade-offs between different measures of quality of care, price, and distance. We will calculate the willingness to pay for different facility attributes and measures of quality of care. We will also calculate how much farther in terms of distance individuals are willing to travel for different facility attributes. We will perform counterfactuals that subsidize the price of different services and that change the distance that households have to travel for care. We can also subsidize certain types of clinics in order to understand the cost required to get households to take up more productive types of care. These counterfactuals will be useful to policymakers interested in how to improve the quality of care in an environment in which many children die needlessly.

#### 4 . 研究成果(research result)

For the first project, we have a manuscript draft, we have estimated the model, and we have programmed the simulations in Fortran. We are currently adjusting the parameter estimates to improve the fit of the model as judged by simulations using Fortran. We aim to have a paper ready for presentation by the end of year. These type of structural projects are often long-term projects. However, the good news is that we can also potential use this framework to tackle other related questions.

The second project was substantially impacted by COVID-19 because the data that forms the basis for the project was being collected from an RCT in DRC run by the World Bank and this RCT and data collection was substantially delayed by health and safety concerns. We finally received the data within the past year and I have been working to estimate the model. We have so many quality measures that we decided to implement a machine learning model selection procedure. However, because our likelihood is nonstandard this involved programming the model selection directly, which has added time to the project. We think the contribution is substantial and hope to have a draft finished by the end of this summer.

5. 主な発表論文等

〔雑誌論文〕 計0件

〔学会発表〕 計0件

〔図書〕 計0件

〔産業財産権〕

〔その他〕

Griffen Webpage <a href="https://andrew-griffen.github.io/">https://andrew-griffen.github.io/</a>
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6. 研究組織

	氏名 (ローマ字氏名) (研究者番号)	所属研究機関・部局・職 (機関番号)	備考
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7. 科研費を使用して開催した国際研究集会

〔国際研究集会〕 計0件

8. 本研究に関連して実施した国際共同研究の実施状況

共同研究相手国	相手方研究機関
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