Essays on government spending and labor market assimilation of U.S. female immigrants

by

George Anaman

B.A., University of Cape Coast, Ghana, 2015

M.A., Eastern Illinois University, USA, 2018

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the
requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Economics
College of Arts and Sciences

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Manhattan, Kansas

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Abstract

This dissertation comprises two chapters on government spending and one on the labor market assimilation of U.S. female immigrants. The first chapter studies the macroeconomic effect of government transfer payments over the business cycle in the United States. The second chapter analyzes the influence of increased public education expenditures on economic growth in the context of government education reforms in four selected countries. The third chapter uses cohort analysis to explore U.S. female immigrants' economic performance.

The first chapter, co-authored with Dr. Steven P. Cassou and Dr. M. Iqbal Ahmed, investigates whether transfer payments have symmetric effects on personal income and output using state-dependent local projection econometric models. The results show that positive transfer payment impulses have long-lasting stimulative effects on personal income and GDP under symmetric response assumptions. However, when one considers an asymmetry linked to economic conditions, transfer payment effects are more stimulative during economic downturns than during strong economic times. A deeper analysis shows the asymmetry is due to the recent special programs undertaken during the Great Recession and COVID-19. Furthermore, policy expansions for unemployment benefits do not yield significant economic benefits regardless of economic conditions. Transfer payment programs are often motivated by both the benefits to recipients and their economic stimulus effects. Our findings suggest that the economic stimulus effects of transfer payments are small outside of the recent special transfer programs. Thus, transfer payments should be motivated by the benefits to recipients and not on their potential as an economic stimulus.

The second chapter, co-authored with Dr. Jehu A. Mette, analyzes the influence of increased public education expenditures on economic growth in the context of government education reforms in four selected countries. Given that the education reforms prompted

significant increases in government education spending within short periods in these countries, we exploit their quasi-experimental settings to estimate whether the reforms had any long-term influence on the per capita growth rate. Using data from 1974-2018 for 29 countries, we investigate the growth effect of education reforms in Argentina, Finland, Iceland, and New Zealand. In line with the literature on central education spending, we find evidence of a significant increase in the long-term growth in output per capita for all four countries using the difference-in-differences estimation method. However, results from the synthetic control methods show no markedly long-term growth increase in output per capita for all four countries following the educational reforms.

In the third chapter, I explore the labor market conditions changes, specifically labor force participation and employment rates among U.S. female immigrants from 1970 to 2019. Our analysis reveals two interesting findings. First, there is a cohort effect in the labor market conditions of female immigrants, with more recent immigrants having relatively lower labor force participation rates and employment rates than earlier cohorts. Second, there is an acceleration in assimilation, with the more recent cohort of immigrants assimilating faster than the earlier cohort in the labor market.

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Hugh Cassidy

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Dedication

To Francis Anaman & Augustina Agyeman, Andrew & Shannon Trueblood, and Dr. Nina Banks, for their sacrifices, unwavering support, and love for me.

Chapter 1

Are transfer payments stimulative? - Sometimes

1.1 Introduction

U.S. Government transfer payments are a significant federal expenditure, making up about 40 percent of total spending. Most transfer payment programs are motivated by their benefits to the recipients of the payments, but their effects on the macroeconomy are also important. A considerable body of research has focused on how total government spending affects the economy.[1] More recently, the effects of transfer payments in isolation have garnered attention.[2] Despite the recent focus, there are still important gaps in the literature. For instance, it is unclear whether different types of transfer payments have the same impact on economic activities. This paper addresses this gap by examining the disaggregated data of transfer payments. Here, we study the impact of transfer payments on the macroeconomy using modern time series econometric methods to tease out the macroeconomic consequences of

[1] These effects were central to the older Keynesian models. More recent New Classical models questioned these effects, and modern time series econometric methods have sought to resolve these differences. Notable recent contributions include Blanchard and Perotti (2002), Perotti (2007), Mountford and Uhlig (2009), Barro and Redlick (2011), Ramey (2011a,b), Auerbach and Gorodnichenko (2012a,b, 2013), Ramey and Zubairy (2018) and Auerbach et al. (2022).

[2] Romer and Romer (2016), and Rodríguez (2018) use a narrative approach to isolate transfer payment shocks and study the consequences of these shocks.

transfer payment impulses.[3] We further investigate whether there are asymmetric effects of transfer payments where the asymmetry depends on the state of the business cycle. We apply these methods to several subseries of the transfer payment series to isolate the origin of the transfer payment macroeconomic effects. Examining these subcomponents is crucial, as it enables policymakers to distinguish the impact of measures such as unemployment insurance benefits from other types of aid provided during times of crisis, such as during the financial crisis and COVID-19 pandemic. This knowledge can better inform policymakers as they make decisions on economic policies.

Using broadly defined transfer payment data, we do find stimulative effects from transfer payments, particularly during times of economic weakness. However, the subseries analysis shows that most of these stimulative effects are due to one particular subseries, which includes many of the special programs initiated during the two most recent economic downturns. Removing that subseries from the broad transfer payment series, or focusing on data prior to the Great Recession, shows that positive transfer payment impulses have much smaller positive effects and are not as asymmetric over the course of the business cycle. Transfer payment programs are typically motivated by both the benefits to recipients and the stimulative benefit to the economy. These findings show that, outside of the periods where extraordinary transfer payment programs occur, the economic stimulus effects of transfer payments are small, which leads us to conclude that transfer payment programs should only be motivated by the benefits to the recipients.

To provide some background and insight for understanding these results, Figure 1.1 plots several series, including Personal Current Transfer Receipts (PCTR), which is the total amount of transfer payments, Personal Current Transfer Receipts - Other (PCTROTHER), which is a subseries of PCTR and is a catch-all residual category that includes transfer payment programs that do not fit into one of the main categories, and Personal current transfer receipts - Government social benefits to persons: Unemployment insurance (PCTRUNIN).[4]

[3]Time series methods have some advantages over narrative methods, which tend to focus on a few expansionary events because the time series methods use information from the full spectrum of transfer payment experiences to determine their consequences.

[4]These quarterly data series were obtained from the Federal Reserve Bank of St. Louis (FRED) data

Prior to the 2008 Great Recession, the series had fairly stable trends. However, significant transfer payment expansionary programs were implemented during the Great Recession and the COVID-19 recession. These programs included the American Recovery and Reinvestment Act (ARRA) of 2009, the Coronavirus Aid, Relief, and Economic Security (CARES) Act of 2020, and the Consolidated Appropriations Act of 2021, and can be seen as the large spikes in transfer payments during each of the economic downturns.[5] It is these spikes that largely account for the asymmetry in the macroeconomic effects of transfer payments. Since the spikes are recent phenomena, isolating the analysis to data prior to the fourth quarter of 2007 results in no asymmetry.

Also notable in Figure 1.1 is that the spikes for PCTR are almost entirely due to the spikes in the two subseries PCTROTHER and PCTRUNIN, so subseries analysis proved to be useful for teasing out the source of the effects. Like the primary series, PCTR, the subseries PCTROTHER produces strong asymmetric macroeconomic responses. Interestingly, PCTRUNIN does not produce either strong positive responses or asymmetries. We interpret this result to arise from the automatic nature of unemployment insurance which tends to commove with macroeconomic variables as part of the business cycle, thus not producing much of an independent effect on its own. So, despite the large spikes in unemployment insurance during the COVID-19 recession, these spikes were largely consistent with the sizes of the economic declines so as to not to imply an asymmetric effect the way PCTROTHER did. Finally, subtracting the subseries PCTROTHER from PCTR removes most of the spikes from the recessionary programs and running the analysis on that constructed subseries shows no asymmetry and only small stimulative effects from positive impulses.

bank. The abbreviations given in parenthesis are the notations used in FRED. These series are reported in nominal form and for our analysis, the data was left in that form. Other subseries for PCTR include, Personal current transfer receipts - Government social benefits to persons: Social Security (W823RC1), Personal current transfer receipts - Government social benefits to persons: Medicare (W824RC1), Personal current transfer receipts: Government social benefits to persons - Medicaid (W729RC1), and Personal current transfer receipts: Government social benefits to persons - Veterans' benefits (W826RC1). These four components exhibit smooth growth and were not included in Figure 1.1 to preserve clarity for the series of interest.

[5]Related work includes Chodorow-Reich et al. (2012) who study the impact of ARRA on state Medicaid programs and the implications for employment. Oh and Reis (2012) also focus on the Great Recession stimulus, but with a broader focus than just the US program and Kim (2021) focus on the Korean stimulus to these recent events.

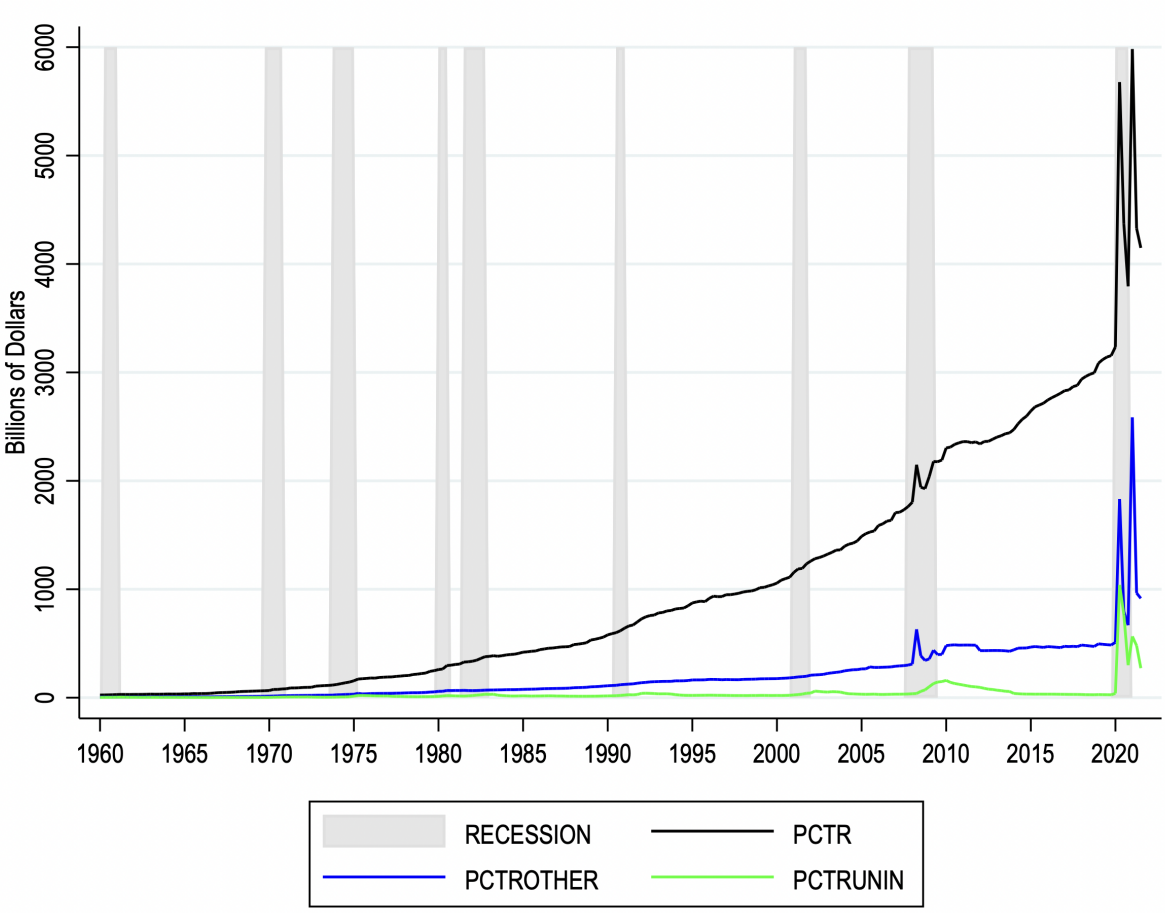


Figure 1.1: Personal current transfer receipts and selected subseries

Our analysis uses modern time series econometric methods, including impulse response functions (IRF) and forecast error variance decompositions (FEVD). We investigate both symmetric and asymmetric models. For the asymmetric models, we base the asymmetry on the Sahm (2019) rule economic series, which is an indicator series designed to capture the strength of the economy over the business cycle.[6] Because of its flexibility for asymmetric model applications, we use the local projection method described in Jordà (2005) to compute these IRF and FEVD under different economic conditions. These methods are well suited for state-dependent time series models and have advantages over the traditional Vector Autoregression (VAR) methods, and have been applied in similar settings by Auer-

[6]The original purpose of the Sahm rule was to provide a signal that could be used to automatically provide stimulus payments when the economy weakens. However, the rule has proved to be useful for other purposes, such as ours here, as it is a good indicator of economic strength.

bach and Gorodnichenko (2012a,b, 2013, 2016), Ramey and Zubairy (2018), Owyang et al. (2013), Ahmed and Cassou (2016, 2021), and Ahmed et al. (2022).

There are several policy implications for these results. First, these results indicate that using transfer payments as an economic stimulus for the economy during expansionary economic conditions does not lead to large gains in personal income and gross domestic product. Second, expansions in unemployment benefits do not result in large gains in personal income and gross domestic product regardless of the economic conditions. The primary stimulative benefit to personal income and gross domestic product from transfer payment expansions comes from special programs that are enacted during contractionary economic conditions, such as those enacted during the Great Recession and the COVID-19 recession. Taken altogether, the small stimulus from ordinary transfer payments should not be a significant motivation for transfer payment programs and the primary motive should remain the benefits to the recipients.

The paper is organized as follows. Section 2 describes the empirical methods. Section 3 presents the results for the PCTR series and undertakes a deeper analysis of the subseries to determine the origin of the results. Section 4 undertakes some robustness exercises, including using alternative measures for economic weakness and introducing a monetary policy variable into the model.

1.2 Empirical methodology

The baseline empirical models use three variables, Personal Income (PI), Gross Domestic Product (GDP), and either total transfer payments (PCTR) or a subseries of total transfer payments, denoted as pi_t, y_t, and tr_t respectively in the time series model below. For models using the full set of data, the series are quarterly series from 1960:01 to 2021:03 and were obtained from the Federal Reserve Bank of St. Louis (FRED) data bank. The various transfer payment series used in this study include the three plotted series in Figure 1.1, while the PI and GDP data were also downloaded from FRED and the abbreviations used here are the same as those used by FRED. The transfer payment series are reported in

nominal terms, and we preserved those measurement units. This means that the PI and GDP data were also used in nominal form to ensure consistency. Dividing each series by a price index such as the GDP deflator does not change the results.

We consider two types of empirical models. The first is a simple linear or symmetric model with no threshold or switching behavior. Because a comparison between symmetric and asymmetric models is undertaken, we use the local projection method suggested by Jordà (2005) because of its ease of application for state-dependent time series models.[7] We begin by describing how to apply this method to a symmetric model and then later extend it to the threshold setting.

The local projection method produces IRFs by running a series of forecast models given by

$$x_{t+s} = \alpha^s + \sum_{i=1}^{p} B_i^{s+1} x_{t-i} + \varepsilon_{t+s}^s \qquad s = 0, 1, ..., h \tag{1.1}$$

where $x_t = [pi_t \quad tr_t \quad y_t]'$ is a vector of the model variables which we wish to forecast s steps ahead for h different forecast horizons using a forecasting model consisting of p lags of the variables in the system. The parameter notations in the model are commonly used, with α^s denoting a 3×1 vector of constants, and B_i^{s+1} denoting 3×3 square matrices of parameters corresponding to the ith lag, x_{t-i}, in the s step ahead forecasting model, and ε_{t+s}^s is a moving average of the forecast errors from time t to time $t+s$. As noted by Jordà (2005), the local projection technique is robust to situations with nonstationary or cointegrated data, so this application, which uses level data, will have no issues.

Jordà (2005) shows that IRFs generated by the local projections are equivalent to those calculated from VAR methods when the true data generating process (DGP) is a VAR, but that the IRFs for other DGPs that are not true VARs are better estimated using this local

[7] In discussing the IRF, we use the traditional interpretation that these represent how variables respond to one unit impulses in a structural shock. An alternative interpretation for the impulse response function under a Cholesky ordering is to note that it is the revision to the conditional forecast for a variable due to a one standard deviation impulse in one of the structural shocks. See Hamilton (1994) pages 318-23 for this approach. To avoid confusion, we stick to the traditional interpretation here.

projection method. The IRFs are defined as

$$\widehat{IR}(t, s, d_i) = B_1^s d_i \qquad s = 0, 1, ..., h \tag{1.2}$$

where $B_1^0 = I$, and d_i is an $n \times 1$ column vector that contains the mapping from the structural shock for the ith element of x_t to the experimental shocks.[8] We construct this mapping matrix using methods suggested by Jordà (2005), which essentially follows methods used in the traditional VAR literature and begins by estimating a linear VAR and applying a Cholesky decomposition to the variance-covariance matrix. For our baseline ordering, we assumed that GDP could contemporaneously affect transfer payments, but not the other way. This assumption reflects the automatic stabilizing nature of many transfer payment programs in that transfer payments respond to GDP. An alternative assumption is to put transfer payments prior to GDP. This alternative assumption may be more appropriate in studies that investigate overall government spending as in Blanchard and Perotti (2002), where overall government spending is viewed as exogenous to the behavior of GDP. In the robustness section below, we investigate this alternative ordering and show that both orderings imply the same behavior. We also assumed that both GDP and transfer payments could contemporaneously affect PI, while PI has no contemporaneous effect on the other series. This resulted in PI being ordered last, transfer payments second, and GDP first. Finally, it is important to recognize that the Cholesky ordering assumptions dissipate within a few periods and the long run impulse responses almost entirely reflect the correlations in the data.

Next, using the local projection technique, one can compute confidence bands using estimates of the standard deviations for the impulses. One issue that needs to be recognized in doing this is that because the DGP is unknown, there could be serial correlation in the error term of (1.1) induced by the successive leads of the dependent variable. We address this issue by using Newey and West (1987) standard errors which correct for heteroskedasticity

[8] Here, we use Jordà's experimental shock terminology, but the terminology reduced form shock is also appropriate.

and autocorrelation (HAC). Letting $\widehat{\sum}_s$ be the estimated HAC corrected variance-covariance matrix of the coefficients $\widehat{B}_1^s$, a 68% (or a one standard deviation) confidence interval for each element of the IRF at horizon s can be constructed by $\widehat{IR}(t,s,d_i) \pm \sigma(d_i' \widehat{\sum}_s d_i)$, where σ is a $n \times 1$ column vector of ones.

Our extension of the baseline model is to incorporate threshold behavior into the impulse response structure that allows the possibility that the IRF may differ depending on whether the economy is in a recession or not. We define our extension to (1.1) by

$$x_{t+s} = I_{t-1}\left[\alpha_R^s + \sum_{i=1}^{p} B_{i,R}^{s+1} x_{t-i}\right] + (1 - I_{t-1})\left[\alpha_E^s + \sum_{i=1}^{p} B_{i,E}^{s+1} x_{t-i}\right] + \varepsilon_{T,t+s}^s \qquad s = 0, 1, ..., h \tag{1.3}$$

where most of the notation carries over from above, but subscripts of R or E have been added to the various parameters to indicate whether the economy is in a recession or an expansion, respectively. We use a different notation of $\varepsilon_{T,t+s}^s$ to denote the error process for this model where the added subscript indicates the error for the threshold model. The threshold dummy variable, denoted by I_t and defined more completely below, indicates the distinction between recessionary and expansionary economic conditions.

By analogy to (1.3), we define the IRFs for the two states of the economy by

$$\widehat{IR}^R(t,s,d_i) = B_{1,R}^s d_i \qquad\qquad s = 0, 1, ..., h \tag{1.4}$$

with normalizations $B_{1,R}^0 = I$ and $B_{1,E}^0 = I$. The confidence bands for the impulse responses of the threshold model are simple extensions of the methodology discussed above.

Our baseline threshold indicator is based on the Sahm's rule described in Sahm (2019). Sahm's rule identifies real-time signals related to changes in the business cycle based on whether the three-month moving average of the unemployment rate rises by 0.50 percentage point or more relative to its low during the past twelve months. Based on this rule, we constructed our policy switches according to

$$I_{t-1} = \begin{cases} 1 & \text{for } S_{t-1} \geq 0.5 \\ 0 & \text{for } S_{t-1} < 0.5 \end{cases} \tag{1.5}$$

where we use S_t to denote Sahm's data series. An alternative indicator is to use the NBER recession date series. We explore this as well as a number of other things in the robustness section below. There we show that Sahm's rule works better for our exercise because the rule is by construction a real-time series and is better at anticipating changes in the business cycle than the NBER recession date series which are determined after recessions have occurred.

Finally, we conclude this section by noting that the primary advantage of the local projection method over the standard VAR approach is that each forecast horizon is computed separately from the others so that it can handle richer econometric specifications. This can be understood by reviewing the IRF computation from the typical VAR model. The VAR approach uses the VAR parameters to generate the moving average form from which the IRFs are generated at each horizon. Thus, the IRFs at all horizons are directly connected to these VAR parameters. On the other hand, the local projection method computes the IRFs from a different forecast equation (here (1.1) or (1.3)), and thus the structure of the IRFs can vary over the horizon. This allows flexibility when the DGP is nonlinear. So, for instance, if the DGP is given by the highly nonlinear structure in (1.3), the linear VAR structure will not be able to handle this as well as the local projection approach which imposes less structure on the IRF. The local projection method is also attractive relative to methods proposed by Auerbach and Gorodnichenko (2012b).[9] In the Smooth Transition Vector Autoregression (STVAR) approach suggested by Auerbach and Gorodnichenko (2012b), it is assumed that the economy stays in the current state over the horizon in which the impulse responses are calculated. For example, Ramey and Zubairy (2018) argue that this type of assumption is inconsistent with the fact that the average NBER recession period typically lasts 3.3 quarters, much shorter than the horizons over which one estimates the IRFs. On the other hand, the local projection approach estimates parameters that are based on data

[9] See Ramey and Zubairy (2018), for details. Also see Auerbach and Gorodnichenko (2013, 2016).

that can be in either state of the world. Thus, these parameters have an averaging effect, and the projections based on these estimates can be interpreted as weighted averages of the two separate state IRFs.

1.3 Results

We discuss the results in two subsections. In the first subsection, we show that there is an asymmetry in the responses to transfer payment impulses, while in the second subsection, we investigate several restricted models designed to establish the origin of the asymmetry.

1.3.1 Asymmetric responses to transfer payment impulses

Since our interest is transfer payments' impact on other economic variables, we only present the responses to transfer payment impulses. Figure 1.2 shows the linear model and the threshold model impulse responses in a side-by-side set of plots, with the linear model results on the left side and the threshold model on the right side. For the linear model, we plot several things in each subplot, including the actual impulse response indicated by a gray line, a sixty-eight percent standard error band, given by the dark blue region and a ninety percent standard error band given by the additional light blue region.[10] Focusing on the bottom row of the linear model, we see that a one percent impulse to transfer payments is relatively long lived, remaining significantly different from zero even after twelve quarters. Next, looking at the top and middle rows, we see that the responses to the transfer payment impulses on PI and GDP are positive and somewhat long lasting, remaining significantly different from zero for six to seven quarters.

Next, focusing on the threshold model in the right panel, we see that the economic state becomes important. To interpret these plots, we have arranged them in the same order as in the linear model. Furthermore, for each subplot, the results for the expansionary economic

[10] A popular convention is only to present the sixty-eight percent, or one standard error bands.

state and the contractionary economic state, as governed by the Sahm's rule, are plotted. To distinguish between the two states, we use the convention of plotting the contractionary state using the same shading convention as the linear model, while for the expansionary state, we plot the responses using a solid black line and then the same two standard error bands are marked with dashed black lines with the narrow set of dashed lines representing the sixty-eight percent band and the wider set representing the ninety percent band. The bottom row again shows that a one percent impulse to transfer payments is relatively long lived in both expansionary and contractionary states. Furthermore, transfer payment responses follow similar and mostly overlapping patterns for both the expansionary and contractionary states. However, the effects of the impulse on PI and GDP are quite different and depend on whether one is in an expansionary or recessionary state. Both top rows show that during the contractionary state, the transfer payment impulse has a significantly positive effect on both PI and GDP for the entire twelve-quarter horizon. Furthermore, during the expansionary state, there are smaller positive and significant responses for about the first six quarters and then the responses become insignificant, like they did in the linear model. Similar state-dependent results were found by Auerbach et al. (2022) for Department of Defense spending during the Covid-19.

1.3.2 The origin of the asymmetry

The U.S. Bureau of Economic Analysis decomposes the Personal Current Transfer Receipts series into seven subseries. Refining the analysis to focus on these subseries can reveal much about the origin of the asymmetry seen in Figure 1.2. In Figure 1.1, we highlighted two subseries which also have rather pronounced spikes during recessionary periods.

These include PCTROTHER, which we have shortened to PCTRO in the graphs and tables below, and PCTRUNIN.[11] Figures 1.3 - 1.5 show impulse responses to one percent impulses in three different series with Figure 1.3 showing the responses to PCTRO, while Figure 1.4 shows the response to PCTRUNIN, and Figure 1.5 shows impulse responses to

[11]The shorter notation of PCTRO is useful in some of the results presented below as it allows for more compact tables.

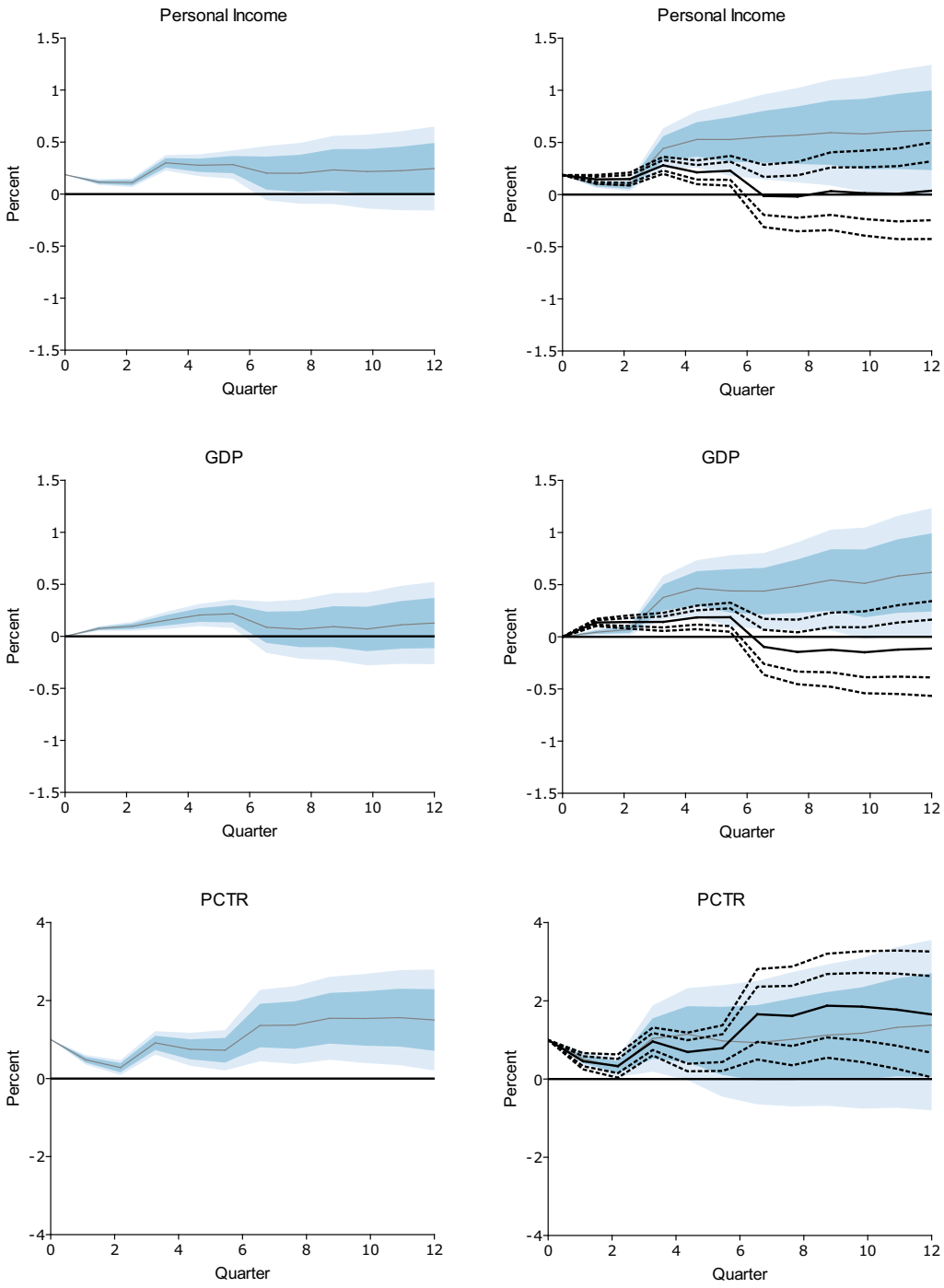


Figure 1.2: Response function to PCTR impulse

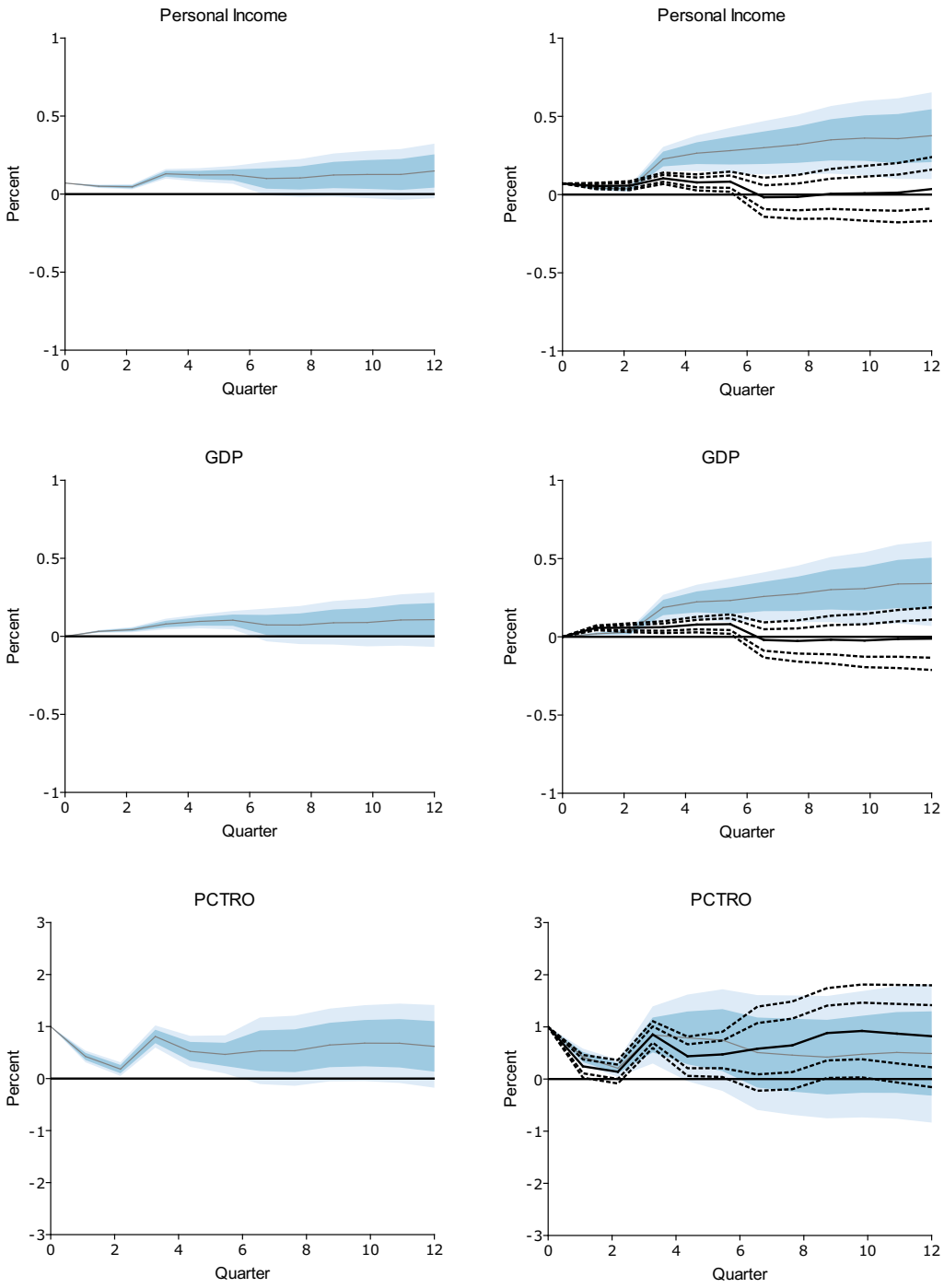


Figure 1.3: Response function to PCTRO impulse

PCTR with the component PCTRO removed. In these figures, we have adopted the same plotting conventions as were used in Figure 1.2.

A quick glance at the three figures shows that the only figure that shows the significant state differences seen in Figure 1.2, is Figure 1.3. In particular, impulses to PCTRO lead to significant long-term gains in PI and GDP during recessionary states, while during expansionary states the effects are small and relatively short-lived, looking very much like the linear model responses. Although some further investigation is warranted before concluding this as the source of the responses seen in Figure 1.2, it is useful to mark this fact as noteworthy and one that we will come back to as we investigate other possibilities.

Figure 1.4 plots the responses to PCTRUNIN. Interestingly, and surprisingly, an impulse to PCTRUNIN does not result in much asymmetry. The impulses do result in relatively small and short-lived positive responses, but these responses are the same, regardless of whether the economy is expanding or contracting. This symmetry occurs despite the outsized increases in PCTRUNIN that occurred during the Great Recession and the COVID-19 recession that were noted earlier in Figure 1.1. We interpret this symmetry as arising because of the automatic nature of unemployment insurance which moves with the economic cycle. So, even though unemployment insurance programs are often expanded and extended during economic downturns, these expansions and extensions are in line with the needs of the downturn and thus do not produce responses that are markedly different than seen in other settings.

Next, Figure 1.5 plots the responses to a series of our own construction. Here, we subtracted the series PCTRO from PCTR and used a minus notation in the graph.[12] As Figure 1.5 indicates, a good amount of the asymmetry goes away. The constructed series does produce short-lived positive responses which die off about the sixth quarter, but the confidence bands largely overlap during the expansionary and contractionary states indicating that the asymmetry is now insignificant.

[12]This minus notation can be mistaken for a dash, so we re-emphasize its meaning here.

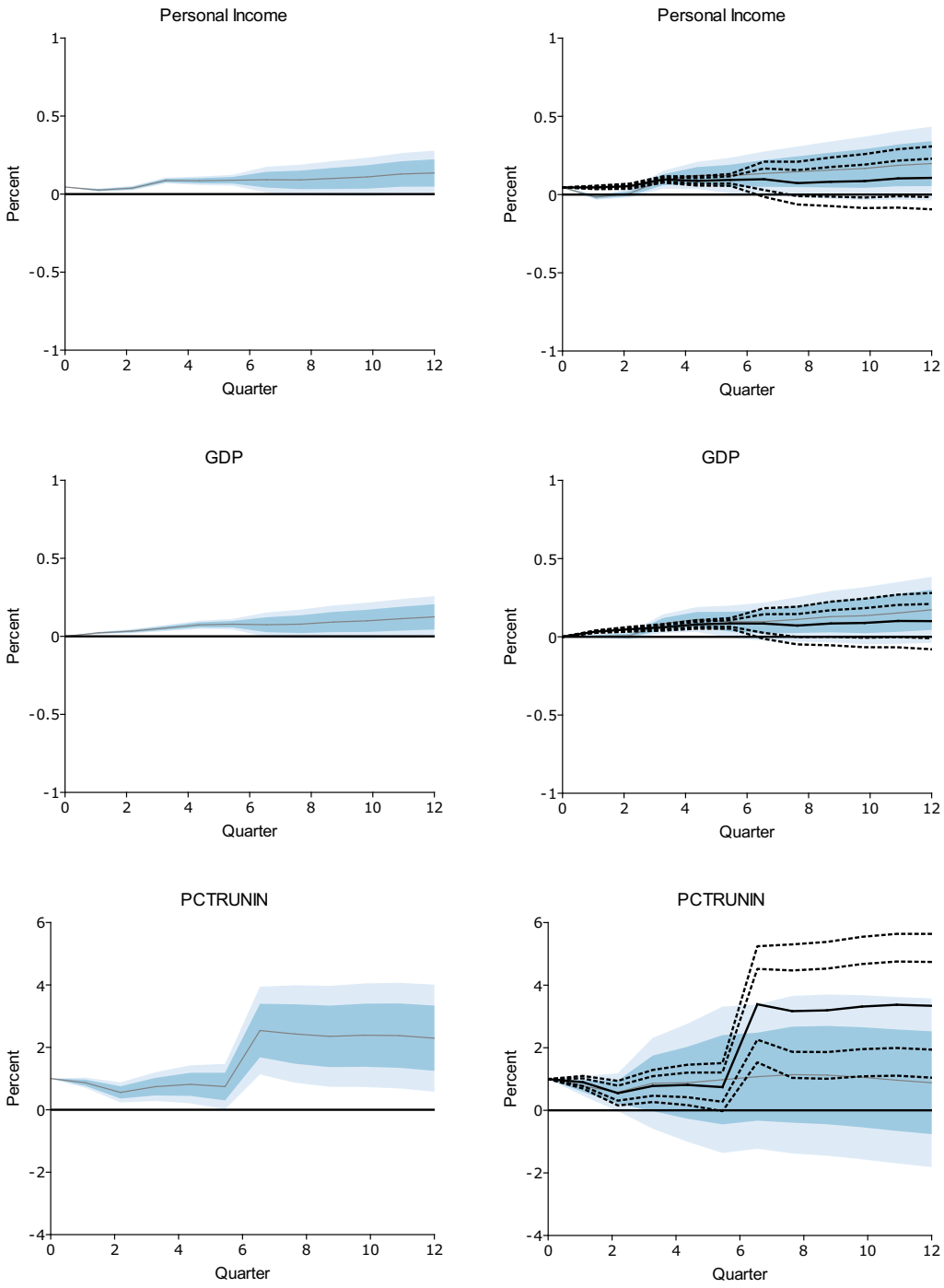


Figure 1.4: Response function to PCTRUNIN impulse

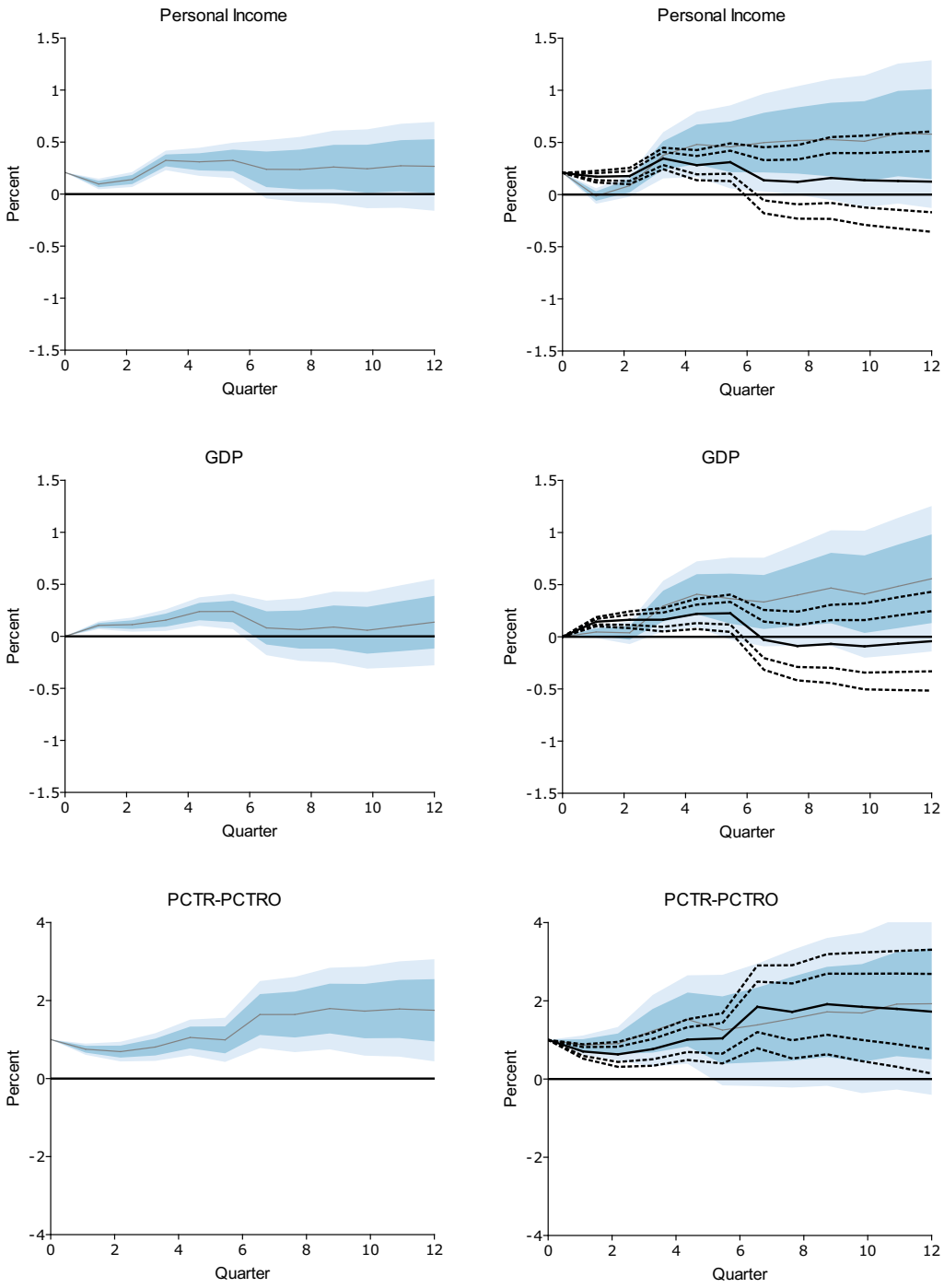


Figure 1.5: Response function to PCTR-PCTRO impulse

Finally, we undertake another exercise to show that the special programs undertaken during the 2008-09 and 2020 recessions are the source of the asymmetric responses. To do this, we focus on a subsample that excludes these recent recessions. Figures 1.6 and 1.7 show the same set of impulse response exercises as in Figures 1.2 and 1.3, respectively, over the interval 1960:1 to 2007:4. These figures show that the asymmetry has largely gone away and thus indicate that it is only the recent special programs implemented during the two recent recessions that are contained in the PCTRO series that generate the asymmetric responses.

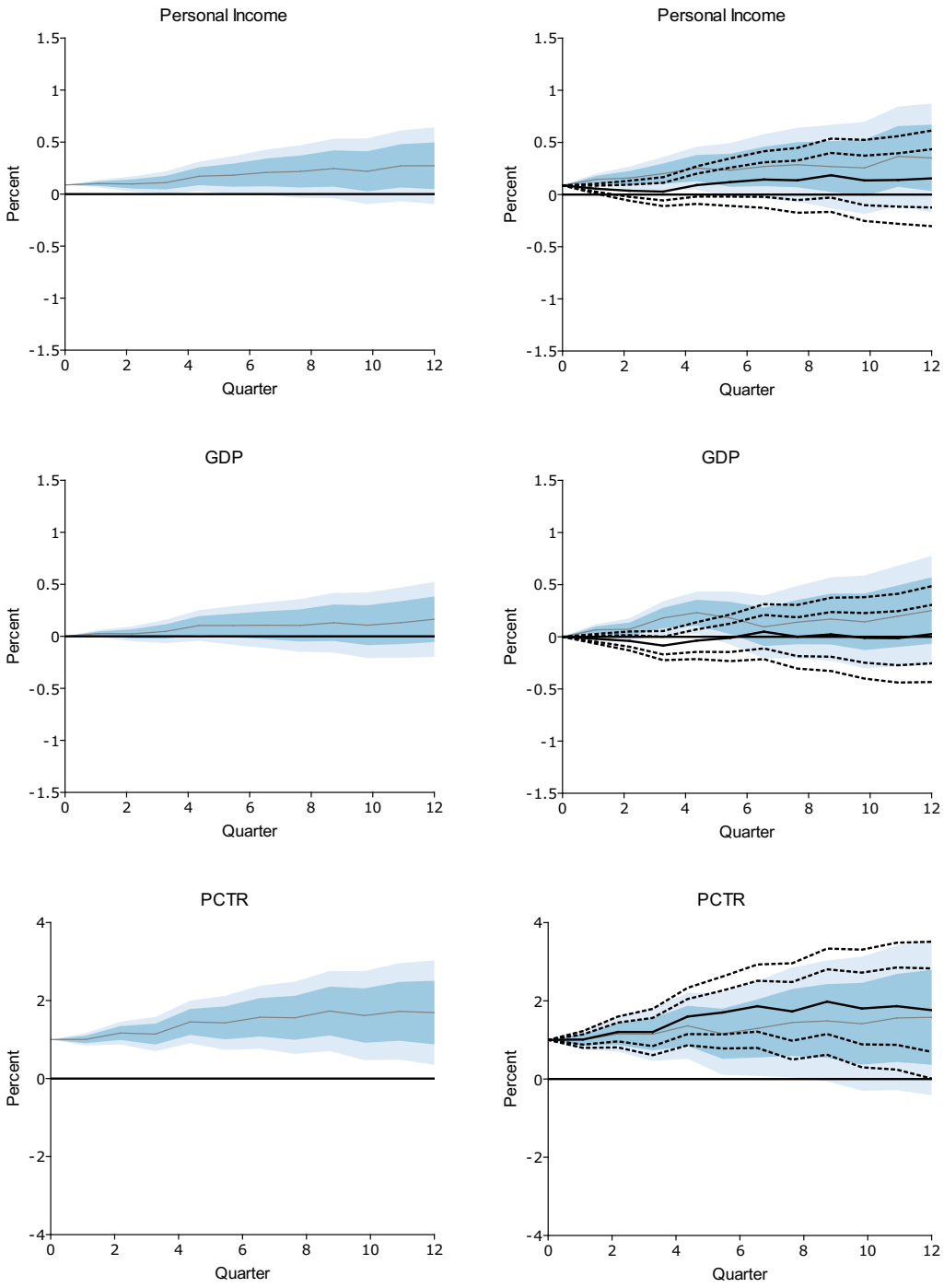


Figure 1.6: Response function to PCTR impulse - 1960:1 to 2005:4

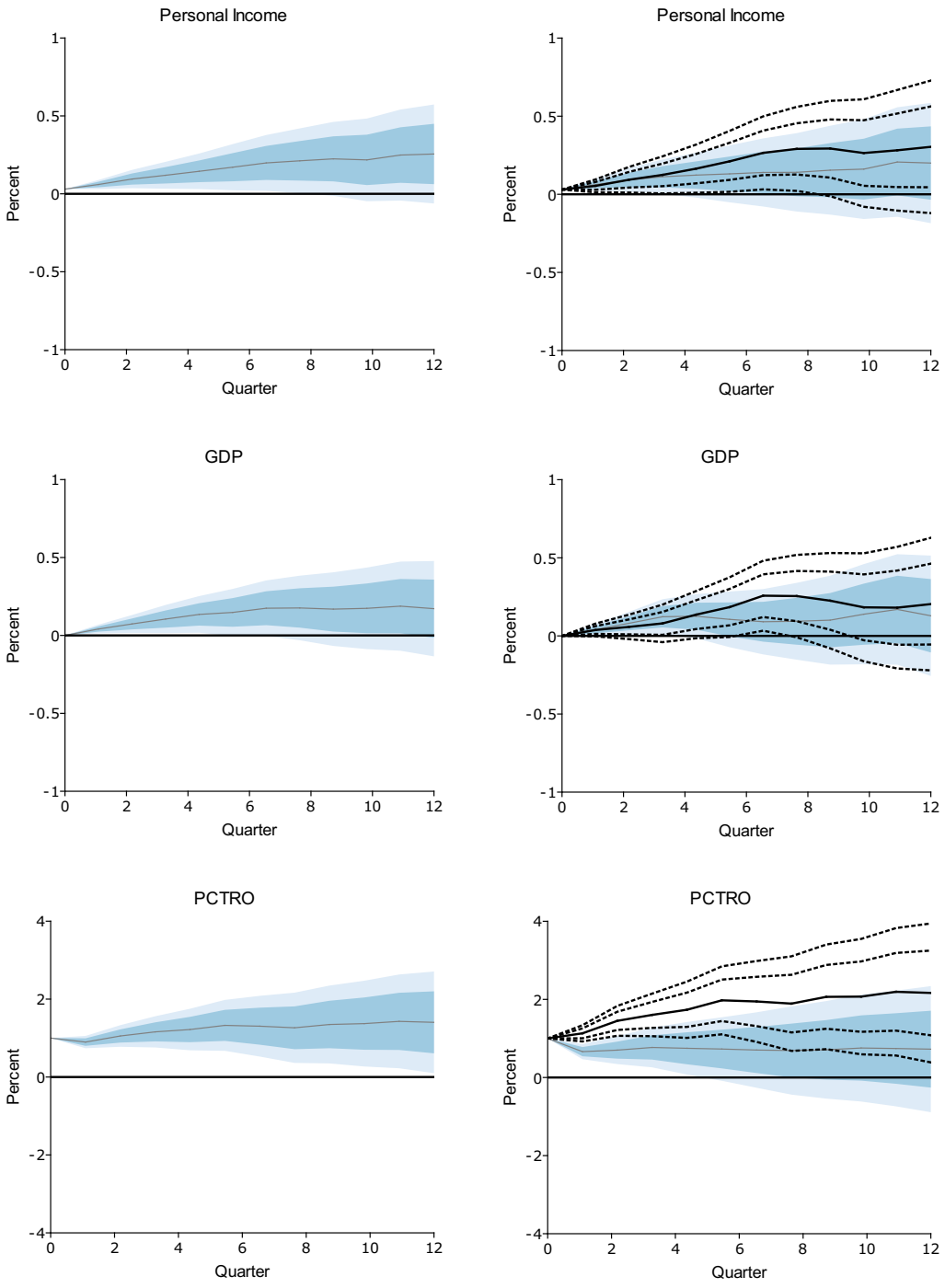


Figure 1.7: Response function to PCTRO impulse - 1960:1 to 2005:4

1.4 Forecast error variance decomposition results

Another useful time series econometric tool for revealing data patterns is the FEVD. Table **??** shows a number of FEVD results arranged in four vertical panels. Each vertical panel reports FEVD for three different forecast horizons in three horizontal panels. Here, we focus on only that part of the forecast error variance due to transfer payments and ignore the forecast error variance due to other components in the model. Each vertical panel consists of three columns. Three of the vertical panels, listed to the left of Table 1, use the full set of data, while one panel, listed to the right of Table 1, uses the subsample 1960:01 to 2007:04. For the full data set, the FEVD are computed with each of the three transfer payment series discussed earlier: PCTR, PCTRO, and PCTR-PCTRO.

Focusing on the PCTR vertical panel, we see three columns, PI, GDP, and PCTR, and then running down the rows of the table, we see FEVD information computed at one-year ahead, two-year ahead, and three-year ahead horizons. For each horizon, three rows are provided with the first row showing the portion of the forecast variable listed at the column head that is due to transfer payments at the one-year horizon for the linear model. Similarly, the next two rows show the portion of the forecast error for the variable listed at the column head that is due to transfer payments at the one-year horizon in the asymmetric model for both the contractionary and expansionary states.

At the one-year horizon, the linear model shows that PCTR explains 54.18% of the forecast error variance for PI, 16.03% of the forecast error variance for GDP, and 74.32% of the forecast error variance for itself. Without noting the numbers, the next two rows show that PCTR explains a large percentage of the forecast error variance for PI and GDP during contractionary states and a considerably smaller percentage of the variance during expansionary states. This pattern of greater accounting of the forecast error variance to PCTR during contractionary states continues down through the two-year and three-year ahead horizons.

Next, moving to the second vertical panel, with the results for PCTRO, we see that PCTRO also shows strong asymmetric results, with the percentage of the forecast error attributable to PCTRO for PI and GDP of similar magnitude to those from PCTR at each of

the forecast horizons. Moving to the third vertical panel, with the results for PCTR-PCTRO, we see the asymmetry has been mitigated in much the same way as we saw in Figure 1.5. Finally, the last vertical panel, which focuses on the early data period, shows no asymmetry, like the results in Figures 1.6 and 1.7.[13]

[13]The results for PCTRUNIN are not presented here to save space, but they are also consistent with the results of Figure 1.4 and do not show an asymmetry.

Table 1.1: FEVD of transfer payment shocks

	Full sample (1960:01-2021:03)									Subsample (1960:01-2007:04)		
	PCTR			PCTRO			PCTR-PCTRO			PCTRO		
States	PI	GDP	PCTR	PI	GDP	PCTRO	PI	GDP	PCTR-PCTRO	PI	GDP	PCTRO
						Forecast horizon of one-year ahead						
Linear	54.18	16.03	74.32	56.8	23.85	83.65	23.48	7.06	73.19	8.77	4.75	93.22
Contractionary	80.31	72.78	83.15	90.28	81.82	93.36	15.58	13.54	67.29	18.85	10.16	90.65
Expansionary	49.53	16.29	68.85	35.96	14.99	68.45	40.84	11.61	77.6	6.07	2.07	93.8
						Forecast horizon of two-year ahead						
Linear	53.48	24.1	84.07	54.52	36.23	85.26	26.42	11.11	80.15	14.83	18.12	90.24
Contractionary	91.75	89.68	85.53	96.07	94.53	91.22	26.9	23.56	72.33	32.56	20.68	80.87
Expansionary	25.74	12.94	78.46	16.54	10.87	73.24	29.44	9.32	84.35	17.89	14.34	90.03
						Forecast horizon of three-year ahead						
Linear	50.58	20.01	89.89	54.81	39.08	88.026	26.23	8.69	80.13	24.74	20.31	80.34
Contractionary	91.82	90.45	88.5	96.1	95.3	90.12	30.39	24.72	65.84	45.96	33.7	79.74
Expansionary	11.72	8.69	87.24	7.53	5.52	76.5	16.03	5.15	82.59	21.69	16.2	78.9

Overall, the FEVD analysis confirms the results seen in the IRF analysis. The FEVD indicates an asymmetry in the economic responses of PI and GDP to both PCTR and PCTRO at all three horizons given in the table. Furthermore, if one removes the PCTRO series from PCTR, or if one focuses on the pre 2008 data, the asymmetry goes away.

1.5 Robustness

Several robustness checks were conducted. These include using the NBER recession dates as the threshold indicator, ordering the variables differently in the VAR, and considering a four-variable model that adds the Federal Funds Rate as an explanatory variable. In the subsections below, we describe these exercises in further detail. An appendix with additional IRF plots is also available from the authors upon request.

1.5.1 Threshold based on the NBER recession dates

Sahm's rule is designed to show the presence of economic weakness. The NBER recession date series is utilized as an alternative threshold indicator, and the resulting IRF outcomes are presented in Figure A.1. With this threshold indicator, it was found that earlier results held up, with both PCTR and PCTRO showing positive effects in the linear models. In contrast, the asymmetric models showed weak stimulative effects during strong economic periods and strong stimulative effects during weak economic periods. However, the asymmetric model results with this alternative threshold indicator are not as strong as the baseline results. One reason could be that the Sahm rule is designed to anticipate forthcoming economic weakness or forthcoming economic strength. These results show that the different states depend partly on anticipation and not just actual experience. Furthermore, the asymmetries went away with the PCTRUNIN data and the constructed series PCTR-PCTRO.

1.5.2 Model in which transfer payments is ordered first

In our baseline Cholesky ordering, we ordered GDP prior to transfer payments to reflect the automatic stabilizing structure of transfer payments. However, a common, more traditional approach for modeling government policy regards policy as being exogenous. If one held this view, one might assume that transfer payments should be ordered prior to GDP. This was the ordering used in Blanchard and Perotti (2002) in their analysis which focused more on general government spending than on transfer payments. As a robustness exercise, we also investigated an ordering in which transfer payments are ordered first, GDP is ordered second, and PI is ordered last. The results of this ordering, shown in Figure A.2, show virtually identical impulse responses as those seen in Figure 1.2, indicating that the ordering does not impact the findings discussed in Section 3. This result is not too surprising since the effects of the Cholesky ordering dissipate quickly and have a limited impact on the response functions for longer horizons.

1.5.3 Model with monetary policy

The previous models only included fiscal policy. One could argue that an important missing variable is a monetary policy variable. So as another check, the Federal Funds Rate was added to the model. We followed common practice in the macroeconomic literature, which is to order monetary policy last so that monetary policy could respond to other variables contemporaneously, but the monetary policy could not affect other variables contemporaneously. The IRFs of the extended model are provided in Figure A.3. This extended model again showed that there are important positive effects from the extended transfer payment series only during economic weakness.

1.6 Conclusion

This paper investigated the stimulative effects of transfer payments on PI and GDP impulse response functions and forecast error variance decompositions. It is shown that under sym-

metric response assumptions, positive transfer payment impulses lead to positive stimulative effects for PI and GDP lasting about six quarters. The origin of this result was investigated using asymmetric models and exploring the subseries of the transfer payment series. It was found that the stimulative effects were asymmetric. During economic weakness, the stimulative effects are relatively lengthy, lasting up to twelve quarters. However, during economic strength, the stimulus was small, and short lived. Breaking transfer payments into its subseries showed that much of the asymmetry is due to the special programs of the Great Recession and the COVID-19 recession. Removing the special programs from the transfer payment data shows a reduced asymmetry but does continue to show greater stimulus during economic weakness. Focusing on data prior to these recent recessions shows much smaller stimulative effects and no asymmetry in the responses. Interestingly, even with the recent recessionary unemployment insurance expansions, unemployment insurance programs do not show any asymmetry, but do show somewhat small stimulative effects.

These results indicate that using transfer payments as an economic stimulus for the economy during expansionary economic conditions does not lead to large gains in personal income and gross domestic product. In addition, regardless of economic conditions, expansions in unemployment benefits do not result in large gains in personal income and gross domestic product. A policy intended to stimulate personal income and gross domestic product through transfer payments will have its greatest impact during contractionary economic conditions and through special programs such as those enacted during the Great Recession and the COVID-19 recession. Because transfer payment programs are often motivated by both the benefits to recipients and the stimulative benefit to the economy, our results show that, outside of the periods where extraordinary expansions occur, the stimulative effects from transfer payment programs are small, and that transfer payments should only be motivated by the benefits to the recipients.

Chapter 2

Revisiting the Growth Effect of Education Spending: A Review of Educational Reforms

2.1 Introduction

Why should we care about public education spending? How should we organize and structure public education spending? These important questions have long taken center stage in discussions in developing and developed countries. The economic literature argues that government spending on education promotes long-run economic growth by improving human capital development required to achieve higher productivity and earnings. The growing importance of government education spending cannot be understated in a globalized economy. Investment in education, on the one hand, positively affects economic growth and, on the other hand, reduces poverty and provides a social and political landscape that attracts foreign investments. It is also a direct tool to bring the populace out of the poverty trap due to better employment opportunities, and it can also generate a positive externality to society.

However, the link between education spending and economic growth is not always clear

in the empirical analysis. Different education systems, reforms, and country-specific characteristics can impact economic outcomes differently. Pro-education-growth researchers argue that educated individuals are more effective and efficient in the workplace because they possess the requisite skills and knowledge to perform their tasks, resulting in higher productivity levels (Lucas Jr, 1988; Romer, 1989; Barro, 1991; Breton, 2013). This higher quality of human capital and productivity stimulates economic growth. Additionally, education engenders innovation, creativity, entrepreneurship, and social mobility, thus promoting the creation of new knowledge, industries, products, and services which increases the aggregate output (Glomm and Ravikumar, 1992; Benhabib and Spiegel, 1994; Eckstein and Zilcha, 1994; Hanushek and Kimko, 2000; Churchill et al., 2017).

In contrast, other researchers find a negative correlation or no significant effect of human capital investment on economic growth. Some of these authors argue that if public education is inappropriately managed, it can lead to excessive government debt, which may crowd out private investment and reduce confidence in the economy. Also, when governments spend large sums of resources on education, they may need to increase future taxes or reduce or reallocate spending in other areas to satisfy the intertemporal budget constraints limiting economic growth (Barro, 1991; Devarajan et al., 1996; Blankenau and Simpson, 2004; Mo, 2007). Another potential issue is that government spending on education can discourage private education sector growth. For instance, if the government provides free education or heavily subsidizes the cost of schooling, then private providers will be driven out of the market, reducing the incentive for them to invest in education. This can result in a lack of competition, low innovation, and diversification in the education sector, which can limit the skills and knowledge in the labor market. Furthermore, investment in human capital may not yield the desired results if the education system is not providing students with marketable skills and the quality of education is low (Hanushek and Woessmann, 2010; Angrist et al., 2021; Grimmer, 2022).

Some authors have made an attempt to reconcile the existing debate by offering plausible explanations for these conflicting results. Some argue that there is a nonlinear relationship between government spending and macroeconomic performance where the macroeconomic

returns to investment in education depend on an optimal size of government expenditure threshold value (Sheehey, 1993; Vedder and Gallaway, 1998). At the same time, others suggest that the extent of accessibility to education by all members of society may influence output growth. Countries where all citizens have access to education regardless of socioeconomic background promote social mobility and reduce economic inequality compared to countries with less accessibility to education (Glomm and Ravikumar, 1992, 1997).

Several explanations are also advanced where the government's quality and efficacy play in the education-growth nexus. Rather than studying public spending in isolation, some studies looked at the interrelationship between public education spending, governance structure, and economic growth (Barro and Lee, 1993; Acemoglu et al., 2008; Trabelsi, 2018). The outcome of these studies shows that enforcement of contracts, protection of intellectual property rights, economic freedom, political stability, and low corruption contribute to more efficient provision of public goods, which in turn is associated with sustained economic growth. On the other hand, countries with weak governance, managerial problems, and weak legal frameworks can be repressive to economic growth even in the presence of elevated public spending (Levine and Renelt, 1992).

In this paper, we revisit the longstanding question of whether government spending on education promotes economic growth. As it currently stands, the empirical evidence for the association between government education spending and growth is mixed and inconclusive. We contribute to the current literature by using state-of-the-art methodologies to evaluate the impact of education spending on economic growth following an educational policy intervention. These methodologies provide rigorous and robust statistical approaches to estimating the effect of policy interventions. By applying them to education reforms, our paper attempts to offer a more precise and nuanced understanding of the impact of education spending on economic growth. We consider four countries, namely, Argentina, Finland, Iceland, and New Zealand, for our investigation because governments in these countries implemented comprehensive educational reforms that led to substantial increases in the government's educational spending in the early 1990s. Two features make these events interesting quasi-experiments to education economists. First, the policy went beyond pre-

scribing a mere increase in education spending. Clear guidelines and new standards were formulated to achieve educational goals, teacher training and certifications, decentralization, and pedagogic models. Second, although higher public education spending was only part of a broader set of structural reforms, they were massive and long-lasting changes for the most part. For example, Argentina went from investing a little over 1.1% of its GDP in 1989 to over 4% in less than a decade following the Federal Law of Education (1993) reform. Likewise, Finland, Iceland, and New Zealand saw a similarly significant rise in public education spending as a share of GDP.

We are fully aware that this quasi-experimental approach has several limitations. For instance, investigating the impact of education spending at the aggregate level is challenging due to the nature of macroeconomic data. At the aggregate level, it may be challenging to disentangle the direct effect of the surge in education spending alone from the other non-education provisions of the reforms. Additionally, having the optimal mix of countries as control units for this impact evaluation study is empirically challenging. Nevertheless, this method will offer a more robust approach to existing studies and provide important insights into the role of higher education spending and strategic reform implementation. We hypothesize that education spending by the government following the education policies may spur economic growth by making human capital more productive in the workforce.

Using data from 1974 - 2018 among a panel of 29 countries, we employ the difference-in-differences (DiD) estimator and the synthetic control method (SCM) to investigate the growth effect of education reforms in Argentina, Finland, Iceland, and New Zealand. In line with the literature on central education spending, we find evidence of a significant increase in the long-term growth in output per capita for all four countries using the difference-in-differences estimation method. However, results from the synthetic control methods show no markedly long-term growth in output per capita for all four countries following the educational reforms.

The remainder of the paper is structured as follows: Section 3.2 presents relevant literature on public education spending and economic growth. Section 2.3 discusses the various educational reforms adopted by the selected countries under study. We then proceed to Sec-

tion 2.4 which presents the data and descriptive statistics. Section 2.5 develops the empirical results while Section 2.6 presents the robustness checks. Finally, Section 2.7 concludes with policy implications.

2.2 Relevant literature

The importance of education has been a widely discussed and researched topic among economists and policymakers over the years. The literature on economic growth highlights the significant impact that investment in education can have, including the development of human capital, decreased fertility rates, increased equality, improved governance, and increased knowledge and innovation within an economy (Benhabib and Spiegel, 1994; Eckstein and Zilcha, 1994; Glomm and Ravikumar, 1997; Churchill et al., 2017; Hanushek and Woessmann, 2010, 2020).

The study of economics and education has a rich history, with early writers including Schultz (1960, 1961), Denison (1966), Miller (1967), Mincer (1974), and Becker (1975). Schultz (1960, 1961), Mincer (1974), and Becker (1975) are especially noteworthy for their contributions to the theoretical foundation of human capital and its connection to education. Schultz viewed education as a form of human capital, as it becomes an integral part of the person who receives it. Although human capital is not a commodity that can be bought, sold, or treated as property (at least not in the U.S.), it provides valuable services to the economy. Becker defined human capital as "activities that influence future monetary and psychic income by increasing the resources in people" and argued that the two primary mechanisms for its accumulation are on-the-job training and schooling. Mincer (1974) similarly described education as an "investment in the stock of human skills." These different views on human capital have led to the expansion of the field of economics of education since different factors can directly or indirectly influence the formation and exploitation of this capital.

Even though our study is empirical, we briefly discuss some theoretical contributions which are worth noting. Before the emergence of human capital theory, the classical school of thought believed that the source of economic growth was driven primarily by exogenous

factors such as capital accumulation, an increase in the stock of the labor force, technological advances, and the limited role of government in the economy. Human capital theorists argued against the conjecture that labor and capital alone are insufficient for the growth dynamics between economies (Schultz, 1960, 1961; Denison, 1966; Mincer, 1974; Becker, 1975; Essardi and Hemza, 2022). Instead, labor quality represents a fundamental variable that explains the evolution of growth dynamics. A quality workforce is characterized by good health and access to science, innovation, and technology education, which enhances their intellectual capacity. This perspective opened the door for further exploration of the role of other factors in economic growth by other growth theorists.

According to the neo-classical growth theory, technology is considered to be external to the economy. It posits that growth in the physical capital stock leads to an increase in per capita income, but long-term growth cannot be sustained through investments in education. This is due to the law of diminishing marginal returns, which implies that as the expenditure on education increases, the quality of education improves up to a point, beyond which it begins to decline (due to high enrollment rate) (Solow, 1956). Contrarily, endogenous growth theorists argue that technology should be considered an internal driver of growth as investments in knowledge, research and development, capital, and human capital can result in long-term economic growth. This theory suggests that investments in both physical and human capital can encourage more economic growth; therefore, the level of human capital directly determines steady-state growth. Additionally, this theory allows for the creation of positive externalities through the spread and production of knowledge (Romer, 1986, 1990; Lucas Jr, 1988). Essardi and Hemza (2022) explain that there are three models for thinking about endogenous growth theory: (1) the human capital accumulation model (Lucas Jr, 1988), (2) the knowledge and research model (Romer, 1986, 1990), (3) and the neo-Schumpeterian model (Aghion and Howitt, 1992).

Although all these growth theories suggest that education can lead to positive macroeconomic outcomes, the empirical evidence is inconclusive. The conflicting results can be attributed to issues with measuring education, such as the indicators used, the quality of data, the time frame studied, the model design, and the unique economic and institutional

circumstances of the countries analyzed (Hanushek and Woessmann, 2008, 2010, 2020; Osiobe et al., 2019; Essardi and Hemza, 2022). This lack of consistency has generated ongoing interest in this area of research.

In a comprehensive cross-country study, Romer (1989) examined the impact of human capital on endogenous growth by using data from 112 market economies from 1960 to 1985. In his theoretical framework, Romer (1989) posits that when individuals invest in their own education and skills, they increase their future earning potential, creating a positive cycle in which higher earnings lead to further investment in human capital and ultimately result in more economic growth. Romer (1989) provides evidence to support his theory by showing a positive correlation between a country's level of education and its economic growth, and argues that policies aimed at boosting human capital are crucial in fostering long-term economic prosperity. In a similar vein, Barro (1991) used data from 98 countries covering the same period (1960 - 1985) to examine the relationship between human capital and economic growth within a neo-classical framework that incorporates diminishing returns to capital. The study found that a country's initial level of human capital positively affects its growth rate, with countries having higher human capital experiencing faster growth, provided it is proportional to their per capita GDP. Breton (2013) conducted research on the impact of education on national output and found that education can have both direct and indirect effects. Educated workers were found to have increased productivity, which directly contributes to the nation's income. Furthermore, the study revealed that the education of workers could also indirectly increase the productivity of other workers and physical capital through a spillover effect. In countries where education levels are high, the spillover effect on other workers is minimal, while in countries with lower levels of education, it is more pronounced. Smith et al. (2016) also explored the link between education, health, and economic growth in Malawi using data from the Malawian Third Integrated Household Survey collected from 2010 to 2011. The study discovered that education could drive economic growth indirectly through improved health. The authors predicted that completing secondary school could increase an individual's annual wages by over 136 percentage points, leading to higher tax revenue and more investment in educational programs in the coun-

try. Meanwhile, Glomm and Ravikumar (1992, 1997) discovered that public education has a greater capacity to reduce income inequality compared to private education, while Gupta et al. (2002) argued that an increase in capital spending could have a positive impact on growth when financed through budget deficits.

While some studies have found a positive relationship between education spending and economic growth, others have not. Levine and Renelt (1992) study of 119 countries between 1960 and 1989 found a statistically insignificant association between education spending and economic growth. Despite Temple (1999) discovering a statistically weak positive link between these two variables, Dessus (1999) posited that these findings may have been influenced by model dependency bias (Osiobe et al., 2019). Bils and Klenow (2000) also concluded that the connection between schooling and growth was too weak to account for a substantial portion of the relationship between the two variables. Even after examining the effect of schooling on technology adoption, the authors found that schooling's impact on growth explained less than one-third of all cross-country relationships (Bils and Klenow, 2000; Grimmer, 2022). Dessus (1999) suggested that, in some cases, an increase in school enrollment may actually reduce the quality of education. Therefore, public investment in education may not be a guarantee of higher growth in developing countries. Similarly, Pritchett (1996, 2001) did not find a positive return of educational attainment on subsequent worker productivity, and suggested that the outcome of increased years of schooling may vary based on a country's educational system and structure (Grimmer, 2022).

Even so, several other studies suggest that education has an adverse effect on growth and development. For example, Devarajan et al. (1996) found that in less developed countries, education spending may be excessive and has a negative effect on economic growth when decomposed into its various components. Employing a Seemingly Unrelated Regression (SUR) and Instrumental Variables (IV) approach, Islam (1995) also documented a negative relationship between average years of schooling and real GDP per capita through a panel data analysis. Along the gender dimension, Barro and Lee (1993) showed that an additional year of female secondary schooling reduces a country's growth rate by 0.9 percentage points, while Costantini and Monni (2008) discovered that secondary school enrollment is negatively

correlated with growth. Benhabib and Spiegel (1994) also argued that while human capital levels increase per capita income, the growth rate in human capital generally has a negative effect on per capita income growth. From a demand and supply side analytical framework of education spending and productivity growth, Mo (2007) finds an inverse relationship between education expenditure and contemporary GDP. Similarly, Nketiah-Amponsah (2009) analyzed the relationship between public spending and economic growth in Ghana from 1970 to 2004 and found that aggregate expenditure has a significant negative relationship with economic growth. Biao (2018) shed more light on this relationship by extending the sample to cover sub-Saharan Africa (SSA). Biao (2018) concludes that the education systems in Africa, which stems from the colonial era, have failed to result in higher economic growth. Additionally, the Western approach to education in Africa disregards local contexts.

The study conducted by Hanushek and Woessmann (2010) draws attention to the crucial need to accurately distinguish the impact of quality education from simply increasing the quantity of schooling on economic growth. The authors emphasize the significance of considering the quality of education as a key factor in determining the returns to education, as merely attending school does not necessarily equate to learning Grimmer (2022). Moreover, the use of average years of schooling as a measure of education carries certain limitations. This measure assumes that a year of schooling has the same impact on knowledge and skills across different education systems, without taking into account cross-country differences in the quality of education. Additionally, the measure presumes that formal schooling is the sole source of education, neglecting the impact of non-school factors on educational outcomes. Extending the work of Hanushek and Woessmann (2010), Angrist et al. (2021) places emphasis on measuring the impact of the quality of education or skills acquired during schooling on economic growth worldwide. They used a different method in their regression model, incorporating more reliable education quality variables in the human capital equation by using regional test scores and international assessments. Results showed that the quality of education has a substantial impact on annual economic growth. In another study, Adu and Denkyirah (2017) analyzed the impact of schooling on Ghana's economic growth between 1980 and 2016. Findings showed that secondary education has a positive relationship with

economic growth in the long run. The authors also found a weak and statistically insignificant relationship between government expenditure as a proxy for the quality of education and economic growth. In contrast, the study by Hanushek and Kimko (2000) finds a positive and statistically significant effect of the quality of education on economic growth, with one country-level standard deviation higher test performance (47-test-score points on the scale used) resulting in a 1 percent increase in annual growth. Other studies have also found similar results that cognitive skills are substantially important for economic growth (Bosworth and Collins, 2003; Coulombe and Tremblay, 2006; Wößmann, 2002, 2003).

Some authors have also highlighted the non-monotonic nature of education spending on economic growth. They argue on the premise that investment in human capital may depend on the optimal size of government expenditure threshold value (Sheehey, 1993; Vedder and Gallaway, 1998). At the same time, others suggest that the (in)effectiveness of public good provision is conditional on the government's quality and efficacy. For example, Barro and Lee (1993), Acemoglu et al. (2008), and Trabelsi (2018) looked at the interrelationship between public education spending, governance structure, and economic growth. Their studies show that enforcement of contracts, protection of intellectual rights, economic freedom, political stability, and low corruption contribute to more efficient provision of public goods, which in turn is associated with sustained economic growth. On the other hand, countries with weak governance, managerial problems, and legal frameworks can repress economic growth even in the presence of elevated public spending (Levine and Renelt, 1992).

2.3 Educational policies background

Educational reforms have widely been viewed as a means of addressing economic challenges such as low productivity, high unemployment rates, and income inequality. Consequently, these reforms have led to an increase in investment in education, with policymakers implementing various measures such as expanding access to education, improving the quality of school infrastructure and teaching, and aligning education with the needs of the labor market. However, the impact of educational reforms on economic growth remains a complex and

contested issue. To better understand the interrelationships between the education system, human capital, and economic structures of the countries under study, we discuss the features of the educational policies implemented in the respective countries.

2.3.1 Argentina

Argentina is the second-largest country in South America and the eighth-largest country globally. The country ranked higher than the United States in terms of standard of living, at least until the latter 1890s. Argentina's economic and political trajectory has not been smooth. The 1930 Great Depression and the 1980 Recession led to an economically depressed and politically unstable state, pushing it back into underdevelopment. However, according to the Human Development Reports, Argentina currently ranks second to Chile in the Human Development Index (a key measure of the population's health, literacy, and standard of living) in the Latin American and the Caribbean region.[1]

Like many other Latin American countries, the turn of political and economic events propelled Argentina to initiate significant structural changes following the nation's return to democracy in the 1980s. Education was a big part of this transformation, and policymakers attempted to cement its function and meet the changing needs of 21st-century society. To put things in perspective, the school system in Argentina at the beginning of the 20th century was modeled around compulsory primary education and secondary education, which comprised seven years and five years of schooling, respectively (Gorostiaga et al., 2003; Muscar, 2013; Osiobe, 2021).

In 1905, the federal government passed a law allowing for creating and administrating its schools, aside from the provincial schools. Initially, secondary schools aimed to prepare students for higher education or to teach at primary schools. However, this changed as new technical schools with vocational orientation got introduced. The new democratic dispensation in the 1980s brought about the elimination of entrance exams and remarkable expansions of secondary schools (Gorostiaga et al., 2003; Muscar, 2013). Net enrollment in secondary

[1] see https://hdr.undp.org/data-center/human-development-index/indicies/HDI

schools grew from 33.4% in 1980 to 53.5% in 1991. Well-functioning political institutions encouraged education actors to openly and freely discuss the pedagogies and contents of the education system. This conscious effort pinnacled with the design of a new comprehensive law of education in the 1990s. This era under Carlos Menem's tenure (1989 - 1999) witnessed an attempt to "modernize" the country and become globally competitive (Gorostiaga et al., 2003). Some liberal policies implemented by Menem's government included openness to international trade, privatization of state-owned enterprises, and the deregulation of the market economy. The economy began to show signs of profound growth following these policies (GDP grew by more than 8% between 1991 and 1994) (Gorostiaga et al., 2003). However, this was short-lived, with the blow of the recession. According to Gorostiaga et al. (2003), the educational reform was supposed to bring organizational and instructional innovations to the public school system. Braslavsky and Tiramonti (1990) and Frigerio (1995) argued that the federal and provincial ministries failed to manage the public school system effectively due to inadequate resources. A byproduct of this mismanagement was the amplification of the existing inequalities in the education sector. Gorostiaga et al. (2003) highlights that the main problems that battered education prior to the reform included the high school dropout rate, repetition rate, outdated curriculum, limited enrollment of students from poor households, and lack of educational resources (Braslavsky, 1999; Gorostiaga et al., 2003). These problems coexisted with convoluted financing sources and inadequate school supervision due to the centralized educational system. This background limitation served as a launchpad to roll out educational reforms. The first step included decentralizing all national secondary schools and teacher training institutions in 1992 - 1993 (Law No. 24049) (Gorostiaga et al., 2003). The second, the Federal Law of Education, was enacted in 1993. This Law and the Higher Education Law (enacted in 1995) outlined a comprehensive education reform (Gorostiaga et al., 2003).

In the early 1990s, most secondary schools in Argentina were under the management of private and national authorities, with the provincial sector having little control or share of the administration (Gorostiaga et al., 2003). The Federal government controlled about 60% of the public secondary schools. By 1992, the provinces in Argentina received the

mandate to manage the national secondary and higher education systems fully. However, some of the provinces complained of needing more resources from the government to ensure a smooth transfer of responsibilities (Gorostiaga et al., 2003). On the other hand, the national government maintained that the sustainable increase in taxes in 1991 would generate the necessary revenues to finance the transfer of duties. Nevertheless, García de Fanelli (1997) and Puiggrós (1997) disagreed and contended that several provinces needed more technical expertise to oversee the new system.

The Federal Law of Education (1993) delineated the distinct roles and coordination mechanisms for each level of government. The national Ministry of Culture and Education is entrusted with evaluating and monitoring the educational system, enforcing compliance with national policies, providing financial and technical assistance to improve the quality and equity of the education sector, and establishing a federal management information system (Gorostiaga et al., 2003). On the other hand, the 23 provinces and the city of Buenos Aires (the federal district) are responsible for the funding, administration, and management of schools, including teacher recruitment and training (Gorostiaga et al., 2003; Osiobe, 2021; Muscar, 2013). According to Gorostiaga et al. (2003), the Federal Council on Culture and Education is the body that engages in dialogue with the provinces on national policy and its implementation, with national and provincial ministries of education as members. A salient feature of the new education law is its emphasis on increased financing for education from the national and local governments, with the educational budget slated to double gradually, with an increase of 20% (Gorostiaga et al., 2003). Furthermore, Decibe (1998) contends that decentralizing education and the new division of responsibilities will promote competitiveness and bolster federalism and local government institutions, including schools (Gorostiaga et al., 2003).

Gorostiaga et al. (2003) reviews the main components of the Federal Law of Education (1993). First, under this national reform strategy, the Education Ministry introduced a new academic framework, beginning with ten years of compulsory education (three years of initial education plus seven years of General Basic Education), then three years of Polimodal (or Multimodal) education, and ending with higher education (comprising universities and

tertiary institutions). The revised framework catered to the unique needs of young schoolers transitioning from primary to secondary school and provided better equity and quality education for low-income students (Braslavsky, 1999; Gorostiaga et al., 2003). The advantage of the Polimodal system included preparing students for citizenship and ethical behavior, equipping them for the job market, and further graduate studies. The reform further empowered provinces to decide on the organization of various modalities and technical specializations while considering the local needs and the schools' institutional capacities (Gorostiaga et al., 2003; Muscar, 2013). This initiative also aimed to strengthen the relationship between employment and education by creating more effective mechanisms for communication and scholarly debate among education stakeholders. To further meet the demands of the economy's productive sectors, the National Ministry established the Institute of Technological Education (INET) in 1995. The INET equipped students with technical-professional skills for specific job requirements (Ministerio de Cultura y Educacion, 1997).

Secondly, the reform introduced a systematic and cohesive approach to the educational system. Before the reform, the school system was characterized by heterogeneous educational content across provinces, culminating in what Braslavsky (1999) called "anarchic diversity." The national Ministry and the Federal Council designed a three-level tier in the new curriculum. The first tier, the general level, constituted overarching objectives and guidelines established by the Federal Council. The second tier, the provincial level, accounted for specific goals and procedures uniquely tailored to each province's characteristics. The third tier, the school level, leveraged the insights and expertise of school principals and teachers in decision-making processes for creating content and educational philosophies. This collaborative approach ensured that educational goals were met while providing room to cater to diverse regional and local needs (Gorostiaga et al., 2003; Braslavsky and Tiramonti, 1990; Braslavsky, 1999; Muscar, 2013).

Thirdly, the implementation of the new curriculum design necessitated the need for teacher training. This training enabled new and existing teachers and principals to adapt to the curriculum changes, improve their subject matter proficiency, and enhance their ability to use educational materials and technology. The Federal Network of Teacher Training

played a central role in providing the necessary resources for teacher training, leveraging the collaboration of Teacher Training Institutes and universities to achieve this objective. In addition, Decibe (1998) highlights that the Teacher Training Institutes underwent a curriculum redesign to align their programs with the requirements of the new curricular design (Gorostiaga et al., 2003).

Fourthly, the reform birthed the National System of Educational Quality Assessment, which was a pivotal step toward the evaluation of students' performance on an annual basis. The system also gathered critical information from school administrators, teachers, and families concerning institutional management, classroom practices, and students' background history. Decibe (1998), and Gorostiaga et al. (2003) expounds that this innovative strategy facilitated the enhancement of coordination and the promotion of development among provinces while utilizing data for informed decision-making. Overall, the system's implementation underscored the government's unwavering commitment to enhancing the quality of education and ensuring that it remained responsive to the dynamic needs of students and stakeholders.

Furthermore, the government introduced a novel school management model through the Institutional Basic Conditions (Condiciones Basixas Institucionales). The primary aim of this model, as opined by Gorostiaga et al. (2003), was to revamp the management and organization of schools while promoting instructional innovations in the application of new curricular guidelines. Under the model, academic institutions were empowered to exercise autonomy in their decision-making processes and develop their management structure customized to their needs. This approach involved the Institutional Educational Project (IEP) - a document produced by respective schools explaining and adapting the Provincial Curricular Design and curating the delivery method of the curriculum (Gorostiaga et al., 2003).

Lastly, the Argentine government provided huge federal funds for improving facilities, computers, and textbooks directly to the poorest primary and secondary schools in the country. This aimed to reduce educational inequality by improving access and quality. Morduchowicz (1999) reported that between 1993 and 1998, the Social Plan for Education (established by the Federal Law) reached more than 17,000 schools and about 3.6 million students,

significantly reducing fragmentation and marginalization in the educational system.

It is worth mentioning that international organizations such as the World Bank, Inter-American Development Bank (IDB), and UNESCO played an essential role in implementing the reform. These international bodies invested heavily in education in Argentina, with loans from the World Bank and the IDB accounting for 2% of national and provincial educational expenditures between 1995 and 1999 (Files, 1995; Gorostiaga et al., 2003; Muscar, 2013). The World Bank invested about USD 410 million to support the decentralization and improvement of the Secondary Education Project. The international institution focused on modernizing the administration, evaluating, and planning capacities and systems at the provincial level, as well as curriculum development and educational resource provision (such as textbooks, libraries, computer, and science laboratories, etc.), expansion of schools, and rehabilitation. The World Bank also supported the development of school-based improvement projects (Files, 1995; Gorostiaga et al., 2003). The IDB also assisted the government with USD 600 million for the Educational Reform and Investment Program (Decibe, 1998).

2.3.2 Finland

Finland is a Nordic country with a varied history of economic performance. Before World War II, the country was largely mono-cultural, peripheral society, and agrarian, with an economy, focused on forestry, agriculture, and traditional industries (Sahlberg, 2007, 2021). The war claimed the lives of about 90,000 Finns. As part of the monetary cost, the Soviets forced the Finnish government to hand over 12% of its territory, which, according to Sahlberg (2021), was estimated to be equivalent to 7% of its Gross Domestic Product (GDP), in exchange for a peace treaty. Against this backdrop, the post-World War II era significantly changed socio-political and economic structures, leading to immediate reforms in education and other social institutions (Dahlman et al., 2006; Sahlberg, 2007, 2021). Today, the world recognizes Finland for its high-quality educational services. However, before the turn of the third millennium, education was restricted to privileged students in larger cities and towns. Sahlberg (2021) report that in 1950, only 27% of 11-year-old Finns enrolled in grammar

schools. In response to the growing public interest in education, the government passed legislation in 1950 to provide subsidies to private entities, reducing the financial risk burden and ensuring the expansion of private schools.

As Finland's economic structure in the 1950s transitioned from farming and small business to industrial and technological production, its political system evolved into a modern welfare democracy. Working-class families actively promoted comprehensive public education during this new political era. The outcome was a galvanization of discussion about education policy that led to revisions to a school model proposed in the 1920s (Aho et al., 2006; Sahlberg, 2007, 2021). The revised model provided universal access to education and a unified curriculum. The nation's overarching goal was to become one of the leading knowledge-based economies on the global stage. One way to achieve this feat was to make quality education accessible to all (Sahlberg, 2021).

To achieve its educational goals, the Finnish government took a significant step by forming the *Primary School Curriculum Committee* in 1945. Departing from the traditional German approach to education in Finland, the committee emphasized the importance of preparing students for the demands of a rapidly changing world by providing modernized presentations, rich educational content, and fostering the child's holistic development. By prioritizing the individual's growth and development, the Finnish government sought to create a new approach to education that would align with its long-term economic and social development goals (Dahlman et al., 2006; Hautamäki and Hautamäki, 2008; Sahlberg, 2007, 2009, 2021). In 1946, the *Education System Committee* was launched, which primarily established regulations for compulsory education and a common framework of principles for interlinking different parts of the education system (Sahlberg, 2021). This committee proposed an 8-year compulsory primary school that could be common to all children, regardless of socioeconomic status. However, parts of the curricula were rigid and received heavy criticism from politicians and various stakeholders. This backlash resulted in the non-implementation of the program [2] (Sahlberg, 2021). The Finnish government established the

[2]For instance, students who had learned foreign languages during primary school were the only ones allowed to enter upper-secondary school or gymnasium. Nonetheless, the committee's proposal stimulated further debate about social justice and equal educational opportunities. These tenets would be realized and

School Program Committee in 1956 to bring coherence to changes in various education sub-sectors and unify the Finnish education system. Key elements of the proposals included; increasing the equality of educational opportunities, basing future compulsory education on a 9-year comprehensive design, and merging private grammar and public civic schools into a new municipal structure. However, this proposal was short-lived because some political actors argued that all children could not achieve similar learning goals. Therefore, the National Board of General Education expanded the School Program Committee in the 1960s. After several intense debates in parliament, the new *Finnish comprehensive school*, or *peruskoulu* system, was enacted in 1970 (Hautamäki and Hautamäki, 2008; Sahlberg, 2021). The government implemented the reforms in multiple waves throughout the 1970s. Before this educational reform, the Finnish education architecture divided students into two separate streams at the age of 11 or 12, with limited possibility of moving between them once a student decides which track to pursue. The new reform merged existing schools into a comprehensive 9-year municipal school, with all students enrolling in the same school regardless of their background or interests (Aho et al., 2006; Hautamäki and Hautamäki, 2008; Sahlberg, 2021). The new system was under the control and operation of local education authorities. It required teachers to employ alternative instructional methods, design learning environments for diverse pupils, and view teaching as a high-status profession. Career guidance and counseling became integral to the comprehensive school curriculum until the end of compulsory education (Sahlberg, 2021).

The emergence of *peruskoulu* led to a rapid expansion of upper-secondary education in Finland. Upper-secondary education also underwent major reformulations to suit economic and political situations better. Finland abolished the traditional school-like system in 1985 and adopted a modular curriculum structure. The new Act on General Upper-Secondary Education replaced the bi-annual semester modality with five or six periods per academic year (Sahlberg, 2021). In the mid-1990s, the existing age cohort-based grouping of students was substituted with a non-class organization structure to give students greater freedom to plan their course sequencing. Vocational upper-secondary education equally had a share in

integrated into the Finnish education policy twenty years later.

the transformation. To meet the expectations of a knowledge-based economy, vocational schools included on-the-job training courses as part of the curriculum. The government allocated a factor of 6% at the top of the school's core funding for staff development to ensure that this education sector remains attractive to students (Sahlberg, 2021).

The *National Curriculum Reform* of 1994 was a significant and momentous educational reform in Finland. The central idea of the reform was to decentralize education governance, empower schools, and increase school autonomy. The reform gave authority to schools to play an active role in curriculum design and implementing pertinent changes. The reform also encouraged schools to collaborate with other schools and network with parents, businesses, and other stakeholders (Aho et al., 2006; Hautamäki and Hautamäki, 2008; Sahlberg, 2007, 2009, 2021). This collaborative effort culminated in the Aquarium Project, a national improvement initiative that transformed schools into active learning communities. According to Sahlberg (2021), this project was unique in Finnish educational administration and rarely found elsewhere. This project encouraged local innovations and research activity among school agents who pursued advanced academic studies in universities. At the beginning of 1997, more than 1,000 projects in 700 schools and 163 municipalities participated in the Aquarium Project. Sahlberg (2021) estimate that about 5,000 teachers and 500 principals were directly involved in this initiative to promote teacher leadership. Undoubtedly, the reform was monumental to Finland's success in international assessments such as Program for International Student Assessment (PISA).

2.3.3 Iceland

Iceland is a Nordic island nation located in the North Atlantic Ocean. Its population is approximately 376,000 as of 2022, making it the second smallest economy in the European Economic Area. Iceland's history interlaces its geography, natural resources, and relationship with larger economies, particularly Norway and Denmark. The country's economy was based on fishing and subsistence agriculture for many years (Bjarnadóttir, 2013). However, the country experienced a period of rapid modernization and economic growth in the 20th

century. The development of modern fishing techniques and the expansion of fishing fleets largely fueled this economic growth. In the 1970s, Iceland's economy suffered from a series of external shocks, including the oil crisis and the collapse of the fishing industry. This event led the government to diversify the economy and focus on other sectors, including tourism, aluminum production, technology, privatization of state-owned enterprises, and the liberalization of financial markets. Owing to this fact, the government of Iceland passed a series of educational reform policy frameworks in the 1990s known as the "Icelandic National Curriculum Guide". This policy was a major overhaul of the country's education system, and it had a significant impact on the quality and accessibility of education in Iceland.[3]

The education system in Iceland has been predominately public, with only a few private institutions. The system has four levels: preschool, compulsory, upper secondary, and higher education. Although preschool education is not mandatory, it is designed for children under six and is governed by the Preschool Act No.90, which came into effect in July 2008 (de Educación, 2010; Esteves et al., 2016). Public pre-primary schools typically accept all children, prioritizing physically challenged children and children of single parents (de Educación, 2010; Esteves et al., 2016). Primary and lower secondary education is mandatory and free for all Icelandic children under the Compulsory School Act of 2008 (de Educación, 2010; Unit, 2011; Esteves et al., 2016). Students who complete all required exams progress to upper secondary education.

In the 1990s, Iceland made significant changes to its education system by creating, reviewing, and expanding existing reforms affecting all formal education levels. Before that, Iceland's spending on education as a percentage of GDP was typically around 1.8% (Suppanz, 2006). However, by 2002, the country's total education spending had increased to 7.5% of GDP. This level of education spending was the highest in the OECD region (Suppanz, 2006). Despite its relatively youthful population, Iceland's expenditure per student is comparatively high. It exceeds the OECD average by over a tenth, primarily due to the increased expenditure on compulsory education. Per-student spending at the primary and

[3] *Notes*: The reforms were reviewed and implemented over several years, and they involved a range of changes to the curriculum, teaching methods, and administrative structures of the education system.

lower secondary levels exceeds the OECD mean by one-third and one-fifth, respectively. Furthermore, Iceland's educational expenditure per student at the compulsory level relative to GDP per capita exceeds the OECD average by approximately 5% (Suppanz, 2006).

Iceland implemented reforms to modernize and diversify its education system, prioritizing individualized learning and student choice and promoting multiculturalism and multilingualism (Suppanz, 2006). A key aspect of the Icelandic education reform was transferring decision-making power and responsibility from the central government to local municipalities at the pre-primary and compulsory education levels. This decentralization has led to significant changes in the education system, including the construction and operation of mandatory schools, teaching and administration, and an increased focus on diversity and innovation at the local level (Suppanz, 2006). In exchange for these responsibilities, municipalities receive a larger share of personal income tax revenues and some special funds. Meanwhile, the central government is responsible for overseeing the implementation of laws and regulations, publishing educational materials, and organizing national examinations (Suppanz, 2006; Esteves et al., 2016).

During the six years leading up to 2003, Iceland experienced an increase in its educational spending-to-GDP ratio, coinciding with the period that the responsibility for compulsory schooling was transferred to local municipalities (Suppanz, 2006). Roughly 67% of the rise in the total education budget was due to local government expenditures. According to Suppanz (2006), the increase in spending was primarily due to a significant expansion in teaching personnel, with a 22% rise in the number of teachers in compulsory schooling between 1998 and 2005 and a 5% growth in student enrollments over the same period. However, a considerable hike in compensation rate also contributed to the growth in education spending (Suppanz, 2006).

Notable changes in the population's educational attainment and incidental economic growth have arguably accompanied the educational reforms implemented in Iceland. In 1991, Iceland had the highest proportion of its population between 15 and 64 years old, with lower than higher-secondary education among Nordic countries (Neycheva and Joensen, 2019). In 2014, the country had the highest employment rate (for adults aged 25 - 64) than their coun-

terparts in the OECD region (Esteves et al., 2016). Despite significant progress, a skills gap between low- and highly-skilled workers persists in Iceland, according to Suppanz (2006). This skill gap may be due to the flexible education system in Iceland, which allows students to quit school temporarily, and the low emphasis on vocational training compared to the academic track (Suppanz, 2006; Neycheva and Joensen, 2019). At the higher education level, Iceland has witnessed a steady expansion in tertiary-educated graduates. According to Suppanz (2006), Iceland's higher education sector recorded more than double the number of student enrollments in the past few decades. Tertiary education enrollment among 20-29-year-old reached one-third of this age group, ranking Iceland fourth among OECD countries. Moreover, enrollment by older students has also increased significantly. The legislative reforms have led to the emergence of mass higher education that has become more diverse, with a substantial increase in the number of programs and diplomas offered (Suppanz, 2006). Additionally, Neycheva and Joensen (2019) found that the share of Iceland's population that graduated from higher education increased almost two-fold, from 17.5% in 1999 to 30% in 2014, making Iceland one of the European economies with a higher-than-average number of tertiary-educated graduates. Iceland also recorded the highest growth rate of 3.7 percentage points for tertiary graduation rate from 1999 to 2014 in the Nordic region, according to Eurostat data cited by Neycheva and Joensen (2019). [4]

This is not surprising as the reforms also aimed to increase the availability of higher education, with the establishment of new universities and the expansion and upgrade of existing institutions (de Educación, 2010). For example, four teacher training institutions merged in 1998 to establish the University of Education, which later joined with the University of Iceland in 2008. Similarly, three art colleges merged in 1999 to form the Academy of the Arts, while the Technical College of Iceland was granted university status in 2002 and merged with Reykjavik University (de Educación, 2010). By 2010, Iceland boasted seven higher education institutions, which adopted the three-cycle degree structure following the implementation of

[4] *Notes*: Neycheva and Joensen (2019) reports that, over the sample period, women outperformed men in tertiary graduation rates. Eurostat data shows that 35 percent of women in Iceland had completed tertiary education compared to only 25% for men, whereas the corresponding numbers for the EU-28 are 27.5 and 24.4 % in 2014. However, the large gender differences in educational attainment are not unusual for the Nordic countries: 11% for Sweden and Finland, and 8% for Denmark and Norway.

the Higher Education Act in 2006 (de Educación, 2010). The government also allocated significant student loans to qualified applicants and funds to foster research and development. Today, Iceland has achieved one of the highest levels of educational achievement globally, bragging of a 99% literacy rate. Additionally, the educational reforms in Iceland have significantly contributed to the country's gender equality, and it is now widely considered one of the most gender-equitable nations globally. The Icelandic educational reforms played a pivotal role in promoting gender parity in the education system, with particular attention given to encouraging women's participation in historically male-dominated fields.

2.3.4 New Zealand

New Zealand is the sixth-largest island country located in the southwestern Pacific Ocean. The country of New Zealand is a high-income country that ranked third in the world's highest GDP per capita in 1950, thirteenth in the 2021 Human Development Index [5] (a key measure of the population's health, literacy, and standard of living), and fifth in the 2023 Economic Freedom Index.[6] The rule of law, trade openness, and low corruption characterize the country.

As a member country of the Organization for Economic Co-operation and Development (OECD), the country has economic systems and social policies that mirror that of other capitalists or market economies in the world (Codd, 1993). Like other countries that experience cyclicity in economic activities, the economic history of New Zealand underwent turbulent periods during the late 1970s and early 1980s, culminating in the reform of the public education system (Codd, 1993; Perris, 1998; Crawford, 2016). We digress here and briefly discuss the education system prior to the educational reform in the late 1980s.

The public education system in New Zealand was a mixture of local and district governance and management, characterized by a central system of regulation and funding (Perris, 1998). To that end, funding sources for schools directly came from the federal government (Minister of Education through the Department of Education), without local or regional

[5] see https://hdr.undp.org/data-center/specific-country-data/countries/NZL
[6] see https://www.heritage.org/index/country/newzealand

taxes for education. Private education formed a notably small share of education in New Zealand (Perris, 1998; Crawford, 2016). It is worth noting that roughly fifty years ago, most privately run schools decided to integrate into the state system so they could receive total state funding as long as they met the requirements set by the state. Regarding early childhood education (for children aged 0 - 5) officially recognized preschools received full government support through teachers' salaries and infrastructural assistance. In New Zealand, children start primary education after turning five years old (Perris, 1998). In terms of operations, one of the ten Education boards managed the primary schools with the primary responsibility of hiring teachers (but teachers were paid directly by the Department of Education). Children then proceed from primary to secondary school after their eighth birthday and must be at this level for another eight years. At the secondary school level, the Board of Governors managed affairs but was directly under the control of the Department of Education, just like the primary schools. Similarly, the Department of Education directly managed all polytechnics and teachers' colleges down to the level of approving the new curriculum and staffing decisions. At the same time, Universities were autonomous of the Department (Codd, 1993; Perris, 1998; Crawford, 2016).

So what events prepared the grounds for the public education system to undergo a rapid and comprehensive transformation? As Perris (1998) rightly put it, "The education changes of 1987 - 91 did not take place in a vacuum or in isolation from other changes which were taking place in society" (p4). During the late 1970s and early 1980s, the country experienced stagnant economic growth, a high unemployment rate (coinciding with a lack of skilled workforce), high foreign debt, and a poor balance of payment (Perris, 1998). In an attempt to correct the distressed economy, the National government under Robert Muldoon, its Prime Minister and Minister of Finance, intervened by setting regulatory systems and controls, ultimately leading the government to take austere measures such as freezing wages and setting price controls. However, the Treasury did not believe in such an approach and drafted up an alternative approach on the premise of the "Chicago school of economics". Unfortunately, Muldoon lost the snap elections following the worsening of the New Zealand dollar and the trade balance in mid-1984. Given the abject failure of the former public poli-

cies, the new government, the Labour government led by David Lange as Prime Minister and Roger Douglas as Minister of Finance, decided to forgo the centrally planned economy and adopted a free-operating market monetarist approach (Boston, 1996; Perris, 1998). With this new approach, there was minimal government intervention, and major sectors of the economy got deregulated. Determined to make radical and sweeping changes across public administrations, the government launched a comprehensive reform agenda that permeated economic and social policies in the late 1980s. Since education was a central spine of the strategy for the government to achieve its twin goals (economic prosperity and social growth), the State Services Commission and the Treasury (with their Ministers) convinced Cabinet that changing the Department of Education by itself was insufficient to achieve the broader objectives (Perris, 1998). Instead, there should be a significant overhaul of the entire education administration as part of the public sector reform (Perris, 1998; Crawford, 2016). From a political standpoint, Perris (1998) argues that the reform was a convenient medium to rebut public criticism about the education standards, which potentially could dent the incumbency's popularity. Needless to say, the review of the public education system was inevitable.

It is imperative to note that the previous education system was fraught with many limitations. For instance, there were lots of bureaucracies. Because the central government made the final decision, the Department of Education could only allot money that the government gave it regardless of the magnitude of the situation at the local level. Additionally, decisions that required immediate response took an interminable period simply because they had to pass information to the Minister. Per Perris (1998)'s account, a simple request from a teacher for paid leave might have to be referred to the Head Office of the Department for a decision to be made. There was also a soft target toward locally-elected Education Boards and their staff, as community members saw them as unproductive and inefficient. There was also lack of information on students' standards of performance coupled with lack of prudent management practices. The barrage of criticism and concerns from the locals partly fuelled the general climate for change in the education system, which is free from centralist constraints Nash (1989).

Nevertheless, by the end of 1993, all major reforms from early childhood education to tertiary education proposed by the Picot Taskforce in 1988 were completed and implemented. The broad tenets of the first round (1989 - 1990) of the reform included abolishing the University Grants Committee (UGC) and the Department of Education, the creation of the Ministry of Education and New Zealand Qualification Authority (NZQA), the establishment of education and training support agencies that will provide labor market and industry training skills to students, vesting autonomous power to all tertiary education institutions, the introduction of a formula-driven funding system that allows the government to allocate funds to schools based on enrollments, the requirement that students contribute to tuition cost by paying a standard fee, the introduction of students grants scheme from the government to students under 20 years, allowing tertiary institutions to award non-university degrees, and all tertiary education institutions were free to enroll international students on a full-cost -recovery basis (Perris, 1998; Crawford, 2016).

In the second round of the reforms (1991 - 1992), the standard tertiary fee got eliminated, and tertiary institutions had the freedom to charge their own fees; the government provided more funds for private training establishments; the initial tertiary grant scheme was extended to include students from the age of 20 to 25 years; the establishment of the student loan scheme; and the enactment of the Industry Training Act 1992 that replaced the Technicians Training Act 1967 and the Apprenticeship Act 1983. In a nutshell, the reform was predicated on a managerial approach where central powers were shifted to the individual educational institutions to determine their needs and want and how they wanted to deliver their educational procedures or services (Crawford, 2016).

Following these radical, different, and very ambitious educational reforms, the government continued its commitment to resourcing the educational sector. From 1993 - 1998, the government set up the Ministerial Consultative Group to conduct an extensive review exercise on tertiary education and asked the group to advise on the contribution, collaboration, and cooperation that can be achieved across tertiary education (Boston, 1996; Crawford, 2016). The outcome of this exercise allowed the government to adopt a recommendation from the consultative group to absorb 75% of tuition fees at the tertiary level. In the early

to late 2000s, the new Labor-led government initiated a second major shift in New Zealand's educational reforms (Crawford, 2016). Some of the changes included the establishment of the Tertiary Education Advisory Commission (TEAC) to map out a new direction for tertiary education, the introduction of fee stabilization that provided extra funding to tertiary schools, writing off interest charges on students loans by the government, and scrapping of the demand-driven funding formula.

Despite the high level of government commitment, it is worth knowing that the policy details and system parameters of the reform faced some contentions or opposition. Some conservative groups were openly critical of the ideals of the reforms and criticized it as a ploy to privatize education and eliminate the state from its primary role of providing education (Codd, 1993). Parents also complained that early childhood education needed to receive more funding as outlined in the part of the reform. Others also commended the reforms but cautioned of difficult times ahead with such high government education expenditure. Nevertheless, the broad direction of the reform has proved durable over time, and researchers report that education actors do not wish to return to the pre-1989 system (Perris, 1998; Crawford, 2016).

2.4 Data

The data used for this study come from four sources. They are the World Bank Indicators (WDI), the Penn World Tables 10 (PWT10), information on banking crisis, and government quality (Acemoglu et al., 2001). We use data from 1974 to 2018 for a group of 32 developed countries.[7] The availability of data for the relevant variables of the study determined the length of the study period and the countries selected. For the analytical estimation, we transform the original annual series by computing non-overlapping 5-year averages to conform with the growth literature (Churchill et al., 2017). Atems and Blankenau (2022) argue

[7]Countries in the sample are: Argentina, Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Finland, France, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

that public education expenditures have a "time-release" effect on output due to the time it takes for educated workers to enter the workforce and eventually add to the country's productive capacity.

The World Development Indicators (WDI) of the World Bank is the origin of our data on education spending (ID: SE.XPD.TOTL.GD.ZS). The variable measures total public education spending from all levels of government (federal, state, and local) expressed as a percentage of GDP. This variable excludes spending of other departments besides the Ministry of Education. This approach is adequate since other reforms may have occurred in the countries of interest around the same time. We measure education spending relative to the size of the economy because we are interested in the influence of education spending but not the bulk of government expenditures. From the WDI, we also gather data on total government spending (% GDP) (ID: NE.CON.GOVT.ZS), gross capital formation (%GDP) (ID: NE.GDI.TOTL.ZS), trade volume (%GDP) (NE.TRD.GNFS.ZS), fertility rates (ID: SP.DYN.TFRT.IN), and the share of the urban population in each country (ID: SP.URB.TOTL.IN.ZS). [8]

We also collect real GDP data at constant 2017 national prices (RGDPNA) from PWT10. We divide this variable by population and then compute the growth rate of this series. This transformed variable will be our outcome variable, and we label it as per capita RGDP growth. Our outcome variable is well suited to gauge the growth in standard of living over time in each country. Feenstra et al. (2015) advise that "*if the sole object is to compare the growth performance of economies, we recommend using the 'RGDPNA' series*". Our objective here is to measure economic activity growth following the educational reforms. Still from PWT10, we obtain data on real internal rate of return (IRR) and capital stock (% population) (RNNA, capital stock at constant 2012 national prices, USD). We express the capital stock (% population) variable on a logarithmic scale. We use data from the Global Financial Safety Net (GFSN) database provided by Scheubel and Stracca (2016) to obtain

[8] Government expenditures on goods and services exclude military spending. Gross capital formation (% GDP) includes additions to the fixed assets of the economy, among others, land, equipment purchases, the construction of roads and railways, private housing, and inventories. Trade openness (% GDP) represents the sum of exports and imports expressed as a share of GDP.

binary data on banking crises for the study period. Lastly, we obtain institutional quality data from Acemoglu et al. (2001). This variable is an index of the quality of governance as measured by the protection against expropriation.

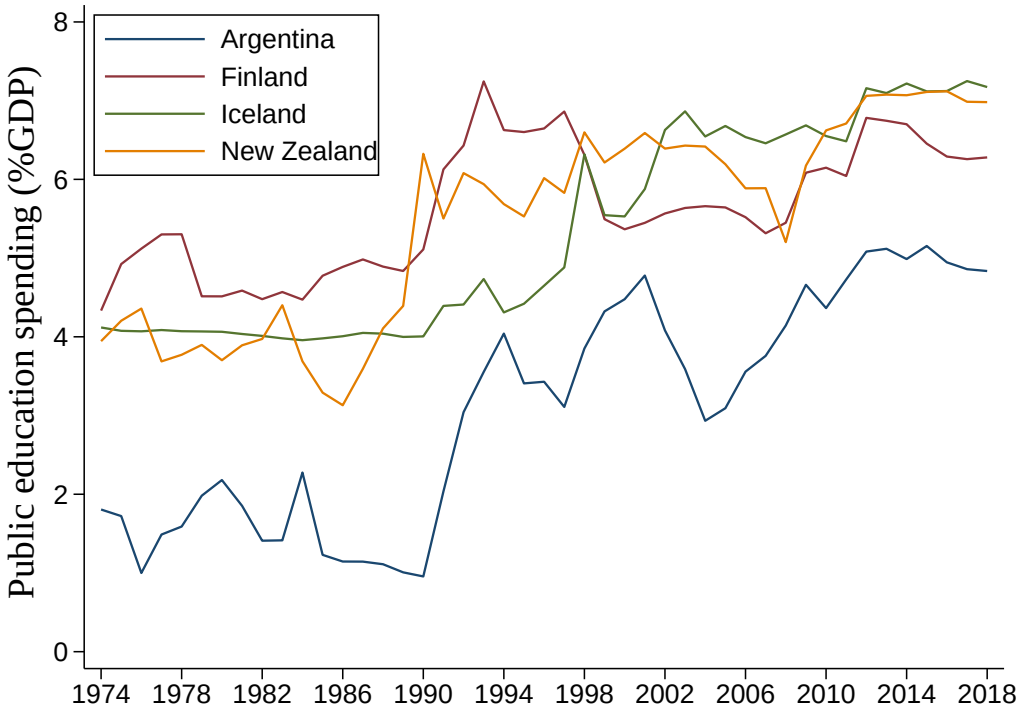
2.4.1 Descriptive Statistics

Table 2.1 shows the descriptive statistics for the variables we consider for this study. Column 2 shows the descriptive statistics for the control countries (28 countries) in the sample excluding the reform countries, while columns 3 to 6 show that for the four countries of interest. We present the standard deviation of the respective variables in parentheses. The average per capita RGDP growth rate in the control set of countries is 1.83%, with a standard deviation of 0.03. The standard deviation shows that the individual countries' standard of living does not vary or deviate much from the sample mean. Argentina has the lowest standard of living, while Iceland has the highest standard of living among the four countries that underwent educational reforms. It is unsurprising that Argentina recorded the lowest standard of living among the four countries because the country experienced significant fluctuations in its per capita income. The volatility reflects the economic instability that Argentina has experienced over time, with political and economic crises leading to periods of rapid inflation and currency devaluation (Gorostiaga et al., 2003). In contrast, Finland, New Zealand, and Iceland have generally experienced an upward trend over the sample period, with some minor fluctuations. The trend reflects the strong economic performance of these countries, driven by factors including agriculture, robust manufacturing sector, technology, and high levels of investments in education and research (Gorostiaga et al., 2003; Bjarnadóttir, 2013; Sahlberg, 2021).

The share of public education spending (%GDP) in the control sample is 4.56%, with a standard deviation of 1.36% (see Table 2.1) . While the government in all four education reform countries have made significant spending on public education over the sample period, there are notable differences in the mean. For example, the mean share of government spending on public education (%GDP) in Argentina is lower than the average public education

spending (%GDP) in the control sample.

Figure 2.1: Public education expenditures as a percentage of GDP



Notes Prior to the 1990s, education spending remained relatively stable in the four countries of interest. The comprehensive educational reforms implemented in the 1990s by these countries coincided with large spending increases by the federal government.

Figure 2.1 shows the annual evolution of public education spending in the four countries which experienced the reforms. We see noticeable spikes in the variables around the time of the comprehensive education reforms. For example, implementing the Federal Law of Education (1993) in Argentina coincided with a spike in public education spending. Since then, the share of GDP allocated to public education has fluctuated but has generally increased relative to the pre-1990s. We see similar spikes in the public education spending (%GDP) series following the enactment of the educational reforms post-1990s in Finland, Iceland, and New Zealand. However, public education spending in Argentina has generally been lower than in the other three education reform countries.

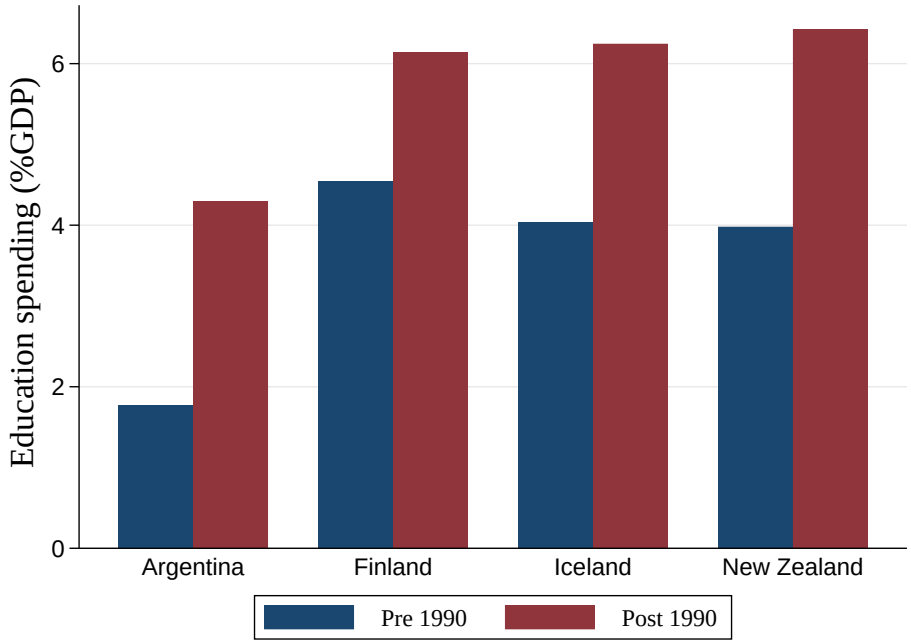


Figure 2.2: Public spending growth on education before and after 1990

Figure 2.2 presents more visual insight into the average growth in public education spending between the two periods, pre and post-1990, for the four countries. All four countries experienced a significant boost in education spending following the 1990s education reforms, with Argentina having the most remarkable change in government spending on education before and after the reform. We investigate these significant changes in education spending to see their impact on output per capita growth rate over time.

For our analytical model, we also account for other variables known to explain economic growth or can potentially affect the relationship between growth and public education expenditures. For example, Goode (1959) argues that the capital stock available per worker (labeled as Capital per capital(Log)) is one of the critical requirements for growth. In Table 2.1, the average worker in Argentina and New Zealand are less equipped with capital than the non-reform sampled countries. Also, the growth literature argues that institutional quality plays a significant role in promoting economic growth. Countries with effective legal systems protecting property rights will likely experience higher growth. In addition, a lawful procedure that recognizes and protects ideas (or intellectual property) is also critical

to encouraging innovation. We measure the variable that captures institutional quality as protection against expropriation. This variable is an index of the quality of governance on a 0 to 10 scale. The highest score means the country has the most robust property rights and the highest protection rights score. Comparing the non-reform sampled countries to the reform countries, we can infer that Argentina's protection against expropriation is below the sample average of the non-reform countries.

The real internal rate of return (IRR), which measures the required rate of return on capital or an estimate of the cost to users of capital, is an essential determinant of economic growth. Researchers have been concerned that high-interest rates may stifle capital formation and subsequent economic growth (Evans, 1985). Argentina recorded the highest real internal rate of return amongst the reform countries.

Aside from that, many studies have found a negative relationship between government sizes and economic progress (Bergh and Henrekson, 2011). One established hypothesis in the literature is that increasing government spending is associated with increasing distortionary taxes to finance such expenditure (Blankenau et al., 2007; Nketiah-Amponsah, 2009). The higher taxes needed to fund these government consumption expenditures may also decrease returns on investment, consequently retarding growth. In Table 2.1, public spending net of education spending is high among Finland and Iceland, while Argentina and New Zealand's public spending net of education spending is below the non-reform sampled countries. Also, Argentina and Iceland had the highest fertility and urban population (% total) rates among the reform countries, respectively.

Next, we consider gross capital formation as a share of GDP, labeled as Investment (% GDP) in Table 2.1. Solow (1962) posit that capital accumulation is one of the critical factors of production that contribute to output growth. As countries invest in more capital, they are able to generate new knowledge and technology, which in turn allows them to be productive, leading to sustained increases in output per capita. The average level of Investment (%GDP) is 23.30% with a standard deviation of 3.79%. All reform countries except for Argentina had higher investment ratios above the mean of sample control countries.

We also consider trade as a share of GDP as a predictor of growth. Dowrick and Golley

(2004) investigate the relationship between trade openness and economic growth and whether benefit from trade varies for different countries. The study shows that since the 1980s, the benefits have been greater among more prosperous economies. The channels discussed were productivity growth and, to a lesser extent, increased investment. The average trade share in the non-reform countres sample is 69.39% of GDP, with a sizeable standard error of 47.96% (see Table 2.1). From a comparative perspective, among the four reform countries, Iceland's economy is more open to international trade (75.68%) than the rest of the reform countries. Kroszner et al. (2007) provides evidence that banking crises mostly impact sectors highly funded by external finance. Except for New Zealand, the remaining three reform countries experienced at least one episode of the banking crisis, although Argentina experienced more banking crises over the sample period.

Lastly, we follow Barro and Sala-i Martin (1990) and Blankenau et al. (2007) in accounting for the initial level of output. The initial level of economic development is often considered in the literature to impact how fast countries grow (Barro and Sala-i Martin, 1990; Blankenau et al., 2007). We follow the literature by using 1974 initial capita RGDP (measured in log terms) for each country to account for convergence among countries.

Table 2.1: Descriptive statistics

Variables	Control Countries	Argentina	Finland	Iceland	New Zealand
Per capita RGDP growth	1.83	0.66	1.87	2.29	1.18
	(0.03)	(0.03)	(0.02)	(0.02)	(0.015)
Public education spending (%GDP)	4.56	3.09	5.63	5.33	5.47
	(1.36)	(1.42)	(0.75)	(1.32)	(1.30)
Capital per capita (Log)	11.87	11.03	11.97	12.34	11.50
	(0.72)	(0.11)	(0.27)	(0.19)	(0.20)
Government Institutions	9.10	6.39	9.73	9.73	9.73
	(1.06)	(0.00)	(0.00)	(0.00)	(0.00)
Real Interest rate of return	0.09	0.15	0.06	0.06	0.08
	(0.05)	(0.03)	(0.01)	(0.00)	(0.02)
Public Spending net Education (%GDP)	13.53	8.43	15.30	15.59	12.55
	(4.05)	(3.11)	(1.70)	(1.83)	(1.45)
Fertility	2.01	2.76	1.72	2.13	2.04
	(0.68)	(0.40)	(0.09)	(0.21)	(0.13)
Urban population (%total)	76.52	87.54	79.28	91.23	85.09
	(11.72)	(3.53)	(5.64)	(2.37)	(1.35)
Investment (%GDP)	23.30	19.43	25.16	23.89	23.50
	(3.79)	(4.07)	(3.26)	(5.86)	(2.24)
Trade (%GDP)	69.39	23.35	64.17	75.68	57.21
	(47.96)	(9.60)	(11.51)	(11.59)	(3.06)
Banking crisis(dummy)	0.16	0.50	0.12	0.12	0.00
	(0.37)	(0.53)	(0.35)	(0.35)	(0.00)
Initial per capita RGDP	9.61	9.78	9.90	9.90	10.07
	(1.57)	(0.00)	(0.00)	(0.00)	(0.00)
Observation	252	9	9	9	9

All variables are averaged over 5-year period starting in 1974 until 2018 for a total of 9 periods per country.

2.5 Empirical methodology: Difference-in-differences estimation

To evaluate the impact of the comprehensive educational reforms on subsequent economic growth in the four reformed countries, we estimate difference-in-differences (DiD) models of per capita RGDP growth. We determine treatment status by the implementation of comprehensive educational reforms and thus use non-reformed countries as the control group. We account for covariates standard in the growth literature. The regression equation is given by:

$$Y_{i.t} = \beta_0 + \beta_1 \text{Treated}_i + \beta_2 \text{Post\_Reform}_t + \beta_3 \text{Treated}_i \times \text{Post\_Reform}_t + \sum_{j=4}^{k} \beta_j X_{j,i,t} + e_{i,t} \quad (2.1)$$

$Y_{i.t}$ is the per capita RGDP growth for country i at time t. $Treated_i$ is a dummy equal to 1 if country i underwent an educational reform; $Post\_Reform_t$ is a dummy equal to 1 for periods t after the implementation of the educational reform; $Treated_i \times Post\_Reform_t$ represent the product of the treatment indicator variable and the post-reform indicator variable; and $X_{j,i,t}$ is a vector of control variable j for country i at time t. The intercept term is the parameter β_0. Our estimated parameters β_1 and β_2 capture the average difference in the outcome variable between the treatment and control groups in the pre-treatment period (before the reform implementation) and the overall time trend in the outcome variable that affects all countries equally over time (regardless of whether they received the treatment or not), respectively. Our estimated coefficient of interest, β_3, allows for estimating the DiD effect. This coefficient captures the difference in the average outcome between the treatment and control groups in the post-treatment period compared to the pre-treatment period. In other words, the difference-in-differences effect captures the difference in the treatment effect between the treatment and control groups before and after the treatment.

To evaluate the economic returns to significant public education spending, we identify the period when the governments of the four selected countries of interest implemented compre-

hensive educational reforms. Since the government of Argentina enacted the Federal Law of Education (1993) in 1993 and the same-year effect is unlikely to boost output, we define 1994 as the first treatment period in the sample. However, since we use 5-year average periods for the DiD estimations, the 1994 treatment period falls in the 1994 - 1998 window. Note here that this 5-year time window will also include the Higher Education Law implemented in 1995 by the federal government. Likewise, for Finland, we rely on the *National Curriculum Reform* of 1994 to identify 1994 - 1998 as the first treatment timing. We also use the 1994 - 1998 time frame as the treatment period for Iceland following the massive education spending by the government. For New Zealand, we use the 1989 - 1993 rolling window as the first treatment period following the major education reform proposed by the Picot Taskforce and implemented in 1988.

Our empirical strategy also requires us to identify a control group of countries that reasonably share similar characteristics with the reformed countries. Initially, we had access to a larger sample of 82 countries. However, to construct comparison countries that reasonably chart the counterfactual path of the reformed countries, we retain only developed countries in the sample period by following the classification of Blankenau et al. (2007).[9] Our final sample pool for the analytical study comprises 28 control countries and the respective treated countries, with a panel structure of 29 countries over the sample period.

2.5.1 Results

In this section, we report the outcome of our empirical estimation of the DiD model for each of the four treated countries. Tables 2.2, 2.3, 2.4, and 2.5 presents the DiD estimations under several specifications for Argentina, Finland, Iceland, and New Zealand, respectively. We begin by reporting a more parsimonious specification in Column (1) for all tables. Without accounting for covariates, Column (1) in Table 2.2 shows a long-run gain in per capita RGDP growth following the educational reforms in Argentina. The parsimonious specification of Column (1) and Column (2) of Tables 2.2 suggest that Argentina experienced roughly a 2.3

[9]It is important to note that we run the analysis including all 82 available countries, and our results are similar. The results are available from the authors upon request.

percentage point increase in growth, on average, after the implementation of the educational reforms. This coefficient is statistically significant at the 1 percent level. However, once we control for other important variables in Column (3) to Column (6), the growth effect of the educational policy shrinks indicating that the observed covariates explains some portion of the growth rate experienced in Argentina. For example, in the full model, Argentina experienced a 1.2 percentage point growth in growth over the post treatment period, and this effect is statistically significant at the 1 percent level. As expected from the literature, the coefficient on government institutions is positive and statistically significant at the 1 percent level in Column (2) to Column (6). This implies that strong government institutions is positively associated with economic growth in Argentina. Government spending net of education is negatively correlated with economic growth in Column (2) and the amount of capital available to labor is negative and statistically significant to economic growth in all specifications. The negative coefficient on Capital per capita (Log) may partly indicate the diminishing returns to capital. Contrary to our a priori expectations, real internal rate of return was positively associated with growth. Even though the share of trade as a percentage of output had roughly a zero magnitude on economic growth, it was statistically significant in Columns (5) and (6). While higher fertility retards growth in per capita income, the investment share of output promotes growth in Argentina. Also, episodes of the banking crises are negatively associated with growth. Finally, the coefficient on initial per capita RGDP is positive and statistically significant, indicating no convergence among countries.

Table 2.3 presents the results for Finland. Columns (1) to (6) suggest that the comprehensive educational reform undertaken by the Finnish government had a long-run positive impact on the country's economic growth rate. A closer analysis of Column (6) shows that following the educational policy, per capita growth rate is estimated to be 1.2 percentage points higher than it would have been without the policy. The coefficients of the covariates, at large, aligns with the signs in the case of Argentina. Table 2.4 shows the results for Iceland. In the case of Iceland, the policy did not significantly affect economic growth in the baseline model (see Column(1)). However, when we account for other growth predictors in Columns (4) to (6), we find that the educational policy positively affected growth. In the

full model, Iceland's economic growth was boosted by 1.1 percentage points, on average, in the post-educational policy period.

Finally, Table 2.5 provides the DiD outputs for New Zealand. We find conclusive evidence based on our sample that the educational policy had a long-term effect on per capita growth.

So far, our DiD models show that the per capita growth rate was higher than it would have been without the policy in all four countries (in the full model specification). However, when we consider the baseline specifications for the respective countries, we find that the educational policy had the most significant impact on Argentina, followed closely by New Zealand.

Table 2.2: Difference-in-differences estimates of Per capita Growth for Argentina

	(1)	(2)	(3)	(4)	(5)	(6)
	Per capita RGDP growth					
did_argentina	0.020***	0.023***	0.016***	0.011***	0.012***	0.012***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
argentina	-0.019***	-0.027***	-0.014**	-0.010***	-0.003	-0.004
	(0.002)	(0.005)	(0.006)	(0.004)	(0.004)	(0.004)
post_reform	0.000	0.000	0.003	-0.001	0.003	0.003
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Government Institutions		-0.000	0.007***	0.007***	0.008***	0.008***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Public Spending net of Education		-0.001**	-0.001	-0.000	-0.001	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Capital per capita (Log)			-0.008**	-0.012***	-0.015***	-0.015***
			(0.003)	(0.003)	(0.003)	(0.003)
Real Internal rate of return			0.087**	0.153***	0.192***	0.190***
			(0.038)	(0.046)	(0.057)	(0.057)
Trade(%GDP)				0.000	0.000***	0.000***
				(0.000)	(0.000)	(0.000)
Fertility				-0.011***	-0.010***	-0.011***
				(0.003)	(0.003)	(0.003)
Urban Population					0.000	0.000
					(0.000)	(0.000)
Investment (% GDP)					0.002***	0.002***
					(0.000)	(0.000)
Banking crisis					-0.006**	-0.005**
					(0.003)	(0.003)
Initial per capita RGDP						0.001**
						(0.000)
Observations	222	222	222	222	222	222
Number of Countries	29	29	29	29	29	29

Notes: The dependent variable is the five-year average of the annual per capita real GDP growth rate. Standard errors are corrected for cross-sectional heteroskedasticity. *** p<0.01, ** p<0.05, * p<0.1

Table 2.3: Difference-in-differences estimates of Per capita Growth for Finland

	(1)	(2)	(3)	(4)	(5)	(6)
	Per capita RGDP growth					
did_finland	0.006***	0.008***	0.005**	0.009***	0.011***	0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
finland	-0.002	-0.001	-0.002	-0.004**	-0.008***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
post_reform	0.000	0.000	0.003	-0.001	0.004	0.004
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Government Institutions		0.000	0.007***	0.007***	0.008***	0.008***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Public Spending net of Education		-0.001**	-0.001	-0.001	-0.001	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Capital per capita (Log)			-0.008**	-0.013***	-0.015***	-0.015***
			(0.003)	(0.003)	(0.003)	(0.003)
Real Internal rate of return (%)			0.087**	0.157***	0.195***	0.192***
			(0.039)	(0.048)	(0.059)	(0.059)
Trade(%GDP)				0.000	0.000***	0.000***
				(0.000)	(0.000)	(0.000)
Fertility				-0.011***	-0.010***	-0.010***
				(0.003)	(0.003)	(0.003)
Urban Population					0.000	0.000
					(0.000)	(0.000)
Investment (% GDP)					0.002***	0.002***
					(0.000)	(0.000)
Banking crisis					-0.006**	-0.006**
					(0.003)	(0.003)
Initial per capita RGDP						0.001**
						(0.000)
Observations	222	222	222	222	222	222
Number of Countries	29	29	29	29	29	29

Notes: The dependent variable is the five-year average of the annual per capita real GDP growth rate. Standard errors are corrected for cross-sectional heteroskedasticity. *** p<0.01, ** p<0.05, * p<0.1

Table 2.4: Difference-in-differences estimates of Per capita Growth for Iceland

	(1)	(2)	(3)	(4)	(5)	(6)
	Per capita RGDP growth					
did_iceland	0.000	0.004	0.002	0.004*	0.011***	0.011***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
iceland	0.003	0.003	0.005***	0.009***	0.005	0.005
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)
post_reform	0.000	0.000	0.003	-0.000	0.004*	0.004*
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Government Institutions		-0.000	0.007***	0.007***	0.008***	0.008***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Public Spending net of Education		-0.001**	-0.001	-0.001	-0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Capital per capita (Log)			-0.008**	-0.013***	-0.015***	-0.016***
			(0.003)	(0.003)	(0.003)	(0.003)
Real Internal rate of return			0.083**	0.149***	0.195***	0.193***
			(0.038)	(0.046)	(0.059)	(0.059)
Trade(%GDP)				0.000	0.000***	0.000***
				(0.000)	(0.000)	(0.000)
Fertility				-0.011***	-0.010***	-0.010***
				(0.003)	(0.003)	(0.003)
Urban Population					0.000	0.000
					(0.000)	(0.000)
Investment (% GDP)					0.002***	0.002***
					(0.000)	(0.000)
Banking crisis					-0.005*	-0.005*
					(0.003)	(0.003)
Initial per capita RGDP						0.001***
						(0.000)
Observations	222	222	222	222	222	222
Number of Countries	29	29	29	29	29	29

Notes: The dependent variable is the five-year average of the annual per capita real GDP growth rate. Standard errors are corrected for cross-sectional heteroskedasticity. *** p<0.01, ** p<0.05, * p<0.1

Table 2.5: Difference-in-differences estimates of Per capita Growth for New Zealand

	(1)	(2)	(3)	(4)	(5)	(6)
	Per capita RGDP growth					
did_nzealand	0.015***	0.013***	0.012***	0.014***	0.014***	0.014***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
nzealand	-0.016***	-0.016***	-0.022***	-0.023***	-0.026***	-0.026***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
post_reform	0.000	0.000	0.003	-0.001	0.003	0.004
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Government Institutions		-0.000	0.007***	0.007***	0.008***	0.008***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Public Spending net of Education		-0.001**	-0.001	-0.001	-0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Capital per capita (Log)			-0.008**	-0.013***	-0.015***	-0.015***
			(0.003)	(0.003)	(0.003)	(0.003)
Real Internal rate of return			0.086**	0.156***	0.193***	0.191***
			(0.038)	(0.047)	(0.057)	(0.058)
Trade(%GDP)				0.000	0.000***	0.000***
				(0.000)	(0.000)	(0.000)
Fertility				-0.011***	-0.010***	-0.010***
				(0.003)	(0.003)	(0.003)
Urban Population					0.000	0.000
					(0.000)	(0.000)
Investment (% GDP)					0.002***	0.002***
					(0.000)	(0.000)
Banking crisis					-0.005*	-0.005*
					(0.003)	(0.003)
Initial per capita RGDP						0.001**
						(0.000)
Observations	222	222	222	222	222	222
Number of Countries	29	29	29	29	29	29

Notes: The dependent variable is the five-year average of the annual per capita real GDP growth rate. Standard errors are corrected for cross-sectional heteroskedasticity. *** p<0.01, ** p<0.05, * p<0.1

2.6 Robustness checks

2.6.1 The synthetic control method

The widely used difference-in-differences approach relies on the parallel trend assumption. This assumption requires that in the absence of a specific event or intervention that is the object of the study, treated units would have followed parallel or common paths to the control units. In many cases, parallel trends may be a questionable modeling assumption in empirical studies. A challenge in this context is selecting suitable comparison units to compare them to the reform countries. If comparison units are not sufficiently similar to the units representing the case of interest, then any difference in outcomes between these two sets of units may merely reflect disparities in their characteristics (Abadie et al., 2015). The synthetic control method (SCM) relaxes the parallel trend assumption by instead relying on a weighted control group designed to closely follow the trend in the pre-policy period, which further allows the effect of the unobserved confounders of public education spending to vary over time.

This section presents the synthetic control method algorithm (Abadie et al., 2010, 2015; Abadie, 2021) in the context of our study of education spending reform. We observe $J+1$ countries, and for each case, only one is exposed to the education spending reform. This implies that while studying the case of Argentina, data from Finland, Iceland, and New Zealand is excluded from the longitudinal data. Countries are indexed by i and are observed for T periods. Following the matching literature, all potential controls (Australia, Belgium,..., United States) are referred to as the "donor pool." We assume that each treated country is uninterruptedly impacted by the policy change following the period of enactment. Suppose Y_{it}^0 is the outcome of interest in country i in year t in the absence of any intervention with $i = 1, ..., J+1$, and time periods $t = 1, ..., T$. Further still, let T_0 be the number of years before the reform, with $1 \leq T_0 < T$. Let Y_{it}^1 be the outcome of interest in country i at time t, assuming exposure to the policy reform in period T_0+1 until T. We assume that the reform did not influence the relevant countries before their legal and effective implementation date.

In other words, for $1 \leq t \leq T_0$ in all countries, $Y_{it}^0 = Y_{it}^1$.[10]

In addition, we further state that $\alpha_{it} = Y_{it}^1 - Y_{it}^0$ is the effect of the education form for country i at time t, and D_{it} is an indicator that takes values based on policy exposure. In particular, D_{it} takes on the value of 1 if the country underwent a reform and 0 otherwise. The observed outcome for the country i in period t is:

$$Y_{it} = Y_{it}^0 + \alpha_{it} D_{it}.$$

We assign the treated country with an index of 1. It is the only state exposed to the reform, and only after period T_0 (with $1 \leq T_0 \leq T$), we have:

$$D_{it} = \begin{cases} 1 & \text{if } i = 1 \text{ and } t > T_0 \\ 0 & \text{otherwise.} \end{cases}$$

We aim to use the synthetic control method to estimate $(\alpha_{1T_{0+1}}, ..., \alpha_{1T})$. For all years post enactment,

$$\alpha_{1t} = Y_{1t}^1 - Y_{1t}^0$$

Each country besides the treated one is assigned a non-negative weight, w_i such that all weights sum up to one. In practice, many countries within the available donor pool receive a weight of 0 and are not used for estimation. We therefore have a $(J+1)$ vector of weights $W = (w_2, ..., w_{J+1})$. The weights that comprise a particular synthetic control unit W^* are chosen to minimize the following criterion based on Abadie (2021):

$$\|X_1 - X_0 W\|_V = \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)}, \tag{2.2}$$

where X_1 is a vector of predictor variables, and X_0 is a matrix of the similar variables for each donor pool countries, and V is a symmetric, positive, semi-definite matrix of weights

[10] Abadie et al. (2010) argues that in practice, the policy could exert influence earlier than the enforcement date. When this occurs, they advise reconsidering T_0 to an earlier and more fitting date.

assigned to the predictor variables. According to Abadie and Gardeazabal (2003), predictor variables help define the weights such that the outcome variable path for the treated unit in the pre-intervention period is best reproduced by the associated synthetic country.

Once the weights vector W^* is produced, it is combined with a matrix Y_0 of each donor country outcome value. In our case, recall that the outcome value is per capita growth. We obtain the counterfactual outcome path as $Y_1^* = Y_0 W^*$. The education reform influence on growth is given by the difference between the observed and the counterfactual. The estimated treatment effect for each period is therefore:

$$\widehat{\alpha_{1t}} = Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt},$$

where $j = 1$ is the treated country and $j \in \{2, ..., J+1\}$ are the other donor pool countries, and T_0 is the number of pre-intervention years. The average treatment effect (ATE) is given by:

$$ATE = \frac{1}{T - T_0} \sum_{t=T_0+1}^{T} \widehat{\alpha_{1t}}.$$

One strength of this method is that it "mechanically" control for many unobserved factors by focusing on creating as good of a pre-period match as possible. The divergence between the actual trend and the synthetic unit is subsequently calculated and is an estimate of the policy change.

2.6.2 Results

We separately apply the synthetic control method to each reform country, starting with Argentina. To maintain consistency with the specification used in the DiD models, we use the same set of control variables and five-year averages for the SCM estimation. We construct the synthetic reform countries as the convex combination of countries in the donor pool that most closely resembled each of the respective four reform countries based on pre-treatment values of the per capita growth predictors.

We present the results in the tables below, which compare the pre-treatment characteristics of the actual reform countries with that of the synthetic countries and the population-weighted average of the selected countries in the donor pool.

Argentina

Using the techniques described in the methodological part of subsection 2.6.1, we construct a synthetic Argentina, a weighted average of the countries reported in Table 2.6. By construction, countries with higher weights closely resemble Argentina based on the pre-treatment variables.

Table 2.7 compares the pre-educational policy characteristics of Argentina to those of synthetic Argentina and those of a population-weighted average of the countries in the donor pool. Overall, the results suggest that synthetic Argentina provides a much better comparison for Argentina than the average of the donor pool countries used in the DiD estimation. Synthetic Argentina is very similar to actual Argentina in capital per capita(Log), real internal rate of return, fertility, banking crisis, and initial per capita RGDP. However, variables like public spending net of education and trade (%GDP), among others, did not produce a good balance between Argentina and synthetic Argentina. Because Argentina had one of the smallest government size and trade (% GDP) in the sample before the education reform, these variables could not be well fitted using a combination of the four comparison countries.

Table 2.6: Country weights for synthetic Argentina

Country	Weight	Country	Weight	Country	Weight
Chile	0.109	Costa Rica	0.051	Greece	0.316
Mexico	0.524				

Notes: Since no extrapolation occurs in the SCM method, all weights are between 0 and 1 and $\sum w_j = 1$.

Table 2.7: Per capita Growth Predictors for Argentina before Education Policy

Variables	Argentina	Synthetic Argentina	Average of donor pool
Government Institutions	6.39	7.61	9.14
Public Spending net of Education	6.33	9.80	13.51
Capital per capita (Log)	10.95	11.19	11.67
Real Internal rate of return	0.14	0.13	0.09
Trade (% GDP)	14.80	35.66	59.76
Fertility	3.15	3.37	2.22
Urban Population	84.34	68.88	71.72
Investment (% GDP)	21.57	24.65	24.44
Banking crisis	0.5	0.20	0.11
Initial per capita RGDP	9.78	9.43	9.86

Finland

Table 2.8 similarly provides the countries and the respective weights used in constructing synthetic Finland. The synthetic Finland is a weighted average of Canada, Denmark, Japan, Netherlands, and Sweden. All other countries in the donor pool obtain zero weights.

Table 2.9 compares the pre-educational policy characteristics of Finland to those of synthetic Finland and those of a population-weighted average of the countries in the donor pool. Overall, the results suggest that synthetic Finland provides a much better comparison for Finland than the average of the donor pool countries used in the DiD estimation. We also see that Finland's balance for the pre-treatment period variables is better, on average, compared to the case of Argentina.

Table 2.8: Country weights for synthetic Finland

Country	Weight	Country	Weight	Country	Weight
Canada	0.213	Denmark	0.003	Japan	0.476
Netherlands	0.152	Sweden	0.156		

Notes: Since no extrapolation occurs in the SCM method, all weights are between 0 and 1 and $\sum w_j = 1$.

Table 2.9: Per capita Growth Predictors for Finland before Education Policy

Variables	Finland	Synthetic Finland	Average of donor pool
Government Institutions	9.73	9.73	9.14
Public Spending net of Education	14.30	14.21	13.51
Capital per capita (Log)	11.73	11.84	11.67
Real Internal rate of return	0.05	0.06	0.09
Trade (% GDP)	53.13	45.54	59.76
Fertility	1.70	1.72	2.22
Urban Population	74.35	75.80	71.72
Investment (% GDP)	28.07	28.00	24.44
Banking crisis	0.25	0.04	0.11
Initial per capita RGDP	9.90	10.00	9.86

Iceland

Table 2.10 similarly provides the countries and the respective weights used in constructing synthetic Iceland. The synthetic Iceland is a weighted average of Belgium(0.488), Japan(0.291), France(0.157), Sweden(0.055), and Mexico(0.009) with weights decreasing in this order. All other countries in the donor pool obtain zero weights.

Table 2.11 compares the pre-educational policy characteristics of Iceland to those of

synthetic Iceland and those of a population-weighted average of the countries in the donor pool. Overall, the results suggest that synthetic Iceland provides a much better comparison for Iceland than the average of the donor pool countries used in the DiD estimation. For example, the synthetic Iceland matches perfectly with the actual Iceland on real internal rate of return in the pre-intervention period.

Table 2.10: Country weights for synthetic Iceland

Country	Weight	Country	Weight	Country	Weight
Belgium	0.488	France	0.157	Japan	0.291
Mexico	0.009	Sweden	0.055		

Notes: Since no extrapolation occurs in the SCM method, all weights are between 0 and 1 and $\sum w_j = 1$.

Table 2.11: Per capita Growth Predictors for Iceland before Education Policy

Variables	Iceland	Synthetic Iceland	Average of donor pool
Government Institutions	9.73	9.67	9.14
Public Spending net of Education	13.94	15.15	13.51
Capital per capita (Log)	12.17	12.00	11.67
Real Internal rate of return	0.06	0.06	0.09
Trade (% GDP)	68.82	70.52	59.76
Fertility	2.28	1.73	2.22
Urban Population	89.06	85.70	71.72
Investment (% GDP)	26.68	26.28	24.44
Banking crisis	0	0.016	0.11
Initial per capita RGDP	9.90	9.97	9.86

New Zealand

Table 2.12 presents the countries and the respective weights used in constructing synthetic New Zealand. Synthetic New Zealand is a weighted average of eight countries out of the twenty-eight donor pool countries. All other countries in the donor pool obtain zero weights.

Table 2.13 compares the pre-intervention features of New Zealand to those of synthetic New Zealand and those of a population-weighted average of the countries in the donor pool. Overall, the results suggest that synthetic New Zealand provides a much better comparison for New Zealand than the average of the donor pool countries used in the DiD estimation. For example, synthetic New Zealand matches perfectly with actual New Zealand on real internal rate of return and fertility in the pre-intervention period. Compared to the average donor pool of countries, synthetic New Zealand also matches New Zealand much closer on the public spending net of education, capital per capita (Log), urban population, investment (%GDP), and banking crisis, among others.

Table 2.12: Country weights for synthetic New Zealand

Country	Weight	Country	Weight	Country	Weight
Australia	0.31	Belgium	0.173	Canada	0.038
Switzerland	0.067	Denmark	0.198	Israel	0.018
Japan	0.091	Mexico	0.104		

Notes: Since no extrapolation occurs in the SCM method, all weights are between 0 and 1 and $\sum w_j = 1$.

Table 2.13: Per capita Growth Predictors for New Zealand before Education Policy

Variables	New Zealand	Synthetic New Zealand	Average of donor pool
Government Institutions	9.73	9.35	9.14
Public Spending net of Education	14.11	14.02	13.49
Capital per capita (Log)	11.27	11.84	11.62
Real Internal rate of return	0.07	0.07	0.09
Trade (% GDP)	56.00	54.73	59.20
Fertility	2.10	2.10	2.29
Urban Population	83.43	82.84	71.12
Investment (% GDP)	25.74	25.47	24.63
Banking crisis	0	0.04	0.12
Initial per capita RGDP	10.07	10.06	9.86

The Effect of the Educational Policy on Economic Growth

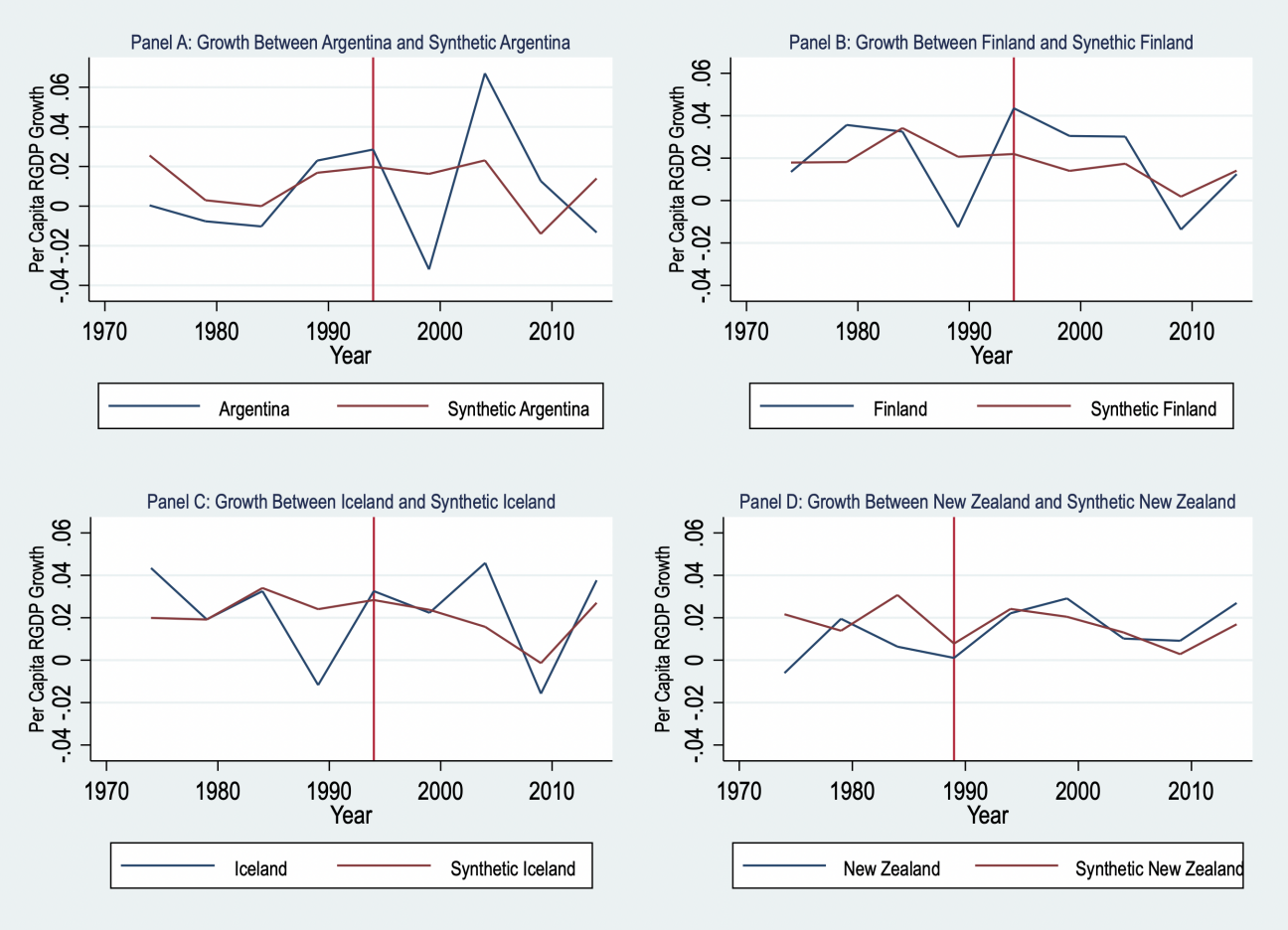
How do we determine whether the comprehensive education policy had any long-term gain in the reform countries? The synthetic control approach is a picture-intensive estimator. Therefore the estimator graphs the outcome of the reform country and the synthetic country, and if the policy had any meaningful impact, the two series should diverge from one another following the post-treatment period but resemble each other in the pre-treatment period (Cunningham, 2021).

Figure 2.3 displays the per capita growth trajectory of each reform country and its synthetic counterpart over the sample period. The vertical line indicates the period in which the comprehensive education policy was enacted in the respective reform country. Panel A shows that Argentina and synthetic Argentina do not track each other well in the pre-intervention period. In other words, synthetic Argentina does not exactly reproduces the per capita growth for Argentina during the entire pre-intervention period. Our actual estimate of the effect of the education reform policy in Argentina on growth is given by the difference between actual Argentina and its synthetic version post the reform period.

Following the policy period, we do not see a clear and consistent divergence between the two series. Argentina's growth declined immediately after the reform but gained momentum in the early 2000s and declined again following the 2007-08 financial recession. The shock had a persistent effect on the average growth trajectory of Argentina. On average, the policy had no meaningful long-term benefit on per capita growth. In Panel B, Finland does not closely resemble its synthetic version in the pre-period. There is no clear divergence between the growth path of Finland and synthetic Finland in the post-intervention period. We can visually conclude that the education policy did not significantly boost growth in the post-period in Finland. We see similar patterns in Panels C and D where the two series are not diverging from one another following the post-treatment period. [11]

[11] One can argue that the conclusion we have may be due to the limited sample size due to the five-year averages of the annual series. We re-estimate our model using three-year averages to increase the sample size, but we get similar results. We try alternative specifications and largely conclude that the policy did not positively impact growth. Results are available upon request.

Figure 2.3: Results for Synthetic Control Methods



Five-year averages of the annual per capita RGDP growth for the reform countries and the synthetic version

An important limitation of the SCM estimates is the inability to calculate neither standard errors for the estimates nor provide a coefficient of determination of the model (R^2). To quantity the significance of our estimates, Abadie et al. (2010) suggest we conduct the so-called "placebo tests." This approach involves iteratively applying the SCM to each country in the donor pool, which we know to have been free of treatment, and obtaining a placebo effect distribution. To calculate the p-value for each post-treatment effect, we find the share of placebo effects that are as large as the main effect from the true treated country. If many placebo effects are as large as the main effect (i.e., the p-value is high), we can infer that the main effect was likely observed by chance. Figure 2.4 shows the p-values of the placebo tests.

At large, we find large p-values in all four reform countries, indicating that the probability of a placebo country having the same post-treatment effect as the reform country is very high. We note here that Argentina and Iceland had smaller p-values in some of the post-period, but at large, the p-values were not consistently small in the entire post-period.

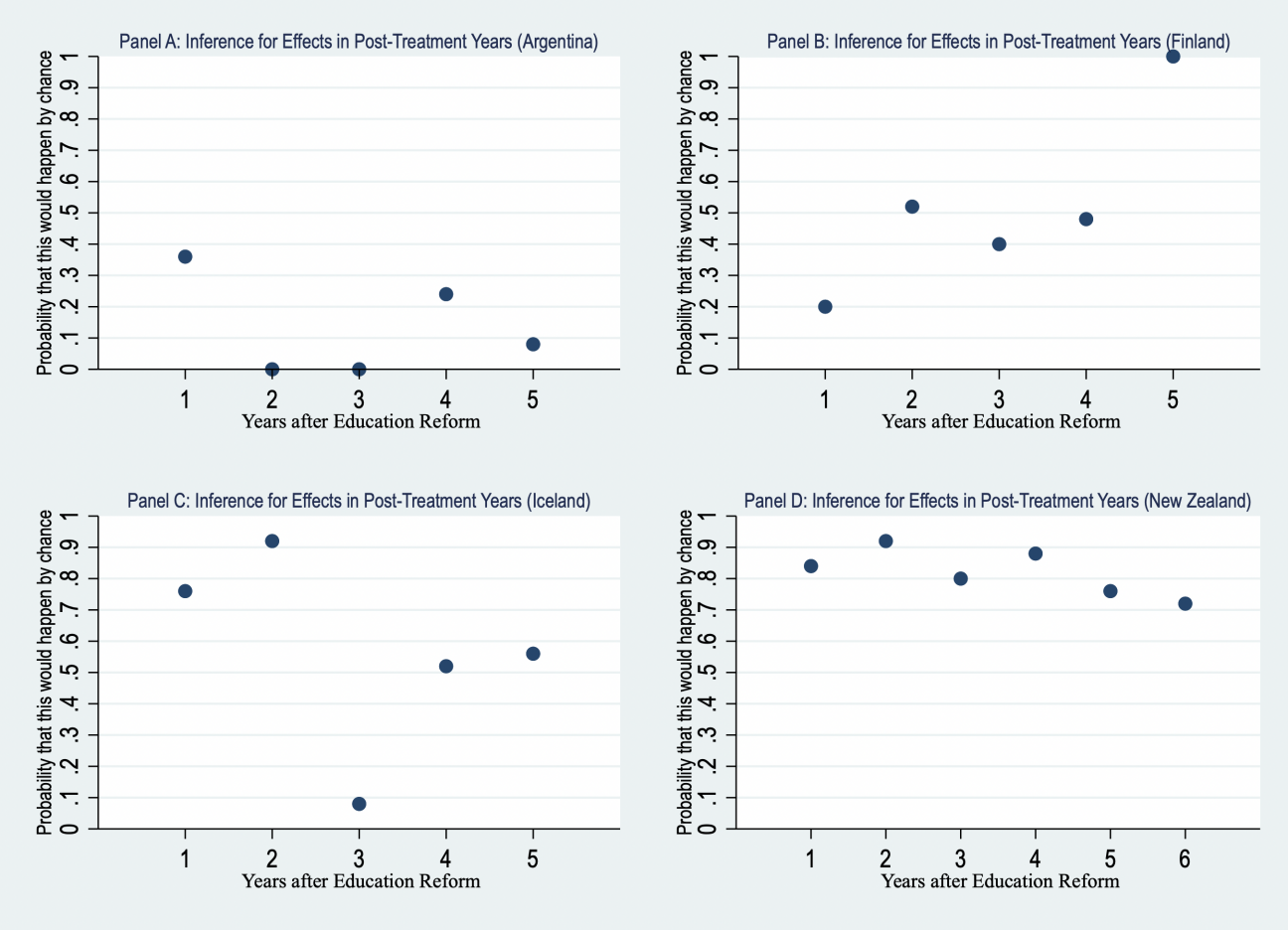


Figure 2.4: Placebo Results for SCM (P-Values)

2.7 Conclusion

In this paper, we investigated the effect of the educational policies implemented in Argentina, Finland, Iceland, and New Zealand and whether governments' investment in the policy had any meaningful long-term growth effect. Using the difference-in-differences estimator, we find that the education policy that triggered substantial increases in government spending led to long-term growth in output per capita for all four countries. However, when we use the

more robust modeling approach, the synthetic control methods show no markedly long-term growth in output per capita for all four countries following the educational reforms.

Despite recognizing the importance of investing in education and creating opportunities for the population, its influence on economic growth is complex and multifaceted. Several factors may contribute to the lack of growth effect in this study. First, the association between education and growth may be influenced by various contextual factors, including the specific characteristics of each country's economy, labor market dynamics, and institutional framework. Second, the impact of education on economic growth is a long-term process that requires sustained efforts and comprehensive strategies. The policy reforms implemented in the examined countries may have needed more time to fully materialize their effects on growth. In our study, we had just two decades of the post-treatment period in the study.

Furthermore, the quality, accessibility of education, and the alignment of educational programs with the evolving needs of the labor market are crucial factors influencing growth potential. Merely increasing education spending without ensuring the relevance and effectiveness of educational interventions may limit the potential positive impact on economic growth. Future research should delve deeper into the specific factors that contribute to the effectiveness of education spending in different contexts and explore alternative approaches to promote growth through education.

Chapter 3

Assimilation of U.S. Female Immigrants: A Cohort Approach

3.1 Introduction

The United States is undoubtedly the epicenter of immigration in the world, where economic prospects attract immigrants. Since the implementation of the 1965 Immigration and Nationality Act (INA) [1], the number of individuals who have immigrated to the United States has increased more than fourfold. According to the Pew Research Center, immigrants accounted for 13.1% of the U.S. population in 2013, almost triple the share (4.8%) in 1970. Of primary interest to policymakers is whether immigrants in the United States successfully integrate into the American world over time. However, the existing body of literature on economic assimilation, while large, has focused mainly on the experience of immigrant men (Chiswick, 1978, 1980; Borjas, 1982, 1985, 1995, 2015). Despite the economic contribution and the burgeoning size of female immigrants transitioning into the U.S. workforce, we know little of their labor market performance. In recent times, immigrant women from the Philip-

[1]The Immigration and Nationality Act of 1965 is a federal law which was passed by U.S. Congress to obliterate the de facto discrimination against Eastern and Southern Europeans, Asians, and other non-Northwestern European ethnic groups from American immigrant policy. The Act gave priority to relatives and children of U.S. citizens and legal permanent residents, professionals and other specialized skilled workers and refugees. Additionally, the Act maintained aggregate immigration limits, but provisions were made to exempt immediate relatives of U.S. citizens from this restriction.

pines, El Salvador, Vietnam, the Dominican Republic, and Colombia have a higher labor force participation rate than U.S.–born women[2]. The few essential first-generation studies that investigated the assimilation of women found that, in general, there is positive assimilation on labor force participation and hours worked (Long, 1980; Reimers, 1985; Baker and Benjamin, 1994; Duleep and Sanders, 1993).

This chapter focuses on how the labor market performance, specifically labor force participation and employment outcomes of immigrant women, change with their time in the U.S. and whether that has evolved across cohorts. This study is essential for two reasons—first, the rate of immigrants in the U.S. has been and continues to grow steadily, forming a significant share of the U.S. population. There is ample evidence to suggest that immigrant women face various challenges in the job market, including limited opportunities for high-status positions, lower pay, and barriers to realizing the full returns of their education (Takaki, 1987; Wilkinson et al., 2006). Some studies conducted in the United States have also indicated that women who are black, Hispanic, or immigrants are disproportionately represented in low-paying and low-status clerical or service jobs relative to their US-born counterparts (Takaki, 1987; Schoeni, 1998; Hondagneu-Sotelo, 1999; Wilkinson et al., 2006). Second, different country of origins might matter due to differences in culture, especially as it relates to female labor force participation and employment (Blau et al., 2011). We build on Schoeni (1998) and Funkhouser et al. (1998), who found that all the previous cross-sectional studies on women's labor force participation overstated the true assimilation rate. That is, the cohort strategy results in lower assimilation estimates, although the effects are still substantial.

We contribute to the literature by updating the existing picture of assimilation to the very recent cohorts by adding nearly three decades of information to the data. This update is important because the nature of migration to the United States has changed substantially over time (especially in the 20th century), notably with a movement away from European and toward Latin American immigrants and now an increase in Indian and East Asian immigrants

[2]Visit https://www.americanimmigrationcouncil.org/research/immigrant-women-and-girls-united-states for more details.

and African immigrants. These immigrant women might have different experiences in the United States. Therefore, updating the literature will give policymakers a historical view and the current picture of the initial gap and the rate of economic assimilation of recently arriving immigrants. Suppose there is a persistent slowdown in the economic assimilation of recent immigrants relative to older cohorts. In that case, it may point to source country characteristics or recent immigrants facing more difficulties, discrimination, or barriers to participation in the labor market, which would call for an effort to identify the causes of such deterioration. On the other hand, if recent immigrants are rapidly assimilating towards the economic status of natives, then we can invoke that individuals immigrating to the U.S. for economic purposes have strong incentives to allocate a significant portion of their investment toward accumulating U.S. - specific human capital skills.

Using the 1970-2019 US census Integrated Public Use Microdata Series (IPUMS), this paper finds that the more recent cohorts have had larger initial gaps than earlier cohorts in the U.S. labor market outcomes. However, the relationships between labor market outcome gaps and years since migration have changed between earlier and more recent cohorts. Although these more recent cohorts started with significant initial gaps, they experienced steep convergence rates with years since migration. The 2005-2011 cohort experienced the fastest assimilation rate in labor force participation and employment probability with time since migration in the United States compared to the 1975-79 cohort.

3.2 Literature Review

The existing body of the literature, while large, has focused mainly on the experience of immigrant men. Chiswick (1978) examined the differences in the earnings experiences of U.S. native and immigrant white men using the 1970 decennial Census. In general, Chiswick (1978) documents that during the initial post-migration period, white immigrant men have lower earnings relative to white native men. However, this earnings disadvantage dissipated, and after roughly 10 – 15 years in the labor market, white immigrant men earnings equate and eventually surpass the earnings of white native men. Complementing Chiswick's study

and focusing on a subset of immigrants, Borjas (1982) measured the extent of differences in the rate of economic mobility among various male Hispanic immigrant groups. Borjas (1982) findings indicate that the earnings of Hispanic immigrant as a single group is positively correlated with years since immigration and there are major differences in the rate of economic mobility of various Hispanic groups. Other studies using cross-sectional analyses, including Carliner (1980) and DeFreitas (1980), essentially confirm the pattern of immigrant earnings during the post-migration period and the earnings differential among immigrant groups.

Borjas (1985) discusses the limitations in the cross-sectional analysis, that is, these analyses confound assimilation impact with possible "quality" differentials among immigrant cohorts (Borjas, 1994, 1995; Schoeni, 1998; Smith, 2004). A single cross-sectional analysis inherently has an issue of not being able to separately control for an immigrant's year of arrival and their duration in the United States. Immigrants from the same country arriving in the United States at different periods may have heterogeneous skills and abilities, which affect their earning distribution. For example, Cuban immigrants who arrived in the second half of the 1960s earned 17 percent higher wage rates than those who arrived in the 1970s; and those who arrived prior to the revolution earned about 40 – 45 percent higher wage rates according to Borjas (1982). Borjas (1985) overcomes this problem by incorporating the cohort effect in his study of immigrants' earnings with multiple cross-sectional data. When we abstract from the incidence of emigration, the cohort approach pool the information in all cross-sections and allows for the comparison of different cohorts of immigrants with natives. This approach allows a comparison of the initial gap and the evolution of their earnings relative to a group of natives with similar age and education. Instead of the rapid growth reported in single cross-sectional studies, the author found that the cohort analysis predicts relatively slow earnings growth rates for most immigrant groups. More recent work by Borjas (2015) shows that there are male cohort effects in immigrants' entry wages with more recent cohorts having relatively lower entry wages and lower wage growth.

Unlike the relatively large empirical investigations of the assimilation patterns of immigrant men, the empirical investigations of assimilation patterns of immigrant women are small. The essential first-generation studies that investigated the assimilation of women

(Long, 1980; Reimers, 1985; Duleep and Sanders, 1993; Baker and Benjamin, 1994) found that, in general, there is positive assimilation on labor force participation and hours worked. While studies have documented positive earnings assimilation for both immigrant males and females, Chiswick (1978) and Long (1980) indicate that the pattern of earnings differentials vary by sex and time. Similarly, Field-Hendrey and Balkan (1991) studies the earnings-experience profiles of female immigrants and native-born women. For the initial gap, immigrants earned 14.4% lower wages than similar native women in the 1970 US Census and 3.3% lower for the 1980 US Census. However, this wage gap experienced by all female immigrants convergences to native women's wages after about ten years of stay in the United States. This finding suggests that female immigrants may initially have lower earnings than native women, but as years since migration and experience increase, these female immigrants eventually catch up. In contrast to Chiswick (1978) and Field-Hendrey and Balkan (1991), Long (1980) found that female immigrants have relatively higher earnings when they arrive in the United States, but their earnings advantage over the native born diminishes with time until they have been in the United States for about 24 years.

Similar to the studies on male immigrants' assimilation, Schoeni (1998) also argues that relying on a single year of cross-sectional data may overstate the female immigrants' assimilation. The author presented the first study on immigrant women using the cohort approach to analyze labor market assimilation. Employing 1970, 1980, and the 1990 U.S. Census data, the author, found lower estimates of assimilation for women's labor force participation. Funkhouser et al. (1998) noted that employment rates of immigrant women increase sharply as they transition from their initial five years of duration in the U.S. to the next five years. In addition, the authors found that immigrant women employment rates change relatively little after approximately 10 years of duration in the U.S. While utilizing the cohort approach to study female immigrant labor force assimilation in the U.S., researchers explored the impact of several variables including source country characteristics, family characteristics, human capital, and proficiency of the English language.

The United States and usual immigrant source countries tend to differ regarding the division of labor by gender. More traditional division of labor by gender is observed in some

immigrant source countries than the United States. To examine the impact of gender roles in immigrant source countries on immigrant women's labor market assimilation profile in the U.S., Blau et al. (2011) utilize a sample of married immigrant women from the 1980-2000 U.S. Censuses and source countries gender role characteristics such as female relative to male labor force participation and women's completed fertility. The authors provide evidence that immigrant women from countries with high female labor supply work more than those from countries with low female labor supply. During the first years following entry into the U.S., both groups of immigrant women work less than native women, however, over time they assimilate to their counterparts. This finding contradicts Funkhouser (2008) result that was derived using the 1980 and 1990 U.S. Censuses. The author found that source countries characteristics are related to employment levels, however, they are not correlated with the relative change of employment rates for females.

Another labor market assimilation variable that is often examined is the English language ability of immigrants. The ability of immigrants to fluently speak English is vital to the smooth transition into the U.S. labor market. According to Carliner (2000) immigrants who have intentions to reside in the United States have the incentive to invest in learning the language before or after their arrival. In general, studies on immigrants' language abilities tend to highlight that years since migration, age at migration, heterogeneity in language skills by country of birth, and education have a significant impact on the language acquisition of immigrants (Veltman, 1988; Portes and Schauffler, 1994; Chiswick, 1991; Chiswick and Miller, 1992; Dustmann, 1994; Carliner, 2000). Using cohort analysis and the observation that the acquisition of English language abilities of immigrants is a continuous process, Funkhouser (2008) provides evidence that language ability does not explain the change in immigrant women's relative employment rates as duration in the U.S. increases.

Antecol (2000) suggests a positive correlation between source country female labor force participation rates and U.S. labor force participation of immigrant women. This result was particularly evident for first-generation immigrants women implying a transfer of cultural factors that affect the labor market participation in the host country. Blau (1991) also investigates the fertility behavior of first-generation immigrant women in the United States,

particularly those from the Middle East, Asia, Latin America, and the Caribbean, where fertility rates are high. The study finds that country of origin characteristics positively and significantly determined immigrant women's fertility behavior in the 1970 and 1980 U.S. Census. This correlation was strong, especially for immigrants who had married before arriving in the United States. Fernández and Fogli (2006) and Fernández and Fogli (2009) extend the analysis of Blau (1991) by studying second-generation American women to mitigate the usual issues associated with immigration, such as selection and the possible disrupted and delayed fertility behavior. Using historical values of female labor force participation and total fertility rate in the parents' source country, the authors find these variables positively explain second-generation American women's work and fertility outcomes. This result was statistically significant even after controlling for various characteristics of a woman, indicating that the culture of the American woman's country of ancestry are related to her labor marker performance. Other studies have also argued the negative relationship between fertility and female labor market outcomes (Brewster and Rindfuss, 2000; Dye, 2008; Chiu and Rastogi, 2008).

In Canada, Baker and Benjamin (1997) provides empirical evidence of how migrant husbands and their wives interact in the labor market. Using data from the Canadian Survey of Consumer Finances (SCF), the author finds that upon entry, the labor force participation rate for immigrant women is higher than comparable natives. However, this initial advantage declines over time. According to Baker and Benjamin (1997), this divergence away from native labor supply is because immigrant women tend to find employment shortly after arrival in jobs that offer relatively high initial wages (but less wage growth rate) to finance their spouse's human capital investment in the host country. These women eventually exit the labor market once their spouse's investment returns become higher, indicating that family investment strategy may play an essential role in immigrants women's labor market assimilation profiles. In a similar study, Cobb-Clark and Crossley (2004) uses the Longitudinal Survey of Immigrants to Australia (LSIA) data to analyze the labor market behavior of the spouse of the principal applicant who applied for admission to Australia. When the applicant's spouse is a woman, she works more hours upon arrival than immigrant women

in nontraditional households.

Exploring comparative immigration studies, Reitz (1998) conducted an extensive study on immigrants' earnings in Australia, the United States, and Canada. Compared with native women, the study reveals that immigrant women in the United States performed poorly than in Canada or Australia. While Reitz (1998) found that educational attainment explains more of the observed differences in earnings between these two groups, Antecol et al. (2002) attribute the income gap between immigrant and native women to differences in country of origin. Their study found that the income gap disadvantage substantially reduces when one removes Latin American immigrants from the U.S. analysis. This outcome is because Latin American women immigrants have relatively lower educational attainment and linguistic ability in the U.S. than other immigrant women. In essence, the findings of U.S women immigrant performing poorly than their counterparts in the Canadian or Australian labor market are due to the higher educational attainment and linguistic abilities of immigrant women in the latter countries.

Focusing only on the United States and Canada, Wilkinson et al. (2006) explores how the different stages of the settlement in the host country could affect the labor market experiences of immigrant women. The empirical evidence suggests that the total income received from wages and salaries is much lower for immigrant women than native-born women upon arrival. Nevertheless, the incomes of long-term (more than ten years) immigrant women achieve near convergence with native-born women after seven to ten years. Additionally, the returns on education for immigrant women begin to approach those of Canadian-and US-native women. However, this returns to education for immigrants was still lower than comparable native women even after a decade of residence in the host country. The authors documented the same pattern with occupational status, indicating that immigrant women, on average, take up jobs that have lower returns than native women even after accounting for education and other factors. Similarly, Chiu and Rastogi (2008) and Schoeni (1998) argue that educational status predicts labor force participation and employment and may differ between natives and immigrants. Funkhouser (2008) provides further evidence that the change in employment rates relative to natives is larger for immigrants with more education than for immigrants

with less education.

3.3 Empirical Evidence on Aging and Cohort Effects

This study relies on data from the US census Integrated Public Use Microdata Series (IPUMS) (Ruggles et al., 2020) [3]. We use available decennial census data between 1970 and 2000, as well as the pooled 2009 to 2011 (which we refer to as 2010) and the 2019 American Community Surveys (ACS) samples. Following Schoeni (1998), Funkhouser et al. (1998), and Chiu and Rastogi (2008), we restrict our sample to females from ages 25 - 63 years who are civilians and living in one of the 50 U.S. states and Washington DC [4]. In this study, a respondent is classified as an "immigrant" if she is either a noncitizen or a naturalized citizen. All other persons are classified as "natives". We delete immigrants who refused to declare their country of birth or do not know their date of entry from the sample.

3.3.1 Source Country Pattern

We first document patterns revealed by the data over the past five decades. Table3.1 presents the averages for the top ten sending countries in terms of immigrants in the United States by the census years. Prior to the 1980s, the majority of female immigrants to the U.S. came from Europe and South America. Several factors, including political and economic reasons, drove this trend. For example, there was an influx of Cuban population in the U.S. between 1960 and 1970 as thousands of Cubans fled to seek asylum in the U.S. [5] Additionally, U.S. immigration policies at the time favored immigrants from Europe, and many European countries had longstanding ties to the United States. However, by the end of the 20th century, the source countries of immigrants to the United States began to shift, with increasing numbers of immigrants coming from Asia and Latin America. For example, the 1980s and the 1990s saw Mexican female immigrants forming the highest share of female

[3]Data are available for download at https://usa.ipums.org/usa.

[4]This age group is selected to prevent the contamination of differential school leaving age and retirement across immigrants and natives.

[5]See https://journals.openedition.org/plc/464?lang=en

Table 3.1: Top 10 Sending Countries and Regions by Survey Year

Birthplace	**1970 (%)**	**Birthplace**	**1980 (%)**	**Birthplace**	**1990 (%)**
Germany	11.57	Mexico	16.68	Mexico	21.63
Canada	11.42	Germany	7.85	West Indies	7.35
Mexico	9.71	Canada	6.04	Central America	6.66
Italy	6.89	West Indies	5.95	South America	6.31
England	6.64	Cuba	5.18	Philippines	6.09
Cuba	6.10	South America	5.14	China	5.21
South America	5.14	Philippines	4.79	Germany	4.36
Poland	3.50	Italy	4.28	Korea	3.82
West Indies	3.39	England	4.28	Cuba	3.71
Ireland	2.54	China	3.99	Canada	3.47
Birthplace	**2000 (%)**	**Birthplace**	**2010 (%)**	**Birthplace**	**2019 (%)**
Mexico	27.96	Mexico	29.28	Mexico	25.38
West Indies	7.72	Central America	7.86	Central America	8.39
Central America	7.18	South America	7.42	India	8.15
South America	6.76	West Indies	7.18	South America	7.93
Philippines	5.45	India	6.09	West Indies	7.28
China	5.28	China	5.56	China	6.59
India	4.44	Philippines	5.31	Africa	5.51
Vietnam	3.55	Africa	3.76	Philippines	5.03
Korea	3.33	Vietnam	3.31	Vietnam	3.12
Africa	2.64	Korea	3.05	Other USSR/Russia	2.82

immigrants in the United States. Recently, the source countries and regions of immigrants to the United States have been more diverse than ever. In the 2000s and 2010 surveys, the top ten countries of origin for female immigrants to the United States included India, Vietnam, and Africa. By 2019, female immigrants from Other USSR/Russia made up part of the top ten sending countries to the United States.

3.3.2 Estimation and Result

We focus on two labor market outcomes: labor force participation and employment status. The labor force participation measures if an individual is currently in the labor force (i.e., employed or unemployed) or is out of the labor force. Employment status measures if the respondent is employed or is unemployed but in the labor force. We study both the labor

force participation and employment status of respondents because labor force participation is an indicator of the first stage of transition to the labor market, and therefore will help us understand the labor market attachment decisions of female immigrants over the years. On the other hand, employment indicates success in finding a job, given that the respondent decides to participate in the labor force. An increase in labor force participation could result from an increase in the number of people employed, unemployed, or both. Therefore, the employment variable will capture the success rate of female immigrants in finding a job in the host country.

We start by estimating the following equation for each of the census cross sections:

$$LFPR_{\ell\tau} = \phi_{c\tau} + X_{\ell\tau}\beta_{\tau} + \varepsilon_{\ell\tau} \tag{3.1}$$

$\text{LFPR}_{\ell\tau}$ is a dummy variable that identifies whether person ℓ was in the labor force in cross section τ. X is a third-order polynomial for the individual's age; and $\phi_{c\tau}$ is a vector of fixed effects representing each immigrant cohort in the particular cross section τ (with the native fixed effect being omitted from the regression); and $\varepsilon_{\ell\tau}$ is the error term.

Next, we estimate the following equation using the second dependent variable

$$EMP_{\ell\tau} = \phi_{c\tau} + X_{\ell\tau}\beta_{\tau} + \varepsilon_{\ell\tau} \tag{3.2}$$

$\text{EMP}_{\ell\tau}$ is a dummy variable that identifies whether an individual ℓ was employed in cross section τ. We are therefore constructing the $\text{EMP}_{\ell\tau}$ as the probability of being employed for this group. The rest of the variables hold as defined in equation (1). Note that this model contains only individuals in the labor force prior to the census year.

Table 3.2 reports the estimated cohort fixed effects. An examination of these age-adjusted labor force participation gaps reveals two interesting findings. First, the more recent cohorts have relatively lower labor market participation rates than earlier cohorts (through to 2000). Let us consider, for example, the broad trend in the labor market gap between the more recent cohort of immigrants and natives in each cross section. In the 1970 census, the immigrants that arrived over the 1965-69 period were 2.5 percentage points more likely to

be in the labor force than comparably aged natives. This cohort of immigrants had a positive initial gap in the probability of entering the labor force. They outperformed natives in the labor market attachment upon their arrival—however, the picture changes after a decade. In 1980, the most recent wave of immigrants was 11.8 percentage points less likely to join the labor force than natives in the same survey year. By 2000, this labor market entry disadvantage had grown to 25.2 percentage points. By 2010, however, the long-run trend in level cohort effects seems to have contracted a little, and the latest wave of immigrants was 22.9 percentage points less likely to join the U.S. labor force than natives. The labor market entry disadvantage shrank further in 2019 to 19 percentage points. The initial labor force participation gaps relative to natives are also shown in figure 3.1.

For this study, we define the rate of labor force assimilation as the rate at which the labor force participation rate (or the labor force participation probability) gap between immigrants and natives possibly converges with years since migration. In addition to the cohort effects in the labor force participation rate levels, the age-adjusted labor market gaps reported in table 3.2 suggest another interesting finding: there seems to have been a "break" in or after 1990. Specifically, the immigrants who arrived after 1989 experienced a far higher labor force assimilation than earlier arrivals and the most recent arrivals after a decade of them arriving in the United States. In other words, the data suggest two things. First, the initial gaps of recent cohorts are greater than earlier cohorts in terms of labor force participation rate. Second, the rate of growth of immigrant labor market participation is higher for the more recent cohorts than the earlier cohort. Figure 3.1 also shows the assimilation graphically by illustrating the labor force participation gaps by cohort and years since migration (Panel A), while Panel B illustrates the relative convergence rate across cohorts by comparing their labor force participation rates at different years since migration values, normalized by their initial labor force participation rate gaps.

For our argument to be straightforward, let us assume that change in the business cycle is independent of immigrants' relative labor force participation [6]. The cohort effects in the

[6]It is important to recognize that the operating assumption may be problematic. Specifically for the 2010 Census, immigrants may be more vulnerable than natives to the effects of the 2007-2009 recession caused by the housing market collapse. This economic shake-up might impact marginally attached immigrant workers

rate of labor force assimilation can then be detected by "tracking" a specific cohort across censuses. For example, consider the cohort that entered the United States between 1985 and 1989. This group's relative labor force participation rate improved from a disadvantage of 19.7 percentage points at the time of entry in 1990 to 12 percentage points in 2000 –a growth rate of just 7.7 percentage points over their first decade in the country. After another ten years, there is an 11.4 percentage points improvement in the labor market disadvantage.

In contrast, the cohort that entered the country between 1990 and 1994 was 15.2 percentage points less likely to join the labor force than natives in the 2000 census. This disadvantage improved by 12.2 percentage points in the 2010 census. This rate of labor force assimilation increased by an outstanding 19.2 percentage points for the 1995-1999 cohort from the 2000 to 2010 census sample. Even though the 1995-1999 arrivals had the highest disadvantage (in the 2000 census) in the labor force attachment, they assimilated more quickly with years since migration than their counterpart who arrived before the 1990s. We see a similar pattern for cohorts that also arrived in the early to late 2000s.

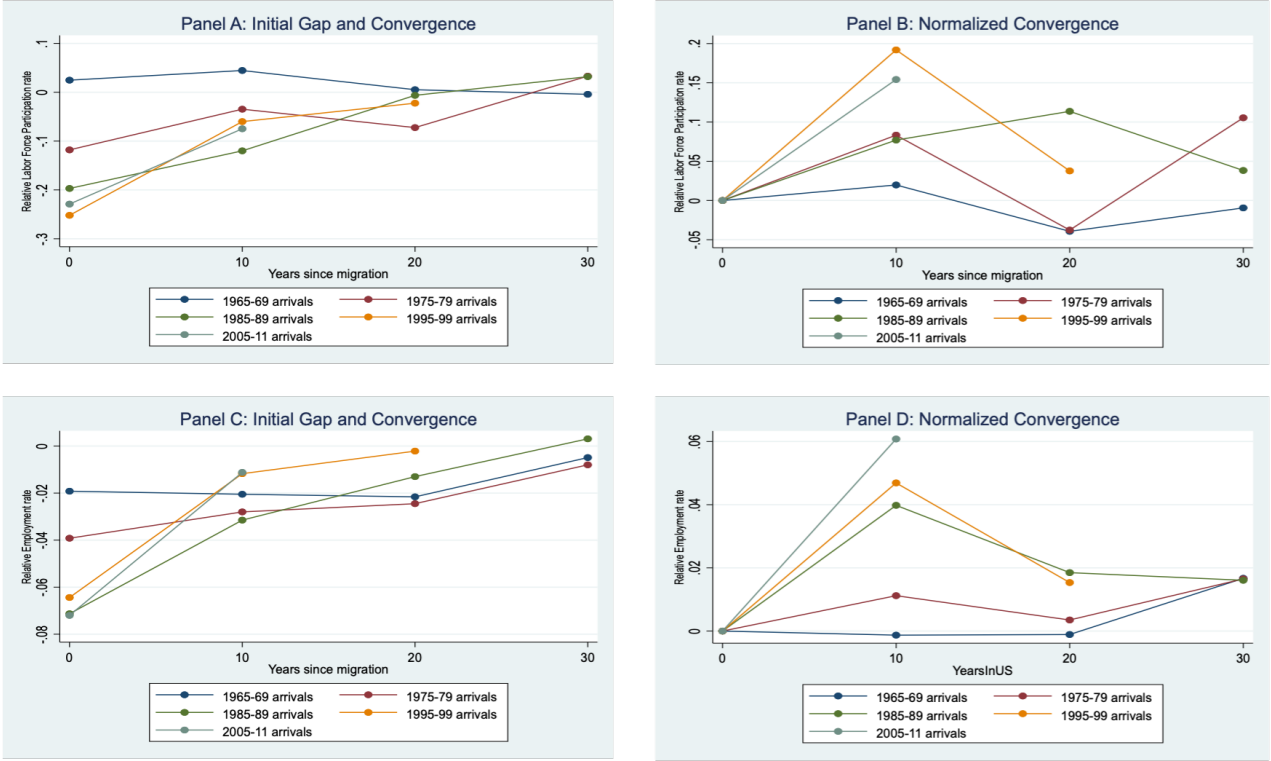
and discourage immigrant workers more than natives. As a result, the average immigrant's propensity to join the labor force participation might be lower relative to natives.

Table 3.2: Age-Adjusted Labor Force Participation Rate of Immigrant Cohorts Relative to Natives, by Census Cross Section

COHORT	1970	1980	1990	2000	2010	2019
1950-59 arrivals	0.007***	0.006***	0.075***	...	...	...
	(0.000)	(0.001)	(0.004)			
1960-64 arrivals	0.029***	0.021***	-0.009***	0.052***	...	...
	(0.000)	(0.001)	(0.001)	(0.005)		
1965-69 arrivals	0.025***	0.044***	0.005***	-0.004	...	...
	(0.000)	(0.000)	(0.001)	(0.002)		
1970-74 arrivals	...	0.012***	-0.019***	-0.051***	0.026***	...
		(0.000)	(0.000)	(0.001)	(0.002)	
1975-79 arrivals	...	-0.118***	-0.035***	-0.072***	0.033***	...
		(0.000)	(0.000)	(0.001)	(0.002)	
1980-84 arrivals	...	...	-0.075***	-0.090***	0.010***	0.002
			(0.000)	(0.001)	(0.002)	(0.005)
1985-89 arrivals	...	...	-0.197***	-0.120***	-0.006**	0.032***
			(0.000)	(0.001)	(0.002)	(0.004)
1990-94 arrivals	...	...	...	-0.152***	-0.030***	0.012**
				(0.000)	(0.002)	(0.004)
1995-99 arrivals	...	...	...	-0.252***	-0.060***	-0.022***
				(0.001)	(0.001)	(0.003)
2000-04 arrivals	...	...	...	...	-0.229***	-0.075***
					(0.001)	(0.001)
2005-11 arrivals	...	...	...	...	-0.229***	-0.075***
					(0.001)	(0.001)
2012-19 arrivals	...	...	...	...	...	-0.190***
						(0.001)
Observations	1,183,640	2,356,412	2,810,920	3,202,936	2,056,883	674,373
R-squared	0.004	0.012	0.022	0.024	0.019	0.021

Notes: The output presented above are calculated from regressions that are estimated separately for each cross section, which are identified by the year displayed in the column heading. The dependent variable identifies each individual's probability of participating in the labor force, and the explanatory variables include the respondent's age (introduced as a third-order polynomial). The regressions also include a fixed effect for the immigrant cohort that arrived in the U.S. prior to 1950 (not shown in the table). The reference group is comprised of native-born respondents such that the coefficients in each column represent a separate cohort's probability of participating in the labor force relative to native-born respondents in that census (or survey) year. The "2010" cross section is generated from the pooled 2009-11 American Community Surveys (ACS) while the "2019" cross section is generated from the 2019 ACS. Robust standard errors in parentheses are clustered at the cohort level. *** p<0.01, ** p<0.05, * p<0.1

Figure 3.1: Aging Profile for the Relative Labor Force Participation and Employment Rate of Immigrants, by Cohort



Note: Panels A and B are the age-adjusted initial gap and convergence for the relative labor force participation rate of immigrant cohorts obtained from the data reported in table 3.2. The dependent variable identifies each individual's probability of participating in the labor force, and the explanatory variables include the respondent's age (introduced as a third-order polynomial). The reference group is comprised of native-born respondents such that the coefficients on the cohort fixed effects represent each cohort's probability of participating in the labor force relative to native-born in a given survey year, which are used to construct the data points in the upper panel graphs. In Panel B, the relative labor force participation rate for each cohort is normalized to zero at the time of the entry. Panels C and D are the age-adjusted initial gap and convergence for the relative employment rate of immigrant cohorts obtained from the data reported in table 3.3. The dependent variable identifies each individual's probability of being employed, and the explanatory variables include the respondent's age (introduced as a third-order polynomial). The reference group is comprised of native-born respondents such that the coefficients on the cohort fixed effects represent each cohort's probability of being employed relative to native-born in a given survey year, which are used to construct the data points in the lower panel graphs. In Panel D, the relative employment rate for each cohort is normalized to zero at the time of the entry.

We present the estimation of equation 2 in table 3.3. This table reports the estimated cohort fixed effects for the employment rate (or employment probability) of the individual.

An examination of these age-adjusted employment rate gaps equally reveals two interesting findings. First, the more recent cohorts have relatively lower employment rates than earlier cohorts (through to 1990). Let us consider, for example, the trend in the employment probability gap between the more recent cohort of immigrants and natives in each cross section. In the 1970 census, the immigrants that arrived over the 1965-69 period were 1.9 percentage points less likely to be employed than comparably aged natives. This cohort of immigrants had a negative initial gap in the probability of being employed. This negative initial gap worsens for the new cohort that enters the country. In 1980, the most recent immigrant wave was 3.9 percentage points less likely to be employed than natives. By 1990, this disadvantage had grown to 7.1 percentage points before contracting to 6.4 percentage points in 2000. By 2010, however, the long-run trend in level cohort effects seems to have resurfaced, but this was short-lived as the latest wave of immigrants in 2019 saw a marginal improvement in their employment entry gap (for example, the cohort that arrived between 2012 and 2019 were only 3.4 percentage points less likely to be employed compared to the 2005 and 2011 cohort who were 7.2 percentage points less likely to be employed than natives).

As presented in table 3.2, table 3.3 similarly suggests a faster assimilation rate of the recent cohort in terms of getting employed than earlier cohorts. Suppose again that changes in aggregate economic conditions do not affect the relative employment rate of immigrant [7]. The cohort effects in the rate of employment rate assimilation can then be detected by "tracking" a specific cohort across censuses. Consider, for instance, the cohort that entered the country between 1985 and 1989. This group's relative job uptake rate improved from a disadvantage of 7.1 percentage points at the time of entry in 1990 to 3.1 percentage points in 2000 –a growth rate of just 3.9 percentage points over a decade in the United States. After another ten years, the assimilation rate fell to 1.85 percentage points. In contrast, the cohort that entered the country between 1995 to 1999 was 6.4 percentage points less likely to be employed than natives in the 2000 census. This initial disadvantage improved

[7] Again, the operating assumption may be problematic. Specifically for the 2010 Census, immigrants may be more vulnerable than natives to the effects of the 2007-2009 recession caused by the housing market collapse. Employment rates may be lower for immigrants than natives, especially in industries like construction and hospitality, which were hit hard by the recession. As a result, the cyclical unemployment rates might differ for the immigrants and natives.

by 4.69 percentage points after just ten years in the United States. Additionally, the cohort that entered the country between 2005 and 2011 was 7.2 percentage points less likely to be employed than comparably aged natives upon entry. This entry disadvantage improved by about 6.1 percent after just ten years in the United States. To put things in perspective, even though the latest arriving cohort (in the 2010 census) suffered the most from an entry employment disadvantage, they experienced the fastest assimilation in the labor market after just ten years in the United States.

Our data provide evidence of cohort effects on immigrants' labor market outcomes in terms of both initial gaps and growth rates. However, Borjas (1985) argues that isolating the impact of aging and cohort effects can be methodologically challenging.

Proper identification requires panel data where an individual can be observed over time. Borjas (1985) argues that an alternative approach is using a number of randomly drawn cross sections so that the average member of a specific cohort can be "tracked" across survey years. We follow Borjas (1985) identification strategy by pooling the available cross-sectional data for immigrants and natives. The immigrant labor market outcome function is presented below:

$$Y_{\ell\tau} = X_{\ell\tau}\varphi_i + \alpha y_{\ell\tau} + \beta C_\ell + \theta\left(y_{\ell\tau}C_\ell\right) + \gamma_i \pi_{\ell\tau} + \varepsilon_{\ell\tau} \tag{3.3}$$

Native labor market outcome function:

$$Y_{\ell\tau} = X_{\ell\tau}\varphi_n + \gamma_n \pi_{\ell\tau} + \varepsilon_{\ell\tau} \tag{3.4}$$

where $\mathrm{Y}_{\ell\tau}$ is the vector containing labor force participation and employment status outcomes; $X_{\ell\tau}$ is a third-order polynomial for the age of each respondent, $y_{\ell\tau}$ is a third-order polynomial that identifies the number of years that the immigrants have stayed in the U.S.; C_ℓ is a vector of dummy variables identifying each immigrant cohort; and $y_{\ell\tau}C_\ell$ measures the linear combination of cohort-specific and duration in the U.S. trend; and $\pi_{\ell\tau}$ is an dummy variable indicating survey fixed effect. The parameter α measures the value of acquiring additional year of U.S. experience and represents an aging effect. Our estimated param-

Table 3.3: Age-Adjusted Employment Rate of Immigrant Cohorts Relative to Natives, by Census Cross Section

COHORT	1970	1980	1990	2000	2010	2019
1950-59 arrivals	-0.011***	-0.010***	-0.002***	...	...	...
	(0.000)	(0.000)	(0.000)			
1960-64 arrivals	-0.016***	-0.016***	-0.016***	0.005***	...	...
	(0.000)	(0.000)	(0.001)	(0.000)		
1965-69 arrivals	-0.019***	-0.021***	-0.022***	-0.005***	...	...
	(0.000)	(0.000)	(0.001)	(0.000)		
1970-74 arrivals	...	-0.023***	-0.029***	-0.023***	0.005***	...
		(0.000)	(0.000)	(0.000)	(0.000)	
1975-79 arrivals	...	-0.039***	-0.028***	-0.025***	-0.008***	...
		(0.000)	(0.000)	(0.000)	(0.001)	
1980-84 arrivals	...	...	-0.037***	-0.031***	-0.003***	0.004***
			(0.000)	(0.000)	(0.001)	(0.000)
1985-89 arrivals	...	...	-0.071***	-0.032***	-0.013**	0.003***
			(0.000)	(0.000)	(0.001)	(0.000)
1990-94 arrivals	...	...	...	-0.036***	-0.015***	0.003***
				(0.000)	(0.000)	(0.000)
1995-99 arrivals	...	...	...	-0.064***	-0.017***	-0.002***
				(0.000)	(0.000)	(0.000)
2000-04 arrivals	...	...	...	...	-0.023***	-0.004***
					(0.000)	(0.000)
2005-11 arrivals	...	...	...	...	-0.072***	-0.011***
					(0.000)	(0.000)
2012-19 arrivals	...	...	...	...	...	-0.034***
						(0.000)
Observations	588,772	1,456,100	2,038,825	2,331,031	1,558,120	518,719
R-squared	0.001	0.002	0.004	0.005	0.003	0.002

Notes: The output presented above are calculated from regressions that are estimated separately for each cross section, which are identified by the year displayed in the column heading. The dependent variable identifies each individual's probability of being employed, and the explanatory variables include the respondent's age (introduced as a third-order polynomial). The regressions also include a fixed effect for the immigrant cohort that arrived in the U.S. prior to 1950 (not shown in the table). The reference group is comprised of native-born respondents such that the coefficients in each column represent a separate cohort's probability of being employed relative to native-born respondents in that census (or survey) year. The "2010" cross section is generated from the pooled 2009-11 American Community Surveys (ACS) while the "2019" cross section is generated from the 2019 ACS. Robust standard errors in parentheses are clustered at the cohort level. *** p<0.01, ** p<0.05, * p<0.1

eters of interest, β and θ capture the labor market outcome gap of a specific cohort at arrival, and the assimilation rate (or average growth) of that specific cohort over time in the United States, respectively. The estimated coefficient γ_i and γ_n give the impact of changes in macroeconomic conditions on immigrant and native labor market outcomes, respectively, and measure the period effect.

It is established in the literature that parameters measuring the aging, cohort, and period effects in equation (3) are not independently identified. The issue of identification arises due to the following identity:

$$y_{\ell\tau} \equiv T_1 + \pi_{\ell\tau}\,(T_2 - T_1) - C_\ell \tag{3.5}$$

Equation (5) shows that we cannot separately identify the parameters capturing aging ($y_{\ell\tau}$),cohort(C_ℓ), and period effects($\pi_{\ell\tau}$) in the model because they are perfectly collinear. To identify the parameters, we follow Borjas (1985) and make the assumption that the period effects are the same for natives and immigrants:

$$\gamma_i = \gamma_n \tag{3.6}$$

In other words, macroeconomic trends should equally impact natives and immigrants in the same way. We can think about this restriction as the period effect for immigrants,γ_i, is exogenous to the immigrant-specific labor participation outcomes.

The empirical analyses reported below are drawn from the framework suggested by equation (3) in many ways. First, the regression stacks data from the six cross-sections available between 1970 and 2019 so that the period effects are measured by the vector of fixed effects indicating the cross section from which an individual is drawn. Model 1 of table 3.4 presents the initial gaps in labor force participation and duration in the United States. This model allows us to compare each successive cohort's initial labor market gap with the 1975-79 arriving cohort. Also, all regressions include immigrant fixed effect and the respondent's age (introduced as a third-order polynomial) fully interacted with a variable indicating if the person is foreign-or-native-born (immigrant fixed effect). We present selected coefficients from the

regression model for brevity and to conveniently illustrate the direction of the cohort effects. The estimation suggests that compared to the 1975-79 cohort, later successive immigrant cohorts experienced a larger initial entry disadvantage in labor force participation.

Model 1 shows that the 1965-69 arriving cohort had an initial entry advantage over the 1975-79 cohort in labor force participation. However, successive immigrant cohorts arriving after the 1975-79 cohort experienced a relatively worse initial gap. For example, the 1985-89 cohort was 4.3 percentage points less likely to join the labor force than the 1975-79 cohorts after arriving in the United States. This relative initial negative gap in labor force participation grew bigger for successive cohorts arriving in the United States, and narrowed for the latest 2012-2019 arriving cohort. All the coefficients were statistically significant at the 1 percent level. Even though these observations largely align with the earlier findings in table 3.2 using the individual cross-sectional data that more recent cohorts have larger negative entry disadvantages in the labor force, we acknowledge here that the estimates in table 3.2 showed little gap across the survey years. The estimates differ because Model 1 of table 3.4 assumes a constant assimilation rate across cohorts. Next, the coefficients on the Years Since Migration (YSM) variables predict that, during the first ten years after migration, labor force participation rate increases by roughly 17 percentage points.

Model 2 presents the full model suggested by equation (3). This model allows for both initial gaps and assimilation profiles of respective cohorts. Thus, Model 2 allows assimilation patterns to differ across arrival cohorts. Even though the coefficients capturing the initial gaps increased in magnitude, at large, it follows the same pattern as Model 1. Aside from the 1965-69 cohort, the 1985-89 cohort was 9.9 percentage points less likely to be in the labor force than the 1975-79 arriving cohort. This relative initial entry disadvantage in labor force participation persisted for successive cohorts until it contracted marginally for the most recent arriving cohorts in the 2000s. Additionally, the coefficients on the YSM variables predict that, during the first ten years after migration, labor force participation rate increases by 10 percentage points.

The regression equation in Model 2 reveals that the assimilation rate in labor force participation (captured by the interaction between cohort dummies and YSM) increased noticeably

with the more recent cohorts. Immigrants who arrived in the late 1980s experienced a 0.5 percentage point increase in the likelihood of participating in the labor force relative to the 1975-79 arriving cohort for each additional year of residence in the United States. Additionally, immigrants who arrived in the late 1990s could expect a 0.8 percentage points growth in the likelihood of participating in the labor force for each additional year in the U.S. relative to the 1975-79 cohort. The more recent cohort, the 2005-2011 arrivals, experienced the fastest assimilation in joining the labor force for each passing year. At large, more recent cohorts tend to assimilate faster into the labor force than their earlier cohorts.

We replicate the estimations in table 3.4 in table 3.5 by using employment status as our outcome variable. Model 1 presents the initial gaps in employment probability and duration in the United States.

This model allows us to compare each successive cohort's initial employment gap with the 1975-79 arriving cohort as the omitted group. Also, all regressions include immigrant fixed effect and the respondent's age (introduced as a third-order polynomial) fully interacted with a variable indicating if the person is foreign-or-native-born(immigrant fixed effect). We present selected coefficients from the regression model for brevity. The estimation suggests that compared to the 1975-79 cohort, the 1965-69 cohort had a 0.6 percentage points initial advantage in the probability of employment. However, we see a reverse in the relative initial gap for later successive immigrant cohorts until the latest wave of immigrants. For instance, the 1985-89 cohort is likely to join the labor force, which is 1.1 percentage points below those of the 1975-79 cohort. The initial negative gap in the labor force narrowed for the 1995-99 cohort, expanded again for the 2005-2011 cohort, and reversed to a positive gap (initial advantage) for the most recent cohort. The positive value for the latest wave of immigrants demonstrates that the 2012-2019 cohort had 1.6 percentage points initial advantage in employment probability over the 1975-79 cohort. Note also that Model 1 documents that deterioration in employment probability precipitated momentarily around the late 1990s, plunged into further decline in 2005-2011, and stopped again in 2012-2019, similar to the pattern we saw in table 3.3. Next, the coefficients on the Years Since Migration (YSM) variables predict that, during the first ten years after migration, employment probability

Table 3.4: Cohort Effects in Labor Force Participation Levels and Assimilation

Initial Gaps	Model 1	Model 2
1965-69 arrivals	0.059***	0.124***
	(0.003)	(0.002)
1985-89 arrivals	-0.043***	-0.099***
	(0.001)	(0.000)
1995-99 arrivals	-0.062***	-0.140***
	(0.020)	(0.003)
2005-2011 arrivals	-0.084***	-0.166***
	(0.007)	(0.005)
2012-2019 arrivals	-0.071***	-0.146***
	(0.010)	(0.010)
YSM	0.033***	0.023***
	(0.007)	(0.006)
$YSM^2/10$	-0.019***	-0.016***
	(0.005)	(0.005)
$YSM^3/100$	0.003***	0.003***
	(0.001)	(0.001)
1965-69 arrivals × YSM		-0.004***
		(0.000)
1985-89 arrivals × YSM		0.005***
		(0.000)
1995-99 arrivals × YSM		0.008***
		(0.000)
2000-2004 arrivals × YSM		0.006***
		(0.001)
2005-2011 arrivals × YSM		0.011***
		(0.001)
Observations	11,820,848	11,820,848
R-squared	0.049	0.050

Notes: The estimates presented here are obtained from regressions that are ran on the set of pooled cross sections from 1970, 1980, 1990, 2000, 2010, and 2019. All regressions include immigrant fixed effect, the respondent's age (introduced as a third-order polynomial) fully interacted with a variable indicating if the person is foreign-or-native-born, and the omitted group is comprised of 1975-97 cohort. Robust standard errors in parentheses are clustered at the cohort level. *** p<0.01, ** p<0.05, * p<0.1

increases by 7 percentage points.

Model 2 allows for both initial employment gaps and assimilation profiles of respective cohorts. We see an increase in the magnitude (in absolute terms) of the initial gaps coefficients except for the 2012-2019 cohort, with a switch in direction. That is, successive immigrant cohorts arriving after the 1975-79 cohort experienced a larger negative initial gap in employment probability. The coefficients are statistically significant at the 1 percent level. The coefficients capturing duration in the U.S. changes marginally in size but predict that, during the first ten years after migration, employment probability increases by 6 percentage points.

Turning to the patterns in the assimilation rate in employment (measured by the interaction between cohort dummies and YSM), we find that the assimilation rate in employment increased noticeably with the more recent cohort. Immigrants who arrived in the late 1980s and 1990s experienced a 0.2 percentage point increase in the probability of getting employed to the 1975-79 arriving cohort for each additional year of residence in the United States. Additionally, immigrants who arrived in 2005-2011 could expect a 0.6 percentage points growth in the probability of getting employed for each additional year in the U.S. relative to the 1975-79 cohort. The more recent cohort, 2005-2011 arrivals, experienced the fastest assimilation in employment. More recent cohorts tend to assimilate faster into getting jobs and making a living than their earlier cohorts.

Table 3.5: Cohort Effects in Employment Levels and Assimilation

Initial Gaps	Model 1	Model 2
1965-69 arrivals	0.006***	0.014***
	(0.001)	(0.001)
1985-89 arrivals	-0.011***	-0.032***
	(0.000)	(0.000)
1995-99 arrivals	-0.001***	-0.023***
	(0.001)	(0.001)
2005-2011 arrivals	-0.008***	-0.055***
	(0.002)	(0.002)
2012-2019 arrivals	0.016***	-0.013***
	(0.003)	(0.005)
YSM	0.014***	0.011***
	(0.004)	(0.003)
$YSM^2/10$	-0.008**	-0.006**
	(0.002)	(0.002)
$YSM^3/100$	0.001**	0.001**
	(0.000)	(0.000)
1965-69 arrivals × YSM		-0.001***
		(0.000)
1985-89 arrivals × YSM		0.002***
		(0.000)
1995-99 arrivals × YSM		0.002***
		(0.000)
2005-2011 arrivals × YSM		0.006***
		(0.001)
Observations	8,261,456	8,261,456
R-squared	0.008	0.008

Notes: The estimates presented here are obtained from regressions that are ran on the set of pooled cross sections from 1970, 1980, 1990, 2000, 2010, and 2019. All regressions include immigrant fixed effect, the respondent's age (introduced as a third-order polynomial) fully interacted with a variable indicating if the person is foreign-or-native-born, and the omitted group is comprised of 1975-79 cohort. Robust standard errors in parentheses are clustered at the cohort level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

3.3.3 The Changing Composition of the Immigrant Population

What explains the basic pattern in Figure 3.1? In this section, we explore possible variables that could explain why the rate of labor market outcomes assimilation increased for the more recent immigrant cohorts. We consider factors like educational attainment, marital status, and the presence of children in the household, which may influence labor market decisions. For example, an individual with a higher level of education may fare well in terms of employment and labor force participation and may differ between natives and immigrants Chiu and Rastogi (2008). Numerous factors, such as immigration policy, labor demand, and economic motives for immigrating, may result in the concentration of the foreign-born in low and high educational attainment categories.

Model 1 of tables 3.6 and 3.7 extend equation (3) by including years of education, marital status, and number of children in the household in our regression. Although the regression model contains the full set of regressors, we report only selected coefficients not to crowd the table and to conveniently track our primary variables of interest, the level and growth cohort differences. Accounting for these variables in our model does not substantially attenuate the shifts in entry labor market status observed across successive immigrant cohorts. Note also that the assimilation profiles in tables 3.6 and 3.7 are mostly the same compared to tables 4 and 5. Accounting for education, marital status, and the number of children does not explain the basic pattern in initial entry and growth patterns of successive cohorts.

Could compositional changes explain the initial differential gaps and the acceleration in the assimilation rate? Specifically, we explore whether the cohort effects may be explained by the changing national origin mix of immigrants or by changes in the geographic sorting of immigrants across U.S. states. According to Borjas (1985, 2015), the national origin mix of the immigrant workforce is highly associated with the skill composition of immigrant workers.

Model 2 of tables 3.6 and 3.7 add the country of origin fixed effect to the regression. The regression continues to reveal the same pattern in the rate of labor market assimilation, even within national origin groups. In other words, the country of origin mix does not explain

the cohort differences in the rate of assimilation that we presented using the raw data.

The changing assimilation rate could be attributed to immigrants' changing geographic settling patterns across the United States. If fewer immigrants are choosing to settle in the typical immigrant-receiving states and states with little history of immigration are seeing a surge in the number of immigrant workers, then this geographic redistribution could potentially impact the labor market outcomes of immigrants. For example, Kandel and Parrado (2005) and Fennelly (2005) suggest that although most immigrants continue to reside in major US cities, rural areas have experienced significant growth in their immigrant population. Kandel and Parrado (2005) argues that restructuring major rural industries has opened up more economic opportunities for immigrants, thus enticing waves of immigrants to move to rural areas of the South and Midwest (Hernández-León and Zúñiga, 2003; Fennelly, 2005; Baird et al., 2008).

We account for state fixed effect in Model 3 of tables 3.6 and 3.7. Again, accounting for this variable does not alter any of the substantive findings. In other words, the regression continues to reveal an increase in assimilation rate even within national origin groups and geographic settlement areas. Lastly, we allow the state-level effect to vary by survey year in Model 4 of tables 3.6 and 3.7. We do this because, for example, Florida in 2010 may differ from Florida in 1970. At large, our primary findings remain the same. In a nutshell, the human capital, family context, and the changing composition of the immigrant population do not explain the cohort differences in the assimilation rate.

Table 3.6: Sensitivity of Estimated Cohort Effect to Compositional Changes in Labor Force Participation

Initial Gaps	Model 1	Model 2	Model 3	Model 4
1965-69 arrivals	0.097***	0.092***	0.091***	0.093***
	(0.002)	(0.005)	(0.005)	(0.005)
1985-89 arrivals	-0.101***	-0.103***	-0.103***	-0.096***
	(0.000)	(0.001)	(0.001)	(0.001)
1995-99 arrivals	-0.150***	-0.148***	-0.150***	-0.142***
	(0.004)	(0.004)	(0.004)	(0.005)
2005-11 arrivals	-0.195***	-0.189***	-0.191***	-0.188***
	(0.005)	(0.006)	(0.006)	(0.006)
2012-19 arrivals	-0.188***	-0.186***	-0.188***	-0.185***
	(0.011)	(0.012)	(0.012)	(0.012)
YSM	0.026***	0.024***	0.024***	0.025 ***
	(0.006)	(0.006)	(0.006)	(0.006)
$YSM^2/10$	-0.019***	-0.017***	-0.017***	-0.017***
	(0.005)	(0.004)	(0.004)	(0.004)
$YSM^3/100$	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
YSM interacted with				
1965-69 arrivals	-0.004***	-0.004***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
1985-89 arrivals	0.005***	0.005***	0.005***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
1995-99 arrivals	0.008***	0.008***	0.008***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)
2005-11 arrivals	0.012***	0.011***	0.011***	0.010 ***
	(0.001)	(0.001)	(0.001)	(0.001)
Country FE	NO	YES	YES	YES
State FE	NO	NO	YES	YES
State FE × Survey Year	NO	NO	NO	YES
Observations	11,820,848	11,820,848	11,820,848	11,820,848
R-squared	0.103	0.105	0.107	0.108

Notes: The estimates presented here are obtained from regressions that are ran on the set of pooled cross sections from 1970, 1980, 1990, 2000, 2010, and 2019. All regressions include immigrant fixed effect, the respondent's age (introduced as a third-order polynomial) fully interacted with a variable indicating if the person is foreign-or native-born, education (in years), marital status, number of children in household, and the omitted group is comprised of 1975-79 cohort. Robust standard errors in parentheses are clustered at the cohort level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.7: Sensitivity of Estimated Cohort Effect to Compositional Changes in Employment

Initial Gaps	Model 1	Model 2	Model 3	Model 4
1965-69 arrivals	0.013***	0.015***	0.015***	0.019***
	(0.001)	(0.001)	(0.001)	(0.001)
1985-89 arrivals	-0.033***	-0.032***	-0.032***	-0.030***
	(0.000)	(0.000)	(0.000)	(0.001)
1995-99 arrivals	-0.028***	-0.023***	-0.024***	-0.019***
	(0.001)	(0.001)	(0.001)	(0.002)
2005-11 arrivals	-0.064***	-0.059***	-0.060***	-0.054***
	(0.002)	(0.002)	(0.002)	(0.002)
2012-19 arrivals	-0.028***	-0.023***	-0.024***	-0.020***
	(0.005)	(0.005)	(0.005)	(0.006)
YSM	0.010***	0.011***	0.011***	0.011***
	(0.003)	(0.003)	(0.003)	(0.003)
$YSM^2/10$	-0.007**	-0.007**	-0.007**	-0.007**
	(0.002)	(0.002)	(0.002)	(0.002)
$YSM^3/100$	0.001**	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
YSM interacted with				
1965-69 arrivals	-0.000***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
1985-89 arrivals	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
1995-99 arrivals	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
2005-11 arrivals	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Country FE	NO	YES	YES	YES
State FE	NO	NO	YES	YES
State FE × Survey Year	NO	NO	NO	YES
Observations	8,261,456	8,261,456	8,261,456	8,261,456
R-squared	0.020	0.021	0.022	0.023

Notes: The estimates presented here are obtained from regressions that are ran on the set of pooled cross sections from 1970, 1980, 1990, 2000, 2010, and 2019. All regressions include immigrant fixed effect, the respondent's age (introduced as a third-order polynomial) fully interacted with a variable indicating if the person is foreign-or native-born, education (in years), marital status, number of children in household, and the omitted group is comprised of 1975-79 cohort. Robust standard errors in parentheses are clustered at the cohort level. p<0.01, ** p<0.05, * p<0.1

3.4 Conclusion

This paper uses data from the 1970-2019 U.S. census Integrated Public Use Microdata (IPUMS) to document and examine the long-run trends in female immigrants' labor market conditions over the past few decades. The paper's main finding is that there are cohort effects in labor market conditions of female immigrants, with more recent immigrants having relatively lower labor force participation rates and employment rates than earlier cohorts. However, regarding the rate of assimilation in the labor market, the more recent cohort tends to assimilate faster than the earlier cohort. It would be interesting for future researchers to examine the potential mechanism explaining the speed of assimilation in the labor market for more recent cohorts than the earlier cohort. Notwithstanding, our results indicate that the labor market outcomes for female immigrants tend to improve with time in the United States, especially for more recent cohorts. This result in the assimilation trend is encouraging, as it suggests that policies and programs aimed at promoting immigrant integration and employment opportunities may have a positive impact.

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Appendix A

Appendix: Chapter 1

A.1 Data

Column 1 - Year

Column 2 - Quarter

Column 3 - Real Personal Income (RPI), from FRED. Original source: U.S. Bureau of Economic Analysis.

Column 4 - Real GDP (GDPC1), from FRED. Original source: U.S. Bureau of Economic Analysis.

Column 5 - Nominal Personal Income (PINCOME), from FRED. Billions of dollars, seasonally adjusted annual rate. Quarterly average. Original source: U.S. Bureau of Economic Analysis.

Column 6 - Nominal GDP (GDP), from FRED. Billions of dollars, seasonally adjusted annual rate. Quarterly average. Original source: U.S. Bureau of Economic Analysis.

Column 7 - Personal Current Transfer Receipts (PCTR), from FRED. Billions of dollars, seasonally adjusted annual rate. Quarterly average. Original source: U.S. Bureau of Economic Analysis.

Column 8 - Personal current transfer receipts: Government social benefits to persons: Other (W827RC1), from FRED. Billions of dollars, seasonally adjusted annual rate. Quarterly

average. Original source: U.S. Bureau of Economic Analysis.

Column 9 - Federal Funds Effective Rate (FEDFUNDS), from FRED. Original source: Board of Governors of the Federal Reserve System (US).

Column 10 - Unemployment Rate (UNRATE), from FRED. Original source: U.S. Bureau of Labor Statistics.

Column 11 - NBER based Recession Indicators for the United States from the Peak through the Trough (USRECQM), from FRED. Source is listed as the Federal Reserve Bank of St. Louis.

Column 12 - Real-time Sahm Rule Recession Indicator (SAHMREALTIME), from FRED. Original source Claudia Sahm.

Column 13 - Inflation

Column 14 - ffr_wuxia

Column 15 - Consumer Price Index for All Urban Consumers: All Items in U.S. City Average (CPIAUCSL), from FRED. Original source: U.S. Bureau of Labor Statistics.

Column 16 - Personal Consumption Expenditures (PCE), from FRED. Original source: U.S. Bureau of Economic Analysis.

Column 17 - GDP Implicit Price Deflator in United States (USAGDPDEFQISMEI), from FRED. Original source: Organization for Economic Co-operation and Development.

Column 18 - Personal current transfer receipts: Government social benefits to persons: Unemployment insurance (W825RC1), from FRED. Original source: U.S. Bureau of Economic Analysis.

A.2 FEVD for PCTRUNIN payment shocks

FEVD of PCTRUN shocks

Full sample (1960:Q1-2021:Q3)

PCTRUN			
States	PI	GDP	PCTRUN
Forecast horizon of one-year ahead			
Linear	41.20	18.94	36.31
Recessionary	34.41	32.56	46.15
Expansionary	53.28	24.25	36.67
Forecast horizon of two-year ahead			
Linear	44.13	36.65	54.63
Recessionary	46.70	42.86	59.40
Expansionary	44.53	35.24	54.84
Forecast horizon of three-year ahead			
Linear	65.82	47.05	65.82
Recessionary	50.67	45.89	66.98
Expansionary	33.55	35.66	66.02

A.3 Robustness exercises - Some alternative models

This appendix shows the graphical results for each of the robustness exercises described earlier.

A.3.1 Threshold based on NBER recession dates

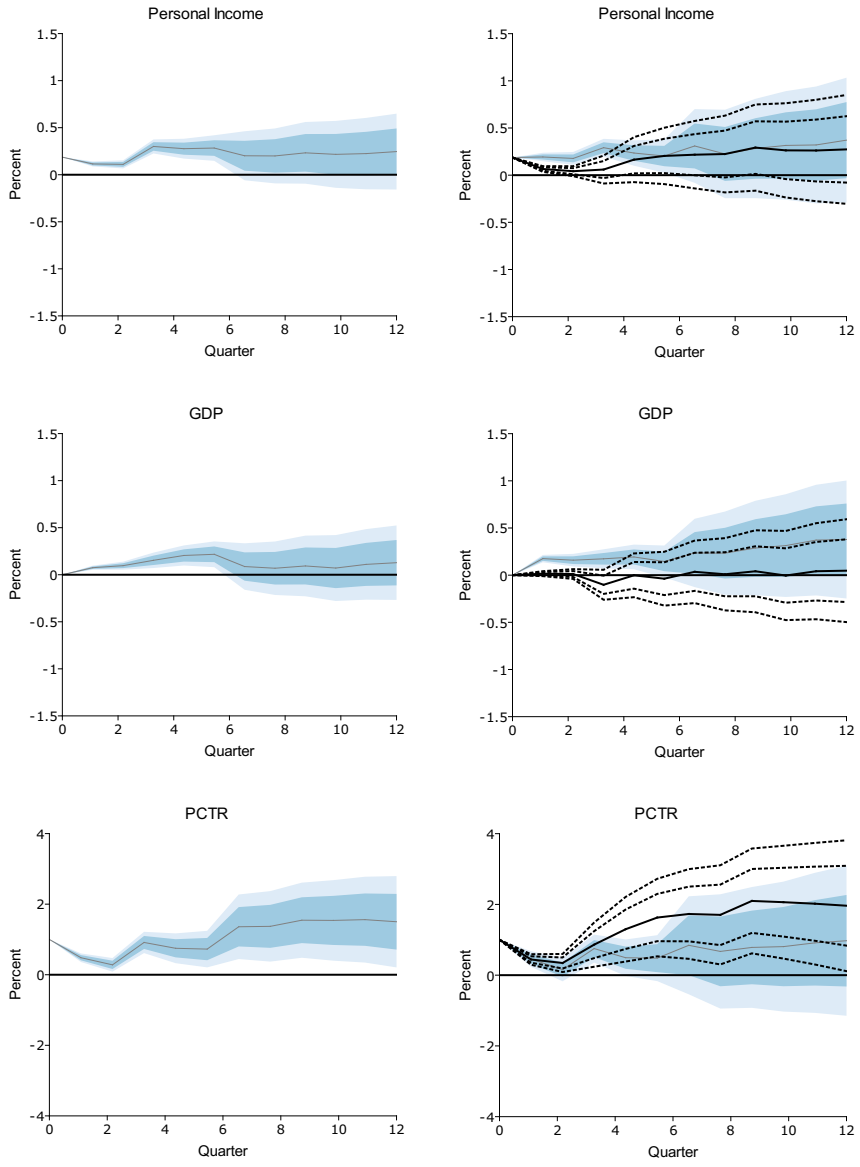

Figure A.1: Response function to PCTR impulse using NBER recession dates as a threshold indicator.

A.3.2 Transfer payments ordered first

A.3.3 Model with monetary policy

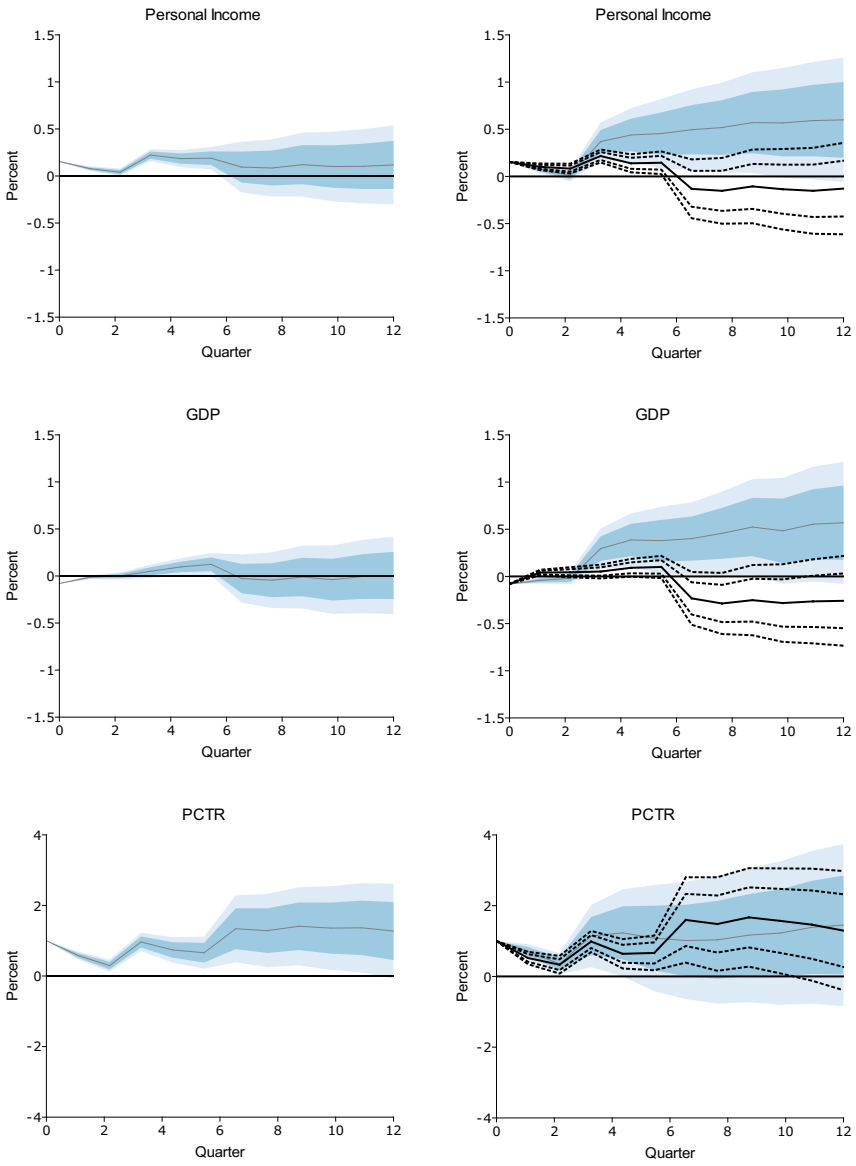

Figure A.2: Response function to PCTR impulse with PCTR ordering first, followed by GDP and personal income.

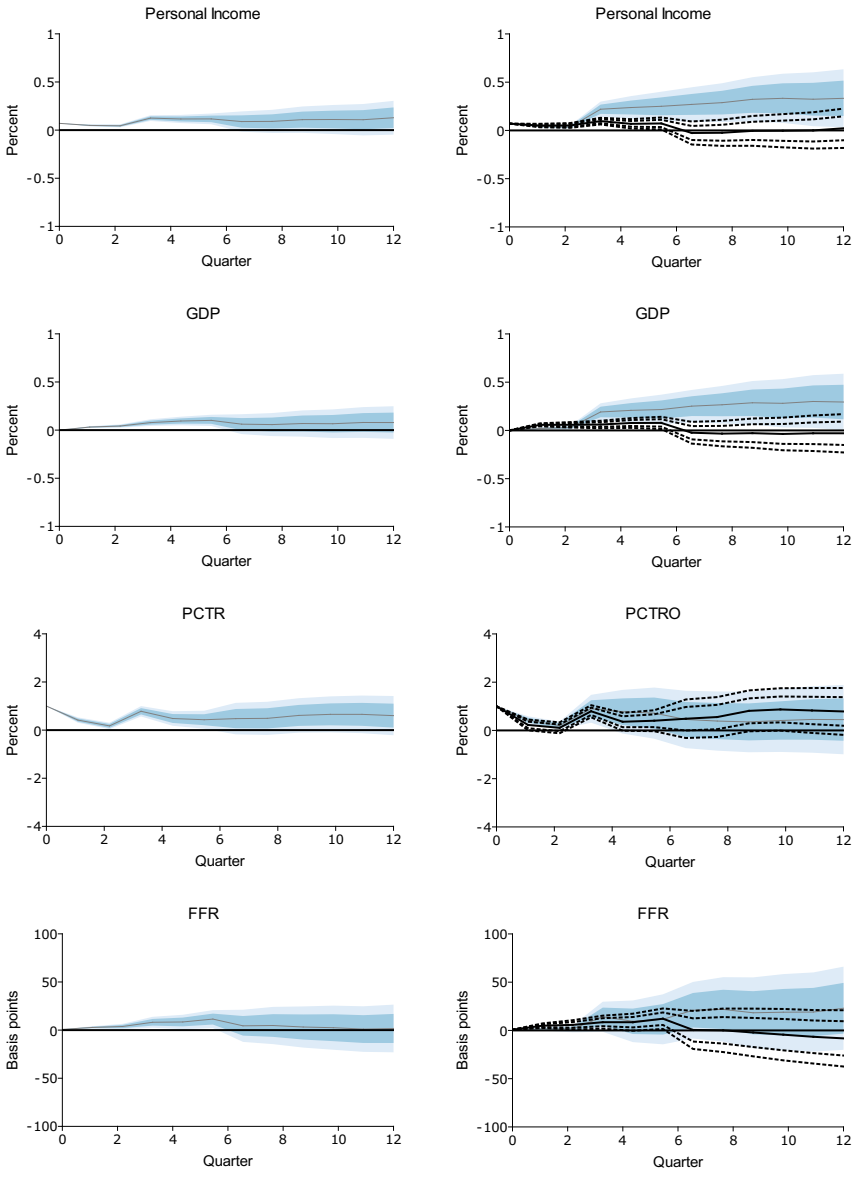

Figure A.3: Response function to PCTRO impulse in an extended VAR including the monetary policy variable.

Appendix B

Appendix: Chapter 2

B.1 List of countries in donor pool

This is the list of countries used in the donor pool:

- Total (29): Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, France, Greece, Hungary, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.