Foreign direct investment and economic development in recipient economies

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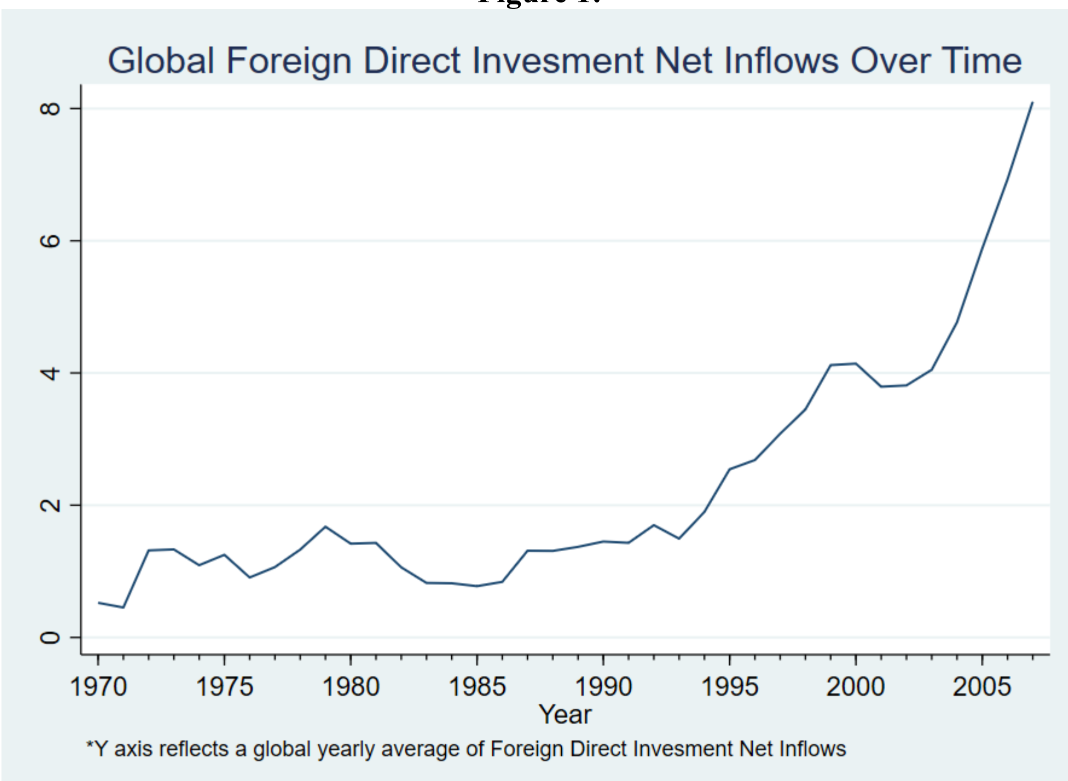
Abstract:

This paper explores the relationship between foreign direct investment (FDI) and economic development in recipient economies. Specifically, I look at GDP growth, GNI growth, total factor productivity, and gross capital formation as measures of economic development. I conduct a cross-country empirical analysis using a regression model with controls and fixed effects. To address the issue of endogeneity between FDI and the measures of economic development, I use identified US monetary "surprises" as an instrumental variable for FDI inflows. This instrumental variables regression approach illuminates a large, significant, positive effect of FDI inflows on all four measures of economic development. The effect of FDI inflows on development is shown to be heterogenous, with non-high-income recipient countries benefiting far more from FDI inflows compared to high-income recipient countries. This paper also uses a local projection approach to identify the extent to which FDI inflows affect economic development across multiple time horizons.

Introduction:

Foreign Direct Investment (FDI) describes an economic relationship in which an individual or entity of a country has "control or a significant degree of influence on the management of an enterprise" located in a *foreign* economy [1]. For instance, if an American automobile manufacturer, such as Ford, owned and operated a car factory in Mexico, this would constitute foreign direct investment. For any given country, FDI may flow inward (foreign investment into the country) or outward (domestic investment abroad). As shown in Figure 1, FDI saw massive growth in global prominence from 1970 to 2007.

Figure 1:

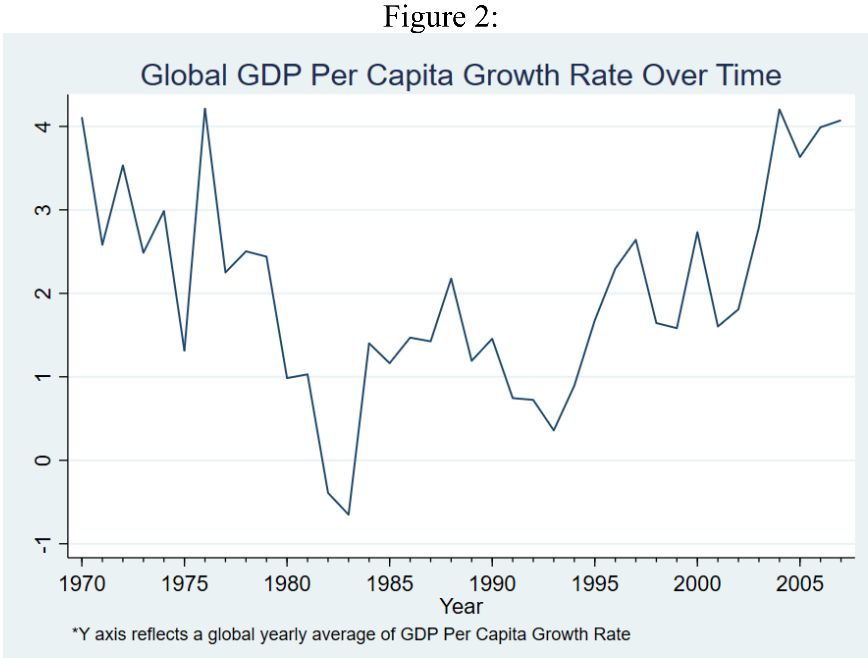


Notes: Data for figure 1 comes from [blank]. The data visualized reflect changes described in the *Data Adjustments* section.

[1] International Monetary Fund, International Financial Statistics and Balance of Payments databases, World Bank, International Debt Statistics, and World Bank and OECD GDP estimates.

Figure 1 depicts the global average of net FDI inflows in this time span. FDI inflows are considered here as a fraction of recipient country GDP to account for differences in recipient economy size. In 1970, the average country received FDI flows[2] amounting to 0.52% of their GDP. By 1990, this average had increased modestly to 1.45%. By 2007, however, the average country was receiving FDI flows constituting 8.11% of their GDP, a more than four-fold increase since 1990. This large increase corresponds to broader, worldwide trends towards globalization and financial integration. During the 1990s, many countries throughout the world (particularly the developing world) embraced free trade, privatization, deregulation, and liberalized financial markets[3]. The large increase in FDI flows can also be linked to improvements in global financial development and integration, and a period of relative macroeconomic stability in emerging market and developing countries[4].

Figure 2:



[2] From this point onward, "FDI inflows" can be assumed to mean net FDI inflows as a percentage of recipient country GDP.
[3] Spence (2021)
[4] Spence (2021)

When considering this unprecedented increase in FDI, a natural question arises: what is the *effect* of FDI inflows on recipient country development? A crude analysis involving a comparison of the global average of FDI inflows over time with the global average of real GDP per capita growth over time (Figure 2) suggests a possible positive correlation. Indeed, the 1990s through 2007, which was marked by immense growth in FDI flows, was also an era of relatively high per capita GDP growth.

The large increase in FDI flows was not random; rather, it reflected a belief amongst policy makers that by receiving FDI inflows, countries would experience certain growth-promoting spillovers, such as technology transfers, skill improvements, and exposure to international production networks. These positive spillovers would modernize and industrialize recipient economies, improving their productive capacity and growth potential. With these theoretical motivations in mind, this paper will make novel contributions to the existing empirical literature as to whether FDI has a positive effect on recipient country economic development.

Previous research has attempted to empirically evaluate the effect of FDI flows on recipient economies, with particular focus on the effect of FDI on real per capita GDP growth. The existing literature has generally painted the picture of a positive relationship. Work has also found that this positive relationship exists heterogeneously; specifically, it has been shown that sufficient human capital and financial development in the recipient country are necessary conditions for the positive spillover effects of FDI to occur and facilitate growth[5]. However, past literature has been limited in its ability to estimate the *causal* impact of FDI inflows on recipient economies. This is because FDI flows do not occur exogenously with respect to the conditions in

[5] Alfaro et. al (2004), Borensztein et. al (1998)

recipient countries, creating a challenging bi-directional causality problem that has not been compellingly addressed in previous studies. This issue is discussed more extensively in the *Literature Review* and *Conceptual Framework* sections.

This paper will contribute to the existing literature in several ways. Firstly, as dependent variables of interest, this paper will consider, in addition to real per capita GDP growth, real per capita GNI growth, gross capital formation, and total factor productivity. While GDP growth[6] is an important metric in evaluating economic success, these other three metrics collectively offer a more holistic view of a recipient economy's development. Specifically, as compared to GDP, GNI allows one to isolate the spending resources available to the domestic residents of the recipient economy. Gross capital formation allows one to identify economic development via the acquisition and expansion of fixed, tangible resources, which is strongly tied to a country's productive capacity. Finally, total factor productivity reveals how efficiently an economy is utilizing the available labor and capital inputs. Whereas seeing the effect of FDI inflows on GDP growth may reveal whether the overarching relationship of interest exists, it does not tell one about whether FDI is inducing growth via the theoretically implied, positive spill-over effects of interest, such as skill transfer, technology transfer, and the acquisition of new processes. In considering the effect of FDI inflows on total factor productivity and gross capital formation, one can empirically investigate these channels of growth promotion.

The true economic question of interest is a causal one; that is, what is the effect of *exogenous* changes in FDI inflows on recipient economies? Estimating a causal effect is difficult for a multitude of reasons. For one, there are many factors outside of FDI inflows that affect macroeconomic outcome variables like growth and productivity. For instance, countries

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[6] From this point on, "GDP growth" can be assumed to mean real per capita GDP growth. This assumption will also apply for "GNI growth".

experiencing an episode of hyperinflation may grow more slowly (in real terms), and the broad, institutional features of certain countries may make them more or less likely to grow while holding all else constant. To address this issue, I use a regression model with controls and fixed effects. As I am working with panel data, I also consider the high possibility that the errors of observations are correlated within country and year cohorts (i.e., there are unobservable factors affecting the growth rates of all observations associated with a given country/year). To address this, I implement clustered standard errors by country and year.

A second issue, which is more challenging, is the issue of endogeneity. FDI flows do *not* occur exogenously with respect to the conditions in recipient countries. As mentioned before, many countries have passed policies designed to attract more FDI. Additionally, changes in the relevant outcome variables *themselves* may affect the level of FDI a country receives. For instance, a country that experiences an uptick in productivity (unrelated to FDI inflows) may attract FDI inflows from international investors who now see FDI there as a more lucrative opportunity. To address this issue, this paper employs a novel instrumental variables identification strategy. I use a dataset from Silvia Miranda-Agrippino containing *identified* monthly US monetary policy shocks based on narrative accounts of FOMC meetings since 1970. The dataset is constructed as a continuation of that created by Romer and Romer (2004), containing variation in the Federal Funds Rate that is unexplained by intentional FED policy. As an instrument for FDI flows, I consider both the standard deviation and aggregation of monthly US monetary shocks in a given year. The intuition behind the instrument and its precise specification are explained more thoroughly in the *Empirical Methodology* section. By implementing this new IV specification, I arrive at a more unbiased estimate of the causal effect of FDI inflows on recipient economies as compared to previous literature.

Another conceptual issue related to the research question is the role of local conditions. Previous work suggests that the relationship FDI has with a recipient economy is dependent on conditions *within* the recipient country. Specifically, this research suggests that sufficient levels of financial development are necessary for recipient economies to absorb the positive externalities associated with FDI[7]. Other factors shown to relate to a country's absorptive capacity are human capital and strong governmental institutions[8]. In this paper, I find that the effect of FDI inflows is positive and statistically significant across the entire dataset, a departure from previous literature. However, I contribute to the notion of absorptive capacity by investigating the heterogenous effect of FDI inflows by recipient-country income level.

A final contribution pertains to the time period over which exogenous changes in FDI inflows affect recipient economies. Previous research has examined the capacity of FDI to affect a country *contemporaneously*. However, there is no reason to believe this relationship exists only contemporaneously. In fact, one may expect that the skill transfers, technology transfers, and other positive spillovers associated with FDI take a year or more to fully impact a recipient country's productive capacity and development. To investigate this, I conduct a local projection analysis in accordance with the framework outlined by Jorda et. al (2005).

Ultimately, the empirical results of this paper indicate that FDI indeed has a significant, positive effect on all the left-hand side variables of interest. The relationships are strongest when using the most robust regression specification, with all relevant controls, fixed effects, IV identification of FDI inflows, and clustering of standard errors by country and year. The positive effect of FDI flows on productivity and gross capital formation are particularly promising as they are indicative of two of the main channels via which FDI facilitates economic development and

[7] Alfaro et. al (2004)
[8] Borensztein et. al (1998)

growth. I additionally find that the growth inducing effect of FDI inflows is driven by non-high-income countries, which aligns with an argument proposed in the *Conceptual Framework* section. The local projection analysis indicates the capacity for FDI inflows to positively affect total factor productivity and gross capital formation up to three years after an exogenous FDI shock, though this same long run effect is not seen with GDP and GNI growth.

The main body of this paper will begin with a brief review of the literature. Then, I will discuss the conceptual background for the relationship between FDI inflows and the relevant outcome variables and discuss the outcome variables' ability to provide a comprehensive picture of an economy's development and productive capacity. I also discuss the underpinnings of US monetary shocks as an instrument for FDI flows, the anticipated heterogeneity by recipient-country income, and finally the motivation behind a local projection analysis. Then, I will discuss the dataset on which our empirical analysis is based. Finally, I discuss the adjustments made to the dataset, the empirical strategy, and the paper's empirical results. I will conclude with a discussion of this paper's implications for policy and future research.

Literature Review:

Borensztein et. al (1998) contribute the seminal empirical analysis on the growth promoting potential of FDI inflows in recipient economies. The paper lays the conceptual framework upon which my own paper builds, describing the technology and skill transfers (positive spillovers) generated by FDI inflows. The work provides evidence of the association between FDI inflows, growth, and gross capital formation. Borensztein et. al additionally describe the concept of a recipient economy's absorptive capacity, i.e. an economy's ability to reap the positive spillover effects of FDI. They find that sufficiently high human capital, as measured by average years of school, is a necessary condition for the positive spillover effects of

FDI. This finding motivates the inclusion of human capital as a control in my own paper. This paper has a few limitations, however. The paper does not (self admittedly) provide a compelling instrument for FDI inflows, opting to use an East Asian dummy and a lagged FDI inflow measure, which collectively do not adhere to the independence assumption of a valid IV [9]. The paper additionally uses some dated econometric techniques, namely not using fixed effects nor clustering standard errors by panel data cohort, techniques that are now widely used. With respect to this paper, my paper will contribute to the literature by introducing a novel IV for FDI inflows that better adheres to the necessary assumptions, and I will use modern econometric techniques for robust causal estimation with cross-country panel data.

Alfaro et. al (2004) expand upon the findings of Borensztein et. al. They first lay out a similar theoretical framework that is highly informative for my own paper. They describe technology transfer, introduction of new processes, managerial skill acquisition, domestic market know-how, international production networks, and introduction to new markets as positive spillovers that facilitate growth in countries that receive FDI. They additionally empirically identify financial development as a necessary local condition through which the positive spillovers of FDI transpire and drive recipient country growth. The control variables used in this paper are the ones used in my own paper. This paper, like Borensztein et. al (1998), has some limitations. It too fails to justify and employ a valid instrument for FDI inflows, opting to use recipient country real exchange rate, which is unlikely to meet the independence assumption of a valid instrument. The regressions also lack the fixed effects and clustered standard errors that have become commonly accepted for cross-country panel data analysis. A final issue, and one that applies equally to the previous paper, is that the relationship between FDI inflows and

[9] Here, and onwards, “IV” should be interpreted to mean instrumental variable.

growth is econometrically presumed to be strictly contemporaneous. As described in the *Conceptual Framework* section, this assumption is problematic. With respect to this paper, my paper will contribute to the literature by introducing a novel IV for FDI inflows, using updated econometric approaches, and by considering the effect of FDI inflows on growth with multi-year lags using a local projection estimation framework. Additionally, my paper will consider not only per capita GDP growth as the left-hand side variable of interest, but also GNI growth, gross capital formation, and total factor productivity. As explained in the *Conceptual Framework* section, considering these outcome variables will help to identify whether FDI inflows are affecting growth via the proposed mechanisms.

In their 2017 paper, Burns et. al conduct a cross-country, panel data, instrument variable – fixed effects regression analysis to evaluate the effect of FDI inflows on health in lower- and middle-income countries. This paper is very similar to my own in that it uses an instrumental variable to identify supply-side, exogenous FDI inflow shocks to estimate the causal impact of FDI on an outcome in recipient countries. Because of the methodological and conceptual similarities, the regression framework used is readily applicable to the analyses in my paper. Specifically, my regression analyses use country and year fixed effects, as well as standard error clustering by panel data group (country-year). Additionally, the metrics used in this paper to evaluate the strength and validity of their instrumental variable are the same metrics I use in my own paper, namely the Kleibergen-Paap F statistic, Kleibergen-Paap LM statistic, and the Hansen J statistic. My own paper will contribute to the literature by applying this cross country, instrumental variable – fixed effects regression framework with a novel instrument for FDI inflows.

As stated, my paper implements a novel instrument variable for FDI inflows using identified, US monetary shocks. The intuition that motivates using US Monetary shocks to instrument for international financial behavior is supported in the existing literature. Miranda-Agrippino and Rey (2020) demonstrate how the hegemonic nature of the US dollar results in US monetary shocks inducing strong movements in international financial behavior. For instance, US monetary contractions can reduce global capital flows and lending by global financial intermediaries. This paper suggests that contractionary monetary policy will have a dampening effect on FDI flows. My own paper will build upon these findings by also considering the standard deviation of monetary policy shocks as a signal for financial volatility, introducing a secondary dampening effect on FDI flows.

Another question highly relevant to the instrumentation of FDI inflows with US monetary shocks is the question of the time frame over which US monetary policy meaningful effects international investment behavior. The answer to this will inform the lag associated with the instrument for FDI inflows. Jorda et al (2023) provide evidence that US monetary shocks can affect real economic behavior and productivity for more than a decade in advanced economies. Since the capacity to invest internationally is deeply related to home economy conditions, this evidence provides justification for instrumenting FDI inflows with US monetary shocks with a multi-year lag. The precise specification of the instrument used in my paper will reflect the findings of Jorda et al (2023) and an optimization of the three metrics used to evaluate the strength and validity of a given instrument: the Kleibergen-Paap F statistic, Kleibergen-Paap LM statistic, and the Hansen J statistic.

In my own paper, a key contribution I make to the literature is estimating the effect of FDI inflows on recipient economies with multi-year lags. To do this, I employ a local projection estimation framework. This framework allows me to estimate the effect of exogenous FDI inflow shocks on recipient economies for the four left hand side variables of interest across various time horizons. This framework was established and rigorously evaluated in the seminal paper from Jorda (2005). This framework is explained more rigorously in the *Empirical Methodology* section.

Conceptual Framework:

The role of FDI

The theoretical underpinnings for FDI's growth inducing effect on recipient countries has been long established. As discussed by Borensztein et. al (1998), multinational firms that invest in other countries bring with them physical technology and industry know-how. FDI, thus, has the potential to make permanent additions to the physical, productive infrastructure in a country, and to generate improvements in productive efficiency within certain industries. Alfaro et. al (2004) expand upon this, adding that FDI brings with it skill transfers and an introduction of the recipient economy to new production networks and new markets. Particularly, domestic workers employed by the investing firm will increase their human capital relative to those not employed by the new firm, and the new firm will establish new linkages between the recipient economy and intermediate good producers and clients. So, in theory, FDI inflows have the capacity to make additions to the recipient country's physical commercial infrastructure, improve capital and labor efficiency, and establish new commercial linkages for the recipient economy. Thus, one expects these positive spillovers to result in enterprises that are more productive and general, localized economic stimulation, which in aggregate create a recipient economy that is more conducive to growth.

Two hypothetical cases provide examples of ways in which these spillovers may work on a firm level. Consider a hypothetical shoe factory located in Mexico (arbitrarily chosen). In one possible reality, the firm is owned and operated exclusively by Mexican investors, and in the other, an American entity holds significant, partial stock and influence in the enterprise. In the first reality, the technology, industry know-how, worker skills, and commercial linkages available to the firm are limited to what is currently available in Mexico. In the second reality, the investing American entity provides new technology that was not otherwise available, equips workers with new skills that were not already available, and establishes best practices for production efficiency in the Mexican shoe industry. One can see then, in this hypothetical example, how reality two allows the firm to be more productive.

A second, more straight forward example involves two possible realities in Mexico: one in which an American firm establishes a brand-new shoe factory, and one in which no such shoe factory exists. In this example, the existence of this new enterprise adds new physical infrastructure to the economy, provides domestic residents with jobs and skills, and ultimately produces goods that would not have otherwise been produced. Ultimately, the aggregation of many cases like this one, and that of the previous example, can create growth in countries receiving FDI.

Though GDP growth is a strong metric for an economy's performance, it is by no means infallible or comprehensive. A basic balance of payments framework reveals that:

GDP = consumer spending + investment + government spending + trade balance

In practice, and in the dataset used in this paper, GDP is calculated based on the total value of what is produced by all resident producers in an economy. However, GDP does not net out factor income payments from abroad. In an FDI relationship, income that is created by the enterprise that is sent back out of the recipient economy to the foreign investor is included in that year's GDP calculation. Gross national income (GNI) *does* account for this; GNI is equal to GDP plus income payments flowing from foreign countries *minus* income payments flowing out of the recipient economy to foreign countries. In this way, GNI (and thus GNI per capita growth) is a better indicator of the actual monetary resources available to the residents of an economy, and thus likely a better measure of the quality of life available to those residents.

With regards to FDI, I anticipate that the same positive spillover effects that create GDP growth will drive up GNI as well. I expect this to occur primarily via the income gained by domestic investors in partnership with foreign investors and the wages earned by those employed by the relevant enterprise. GNI may also increase from stimulatory interactions between the relevant enterprise and the domestic economy (e.g. third-party contractors hired by the enterprise). In theory, a discrepancy between the effect of FDI on GDP growth and the effect of FDI on GNI growth may indicate an extractive relationship, whereby the economic gains created by the FDI are captured almost entirely by the foreign investors, and not shared with the domestic residents.

Gross capital formation (defined more precisely in the **Data** section) describes the amount of physical or fixed capital that exists within an economy. Machinery and roads are examples of this "fixed capital". Foreign firms engaged in FDI directly promote new physical infrastructure in the recipient economy to maintain a productive environment for their investments. This includes things like the creation of a new warehouse to store production surpluses, and the creation of new roads to transport goods more efficiently. As stated, technology transfer, or more broadly, improvements to the physical productive capacity of an economy, is an essential positive spillover, or channel through which FDI inflows drive growth.

Thus, I expect FDI inflows to positively impact gross capital formation, and the existence of such a relationship would be indicative of FDI effecting growth via one of the aforementioned theoretical channels[10].

Total factor productivity (defined more precisely in the **Data** section) reflects how efficiently an economy is using the available resources, namely capital and labor, for production. As mentioned prior, FDI's capacity to improve capital and labor productivity are key positive spillovers that drive gains in GDP growth (in theory). Thus, I anticipate FDI inflows to positively impact total factor productivity, and the existence of such a relationship would be indicative of FDI effecting growth via one of the proposed theoretical channels.

Another issue pertinent to this paper's theoretical underpinnings relates to the time frame over which FDI inflows can affect a recipient economy. In response to an exogenous shift in FDI inflows, the proposed channels by which FDI causes growth (productivity, technology, etc.) may take time to develop. For instance, if a foreign firm makes an investment in year t, it may not be until year t+1 that the workers have been equipped with the new skills, or the factories equipped with the new technology, necessary to induce growth. I address how I deal with this theoretical consideration in the **Empirical Methodology** section.

Heterogeneity:

According to the proposed theoretical framework, FDI causes growth by exposing a recipient economy to positive spillovers (skills, technology, industry know-how) that would not have otherwise been present. Thus, if the gap between what was available (with regards to worker skills, industry know-how, and technology) to a recipient economy prior to foreign investment and after is larger, one would expect the positive spillovers, and thus gains in GDP

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[10] Note that gross capital formation will include government contributions to capital stock, not just private. This lack of precision is tolerated because of the lack of available data for private contributions to capital.

growth, to be larger. Therefore, I expect countries that have lower income relative to potential investors to experience higher growth gains from FDI compared to ones that are high-income and thus have less to gain in terms of new technology and skills. Overall, the relevant economic theory suggests that the growth inducing effect of FDI inflows may be driven primarily by recipient economies that are non-high income.

Data:

To empirically evaluate the relationships of interest, I use a cross-country, panel dataset spanning 172 countries from 1970 to 2007.

The independent variable of interest is net Foreign direct investment (FDI) inflows. This data comes from the International Monetary Fund's Balance of Payments database by way of the World Bank's World Development Indicators database. Foreign direct investment refers to "direct investment equity flows in the reporting economy" minus disinvestment. Direct investment is a subset of international investment in which a resident in one economy has significant control (10% or more ownership of standard voting stock) over an enterprise located in a foreign economy. This type of investment typically involves the establishment of permanent facilities, such as warehouses and factories. FDI may describe the creation of new, foreign-owned enterprises, joint ventures between foreign and domestic investors, and the purchasing of a previously domestic-owned enterprise by a foreign investor. This paper is concerned with the effect of foreign direct investment on *recipient* economies. So, I specifically use the measure of net FDI inflows (as opposed to outflows). I consider *net* inflows as I am primarily concerned with the transient dynamics of recipient economies, rather than the total amount of FDI in an economy at a given time. So, a value of X for net FDI inflows suggests that X dollars' worth of FDI flows entered a country (on net) in a given year.

Gross Domestic Product (GDP) in current US dollars, though not itself a control variable, was also collected for each country. This data comes from World Bank national accounts data, and OECD National Accounts data files. GDP is defined as the "sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products". The calculation does not include deductions for the depreciation of fabricated assets or natural resource degradation. To facilitate easy cross-country comparison, I collect GDP data in *current* US dollars for each country and year available. Though this variable is not used directly, I use it to generate the FDI/GDP variable (the main independent variable of interest), and I log a 3-year rolling average of this variable to account for economy size as a control variable in the analyses.

This paper has four dependent variables of interest: GDP per capita growth, GNI per capita growth, gross capital formation, and total factor production. GDP per capita is calculated as gross domestic product in constant local currency divided by midyear population. The data are given as a percentage to reflect the *real* change in GDP per capita from the previous year. This variable comes from the World Bank national accounts data, and OECD National Accounts data files. GNI per capita growth is calculated the same as GDP per capita growth except that the value for GNI factors out net receipts of primary income from abroad [11]. Gross capital formation is defined as the sum of additions to the fixed assets of an economy plus net changes in the level of inventories, divided by total GDP[12]. Here, fixed assets refer to things like the construction of schools, roads, and railways, as well as machinery and equipment purchases. Inventories are the stock of goods held by firms to "meet temporary or unexpected fluctuations in production or

[11] This means that GNI excludes income made by foreign investors that leaves the reporting economy and includes income that enters the reporting economy via payments from abroad.
[12] Since gross capital formation is given as a ratio in constant currency, it is *real* (not nominal) measure of an economy's infrastructure.

sales, and `work in progress'." This variable comes from World Bank national accounts data, and OECD National Accounts data files. Finally, total factor productivity is defined as the relative level of output divided by the relative level of inputs (labor and capital). It is worth noting that there is no natural interpretation of the TFP of a country, but rather only the relative value. In each year, the United States has a value of 1 for TFP, and values for other countries indicate a country's productivity relative to the US. This data comes from the Penn World Table by Feenstra et. al.

The control variables used in this paper are a log of current GDP, government consumption, population growth, inflation, trade openness, and average years of schooling. I have already described how the current GDP variable is defined and where the data comes from. I include a log of this variable in our cross-country regression analysis in accordance with previous literature to control for the size of the recipient economy[13]. Government consumption is defined as the sum of current government expenditures on goods and services (including employee compensation) as a percentage of GDP[14]. This variable includes most expenditures for national security but excludes any military spending that is part of government capital formation. This variable comes from World Bank national accounts data, and OECD National Accounts data files. To measure inflation, I use the growth rate of the GDP implicit deflator, which reflects the "rate of price change in the economy as a whole". "The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency". This variable comes from World Bank national accounts data, and OECD National Accounts data files. Trade openness is defined as the "sum of exports and imports of goods and services" divided by GDP[15]. This

[13] Note this is a log of a three-year running average of current GDP.
[14] As a ratio in common currency, this is a real measure of government consumption.
[15] See previous footnote.

variable also comes from the World Bank national accounts data, and OECD National Accounts data files. Population growth is measured simply as the “exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage”. The measure of population each year is calculated as the total number of residents regardless of legal status and citizenship. The data come from the following sources: (1) United Nations Population Division. World Population Prospects: 2022 Revision, (2) Census reports and other statistical publications from national statistical offices, (3) Eurostat: Demographic Statistics, (4) United Nations Statistical Division. Population and Vital Statistics Report (various years), (5) U.S. Census Bureau: International Database, and (6) Secretariat of the Pacific Community: Statistics and Demography Programme. Finally, to measure average years of schooling, I use the average years of total schooling for all residents within a country 15 years of age and above. This data comes from researchers Robert J. Barro and Jong-Wha Lee.

Finally, this paper utilizes US monetary shock data to instrument for FDI. The dataset from Silvia Miranda-Agrippino contains identified US monetary surprises in each month from 1969 through 2007. In each month, the value of the US monetary policy surprise (or shock) is defined as the changes in the Federal Funds Rate that are independent of the variation explained by the *intended* rate, which is based on economic forecasts and information available to FOMC policy makers. Thus, one can reasonably assume that the data contained in the Miranda-Agrippino dataset are fluctuations in monetary policy that are exogenous to conditions in potential recipient countries. This data comes from Miranda-Agrippino’s personal website.

Empirical Methodology:

Data Adjustments:

This section describes various adjustments made to deal with potentially problematic aspects of the raw dataset, such as the presence of outliers.

FDI inflows vary strongly in absolute terms because of differences in recipient economy size. So, rather than using net FDI inflows directly, I use the ratio of Net FDI flows to GDP, as done in previous work (Alfaro et. al, 2004). I make a slight adjustment of this specification by using a 3-year running average for GDP rather than the raw values as the denominator[16]. I do this to ensure that the FDI/GDP[17] variable provides a good measure of FDI flows relative to economy size without being (as) vulnerable to year-to-year fluctuations in GDP, which are highly correlated with GDP growth. An additional adjustment I make relative to previous literature is a winsorization process to deal with the presence of outliers. Prior to winsorization, the FDI/GDP variable takes on a maximum value of 1203.87 (Liechtenstein in 2006), meaning that net FDI inflows were 1203.87% of GDP in 2015 in Liechtenstein. Similarly, Luxembourg in 2007 had the minimum value with -67.37. The standard deviation of FDI/GDP prior to winsorization was 27.11. To prevent outlier values from affecting results too strongly, I winsorize the FDI/GDP variable at the 0.01 and .99 percentiles. So, values for the variable greater than or equal to the 99th percentile are assigned the 99th percentile value, and values for the variable less than or equal to the 1st percentile are assigned the 1st percentile value.

On the first two dependent variables of interest, GDP per capita growth and GNI per capita growth, I employ a similar winsorization process at the 1st and 99th percentiles. By

[16] 3 year rolling average = (GDPt + GDPt-1 + GDPt-2) / 3

[17] FDI/GDP, hence forth, is synonymous with “FDI inflows”, each indicating net FDI inflows as a ratio of a three-year rolling average of recipient country GDP.

comparison, total factor production and gross capital formation do not contain extreme outliers (values roughly bounded by the absolute value of 2 and by 100 respectively), so I do not winsorize these variables.

While I use current GDP to derive the FDI/GDP variable, I also control for it in the regression analysis. To deal with the issue of outliers, I winsorize the variable at the 1st and 99th percentile. I also consider a 3-year rolling average of GDP to reduce the correlation between this value and the GDP growth rate (a left-hand side variable). I additionally take the natural log of this 3-year rolling average for the regression analysis in accordance with previous literature[18]. I winsorize population growth at the 1st and 99th percentile to deal with the presence of outliers. As inflation and trade openness have respectively more outliers than the control variables discussed thus far, I winsorize these variables at the 5th and 95 percentiles. By comparison, the government consumption variable does not suffer from extreme outliers, and thus I do not winsorize the variable. For the same reason, I do not winsorize the average years of schooling variable. However, in accordance with previous literature[19], I take the natural log of this variable for the regression analysis.

Empirical Challenges and Strategy:

In exploring the relationship between FDI inflows and the four dependent variables of interest, a logical place to begin is with a basic OLS regression to see if a correlation exists between FDI and each of the variables.

$$y_{it+1} = \beta_0^1 + \beta_1^1 \left(\frac{FDI}{GDP}\right)_{it} + \mu_{it}^1 \qquad (1)$$

[18] Alfaro et. al (2004)
[19] Alfaro et. al (2004)

Under this specification (equation (1)), the dependent variable (GDP per capita growth, total factor productivity, etc.), in country *i* in year *t+1* is represented by $y_{it+1.}$ FDI/GDP_{it} represents net FDI inflows as a percentage of (3-year rolling average) recipient country GDP. Equation (1) suggests that y_{it+1} is a function of FDI/GDP_{it} as well as an error term, $\mu_{it.}$ Equation (1) is simple and provides a quick glimpse into the correlation between FDI inflows and the respective dependent variables.

I intentionally consider this regression specification (and all the ones that follow) with a 1-year lead on the dependent variable. As explained in the *Conceptual Framework* section, there are various mechanisms through which I anticipate positive spillover effects of FDI inflows for recipient economies, which should theoretically take time to fully develop. For instance, if one considers an increase in investment in year *t* corresponding to the construction of a new factory, it is unlikely that the factory is done being built and already contributing to the recipient country's growth within the same year. Including this lag on the left-hand side variable also helps deal with endogeneity between the left-hand side variable and FDI inflows. As an example, consider GDP growth as the left-hand side variable. Each year, FDI flows into a country *throughout* the year, and similarly, the economy grows (or shrinks) *throughout* the year based on different factors. Since I am interested in growth which results as a *response* to FDI inflows, I look only at the growth that *succeeds* changes in investment. This slight adjustment will make the estimated relationship between FDI inflows and the left-hand side variables less subject to omitted variable bias and bi-directional causality.

Despite the described adjustment, equation (1) still certainly suffers from omitted variable bias. Under this specification, the error term μ_{it} includes all the other factors that affect a country's GDP growth rate (or other dependent variable) within a given year. It is plausible, and in fact likely, that these non-specified factors correlate both with the dependent variable and the independent variable, FDI inflows. For instance, country *i* 's per capita GDP growth rate in year *t+1* is likely a function of not just FDI/GDP, but also the quality of country *i*'s institutions. If country *i*'s institutions are then *also* correlated with net FDI inflows, this would introduce bias to the regression model.

A simple improvement can be made by introducing country and year fixed effects. Due to cross-country differences, there are time-invariant qualities within each country group that can affect dependent variable values for each observation in that group. Similarly, there are likely country-invariant factors within each year-cohort that can affect dependent variable values for each observation. Finally, by not clustering our standard errors, I have assumed that the error terms within the country and year cohorts are not correlated with each other. In other words, there are not factors within the error term for country A in year t that are correlated with factors in the error term for country B in year t. This assumption is unreasonable, as it is highly like for correlation to exist across observations of the same country and observations in the same year. For example, a large-scale war in year *t* may impact the GDP growth of all countries in year *t*.

The second regression specification considers these fixed effects and clusters standard errors by country and year.

$$(2) \qquad y_{it+1} = \beta_0^2 + \beta_1^2 \left(\frac{FDI}{GDP}\right)_{it} + \boldsymbol{\delta}^2 \boldsymbol{X_i} + \boldsymbol{\theta}^2 \boldsymbol{Y_t} + \mu_{it}^2$$

In equation (2), $\boldsymbol{X_i}$ represents a vector with dummy variables for each country (value of *i*th entry equal to 1, all others equal to 0) and $\boldsymbol{\delta}^2$ are the coefficients associated with these country fixed effects [20]. Similarly, $\boldsymbol{Y_t}$ represents a vector of the dummy variables for each year (value of *t*th entry equal to 1, all others equal to 0) and $\boldsymbol{\theta^2}$ are the coefficients associated with these time dummy variables. Using this specification, I also cluster the standard errors on the country and time dimension.

Equation (3) is the same as equation (2) except that it includes control variables that reflect certain country-year combinations. The controls I use are the natural log of current GDP, population growth, government consumption, inflation, trade openness, and the natural log of the average years of schooling. These control variables have been chosen in accordance with the existing literature[21].

$$(3) \qquad y_{it+1} = \beta_0^3 + \beta_1^3 \left(\frac{FDI}{GDP}\right)_{it} + \boldsymbol{\sigma^3 C_{it}} + \boldsymbol{\delta^3 X_i} + \boldsymbol{\theta^3 Y_t} + \mu_{it}^3$$

In equation (3), $\boldsymbol{C_{it}}$ represents a vector of the control variables associated with the ith country in year *t*. $\boldsymbol{\sigma^3}$ is a vector of the coefficients corresponding to each of these control variables[22].

Equations (1) through (3) do not address the issue of endogeneity. As discussed, FDI does not flow into recipient countries randomly. Rather, there may be certain conditions within a country that attract (or repel) FDI inflows, such as a new economic policy. Now, this new economic policy may affect growth (or other left hand side variable) via a non-FDI channel, thus obscuring the actual causal effect of FDI inflows on growth when using a basic OLS model. A

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[20] Note that the subscript "2" indicates that $\boldsymbol{\delta^2}$ are the country dummy coefficients for the second equation. These are not squared values. This is true as well for $\boldsymbol{\theta^2}$, and for subsequent equations.
[21] Alfaro et al (2004)
[22] Types of coefficients, such as the coefficient associated with the *(FDI/GDP)* variable are given a superscript to signify what equation they correspond to.

valid instrument variable for FDI inflows solves this issue by isolating changes in FDI inflows that are *exogenous* to the conditions within recipient countries, allowing one to estimate an unbiased *causal* effect of changes in FDI inflows. There are two primary assumptions that must be fulfilled for an instrument to be valid:

1. Relevance: The proposed instrument must be relevant, i.e. it must be correlated with the endogenous explanatory variable (FDI inflows).
2. Independence: The proposed instrument cannot directly affect the dependent variable, nor can it be correlated with other variables in the error term of the regression of interest, i.e. cannot be correlated with variables not controlled for that affect the dependent variable.

The following equations represent the first and second stage for the proposed instrument variable.

1st stage:

$$(4) \qquad (FDI/GDP)_{it} = \pi_0^4 + \pi_1^4 ma_{t-3} + \pi_2^4 msd_{t-3} + \pi_3^4 (msd)^2{}_{t-3} + \mu_{it}^4$$

In equation (4), the "first stage", ma_{t-3} represents the aggregation of monthly US monetary shocks in year *t-3,* msd_{t-3} represents the standard deviation of monthly US monetary shocks in year *t-3*, and $(msd)^2{}_{t-3}$ respresents the squared value of the standard deviation of monthly US monetary shocks in year *t-3*.

2nd stage:

$$(5) \qquad y_{it+1} = \beta_0^5 + \beta_1^5 (\widehat{\frac{FDI}{GDP}})_{it} + \mu_{it}^5$$

$$(6) \qquad y_{it+1} = \beta_0^6 + \beta_1^6 (\widehat{\frac{FDI}{GDP}})_{it} + \boldsymbol{\delta^6 X_i} + \mu_{it}^6$$

$$(7) \qquad y_{it+1} = \beta_0^7 + \beta_1^7 (\widehat{\frac{FDI}{GDP}})_{it} + \boldsymbol{\sigma^7 C_{it}} + \boldsymbol{\delta^7 X_i} + \mu_{it}^7$$

Equations (5), (6), and (7) are nearly identical to equations (1), (2), and (3) respectively except that rather than using $\left(\frac{FDI}{GDP}\right)_{it}$ directly as the explanatory variable, I use $(\widehat{\frac{FDI}{GDP}})_{it}$ which represent the fitted values for $\left(\frac{FDI}{GDP}\right)$ obtained by regressing net FDI inflows (endogenous regressor) on the US monetary shocks (exogenous instrument)[23]. Additionally, equations (5), (6), and (7) notably leave out the time fixed effects. This is done because the instrument varies only on the time dimension, and thus would be perfectly collinear with time fixed effects. These regression specifications do still include the relevant controls, country fixed effects, and I cluster standard errors by country and year.

The instrument for net FDI inflows includes two variables generated with the Miranda-Agrippino US monetary shock dataset. One is the standard deviation of the monthly US monetary shocks within a given year. Intuitively, I expect this to signal the volatility of US monetary policy, and thus the value of the dollar. Given the US dollar's dominant role in international financial transactions, US dollar volatility can greatly impact the perception of risk felt by international investors. Thus, I expect msd_{t-3} to be negatively correlated with net FDI inflows. I additionally include a quadratic term of the standard deviation of US monetary policy to account for potential non-linearity in the relationship between US monetary policy volatility and FDI inflows, and because inclusion proved to create a stronger instrument for FDI. The other variable used is simply the aggregation of the monthly monetary shocks within a year. Theoretically speaking, a large positive value in ma_{t-3} indicates random, contractionary movement in US monetary policy. This contractionary shock will appreciate the value of the US

[23] Here, and continually throughout the paper, I refer to the "instrument" as a singular value. This is done for simplicity, as in actuality, there are three instruments used for FDI inflows, as shown in equation (4).

dollar relative to other currencies. The increased value of the US dollar may increase borrowing costs, so I expect a negative correlation between ma_{t-3} and FDI inflows[24].

I use a 3-year lag on each component of the instrument for FDI for two main reasons. Past empirical literature suggests that the effect of monetary shocks on real behavior can last for up to 10 years[25]. So, there is high reason to assume a strong relationship will exist with a three-year lag. Additionally, the further the monetary shocks are lagged from the FDI inflows variable the less likely they are to be correlated with non-foreign investment drivers of GDP growth (or other left hand side variables).

This instrument for FDI inflows is indeed relevant, as shown by the various statistical tests in the *Empirical Results* section. Though the results also suggest that our instrument adheres to the independence assumption, it is important to understand the limitations of our instrument. Since it is impossible to control for everything that effects a country's growth rate, and since it is possible that US monetary policy can affect growth outside of investment behavior (and the established controls), it is not out of the question that this instrument does not meet the independence assumption. However, our instrument is certainly an improvement on what has been used in previous work, and the causal estimates derived in this paper are likely less biased.

In order analyze the extent to which the effect of FDI inflows on the relevant left hand side variables exists with a lag, I use a local project estimation technique, as outlined by Jorda (2005).

$$y_{it+1} = \beta_0^8 + \beta_1^8 (\widehat{\frac{FDI}{GDP}})_{it} + \boldsymbol{\sigma^8} \boldsymbol{C_{it}} + \boldsymbol{\delta^8 X_i} + \mu_{it}^8 \quad (8)$$

$$y_{it+2} = \beta_0^9 + \beta_1^9 (\widehat{\frac{FDI}{GDP}})_{it} + \rho_2^9 \hat{\mu}_{h-1} + \boldsymbol{\sigma^9} \boldsymbol{C_{it}} + \boldsymbol{\delta^9 X_i} + \mu_{it}^9 \quad (9)$$

[24] Miranda-Agrippino and Rey (2020)
[25] Jorda et. al (2023)

$$(10) \qquad y_{it+3} = \beta_0^{10} + \beta_1^{10}(\frac{\widehat{FDI}}{GDP})_{it} + \rho_2^{10}\hat{\mu}_{h-1} + \boldsymbol{\sigma^{10}}\boldsymbol{C_{it}} + \boldsymbol{\delta^{10}}\boldsymbol{X_i} + \mu_{it}^{10}$$

$$(11) \qquad y_{it+4} = \beta_0^{11} + \beta_1^{11}(\frac{\widehat{FDI}}{GDP})_{it} + \rho_2^{11}\hat{\mu}_{h-1} + \boldsymbol{\sigma^{11}}\boldsymbol{C_{it}} + \boldsymbol{\delta^{11}}\boldsymbol{X_i} + \mu_{it}^{11}$$

Regressions (8) through (11) are nearly identical to equation (7), except that equations (9) through (11) consider the left-hand side variable with progressively longer leads. Additionally, I include as a regressor $\hat{\mu}_{h-1}$ which represents the residual from the local projection estimation of the previous time horizon[26]. This is done in accordance with the optimal framework laid out by Jorda (2005) to achieve estimators with improved efficiency. In doing this, I estimate the effect of exogenous changes in FDI inflows on the relevant left hand side variables over a period of up to four years.

The *Conceptual Framework* section suggests that those countries that are non-high income have more to gain with respect to the positive spillovers brought with FDI inflows. Thus, I expect the positive effect of FDI inflows on GDP growth to be larger for non-high-income countries. To evaluate this empirically, I require no additional equations. Rather, I simply split the observations into a high-income cohort and a non-high-income cohort. Then, I run the regression specification associated with equation (7), the most robust IV specification, to estimate the causal impact of FDI inflows on GDP growth in each cohort. In the interest of not overwhelming the leader, for this heterogeneity analysis I only consider per capita GDP growth as the left-hand side variable.

A final area relevant to this paper's empirical methodology is the issue of data availability. First and foremost, I only consider observations corresponding to the country-year combinations for which data is available for the US monetary shocks, FDI inflows, and each

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[26] Note that we cannot include this for equation 8 as this is the first time horizon for which local projection estimation is computed. The value of h corresponds to the value of the lead on the left-hand side variable.

control variable. This narrows down the dataset to 172 countries from 1970 to 2007[27]. Next, for each left-hand side variable of interest, I further restrict the dataset to include only those original observations that are also non-missing for that left hand side variable. This means that the regression results and analysis associated with different left hand side variables involve different datasets. However, all analyses pertaining to the *same* left hand side variable can be readily compared as they involve the use of the exact same dataset.

Empirical Results:

Descriptive Statistics:

Panel A provides descriptive statistics and data availability for each variable in the dataset.

Panel A: Descriptive Statistics

Variable	Num. Countries	Country Year Pairs	Start Year	End Year	Mean	Std. Dev.	Median	Max	Min
Total Factor Production	115	3326	1970	2007	.72	.27	.73	1.9	.12
Gross Capital Formation	170	4463	1970	2007	23.32	8.4	22.66	89.38	-13.41
GNI Growth	139	2780	1970	2007	2.12	5.03	2.3	16.23	-14.69
GDP Growth	172	4561	1970	2007	2.06	4.93	2.27	16.28	-15.22
FDI	172	4561	1970	2007	2.66	4.8	1.1	40.9	-5.38
Mon. Pol. Shock (Std. Dev.)	172	4561	1970	2007	.2	.2	.14	1.33	.04
Mon. Pol. Shock (aggregate)	172	4561	1970	2007	.03	.95	.24	1.9	-2.29
Avg. Yrs. School (log)	172	4561	1970	2007	1.69	.64	1.87	2.55	-1.24
Trade Openness	172	4561	1970	2007	70.99	36.99	61.49	161.89	25.36
Inflation	172	4561	1970	2007	11.17	12.25	7.18	44.89	-1.65
Population Growth	172	4561	1970	2007	1.79	1.29	1.9	6.43	-1.6
Gov. Consumption	172	4561	1970	2007	15.72	6.97	15.11	105.19	0
Current GDP (3 year avg.)	172	4561	1970	2007	23.35	2.27	23.08	30.33	17.31

The data contained in this panel reflect the data adjustments described in the *Data Adjustments* section (such as winsorization). Across the entire dataset, including missing values, I have data for 172 countries from the year 1970 to 2007. This panel data is not completely balanced however, as I only have 4,561 country-year pairs [28]. One can see that there is significantly less data available for GNI growth and total factor productivity as compared to GDP growth and

27 Note that this panel dataset is not balanced, as I only have 4561 country-year pairs.
28 If dataset was balanced, I would have 6,364 pairs.

gross capital formation. It is important to keep these differences between datasets in mind for the following analyses, as limited data can affect the statistical strength of results.

Panel A provides information on the standard deviation for FDI inflows and the left-hand side variables of interest across the entire dataset. However, one may also be interested in the average variation of these variables *within* countries over time. This information will allow one to better interpret the economic significance of coefficients in the analyses that follow. Panel B provides this information for FDI inflows, per capita GDP growth, per capita GNI growth, total factor productivity, and gross capital formation.

Panel B: Average within-country standard deviation

Variable	Within-country avg. SD
Gross capital formation	5.41
Total Factor Production	.11
GNI Growth	3.98
GDP Growth	4.22
FDI Inflows	2.94

OLS Regressions

Tables 1 through 4 provide the empirical results for the simple OLS regressions for each left-hand side variable of interest. In each table, columns 1, 2, and 3 respectively correspond to equations (1), (2), and (3).

Table 1: OLS Regressions

	(1) GDP Growth	(2) GDP Growth	(3) GDP Growth
FDI/GDP	0.200***	0.112**	0.0972**
	(11.52)	(2.73)	(2.85)
Current GDP (3 yr. avg.)			-1.157*
			(-2.38)
Government Consumption			-0.117***
			(-3.77)
Population Growth			-0.479*
			(-2.34)
Inflation			-0.0353*
			(-2.45)
Trade Openess			0.0241**
			(2.82)
Avg. Yrs. School (log)			-0.775
			(-1.44)
Constant	1.558***	1.773***	31.52**
	(18.36)	(18.90)	(2.74)
Time FE	No	Yes	Yes
Country FE	No	Yes	Yes
Obs.	4361	4359	4359

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1 provides empirical results considering GDP per capita growth as the left-hand side variable of interest. For each specification, the coefficient on the FDI inflows variable remains positive and statistically significant at a 0.01 level or higher. The most basic specification (equation 1) suggests that a one percentage point increase in relative net FDI inflows as a percent of GDP in year t corresponds to a 0.2 percentage point increase in real GDP per capita growth in year t+1. Once I include the relevant controls, country and year fixed effects, and cluster the standard errors by year and country, the coefficient shrinks to ~0.1 (equation 3). Considering Panel B, these results suggest that for an average country, a one standard deviation increase in FDI inflows (2.94) in year t corresponds to a 0.29 percentage point increase in per capita GDP growth in year t+1. This increase in GDP growth constitutes only a 0.07 standard deviation increase. Thus, although these results suggest a statistically significant positive impact of FDI inflows on GDP growth, the coefficient is small in terms of economic significance.

Table 2: OLS Regressions

	(1) GNI Growth	(2) GNI Growth	(3) GNI Growth
FDI/GDP	0.179***	0.0842	0.0581
	(7.03)	(.)	(1.37)
Current GDP (3 yr. avg.)			-1.201*
			(-2.21)
Government Consumption			-0.142**
			(-3.45)
Population Growth			-0.767**
			(-3.06)
Inflation			-0.0217
			(-1.15)
Trade Openess			0.0346*
			(2.62)
Avg. Yrs. School (log)			-1.402
			(-1.73)
Constant	1.651***	1.902	34.42**
	(14.32)	(.)	(2.72)
Time FE	No	Yes	Yes
Country FE	No	Yes	Yes
Obs.	2626	2625	2625

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2 provides empirical results considering GNI per capita growth as the left-hand side variable of interest. Here, FDI inflows have a statistically significant correlation with GNI growth *only* in the most basic specification (equation 1). This specification (column 1) suggests that a one percentage point increase in FDI inflows in year t corresponds to a 0.18 percentage point increase in GNI per capita growth in year t+1. When including the relevant controls, fixed effects, and clustering of standard errors, the coefficient on FDI inflows fails to be statistically significant (column 3, equation 3). Like table 1, these results also suggest that the coefficient on relative FDI, while positive, is small relative to the average variation in FDI inflows and GNI growth countries experience year to year[29].

[29] For this, observe the standard deviation for these variables within countries, see Panel B.

Table 3: OLS Regressions

	(1) Gross Cap. Form.	(2) Gross Cap. Form.	(3) Gross Cap. Form.
FDI/GDP	0.365***	0.279	0.237***
	(10.39)	(.)	(3.62)
Current GDP (3 yr. avg.)			-0.102
			(-0.28)
Government Consumption			-0.115*
			(-2.12)
Population Growth			0.596*
			(2.34)
Inflation			-0.0299
			(-1.32)
Trade Openess			0.0751***
			(3.83)
Avg. Yrs. School (log)			1.796
			(0.94)
Constant	22.37***	22.58	17.81
	(149.48)	(.)	(1.77)
Time FE	No	Yes	Yes
Country FE	No	Yes	Yes
Obs.	4265	4263	4263

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 provides empirical results considering gross capital formation (GCF) as the left-hand side variable. Here, FDI inflows have a statistically significant positive correlation with GCF in the most basic and most robust OLS specification (equation 1 and equation 3). The most robust specification (column 3) suggests that a one percentage point increase in relative FDI inflows in year t corresponds to a 0.24 percentage point increase in GCF as a percent of GDP in year t+1. This result suggests a one standard deviation increase in FDI inflows (2.94) corresponds to a ~0.7 percentage point increase in gross capital formation as a fraction of

GDP. This increase corresponds to a ~0.13 standard deviation increases in GCF. This is the strongest relationship found thus far, but relative to the average year-to-year variation in GCF, the effect is still economically small[30].

[30] Standard deviation of GCF is 5.41, so 0.7 percentage point increase is small, see Panel B.

Table 4: OLS Regressions

	(1) TFP	(2) TFP	(3) TFP
FDI/GDP	0.00381**	0.00410*	0.00243
	(3.24)	(2.30)	(1.76)
Current GDP (3 yr. avg.)			0.0473*
			(2.47)
Government Consumption			0.00139
			(0.81)
Population Growth			0.0151
			(1.47)
Inflation			0.000105
			(0.20)
Trade Openess			0.000336
			(0.63)
Avg. Yrs. School (log)			-0.260***
			(-3.61)
Constant	0.715***	0.714***	-0.0335
	(128.53)	(174.73)	(-0.07)
Time FE	No	Yes	Yes
Country FE	No	Yes	Yes
Obs.	3203	3202	3202

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 provides the final OLS regression analysis, considering total factor productivity (TFP) as the left-hand side variable. Across all three regression specifications, there is a statistically significant positive correlation between relative FDI inflows and TFP with a significance level of 0.1 or higher. The most robust specification (equation 3, column 3) suggests that a one percentage point increase in FDI inflows in year t corresponds to a 0.002 increase in TFP in year t+1. This coefficient indicates that a one standard deviation increase in FDI inflows in year t corresponds to a 0.007 increase in TFP in year t+1. This increase corresponds to a 0.065 standard deviation increase in TFP. This result is broadly like what is seen with each of the other left hand side variables; though FDI inflows are positively correlated with TFP, the relationship is small relative to what can be expected from year-to-year fluctuations in a country's total factor productivity.

The previous tables collectively provide *correlational* evidence, implying a potential, growth-promoting effect of FDI inflows. Specifically, the third columns of tables 1, 3, and 4, collectively suggest that FDI may be promoting growth via the proposed channels of technology transfer and improved labor and capital efficiency. However, the analyses have also suggested that while statistically significant, the correlation between FDI inflows and the left-hand side variables is small. Secondly, these analyses are limited due to their ignorance of the endogeneity problem. Since these regressions do not use an identification strategy for FDI inflows, I am limited in my ability to interpret any of the observed relationships as causal.

Tables 5-8 address the issue of endogeneity. By employing the instrumental variables regression specifications laid out in equations 5, 6, and 7, the following analyses allow one to estimate the causal impact of *exogenous* FDI inflow shocks more precisely on each left-hand side variable. For each table, columns 1, 2 and 3 respectively represent regression equations 5, 6, and 7.

Instrumental Variables Regressions

Table 5: Instrumental Variable Regressions

	(1) GDP Growth	(2) GDP Growth	(3) GDP Growth
FDI/GDP	0.453***	0.430	0.696*
	(4.42)	(1.84)	(2.50)
Current GDP (3 yr. avg.)			-2.292***
			(-4.17)
Government Consumption			-0.0761**
			(-2.76)
Population Growth			-0.738***
			(-3.80)
Inflation			-0.0190
			(-1.38)
Trade Openess			0.00255
			(0.16)
Avg. Yrs. School (log)			2.028**
			(2.77)
Constant	0.876**		
	(3.18)		
Time FE	No	No	No
Country FE	No	Yes	Yes
Kleibergen-Paap rk Wald F statistic	75.99	11.33	34.91
Hansen J stat p-value	0.01000	0.0800	0.650
Kleibergen-Paap LM test p-value	0	0.120	0.0500
Observations	3845	3843	3843

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 provides empirical results considering GDP per capita growth as the left-hand side variable. As shown in equation (4), FDI inflows are instrumented using US monetary shock data. Column 3 provides the results of the most robust IV specification (equation 7) using the relevant control variables, country fixed effects, and a clustering of the standard errors by country and time[31]. The coefficient on FDI inflows in column 3 is statistically significantly

[31] Note that time fixed effects would be perfectly collinear with the IV (which only varies on the time dimension), and thus they are not used for the IV regressions (equations 5-7)

positive at a 0.05 significance level. The result suggests that a one percentage point increase in FDI inflows as a percentage of GDP in year t *causes* a 0.7 percentage point increase in real per capita GDP growth in year t+1. This result indicates that a one standard deviation increase in FDI inflows (2.94) in year t causes a 2.05 percentage point increase in GDP growth in year t+1. This increase of 2.05 constitutes a ~0.48 standard deviation increase in GDP growth[32]. This estimate suggests that the causal effect of FDI inflows on GDP growth is statistically and *economically* significant, particularly in relation to the small effect shown in column 3 of table 1.

This table also provides robust evidence of the strength and validity of the US monetary shock instrument for FDI inflows[33]. The Kleibergen-Paap LM (Lagrange Multiplier) test is an under-identification test for the instrumental variable. Under the null hypothesis, the equation is under identified, indicating the excluded instrument is not valid (i.e. instrument is not correlated with the endogenous regressor, FDI inflows). The p-value of 0.05 for the Kleibergen-Paap LM statistic suggests a rejection of the null with a significance level of 0.05, meaning the model is sufficiently identified (instrument correlated with FDI inflows)[34]. Weak identification occurs when the instrument is correlated with the endogenous regressor, but only weakly, which can result in biased and improperly sized causal estimates. The Kleibergen-Paap Wald rk F statistic is a robust test statistic for weak identification and is a first stage F statistic for the instrument. Stock and Yogo (2005) have compiled critical values for the relative bias and size of the IV estimate[35]. These critical values indicate how large the F stat must be to reject the null hypothesis that the instrument is “weak”, where weakness pertains to the level of bias and size

[32] Standard deviation of in-country per capita GDP growth is 4.22, see Panel B.
[33] For simplicity, we refer to the instrument as singular, when in reality it consists of three components, see *Empirical Methodology.*
[34] Here, for simplicity, we consider the p-value for the most robust IV specification, column 3, equation (7)
[35] These critical values are based on estimation type (IV) the number of endogenous regressors and the number of instruments; thus, these critical values are the same across tables 6, 7, 8, and 9.

distortion of the IV estimate. The results of column 3 show an F stat of 34.91, which is larger than all Stock-Yogo critical values for IV bias and size, indicating a rejection of the null hypothesis that the instrument is weak[36]. Finally, the Hansen J statistic reflects a test of overidentification. Under the null hypothesis, the instrument is valid, meaning it is uncorrelated with the error term. The large Hansen J p-value of 0.65 indicates a failure to reject this null hypothesis, thus I conclude that the instrument is indeed valid. Overall, the three tests described indicate that the instrument used is strongly correlated with FDI inflows and does not overidentify the model (uncorrelated with the error term).

[36] For these critical values, see the appendix.

Table 6: Instrumental Variable Regressions

	(1) GNI Growth	(2) GNI Growth	(3) GNI Growth
FDI/GDP	0.509***	0.582	1.038*
	(4.21)	(1.86)	(2.32)
Current GDP (3 yr. avg.)			-2.516***
			(-3.78)
Government Consumption			-0.0412
			(-0.70)
Population Growth			-1.008***
			(-4.09)
Inflation			0.0187
			(0.93)
Trade Openess			-0.0186
			(-0.56)
Avg. Yrs. School (log)			2.869*
			(2.53)
Constant	0.732*		
	(2.14)		
Time FE	No	No	No
Country FE	No	Yes	Yes
Kleibergen-Paap rk Wald F statistic	56.15	8.990	25.41
Hansen J stat p-value	0.0200	0.140	.
Kleibergen-Paap LM test p-value	0	0.110	0.0700
Observations	2224	2219	2219

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6 provides empirical results considering GNI per capita growth as the left-hand side variable, using the same instrumental variables approach as in table 5. Under the most robust regression specification (column 3, equation 7), the coefficient on FDI inflows is statistically significantly positive at a 0.05 significance level. The coefficient on FDI inflows indicates that a one percentage point increase in FDI inflows as a percentage of GDP in year t *causes* a 1.04 percentage point increase in GNI growth in year t+1. This result suggests that a one standard deviation increase in FDI inflows causes a 3.05 percentage point increase in GNI growth the following year, constituting a ~0.77 standard deviation increase. This result, particularly compared to the smaller, statistically insignificant relationship between FDI inflows and GNI suggested by table 2, column 3, is statistically and *economically* significant.

As in table 5, table 6's results broadly confirm the strength of the instrument for FDI inflows[37]. The Kleibergen-Paap LM statistic p-value of 0.07 indicates a rejection of the null hypothesis that the instrument is invalid at a 0.10 significance level. The first stage F statistic of 25.41 is larger than all associated Stock-Yogo critical values for IV bias and size, indicating a rejection of the null hypothesis that the instrument for FDI inflows is weak[38]. The Hansen J statistic, which corresponds to the overidentification test for the instrument, is not available for the most robust IV specification for table 6 (column 3, equation 7). This is likely due to the limited data available for these regressions relative to what was available for the GDP growth regressions (2780 versus 4561), resulting in time clusters that are too small. Overall, though there is still evidence of the strength of the instrument in the first two indicators, one must consider the limitations brought on by this issue of limited data availability.

[37] To evaluate this, I use the results of column 3, the most robust IV specification (equation 7).
[38] See appendix for Stock Yogo Critical Values.

Table 7: Instrumental Variable Regressions

	(1) GCP	(2) GCP	(3) GCP
FDI/GDP	0.205	0.343	0.766*
	(1.25)	(0.84)	(2.36)
Current GDP (3 yr. avg.)			-2.047**
			(-3.03)
Government Consumption			-0.0629
			(-1.04)
Population Growth			0.714**
			(2.81)
Inflation			0.00263
			(0.11)
Trade Openess			0.0468
			(1.69)
Avg. Yrs. School (log)			-1.185
			(-0.76)
Constant	22.64***		
	(50.45)		
Time FE	No	No	No
Country FE	No	Yes	Yes
Kleibergen-Paap rk Wald F statistic	75.18	11.12	37.84
Hansen J stat p-value	0	0.0400	0.610
Kleibergen-Paap LM test p-value	0	0.120	0.0500
Observations	3751	3749	3749

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7 repeats this analysis considering gross capital formation as the left-hand side variable. Under the most robust IV regression specification (column 3, equation 7), the coefficient on FDI inflows is statistically significantly positive at a 0.05 significance level. The coefficient on FDI inflows indicates that a one percentage point increase in FDI inflows as a percentage of GDP in year t *causes* a 0.766 percentage point increase in gross capital formation as a percentage of GDP in year t+1. This result suggests that a one standard deviation increase in FDI inflows causes a 2.25 percentage point increase in GCF, constituting a ~0.42 standard deviation increase. As compared to GDP and GNI per capita growth, the results here indicate a relationship more like what was seen by the most robust OLS equation estimate[39]. Overall, as with GDP and GNI growth, I conclude that the causal effect of FDI inflows on gross capital formation is both statistically and economically significantly positive.

The three metrics used to evaluate the instrument are similar here as in table 5 due to the similar sample size used for each analysis (4561 and 4463). The Kleibergen-Paap LM statistic p-value of 0.05 indicates a rejection of the null hypothesis that the instrument is invalid at a 0.05 significance level. The first stage F statistic of 37.84 is larger than all associated Stock-Yogo critical values for IV bias and size, indicating a rejection of the null hypothesis that the instrument for FDI inflows is weak[40]. The Hansen J statistic, which corresponds to the overidentification test for the instrument, has a value of 0.610, which indicates a failure to reject the null hypothesis that the instrument satisfies the overidentifying assumption. Collectively, these metrics suggest the instrument used for FDI inflows adheres to the necessary assumptions for a valid and strong instrument.

[39] For this reference table 3, column 3, equation 3.
[40] See appendix for Stock-Yogo critical values.

Table 8: Instrumental Variable Regressions

	(1) TFP	(2) TFP	(3) TFP
FDI/GDP	-0.0128*	-0.00838	0.0193*
	(-2.04)	(-0.74)	(2.54)
Current GDP (3 yr. avg.)			0.0209
			(0.88)
Government Consumption			0.00356
			(1.69)
Population Growth			0.0175
			(1.57)
Inflation			0.00113
			(1.89)
Trade Openess			-0.000724
			(-1.12)
Avg. Yrs. School (log)			-0.327***
			(-5.13)
Constant	0.756***		
	(47.16)		
Time FE	No	No	No
Country FE	No	Yes	Yes
Kleibergen-Paap rk Wald F statistic	63.61	10.50	234.5
Hansen J stat p-value	0	0.01000	.
Kleibergen-Paap LM test p-value	0	0.130	0.0500
Observations	2851	2851	2851

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The final left hand side variable, total factor productivity, is analyzed in table 8. Under the most robust regression specification (column 3, equation 7), the coefficient on FDI inflows is statistically significantly positive at a 0.05 significance level. This coefficient on FDI inflows indicates that a one percentage point increase in FDI inflows as a percentage of GDP in year t *causes* a 0.02 increase in TFP in year t+1. This result suggests that a one standard deviation increase in FDI inflows causes a 0.057 increase in TFP, constituting a ~0.52 standard deviation increase. This result is quite economically significant, a contrast to the economically insignificant coefficient on FDI inflows in table 4, column 3.

Table 8's results broadly confirm the strength of the instrument for FDI inflows with the same data availability related limitations of table 6. For the third column (most robust specification), the Kleibergen-Paap LM statistic p-value of 0.05 indicates a rejection of the null hypothesis that the instrument is invalid at a 0.05 significance level. The first stage F statistic of 234.5 is much larger than all associated Stock-Yogo critical values for IV bias and size, indicating a rejection of the null hypothesis that the instrument for FDI inflows is weak. The Hansen J statistic, which corresponds to the overidentification test for the instrument, is not available for the most robust IV specification for table 6. This is, again, likely due to the limited data available for these regressions relative to what was available for the GDP growth regressions (3326 versus 4561), resulting in time clusters that are too small. Overall, though there is still evidence of the strength of the instrument, one must consider the limitations brought on by this issue of data availability.

Heterogeneity:

Table 9: GDP Growth; Income Heterogeneity

	(1) Full Dataset	(2) High Income	(3) Non High Income
FDI/GDP	0.696*	0.0868	1.152**
	(2.50)	(0.27)	(3.58)
Current GDP (3 yr. avg.)	-2.292***	-1.838*	-2.101***
	(-4.17)	(-2.22)	(-4.51)
Government Consumption	-0.0761**	-0.134	-0.0539
	(-2.76)	(-1.98)	(-1.78)
Population Growth	-0.738***	-0.555**	-0.635*
	(-3.80)	(-2.98)	(-2.51)
Inflation	-0.0190	-0.0535	0.00112
	(-1.38)	(-1.54)	(0.08)
Trade Openess	0.00255	0.0338	-0.00368
	(0.16)	(1.39)	(-0.22)
Avg. Yrs. School (log)	2.028**	5.625	1.535
	(2.77)	(1.88)	(1.82)
Time FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Kleibergen-Paap rk Wald F statistic	34.91	13.58	14.61
Hansen J stat p-value	0.650	0.550	0.550
Kleibergen-Paap LM test p-value	0.0500	0.170	0.0700
Observations	3843	1317	2526

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As described in the *Conceptual Framework* section, one would expect the growth inducing causal effect of FDI inflows to be more pronounced for countries with a greater initial gap in productive capacity, worker skills, capital productivity, etc. Therefore, one would expect the effect of FDI inflows on GDP growth in high income countries to be smaller (compared to non-high-income countries), as they have less to gain from the positive spillovers associated with FDI. Table 9 provides an empirical confirmation of this intuition. Column 2 shows the results of the most sophisticated IV regression equation (equation 7) considering real per capita GDP growth as the left-hand side variable for high-income recipient countries. Conversely, column 3 shows the same but only for non-high-income recipient countries. The results suggest that FDI inflows have no statistically significant causal impact on high income recipient countries, whereas the effect for non-high-income countries is both statistically and economically large. In fact, the coefficient for FDI inflows in column 3 suggests that a one percentage point increase in FDI inflows as a percent of GDP in year t causes a 1.152 percentage point increase in recipient country per capita GDP growth rate in year t+1. This effect has particularly high economic significance when compared to the coefficient on FDI inflows seen in table 5, column 3. The first stage F statistic, Hansen J statistic p-value, and LM test p-value collectively indicate the strength and validity of the instrument for FDI inflows for both columns 2 and 3[41]. Overall, table 9 provides evidence of a recipient country-income-based heterogenous effect of FDI inflows on recipient country growth, confirming the theoretic intuition described in the *Conceptual Framework* section.

Local Projection:

As discussed in the *Conceptual Framework* section, there is no reason to assume that the positive spillovers associated with FDI inflows exist only with a one-year lag. Alternatively, exogenous shocks in FDI inflows in year t may create positive spillovers for the recipient country in year t+1, t+2, and so on. For example, say foreign company A invests X amount of money into an enterprise located in Argentina in year t. As a part of their investment, company A implements a program to train workers to raise their productivity. It is highly conceivable that it may take 2 or 3 years for workers to fully actualize the skills transferred to them via the training.

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[41] Compare each F-statistic to Stock-Yogo critical values in the appendix, see p-values for Hansen J test (fail to reject null that the instrument is valid).

Thus, the investment may affect total factor productivity (which accounts for labor productivity) with a two- or three-year lag.

By using a local projection estimation strategy as proposed by Jorda et. al (2005), I estimate the long run, cumulative impact of exogenous shocks to FDI inflows on the relevant left hand side variables. The following figures reflect the results of regression equations 8, 9, 10, and 11 for each left-hand side variable of interest. The estimate lagged impact of FDI inflows on the left-hand side variables over several time horizons creates what is known as an impulse response function.

Figure 3

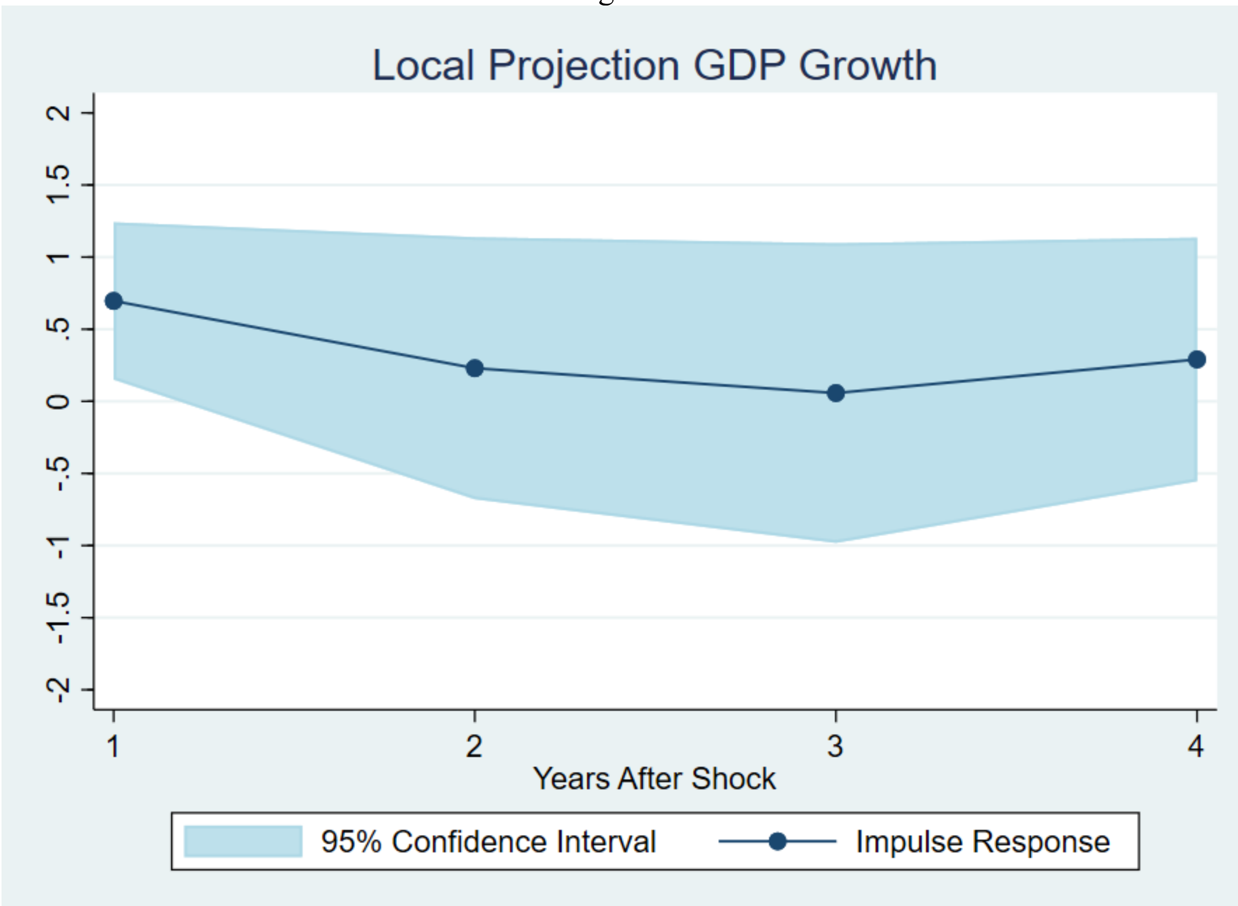


Figure 3 shows the local projection estimation results with per capita GDP growth as the left-hand side variable. The results indicate that the effect of FDI inflow shocks on recipient country GDP growth exists only with a one-year lag. In other words, the effect of FDI inflows in year t on GDP growth in years t+2, t+3, and t+4 is statistically indistinguishable from 0.

Figure 4

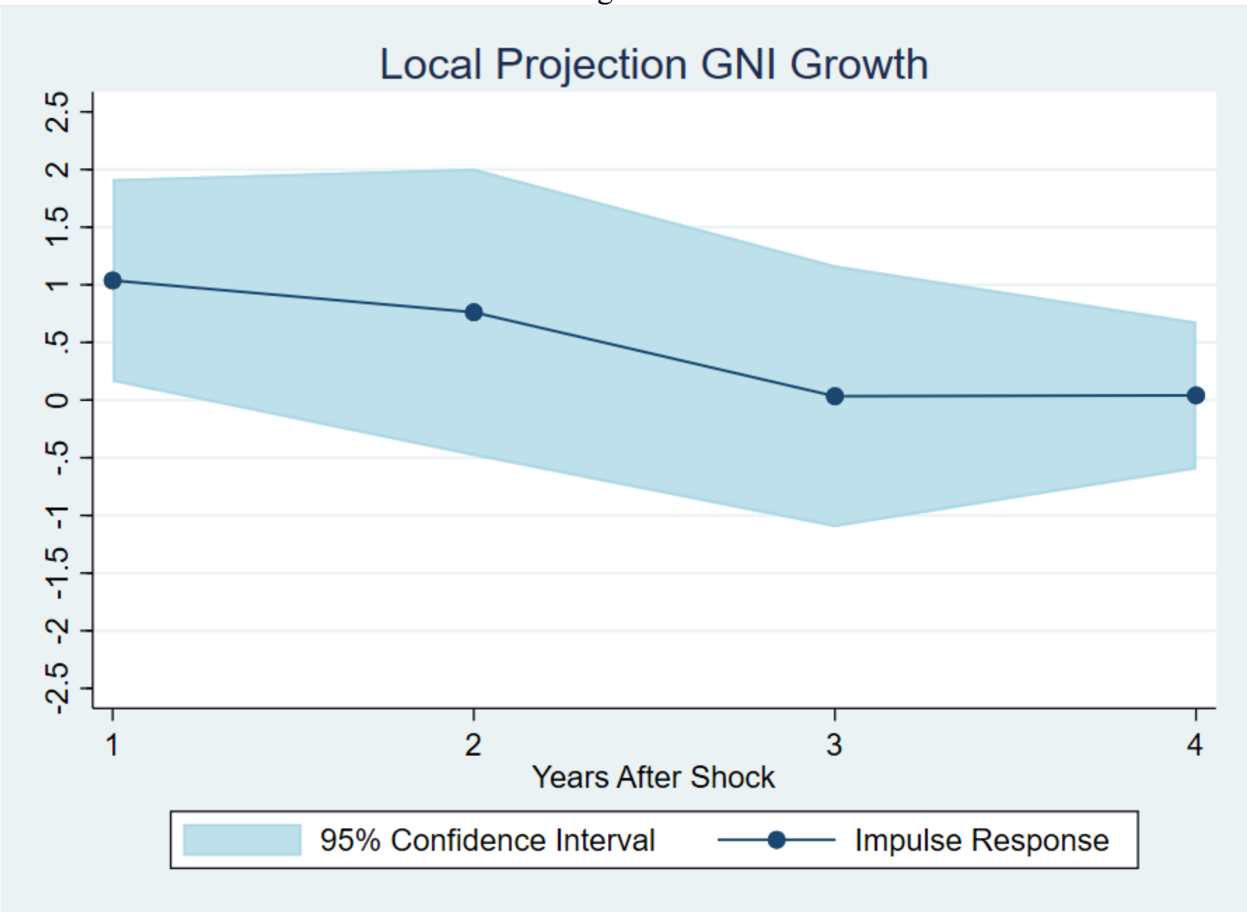
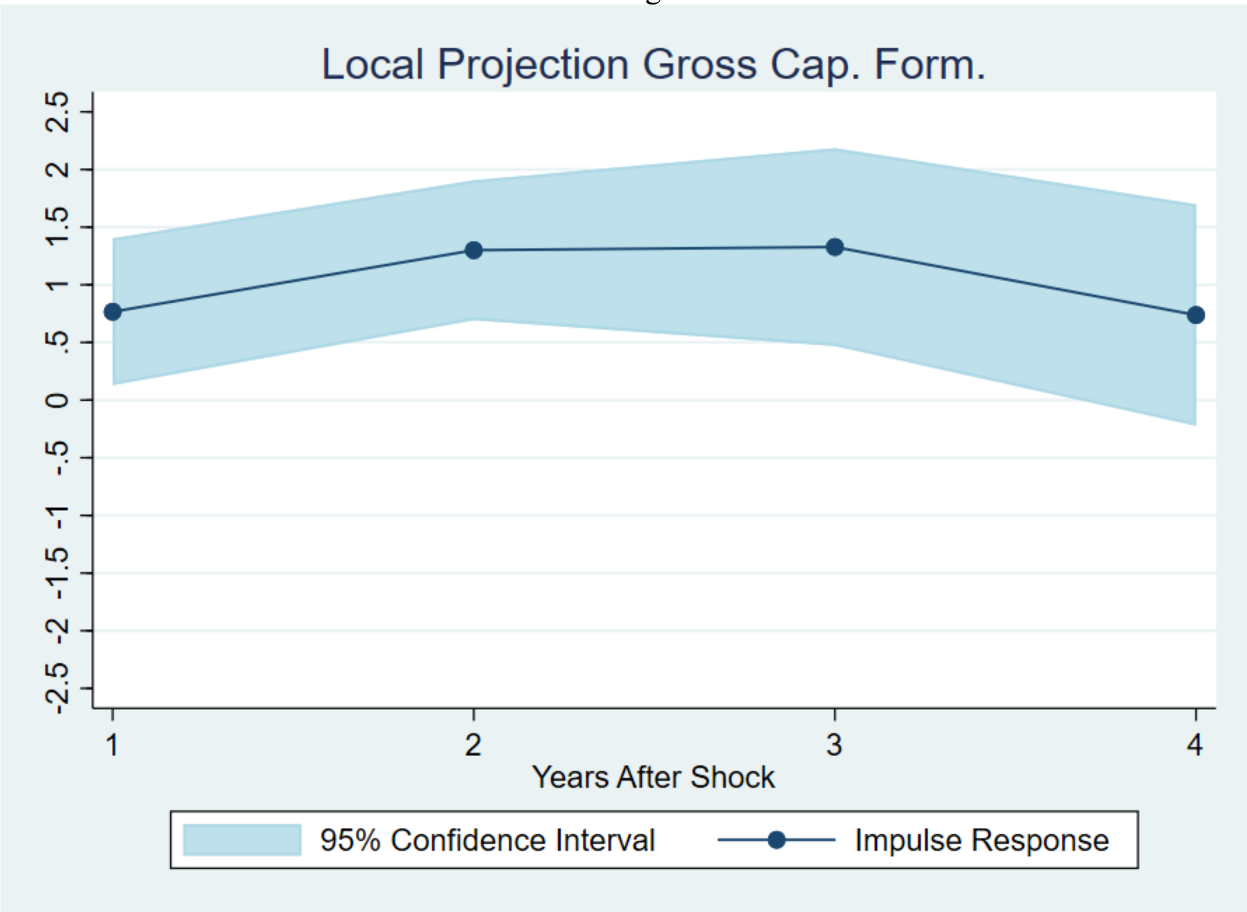


Figure 4 shows the local projection estimation results with per capita GNI growth as the left-hand side variable. The results here are very similar to those in figure 3. The graph indicates that FDI inflows have a statistically significant effect on GNI growth only with a one-year lag. So, the effect of FDI inflows in year t on GNI growth in years t+2, t+3, and t+4 is statistically indistinguishable from 0.

Figure 5



As shown in figure 5, the local projection estimate for gross capital formation reveals a much different story than that for GDP and GNI growth. Here, FDI inflows in year t have a positive, statistically significant impact on gross capital formation in year t+1, t+2, and t+3. The effect is similarly economically significant across all three time horizons. These results indicate that the positive spillover effects of FDI inflows exist up to three years after an exogenous increase in said inflows. This result is rather intuitive based on the discussions in the *Conceptual Framework* section. For example, say a firm invests $1,000,00 into a Mexican enterprise in year t. Perhaps this money is spent relatively evenly in year t+1, t+2, and t+3, to construct new warehouse facilities and factories. The aggregation of many cases like the one described can explain the effect visualized in figure 5.

Figure 6

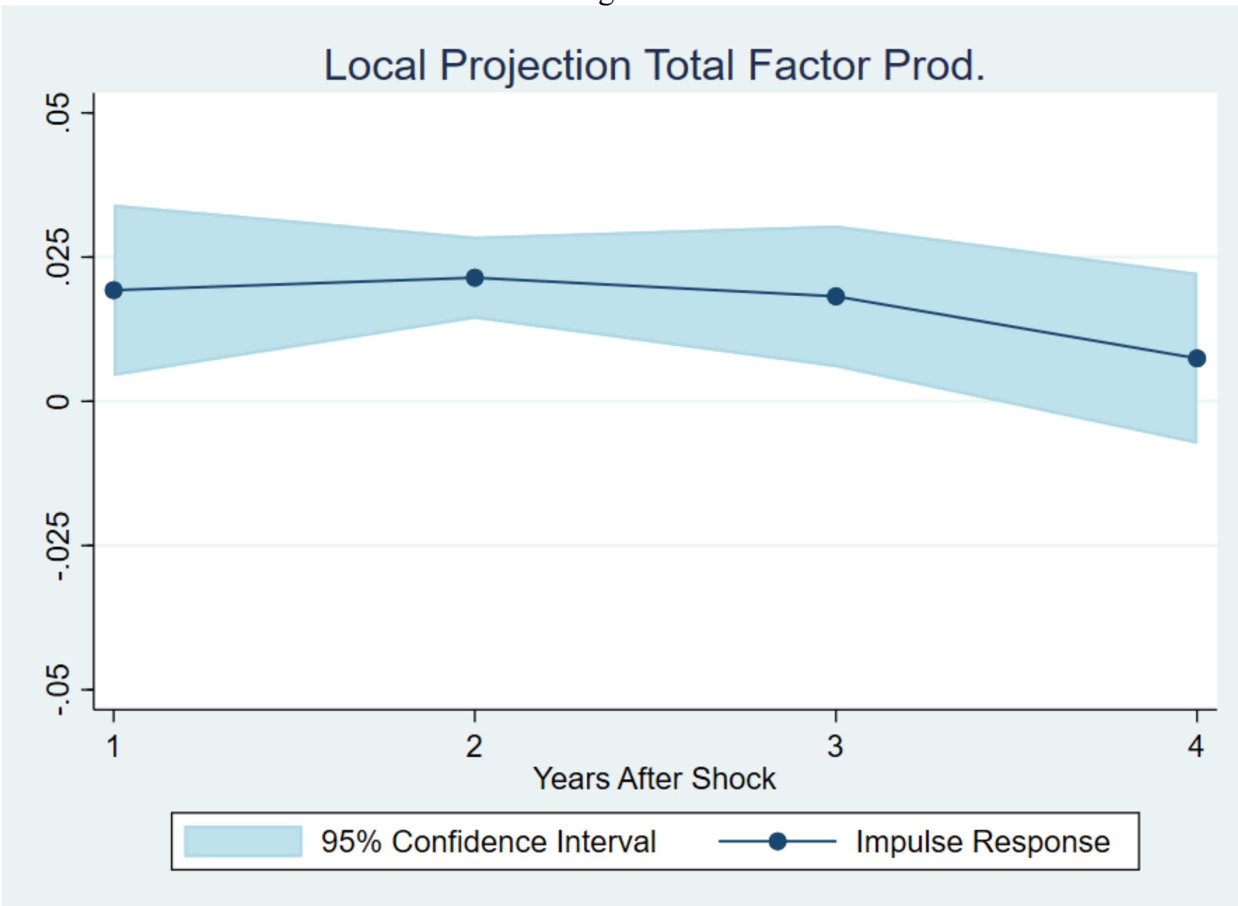


Figure 6 tells a very similar story to figure 5. Here, the local projection estimation for total factor productivity demonstrates that FDI inflows in year t have a positive, statistically significant impact on total factor productivity in year t+1, t+2, and t+3. The effect is similarly of high economic significance across all three time horizons. This result is intuitive based on the discussions in the *Conceptual Framework* section. For example, say a firm invests $1,000,00 into a Peruvian enterprise in year t. Perhaps this money is spent relatively evenly in year t+1, t+2, and t+3, on a multi-month program to train new employees as the enterprise expands. The aggregation of many cases like the one described can explain the effect visualized in figure 6.

Local projection discussion:

The use of the local projections framework to evaluate the effect of FDI inflows on recipient economies provides several valuable insights. The empirical results suggest that FDI inflows indeed induce positive spillover effects on recipient economies in the form of improvements to productive capacity and increased capital and labor productivity with up to a three-year lag. Interestingly, FDI inflows seem to statistically significantly effect GDP and GNI growth with a one-year lag only. This incongruence is somewhat puzzling, as one would expect that the growth promoting effect of FDI inflows would exist as long as the positive spillover effects of FDI inflows exist. An in-depth investigation of this incongruence is out of the scope of this paper and will likely be the subject of future research.

Conclusion:

In this paper, I make new contributions to the literature studying the relationship between FDI inflows and development in recipient economies. I present a conceptual framework, inspired by previous literature, that details the mechanisms through which FDI drive recipient country growth in theory. Specifically, technology transfer, new productive infrastructure, skill transfer, and domestic market know-how are key positive spillovers that drive recipient economy growth. To evaluate the existence of a growth promoting effect of FDI inflows via these theoretically motivated channels, I propose using real per capita GDP growth, total factor productivity, and gross capital formation as left-hand side variables. I additionally use real per capita GNI growth as a left-hand side variable to evaluate whether FDI inflows generate an extractive relationship with recipient countries.

This paper also introduces a novel instrument for FDI inflows using a dataset of identified US monetary policy shocks from Miranda-Agrippino, addressing the issue of endogeneity in a way yet to be done in previous research. By combining this with a fixed effect, cross-country, panel data regression framework, my paper ultimately finds evidence that FDI inflows indeed induce GDP growth in recipient economies via the proposed theoretical mechanisms. I additionally provide evidence that these results are being driven primarily by non-high-income recipient countries, coinciding with the theoretical claim that countries with lower initial productive capabilities have more to gain from additional FDI. Finally, I employ the local projection estimation approach introduced by Jorda (2005). This analysis reveals that shocks to FDI inflows can generate statistically significant positive changes in gross capital formation and total factor productivity with up to a three-year lag. For GNI and GDP growth, this effect exists (empirically speaking) with a one-year lag only.

There are three primary limitations of my paper. The first relates to the instrumental variable identification strategy used for FDI inflows. Though robust analysis contained in this paper suggests that the instrument used is strong and valid, there is a possibility that the instrument used does not meet the necessary independence assumption. Specifically, given the capacity of US monetary shocks to influence FDI inflows with a three-year lag, it is conceivable that other economic factors, that themselves correlate with growth and are not controlled for, are influenced by US monetary shocks. A second limitation relates to the imprecision inherent in cross-country analysis. In this paper, I evaluate the growth inducing capabilities of FDI using macro-level data. However, firm-level data analysis is necessary to provide robust verification that FDI creates the positive spillovers that drive country level growth in aggregate. Finally, while this dataset reflects a growth inducing effect of FDI inflows, I consider only the years 1970-2007. At the time of this paper's writing, this is nearly 20 years in the past. It will be necessary to see if this effect of FDI inflows has persisted in recent years. Despite the strong evidence that this paper presents, with the limitations described in mind, I do not make any direct policy prescriptions for countries.

There is much to be done as far as future research into this topic. As mentioned, empirical research at the firm level, with valid identification strategies for exogenous shocks to FDI inflows, is necessary to fully understand the growth promoting potential of FDI inflows via the proposed positive spillovers. Additionally, future research should investigate the implications of FDI inflows for non-growth-related variables. For instance, the effect of FDI inflows on pollution, employment, and inequality. Finally, future research should try to recreate the results of this one with more recent data to see if the observed relationships still exist.

Appendix:

Stock and Yogo values for IV regressions:

Here I provide Stock-Yogo critical values to contextualize the size of the first stage F-statistics for key regressions.

Table 5,6, 7, 8; column 3; Table 9 columns 1 and 2; Stock-Yogo Critical Values

- 5% maximal IV relative bias 13.91
- 10% maximal IV relative bias 9.08
- 20% maximal IV relative bias 6.46
- 30% maximal IV relative bias 5.39
- 10% maximal IV size 22.30
- 15% maximal IV size 12.83
- 20% maximal IV size 9.54
- 25% maximal IV size 7.80

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