THREE ESSAYS ON MACROECONOMICS AND DEVELOPMENT

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THREE ESSAYS ON MACROECONOMICS AND DEVELOPMENT

A Dissertation Presented
by
GUILHERME KLEIN MARTINS

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of
DOCTOR OF PHILOSOPHY

February 2023
Economics
THREE ESSAYS ON MACROECONOMICS AND DEVELOPMENT

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GUILHERME KLEIN MARTINS

Approved as to style and content by:

Peter Skott, Chair

Daniele Girardi, Member

Arslan Razmi, Member

Christian Rojas, Member

James Heintz, Department Chair
Economics
ACKNOWLEDGMENTS

I can not be thankful enough for the generosity of my committee members. My foremost thanks are to Peter Skott, who has supported me even before my start at UMass. Peter’s lectures deeply shaped how I see economics, and I know this is true for so many of his students and colleagues. I also learned invaluable lessons by having the honour of being his co-author.

Arslan Razmi has also been of unique importance to my development during the Ph.D. program. Not only he bared with me and my endless questions while I was taking his classes, but I also had the privilege to work with him as a research assistant for a project that became a co-authored paper. Arslan’s patience and trust during this work were essential for my training as a researcher.

I also feel very lucky to have met Daniele Girardi at UMass and to have him on my committee. I worked with him as a teaching and research assistant, and Daniele was such a great mentor in both situations. He has also provided acute insights to my research. I am confident to say that the first essay of this dissertation would not exist without Daniele’s suggestions.

I would also like to thank Christian Rojas for accepting to be part of my committee from the first moment and for his invaluable comments that helped improve the essays.

I learned that the capacity to transmit knowledge and encourage intellectual curiosity can also be - mostly tacitly - taught. I have been lucky to learn that from you all during this process. I hope I will have the capacity and generosity to do the same for other people.

I would also like to thank Mark Landeryou, our graduate program manager, for assisting me multiple times over the years.

During these four years in the US, a number of people have been essential. Debora shared most of this journey with me and I am grateful for all the companionship and support. Alicia and Mati welcomed and made me feel at home from the first days. I have also been lucky to be at UMass at the same time as people that became friends; in particular, I want to thank Cosku, Anamika, Adam, Esra, Mateo, Nico, and Raphael.
I am deeply thankful to Laura for the many conversations and suggestions that shaped this dissertation, and for the encouragement for the next steps. But this gratitude, however deep, is incomparable to the one I feel for sharing my life with you. Thank you for everything.

I am sure that without my family, I would not even imagine the possibility of walking this path that leads now to this dissertation. To my parents, Christina and Amauri, thank you for giving me all the opportunities to succeed professionally while showing me that this is not the most important thing in life. To my sister, Marcela, thank you for being with me in each step of my life and teaching me so much. For my grandparents, Erminia, Hilda, and João, thank you for being examples of strength, each in its own way.
ABSTRACT

THREE ESSAYS ON MACROECONOMICS AND DEVELOPMENT

FEBRUARY 2023

GUILHERME KLEIN MARTINS
B.Sc., UNIVERSITY OF SÃO PAULO
M.Sc., UNIVERSITY OF SÃO PAULO
M.Sc., UNIVERSITY OF MASSACHUSETTS AMHERST
Ph.D., UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Professor Peter Skott

This dissertation is a collection of essays that relate, in different forms, macroeconomic policies to economic development. Essay 1 provides evidence that austerity shocks have long-run negative effects on GDP. Besides addressing the important gap in the growing fiscal research regarding the short time horizon of the estimations, the paper analyzes two other important assumptions made in the literature regarding the (i) symmetry of episodes of fiscal expansion and contraction and (ii) uniformity of fiscal multipliers for different sizes of shocks. We use narrative fiscal shocks and propensity score reweighting in a local projections setup to account for the potential endogeneity of austerity policies and the non-linearity of its effects over time. The estimation is also adapted to eliminate the bias that emerges when multiple shocks might occur within the time horizon of interest. Our baseline results show that contractionary fiscal shocks larger than 1.5% of GDP generate a negative effect of more than 3% on GDP even after 15 years. The drop in GDP reaches 5.5% for fiscal contractions larger than 3%. Evidence is also found linking austerity with smaller capital stock in the long-run. The results are robust to different fiscal shocks datasets, the exclusion of particular countries and shocks, alternative estimation methods, and the use of cleaner controls. Besides understanding the consequences
of this particular policy, the results contribute to the broader discussion on the long-run effects of demand by suggesting that such shocks might permanently affect the economy.

Essay 2 reviews different literature strands and performs an empirical test to evaluate how capital ownership, particularly its nationality, might affect long-run economic development. Our results indicate that low and middle-income countries with larger foreign capital stock in 1980 had lower economic growth over the next 39 years. The estimations also indicate that these economies developed a less specialized export basket, which became relatively more concentrated in low-tech goods. The results are inverted to high-income economies, for which the effects are positive on GDP growth and export specialization and complexification. The results are in line with the evidence that countries can benefit from foreign investment only if they have sufficiently developed ‘absorptive capabilities’ (e.g., financial markets and human capital). The results can also be interpreted in light of theoretical and empirical evidence that foreign capital might reinforce static comparative advantages in developing economies, particularly in middle-income ones.

Essay 3 is a paper co-authored with Peter Skott (published at Industrial and Corporate Change; Martins and Skott (2021)). The article presents a model in which distributional conflict and cross-sectoral interactions between demand and supply side forces determine inflation in developing countries. We show that the standard macroeconomic policy recommendations of inflation targeting and balanced budgets (i) increase volatility by amplifying external shocks and (ii) can lead to premature deindustrialization. The recent Brazilian experience is used to illustrate the argument.
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CHAPTER 1
LONG-RUN EFFECTS OF AUSTERITY

1.1 Introduction

In August 2022, Greece exited the European Union’s ‘enhanced surveillance’, a framework established to ensure the policies implemented in the country from 2010 would not be reversed. These measures, aimed at decreasing public indebtedness, included large cuts to public spending, privatizations, and tax increases. After 12 years of its implementation, it is not clear how successful the strategy was. Greece’s general government debt went from 130% of GDP in 2010 to 224% in 2021, while the average of OECD countries went from 70% to 94.7%. Greek real GDP per capita in 2021 is still 12.7% lower than in 2010, while the European Union (EU) expanded 12.1%. The labor market was also impacted significantly: while the EU had an increase of 3.5% in its labor force, Greece had a reduction of 8.4%. Moreover, long-term unemployment increased by more than 41% in the country between 2010 and 2021, while it fell by 7% in OECD.

However, it is clear that to evaluate the success of the austerity strategy it is not sufficient to compare averages. Ideally, one would have to compare Greece’s performance in the period to what would have happened if different policies had been implemented. Moreover, to take more general conclusions that can inform policy, it is also relevant to understand the timing of effects; that is, how much of the decrease in GDP in 2021 is related to the austerity implemented in 2017 and how much to the policies applied still in 2010, for instance. Such analysis of the long-run effects of austerity, however, is nonexistent in the literature, despite being central to the discussion that dominated economic and policy debates in recent decades. This paper seeks to fill this gap.

In different moments in the past 15 years, due to economic crises, such as the financial in 2007, the debt one in the Eurozone, and the Covid pandemic, or by broader theoretical reasons, such as the discussions of a ‘secular stagnation’ and a zero-lower bond for monetary

---

1 Data from the World Bank. Calculated at 2015 constant US dollars.

2 As a share of total unemployment. Long-term unemployment defined as unemployment by more than one year.
policy, more aggressive fiscal policy has been brought to the fore. This movement has also been
accompanied by a ‘renaissance in fiscal research’, as pointed out by V. Ramey (2019), which
led to a significant improvement in our knowledge about the topic. The literature, however,
focuses on (i) the short and medium-runs effects of (ii) fiscal shocks in general.

There might be different reasons for the shorter-run focus. V. Ramey (ibid.) points to
methodological issues, arguing that the methods to estimate long-run effects would be different
than those commonly employed in the fiscal literature. Another potential explanation is the
theoretical understanding that demand shocks have only short-term effects, with supply-side
factors determining the long-run. Both arguments, however, should not prevent an interest in
estimating the long-run effects of these shocks. First, there are now methods widely used in
the literature to estimate the effects of similar shocks over extended time horizons. Second,
although the idea of neutrality of demand in the long-run is still important, there has been
growing interest in recent years in the long-term effects of shocks, particularly negative ones
related, for instance, to political, banking, or financial crises (e.g., Yellen (2016) and Blanchard,
Cerutti, et al. (2015)). By estimating the long-run effects of fiscal shocks, one can also contribute
to this emerging literature on the persistence of demand shocks.

Not least important is the fact that the literature tends to analyze the effects of fiscal shocks
in general, and not of austerity policies. This is not only an important gap but, not rarely, a
source of misunderstanding as the estimated effects of fiscal shocks in general are implied to
hold for austerity measures in particular. Due to its deep implications on social and political
spheres, economists’ use of the term should dialogue with other areas of knowledge and the
broader public, for which austerity tends to mean ‘enforced or extreme economy especially on
a national scale’, as defined by the Merriam-Webster dictionary. Less anecdotally and without
resorting to other fields, this is also recognized by Alesina, Favero, et al. (2019a): “[t]he term
“austerity” indicates a policy of sizeable reduction of government deficits and stabilization of
government debt achieved by means of spending cuts or tax increases, or both.” (p.1, italics

---

3This might be a too general statement, but exceptions seem to be extremely rare indeed. One that could
be cited is Fatás and Summers (2018), that look exclusively to consolidations that took place in 2010-2011 and
whose estimations are completely based on forecasts, both for GDP (up to 2021) and for the structural balance.
Although informative, these estimations seem to be significantly less robust than those that take into account a
much larger number of shocks, use methods to achieve shocks that are as exogenous as, arguably, possible, and
that do not rely on forecast errors, for instance.
The literature, however, with very few exceptions,\(^4\) ignores this definition in two important ways by assuming that (i) fiscal contractions and expansions are symmetrical, and (ii) that the effects are linear on the size of the shock.\(^5\)

There are multiple theoretical reasons why these two aspects might be relevant. The recognition that positive and negative demand shocks tend to have asymmetrical effects is not new (e.g., De Long et al. (1988), Cover (1992)). There are different channels through which this could operate. The economy can have multiple equilibriums\(^6\), with positive and negative shocks pushing the economy to different ‘steady-states’. Another channel is more explicit in efficiency wages models (e.g., Summers (1988)), in which workers quickly adjust their wage expectations upwards after a positive shock but do not do so following a negative one; the validity of this channel is reinforced by research on behavioral economics, for instance regarding self-serving biases (Babcock and Loewenstein (1997)) and money illusion (Fehr and Tyran (2001)). The effects might be asymmetrical also due to different reactions of the financial market: as in Greenwald et al. (1988), banks can either remain healthy - the probable outcome of a positive shock -, or fail - a possible result of negative shocks. While the first situation might not generate permanent effects, the second tends to do so.

Regarding heterogeneous effects by the shock size, most of these reasons can also be important: shifts between equilibriums might depend on the size of the initial departure from the former equilibrium; the cognitive costs related to operating with nominal or real values are non-linear\(^7\); financial institutions are resilient to relatively small negative shocks. An additional channel might be related to factor hoarding: in face of a small demand shock, output might be adjusted via changes in capacity utilization and work intensity, while larger shocks tend to generate modifications in investment plans and labor demand, with larger impacts on aggregate demand. All these reasons might impact not only the proportional effects (or multiplier, in a more general usage of the term) of the shocks, but also their persistence over time.

---

4Alesina and Ardagna (2010) is an important exception, as the authors calculate separately the effects of expansions and contractions using the CAPB method.

5As will be resumed in section 1.2, in some sense the size of the shock is relevant for an important strand of the literature, as in Alesina, Favero, et al. (2019b), in which the size matters as the average elasticity is calculated; or in Alesina and Ardagna (2010), in which they declare a shock only changes in the adjusted primary balance larger than 1.5% - in this case, again, however, it is only the average effect that is calculated.

6Due to increasing returns to scale, or asymmetric information, for instance.

7Money illusion is more probable for relatively low levels of inflation.
Therefore, taking into consideration the direction and the size of the fiscal shock is important not only as a matter of following the definition of austerity, but also because there are multiple theoretical reasons indicating that the effects might not be symmetrical and proportional. A more detailed description of such theoretical reasons is beyond the scope of the paper. The discussion of how the empirical literature deals with these dimensions is resumed in section 1.2.

This paper aims to fill this important gap in the literature by estimating the effects of austerity - understood as contractionary fiscal shocks of significant magnitude - over a time horizon of 15 years. Results indicate that sufficiently large shocks (more than 1.5% of GDP in the baseline case and 1% of GDP in robustness exercises) generate a significant and persistent reduction in GDP even after 15 years; this result is robust to the use of alternative datasets (both of extended GDP and austerity shocks), the exclusion of countries and episodes, and the implementation of different estimation methods. There is also evidence that short- and long-run multipliers are different for relatively small and large shocks. We also find indications that spending cuts generate larger negative effects on GDP, and that austerity shocks are associated with lower capital stock.

Besides this introduction, the paper has three other parts. In section 1.2, we present the current research on fiscal shocks to locate this paper in the broad literature and introduce, by comparisons, the methodology used in the empirical estimations. Section 1.3 explains the method and data in more detail and presents our baseline estimations. It is followed by section 1.4, in which a series of robustness checks and extensions are performed. Section 2.4 concludes the paper.

1.2 Fiscal Research

To help organize the literature, one can point, in line with V. Ramey (2019), to the three main methods used in empirical fiscal research: i) aggregate country-level time series or panel estimates, ii) estimated or calibrated New Keynesian DSGE models, and iii) ‘natural experiment approaches’ that use, for instance, variations in sub-national units for identification.\(^8\) Each of those has its weaknesses: time series methods require exogenous variation in policy, which

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\(^8\)Using war-induced government spending for identification can also be fitted in this category; however, this method does not apply well to other countries with lower defense spending or for those that the fluctuations are associated with conflict within the country.
sometimes forces the use of inadequate instruments; estimations based on DSGE models, on their part, rely on strong assumptions about the generating process of unobserved shocks and the theoretical structure. Moreover, subnational analyses do not lead directly to macroeconomic estimations, also requiring some theoretical model to do this passage.

All considered, the literature, following efforts to improve the main weakness of the method and capture shocks that are as exogenous as possible, has been converging to the use of country-level data of exogenous policy changes. A traditional method in the literature is the cyclically adjusted primary balance (CAPB) method (e.g., Blanchard and Perotti (2002), Alesina and Ardagna (2010)). The idea is that, by calculating how much the components of the government budget change along the economic cycle, one can net this effect from actual government primary balance and thus check if the public sector is acting with a positive, negative, or neutral impulse in the economy.

This method has received multiple criticisms. C. Romer and D. Romer (2010) point out that CAPB is affected by nonpolicy changes that might be correlated with other elements affecting output. Another argument, which goes to the heart of the endogeneity concern, is that even if the CAPB method correctly indicates a discretionary policy change, its motivation might be related to cyclical fluctuations: governments might cut spending if inflation is increasing; social expenditure tends to increase in recessions, and so on (e.g., Devries et al. (2011); Ball et al. (2013)). Caveats can also be made on the subjectivity of the method to extract the economic cycle out of data (and how estimations tend to be sensitive to this choice), as well as the usual assumption of a constant elasticity of expenditure to the economic cycle (e.g., C. Romer and D. Romer (2010); Agnello and Sousa (2014)).

An alternative to CAPB that recently gained ground is the ‘narrative approach’. This method tries to look directly at exogenous fiscal shocks, that is, changes in government expen-

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9. That are either exogenous but not very relevant (have a low correlation to the fiscal variable) or relevant but not exogenous or unanticipated. An example of the first type is military news, which are weak instruments after 1954 (V. A. Ramey (2011)); an example of the latter is the one-step ahead forecast error of government spending, used in Blanchard and Perotti (2002).

10. An example given by the authors (a similar argument is made by David and Leigh (2018)) is a stock market boom that raises cyclically adjusted revenues due to capital gains realizations but also correlates with other elements in the economy that will generate a future increase in output.

11. There are other procedures that are similar in spirit to CAPB. Mountford and Uhlig (2009), for instance, main identification strategy using VARs is imposing sign restrictions: for instance, the impulse response function of the government revenue (spending) will be positive for four quarters following a positive shock of the same variable and, even more important, that the shock is orthogonal to the business cycle and monetary policy.
duration or revenue that are not related to the business cycle. In the most recent and consolidated
datasets, these shocks are identified by the analysis of official documents (congressional debates,
speeches, budget documents, etc.) and consider as exogenous the changes motivated by the goal
of increasing long-run growth or reducing the budget deficit.\textsuperscript{12}

This method is increasingly recognized as an important step in improving estimations based
on panel data. However, it is also not exempt from criticism. Jordà and Taylor (2016) show
that the time of fiscal shocks in the IMF fiscal narrative dataset (Devries et al. (2011)) can
be predicted by some state variables - for instance, fiscal consolidations are more likely when
public debt to GDP is high and when GDP growth is below potential. They propose using a
propensity weighting strategy to further improve the identification of fiscal shocks: a higher
weight is given to countries that, although having a higher probability of having a shock, do not
have one. At the current stage of the literature, this combination of narrative fiscal shocks and
propensity weighting seems to be the best strategy to analyze fiscal shocks, and is, therefore,
the one employed in this paper. More details of the method will be presented in section 1.3.

In terms of methods to get impulse response functions of the output after the fiscal shocks,
there are two main alternatives in the literature. The one used in this paper is based on Local
Projections (Jordà (2005)), which has the advantage of not requiring the assumption of any
particular functional form.\textsuperscript{13} An alternative econometric method that is also widely used is
Vector Autoregressions (VARs); it requires, however, the assumption of a model and, although
generating a smaller variance, it tends to produce a more biased estimation, increasingly so for
long horizons (Li et al. (2022); Jordà, Singh, et al. (2020)).\textsuperscript{14}

After this brief overview of the state of the literature, we can return to the observation
by V. Ramey (2019), mentioned in section 1.1, that the long-run effects of fiscal shocks are

\textsuperscript{12}Another implementation adopted by the literature with this method is to look at military spending related
to foreign conflicts (e.g., V. Ramey and M. Shapiro (1998)).

\textsuperscript{13}Jordà and Taylor (2016) argue that the method also provides better control for observable variables and is
more reliable when the instrumental variables (for the fiscal shocks) themselves might be endogenous.

\textsuperscript{14}V. A. Ramey and Zubairy (2018) use the paper of Auerbach and Gorodnichenko (2012b) to exemplify other
differences between using local projections (LP) and VARs in those estimations, particularly in the context of
estimating the effects of fiscal changes based on different states of the economy. With the Jordà method (Jordà
(2005)), the transition between states (booms and recessions, for instance) appears directly if it is caused by
the (average) shock or is captured by the other control variables. With regime-switching VAR models, as in
Auerbach and Gorodnichenko (2012b), ones has to make assumptions; in this case, about when the parameters
should switch between states (they assume that economic states last for at least 20 quarters). In their subsequent
work, Auerbach and Gorodnichenko (2012a) perform a very similar exercise, but using local projections instead
of structural vector autoregression due to the advantage mentioned above, but also because local projections tend
to facilitate the correction of errors correlation within countries and it does no constrain the shape of the IRF.
not estimated due to methodological limitations. Semi-parametric methods have been used in estimations with similar setups over long time horizons. Jordà, Singh, et al. (2020) use local projections with instrumental variables to calculate the effects of monetary shocks over 12 years, and Acemoglu, Naidu, et al. (2019) implement local projections with different propensity weighting methods to estimate the effects of democracy on a thirty-years horizon, to name a couple. Therefore, it is not unusual in recent research to use the methods implemented here to calculate long-run effects of similar shocks. Additionally, in this paper, we adapt our estimations to account for a potential bias that emerges when multiple shocks occur within the forecasted horizon. Following the suggestion by Teulings and Zubanov (2014), this consists of controlling for a flexible number of treatment leads in the local projections regressions. The econometric strategy is explained in more detail in section 1.3.

As also indicated in section 1.1, another potential explanation for the lack of research on the long-run effects of fiscal shocks, however, is the theoretical understanding that demand shocks only have short-run effects, with supply determining the long-run. This view has prevailed in economic theory (Yellen (2016)), from 'standard’ growth models, such as Solow (1956), to both new classical (and real business cycle) and most of the new Keynesian models, and has largely informed macroeconomic empirical research.15 In recent years a number of papers resumed the discussion about the long-term effects of negative shocks, but most focus on the effects of political, banking, or financial crises, while others look at GDP and estimations of its trend to identify recessions and analyze their effects over time (Haltmaier (2013) over a 4-year horizon; Cerra and Saxena (2008), Martin et al. (2015) and Blanchard, Cerutti, et al. (2015) over a maximum horizon of 10 years are some examples). However, there are no such estimations for fiscal shocks. Therefore, by estimating the long-run effects of austerity, this paper also contributes to the broader debate on the persistent effects of demand shocks.

Table 1.1 lists some of the most influential papers in the fiscal research literature. The literature is vast, and the list is produced to include papers closer to ours in estimating shocks using country-level data, but also to illustrate the diversity of empirical methods used. The

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15 A classical example is Blanchard and Quah (1989).
the maximum time horizon.\textsuperscript{16}

Table 1.1: Selected studies of the effect of fiscal shocks on GDP

<table>
<thead>
<tr>
<th>Authors</th>
<th>Data Identification</th>
<th>Data</th>
<th>Method</th>
<th>Max. Horizon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alesina, Favero, et al. (2019b)</td>
<td>Narrative</td>
<td>16 OECD Countries 1978-2014</td>
<td>VAR</td>
<td>Five years</td>
</tr>
<tr>
<td>Jordà and Taylor (2016)</td>
<td>Narrative</td>
<td>17 OECD Countries 1960-2007</td>
<td>LP (AIPW)</td>
<td>Five years</td>
</tr>
<tr>
<td>Riera-Crichton et al. (2016)</td>
<td>Narrative (VAT changes)</td>
<td>15 OECD Countries 1980-2009</td>
<td>LP</td>
<td>One year</td>
</tr>
<tr>
<td>Guajardo et al. (2014)</td>
<td>CAPB inst. by narrative</td>
<td>17 OECD Countries 1978-2009</td>
<td>2SLS and VAR</td>
<td>Five years</td>
</tr>
<tr>
<td>Ilzetzki et al. (2013)</td>
<td>CAPB (Expenditure)</td>
<td>44 countries 1960-2007</td>
<td>VAR</td>
<td>Five years</td>
</tr>
<tr>
<td>Baum et al. (2012)</td>
<td>CAPB</td>
<td>6 OECD Countries 1965-2011</td>
<td>TVAR</td>
<td>Three years</td>
</tr>
<tr>
<td>Auerbach and Gorodnichenko (2012b)</td>
<td>CAPB inst. by forecast</td>
<td>US 1966-2009</td>
<td>STVAR</td>
<td>Five years</td>
</tr>
</tbody>
</table>

\textit{Note:} AIPW: Augmented Inverse Propensity Weighted Estimator; TVAR: Threshold Vector Autoregression. STVAR is an extension of smooth transition autoregressive (STAR) models.

However, there is another important element that is common in these works and, as mentioned in section 1.1, is explored in this paper: the assumption of linearity of the effect of fiscal change. This assumption appears in two forms: that positive and negative shocks are taken to be symmetrical, and that shocks of different sizes have the same proportional effects. The symmetry assumption is explicit when the estimated effect of a fiscal shock is the average (weighted by the number of respective shocks) of the effects of positive and (inverted) negative shocks. Once one considers the theoretical reasons why the effects might not be symmetrical, such as the ones presented in section 1.1, it is clear how the assumption can be misleading. Assume, for instance, that in a sample there is the same number of fiscal expansions and contractions, and, to simplify, that the size of all shocks is 1\% of GDP in absolute terms. Assume, finally, that the average effect of expansions is to increase GDP by 10\% and contractions do not change GDP. In this case, grouping all estimations, we would get the result that an increase (decrease) in the fiscal variable of 1\% of GDP will increase (decrease) GDP by 5\%. This, of course, is correct as an average effect. However, it obscures essential differences between the two types of policies.

\textsuperscript{16}In some of the papers, such as in Ilzetzki et al. (2013), a ‘long-run’ effect is also calculated by assuming time goes to infinite; in practice, this is equivalent to the effect achieved with the convergence in the maximum horizon.
The assumption that shocks of different sizes have proportional effects tends to be more explicit in papers that use narrative fiscal shocks as the ‘treatment’ variable, given that not rarely the independent variable is binary (fiscal shock or without fiscal shock), as in Jordà and Taylor (2016). However, even in estimations with a ‘continuous’ treatment, that is, the size of the shock as the independent variable, for instance, a limitation persists. First, because these estimations would still capture the average size of the effect, and, a priori, it is possible that shocks of different sizes have different proportional effects (or multipliers, in a more general use of the term). The limitation of taking into account only the average effects is highlighted in a sample with a large number of small shocks, which is the case even for the most common narrative fiscal shocks datasets.

Secondly, because in the particular discussions about austerity measures, to which many of the papers listed participate, considering shocks of all sizes and assuming they have the same elasticities is misleading. As indicated in the introduction (section 1.1), the term ‘austerity’ carries a more or less specific meaning among economists and the general public, that of a significant reduction in government primary balance, and, not rarely, a more specific understanding of a reduction in public spending. It must be acknowledged that the literature, by analyzing differences in the shocks led by taxes or spending changes, advanced significantly in understanding this latter aspect of what is sometimes taken to be austerity shocks in the short-run. The broader aspect related to the size of the shock, however, has not been explored yet.

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17 Which is the norm in estimations using VARs, but can also be applied with other methods, such as the Local Projections, as in Alesina, Favero, et al. (2019b) and Riera-Crichton et al. (2016).

18 Examples are abundant. In this article, for instance, it is suggested that tax increases would be required to end austerity (that is, the reduction in public spending): https://www.theguardian.com/politics/2018/oct/04/is-austerity-really-over-theresa-mays-promise-lacks-key-details. In this New York Times article, austerity is defined as “a campaign of budget cutting” (https://www.nytimes.com/2019/02/24/world/europe/britain-austerity-may-budget.html). In this UN report, austerity is also associated with spending cuts: “austerity policies(...) eliminated many social services, reduced policing services to skeletal proportions, closed libraries in record numbers, shrunk community and youth centres, and sold off public spaces and buildings including parks and recreation centres” (https://www.ohchr.org/en/documents/country-reports/ahrc4139add1-visit-united-kingdom-great-britain-and-northern-ireland).

19 It must be noted also that some earlier works that used the CAPB method were closer to our claim that the shock must be large enough to be considered an austerity shock. In Alesina and Ardagna (2010), for instance, it was considered a shock if the CAPB changed by more than 1.5% of GDP. The goal of the threshold, however, was to be sure one was capturing a shock and not to focus on large ones - it is relevant to note that the size of the shocks captured by the CAPB method are significantly larger: 2.4% of GDP in Alesina and Ardagna (ibid.) compared to 0.9% in Devries et al. (2011).
For these reasons, we believe that estimating separately the effects of (i) only contractionary shocks, and (ii) by different size brackets, is also an important contribution of this paper to the literature.

In terms of the results, the literature is also heterogeneous, although there has been a convergence in recent years towards the direction of the short-run effects on GDP of fiscal consolidations to be negative, with a larger multiplier for tax changes than spending (V. Ramey (2019)). An important exception is a paper by Alesina and Ardagna (2010), which found that negative fiscal shocks had a positive effect on output in a three-year horizon, sparking an intense discussion around the “expansionary austerity” hypothesis. The authors propose a few channels through which the effects could take place. On the demand side, if agents believe that the shock prevents a much more disruptive adjustment in the future, it would generate a positive wealth effect, which might increase demand. Also, if agents believe the adjustment is credible and avoids default, they would ask for lower premiums on government bonds, reducing interest rates. On the supply side, the main channel would be via the labor market. Expenditure cuts (in government jobs and wages, for instance) would worsen workers’ fallback position, decreasing wages in the private sector, allegedly increasing profits, investment and competitiveness. Increases in taxes, on the other side, would tend to increase the pretax real wage, squeezing profits, investment and competitiveness.

However interesting these theoretical channels might be, most of the papers that followed pointed in the opposite direction. Let us mention two that are closely related to ours. Jordà and Taylor (2016) first replicate, using LP, the results of Alesina and Ardagna (2010), but, the authors show that this result is driven entirely by the effects of contractionary policies during booms. The next step given by Jordà and Taylor (2016), and already mentioned, is to show that narrative episodes are not good instruments as they are also endogenous. Given this, the statistical design proposed by Jordà and Taylor (ibid.) is the following: i) use the consolidation episodes identified in the IMF narrative dataset as the maximum subset of episodes (a ‘pseudo-

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20First, they indicate that for a number of variables (Public debt to GDP ratio, deviation of log output from trend, output growth rate, and lagged value of treatment), the means are statistically different for ‘treated’ and control groups, indicating that the distribution of treatment is significantly different than an ideal randomised controlled trial. The authors also find that other variables, usually omitted in the regressions that try to identify the causal effect of fiscal shocks on output, are significant in explaining GDP fluctuations in a regression that also contains fiscal shocks (CAPB and its instrumentalized versions) as an independent variable. Finally, using different binary classification models, they show that the occurrence of fiscal consolidations (as indicated by the IMF narrative dataset) can be predicted by a number of variables (public debt to GDP ratio; the output gap; GDP growth; and fiscal consolidation itself).
IV' step); ii) add the covariates that can predict the fiscal shock or influence output as controls; and iii) use inverse propensity score weighting to re-randomize the allocation of the consolidation episodes. With this setup, similar to the one employed in this paper, the authors find that consolidation episodes are associated with lower GDP within a five-year horizon.

Alesina, Favero, et al. (2019b) present the analysis of austerity plans in 16 OECD countries from the 1970s to 2014 using the narrative approach by extending the dataset elaborated by Devries et al. (2011). They use panel vector autoregression approach to analyze the effect of such plans on a 4-year time horizon. They argue that while austerity based on spending cuts generates minor negative effects and only in the first year, plans based on tax increases reduce GDP by about 2% after four years.

Our paper can be placed within this large and emerging fiscal research literature. There are a number of gaps and issues, however, that this work aims at addressing. The main one is to examine the long-run effects of austerity shocks, resorting to modifications in the estimation method to account for particularities of the time horizon and the fact that multiple shocks occur in the horizon of interest. Secondly, this paper does not assume, as the majority of the literature, that positive and negative shocks are symmetrical. Finally, this paper does not assume that the fiscal multiplier is the same regardless of the shock size, which is particularly relevant not only to the conceptual discussion about austerity, but also because the shocks are “too common” in the datasets, weakening identification.

1.3 Estimations

1.3.1 Baseline

As previously mentioned, despite its weakness, the narrative approach to identify fiscal shocks has been recognized in the literature as the best option to deal with endogeneity. In this paper, we use the dataset of narrative fiscal shocks compiled by Alesina, Azzalini, et al. (2018), which is, to the best of our knowledge, the largest available, covering 16 OECD countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Portugal, Spain, Sweden, the United Kingdom, and the United States) from 1978 to 2014. The dataset by Alesina, Azzalini, et al. (ibid.) takes Devries et al. (2011) as a starting point but has several differences. The most explicit ones are the extension of the dataset from

21The analysis is initially presented in Alesina, Favero, et al. (2019a).
Table 1.2: Description of narrative fiscal shocks in Alesina, Azzalini, et al. (2018)

<table>
<thead>
<tr>
<th></th>
<th>Any Size</th>
<th>&gt;1% GDP</th>
<th>&gt;2% GDP</th>
<th>&gt;3% GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>232</td>
<td>128</td>
<td>69</td>
<td>33</td>
</tr>
<tr>
<td>Expansions</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Contractions</td>
<td>223</td>
<td>128</td>
<td>69</td>
<td>33</td>
</tr>
<tr>
<td>Range of shocks</td>
<td>10.0%</td>
<td>8.7%</td>
<td>7.7%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Avg. Size of Contraction</td>
<td>1.6%</td>
<td>2.5%</td>
<td>3.4%</td>
<td>4.4%</td>
</tr>
</tbody>
</table>

Note: Range of shocks is the difference between the largest and smallest shock (in the case with expansions, the largest expansion is considered the ‘smallest shock’).

2007 to 2014, which is particularly important given the number of austerity policies implemented in this period, and the exclusion of the Netherlands from the sample. However, the changes are deeper, as the authors re-classify the shocks based on the original sources and, thus, significant discrepancies in the size of the shocks are frequent, and it is not rare that episodes found in one sample are not present in the other. Some basic descriptive statistics of the sample are displayed in table 2.1; more than half of the contractionary shocks are smaller than 1% of GDP and only around 15% is larger than 3% of GDP. As indicated before, we use only the negative shocks in the sample.

Alesina, Azzalini, et al. (2018) implement vector autoregressions to evaluate the effects of such shocks. For the reasons described in previous sections, we estimate the effects using a semi-parametric method. More specifically, we will use an extension of the Augmented Inverse Propensity Weighted Estimator (AIPW). According to Lunceford and Davidian (2004) and Jordà and Taylor (2016), the AIPW is the estimator with the smallest asymptotic variance within the class of the double-robust estimators - that is, those for which it is sufficient that either the conditional mean model (‘outcome model’) or the propensity score model (‘treatment model’) to be correctly specified for the estimator to be consistent.

As indicated in section 1.2, the ‘treatment model’ is used to calculate the probability of each unit (country-year) to have an austerity shock. The variables used in the probit to estimate this probability are:22 country dummies, debt (% GDP), GDP gap (as measured by HP filter), real GDP growth (current and one lag), a dummy for an episode of fiscal consolidation in the previous year, long-term and short-term interest rates, current account (% GDP), change in the

22 As mentioned, this follows the procedure adopted by Jordà and Taylor (2016).

23 In the appendix, we also test the results including time dummies.
investment to GDP ratio, real private loan growth, and CPI inflation rate. Except for the data on the current account, which we extract from the OECD, and the one for real private loan growth, obtained with the Bank for International Settlements (BIS), the source for the other variables is the data employed by Alesina, Azzalini, et al. (2018). After the ‘preliminary’ stage of reweighting the sample, we can proceed to the ‘outcome model’, in which a regular difference-in-differences regression is performed with controls for conditional mean. We follow Jordà and Taylor (2016) and control for a cyclical component of GDP, country-fixed effects, and two lags of change in GDP.

More specifically, the estimator can be written as:

\[
\hat{\Lambda}_{APW}^h = \frac{1}{n}\sum_t \left\{ \frac{D_t(y_{t+h} - y_t)}{p_t} - \frac{(1-D_t)(y_{t+h} - y_t)}{(1-p_t)} \right\} - \frac{(D_t - \hat{p}_t)}{p_t(1-p_t)} \left[ (1-\hat{p}_t)m_1^h(X_t, \hat{\theta}_1^h) + \hat{p}_tm_0^h(X_t, \hat{\theta}_0^h) \right] \quad (1.1)
\]

For which: \( y_{t+h} \) is the variable of interest at time \( t + h \), \( D_t \) is the fiscal policy variable, \( \hat{p}_t \) is the policy propensity score at time \( t \) given the relevant set of covariates contained at \( X_t \), and \( m_j^h \) is a generic specification of the conditional mean of \( y_{t+h} - y_t \) in the subpopulation \( j \) (that is, with or without a shock). Finally, \( \hat{\theta}_j^h = (\alpha_j^h \beta_j^h)' \), with \( \alpha_j^h \) indicated what would be the size of \( (y_{t+h} - y_t) \) for group \( j \) in the absence of treatment and \( \beta_j^h \) the estimator of the covariates over \( (y_{t+h} - y_t) \).

An important adjustment to this method is required. The main problem to be addressed here is that in settings in which the “treatment” (austerity shocks) can occur multiple times, it is possible that, when interested in the effect of treatment at time \( t \) on \( (y_{t+h} - y_t) \), another treatment takes place between time \( t \) and time \( h \). In those cases, the effect of \( D_{t+j} \) for \( j < h \) is absorbed by the fixed effects coefficients of the regression, biasing the estimation of the

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\(^{24}\)It can be found here: www.igier.unibocconi.it/fiscalplans. The GDP data is in volume at market prices. For some data points, we had to make some minor adjustments. For 4 data points of indebtedness, we perform linear interpolation (Belgium 1989, Denmark 1997, Sweden 2003, Finland 1980). Moreover, for Germany and Ireland before 1990, we use the change in the correspondent variables of short and long-term interest rates in Jordà and Taylor (2016) to extrapolate these variables; the same procedure was implemented for CPI inflation in England before 1988 and for short-term interest rate from Sweden before 1982.

\(^{25}\)In appendix A.1, we test with an additional lag of GDP change to address any concern with pre-trends.

\(^{26}\)In our baseline regressions, we will follow the assumption made in most macro estimations using VARs and which is also performed by Jordà and Taylor (2016) (table 8) that \( \theta_0^h = \theta_1^h \).
treatment itself. This problem increases with the forecasted horizon; thus, it is an important problem for long-run estimations such as the ones performed in this paper. The solution, proposed by Teulings and Zubanov (2014) and followed in this paper, is to include future fiscal shocks occurring up to time $h$ in the future ($\sum_{j=0}^{h-1} \Lambda^h D_{t+h-j}$) as controls.

Figure 1.1 presents the main results of our estimations, namely the effects on GDP of contractionary fiscal shocks of different sizes. As can be seen, when all contractionary shocks are considered, a negative effect on GDP is present in most years, but in a statistically significant way only in the fourth and fifth years after the shock. The results are different for larger shocks: for those larger than 1.5% of GDP, the coefficients tend to be larger (in absolute terms) and more significant (statistically), including after 15 years, for which the coefficient is -3.5% of GDP. When restricting the analysis to stronger shocks, larger than 3% of GDP, the coefficients are even more negative and statistically significant for every year; those shocks are associated with a reduction in GDP of 5.6% after 15 years.27 In other words, our estimations suggest that relatively large contractionary fiscal shocks generate significant long-run negative effects on GDP.

It can be argued that the choice for the thresholds for the minimum size of the shock is somehow subjective. The choice of 1.5% (and its multipliers) of GDP as the baseline follows the threshold adopted in some papers to establish the minimum size of the change in the cyclically adjusted primary balance for a fiscal shock (Alesina and Perotti (1995), Alesina and Ardagna (2010)). To reduce concerns that these choices are driving our results, we test other minimum thresholds in the robustness section (subsection 1.4.1).

27These results do not tell us nothing about different proportional effects of the shocks; we explore this issue in the next section (subsection 1.4.4).
It is important to note that the narrative fiscal data from Alesina, Azzalini, et al. (2018) considers fiscal plans and divides the austerity measures into three categories: (i) shocks that took place in time $t$ and were not previously announced; (ii) measures that take place in time $t$ and that were announced in the past; and (iii) measures announced in time $t$ to be implemented in $t+1$. In line with the authors’ use of their dataset in Alesina, Azzalini, et al. (ibid.), the size of a shock in time $t$ is assumed to be the sum of all three categories. In the appendix (section A.4), we also add robustness exercises of estimations that use only actual shocks (anticipated or not) and the results of negative effects in the long-run persist for shocks larger than 3% of GDP, with even larger negative effects after 15 years.

An important discussion in the literature is whether austerity policies based on expenditure reduction have the same effects as those implemented via tax increases. In figure 1.2, we explore the question by looking at each type of policy. There are different ways of defining each of these shocks; in the baseline specification used here, we consider all tax or expenditure shocks - a

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28See, for instance, the discussion in p. 149 about expenditure vs. tax based shocks. This is also described in the book Alesina, Favero, et al. (2019a).
usual alternative in the literature is to consider a tax or expenditure shock if the larger part of the austerity measure is based on it. While tax increases do not generate any significant change in GDP, reductions in government expenditure tend to significantly decrease GDP over extended periods. The result that spending cuts harm GDP more than tax increases is also robust to the use of only actual shocks that take place in time \( t \), as can be seen in the appendix.

Hence, spending-based fiscal shocks seem to be responsible for the significant negative long-run effect of austerity found in our overall estimations. This result differs from the majority obtained in the fiscal multiplier literature that uses time-series data, as summarized by V. Ramey (2019). These papers frequently find a larger negative multiplier (for up to five years) for tax increases than for spending cuts. Effects estimated by calibrated DSGE models are, in general, more in line with the results found here.

Figure 1.2: Type of shock

Note: Dots indicate estimated coefficients. The bars indicate a 95% confidence interval.

1.3.2 Extended dataset and different GDP measure

The discussion regarding austerity regained centrality after the great financial crisis of 2007 and its repercussions in the European debt crises some years later. This period was marked by countries adopting fiscal austerity measures with the goals of controlling indebtedness and
increasing GDP growth, which could be directly connected due to a “debt intolerance” (Reinhart and Rogoff (2010)) or the channels indicated by the “expansionary austerity” hypothesis presented before.

Given that our series goes up to 2014, an important limitation of the estimations is the exclusion of the long-run effects of this recent wave of austerity. A simple solution would be to extend the data on GDP; in our baseline specification, however, there is an additional problem: we are controlling for shocks occurring between \( t \) and \( t + h \). Therefore, we would also need to extend the fiscal shock data. Given the nonexistence of a longer narrative dataset, we perform an intermediate solution: while we keep using the same narrative shocks as treatments, we extend the series of shocks to be used as controls with a measure of fiscal shock based on the cyclically-adjusted primary balance (CAPB) calculated by the IMF. Following the usual procedure in the literature, we look at the annual change in the CAPB and assume that a shock occurs when the CAPB increases by at least 1.5% as a percentage of GDP. Finally, to generate a series for GDP up to 2019 - and to take into account there might have been revisions in the growth rates since the data was compiled by Alesina, Favero, et al. (2019a) - we use data from OECD on the growth rate of GDP (in volume). As a robustness test, available in the appendix, we perform the same estimation using GDP at constant national prices, from PWT 10.0; the results are very similar.

As can be seen in figure 1.3, qualitative results persist: for a sufficiently large austerity shock, there are statistically significant long-run effects on GDP. \(^{29}\)

\(^{29}\)We do not calculate the effect by type of austerity with this extended dataset as the measure of CAPB that we are using do not discriminate between tax and expenditure changes; therefore, its use, even only as a control and for a short period of time would not be adequate.
1.4 Extensions and Robustness

1.4.1 Alternative thresholds

As indicated above, the choice of 1.5% of GDP as our baseline threshold is based on other important papers in the literature. However, it is clear that if the results are too sensitive to this threshold, the generality of our argument - that austerity shocks, understood as significantly large negative fiscal shocks, have long-run effects - is weakened. To address this, we test the effect on GDP after 15 years of shocks considering four other thresholds. Figure 1.4.1 indicates that shocks larger than 1%, 2%, and 2.5% of GDP - besides the baseline cases of 1.5% and 3% - have long-run effects on GDP.

*Note:* Dots indicate estimated coefficients. The bars indicate a 95% confidence interval.
1.4.2 Alternative dataset

Another important dataset of narrative fiscal shocks is the one from Devries et al. (2011), which covers 17 OECD countries from 1978 to 2007. As mentioned before, this dataset has several differences with respect to the one elaborated by Alesina, Favero, et al. (2019a) even for the years covered by both, and it excludes this most recent wave of austerity plans after the Global Financial Crisis. Thus, checking if the effects of this alternative sample of shocks align with our baseline results can serve as an important robustness check.

Applying our baseline estimation strategy and taking advantage that this is also the method implemented by Jordà and Taylor (2016), we employ the same data used by them to calculate the probability of being “treated”. Only the dummy for an episode of fiscal consolidation in

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As indicated in section 1.3, the variables are: country dummies, debt (% GDP), GDP gap (as measured by HP filter), real GDP growth (current and one lag), long-term and short-term interest rates, current account (% GDP), change in the investment to GDP ratio, real private loan growth, CPI inflation rate, and a dummy for an episode of fiscal consolidation in the previous year.
the previous year is slightly different from the one of Jordà and Taylor (2016), as they use a treatment variable that also includes fiscal expansions.\footnote{There seems to be a problem in Jordà and Taylor (2016) as it is not the case that the authors are assuming that expansions and contractions are symmetrical, but instead, in their regressions, expansions are entering as contractions - that is, the dummy of treatment takes 1 for both expansions and contractions. That ends up being a minor problem in practical terms given that the number of expansions is very small. However, there are some differences if the estimation is adjusted to contain only contractions: the effect after 5 years, in the restricted case (table 8), drops to -0.9% and is significant only at 10%, while in Jordà and Taylor (ibid.), the effect is of -1.1% and significant at 5%.
}

Figure 1.5 presents our results, which are very similar to the ones from Jordà and Taylor (ibid.) for short-run periods and considering all negative fiscal shocks, but for horizons longer than those estimated by the authors, the results are statistically insignificant. However, once again, when the shock size is taken into account, the results indicate something different. Using again our baseline threshold of shocks larger than 1.5% of GDP, the negative effect on GDP is statistically significant in all years after the shock with the exception of the eighth year.

\textbf{Figure 1.5: Effect by shock size - alternative dataset}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1_5.png}
\caption*{Note: Dots indicate estimated coefficients. The bars indicate a 90\% confidence interval.}
\end{figure}

The narrative shocks in the Devries et al. (2011) dataset tend to be smaller than the ones in Alesina, Favero, et al. (2019a), and thus there are not enough observations to perform the
estimations for shocks larger than 3% of GDP. In figure 1.6, we apply the same reasoning used in section 1.4.1 and get a qualitatively similar result indicating that our findings regarding the long-run effects of austerity shocks are robust to different thresholds for the minimum size of the shocks.

![Figure 1.6: Effect by shock size - alternative dataset and thresholds](image)

*Note: Dots indicate estimated coefficients. The bars indicate a 90% confidence interval.*

Still using the data employed by Devries et al. (2011), one can check if the results by the type of shock also hold. Figure 1.7 indicates that, although expenditure cuts tend to have a more negative effect in the long-run, the coefficients are consistently statistically non-significant at 10% eleven years after the shock.
1.4.3 Excluding episodes and countries

As indicated in table 2.1, there is a wide spectrum of shock sizes, this being one of the key venues of exploration in our paper. However, given that we are placing only a lower limit to the shocks, particularly large austerity measures may be driving our results. To test the robustness of our results to this possibility, we re-run the baseline estimation for shocks larger than three percent of GDP excluding one episode at a time and check if the effects on GDP after fifteen years hold. Figure 1.8 shows that the results are robust to the exclusion of any particular shocks.

Note: Dots indicate estimated coefficients. The bars indicate a 90% confidence interval.
The same exercise is performed for the types of shocks. As can be seen in figure 1.9, the result that increases in taxes are not associated with a change in GDP is consistent with the exclusion of any particular shock. For the case of spending, all estimations indicate a large negative coefficient, although the exclusion of three particular shocks decreases the statistical significance - in two of them, notwithstanding, it remains significant at 90%.
Figure 1.9: Robustness check - Excluding shocks - Type

**Note:** Dots indicate estimated coefficients. The bars indicate a 95% confidence interval.

A final exercise excludes entire countries of the sample. One reason for this exercise is the exclusion of a larger group of observations at each time (compared with the exclusion of particular shocks). Another is that it is possible that for some countries the shocks have a larger degree of endogeneity: for instance, contrary to Devries et al. (2011), Alesina, Favero, et al. (2019a) exclude the Netherlands from their sample given that the fiscal rule of the country leads to a particularly large correlation between fiscal adjustments and past output growth. As can be seen in figure 1.10, the effects by size and type of shock are very similar to the baseline estimation, with austerity measures larger than 1.5% and 3% of GDP having a negative and statistically significant effect after 15 years in the vast majority of cases, as well as the effect of expenditure cuts in contrast to increases in taxes.
1.4.4 Continuous treatment

A question that might be of interest is if the proportional effects of the shocks of different sizes are also relevant. That is, if a shock 1% larger (as a % of GDP) has a different effect considering all the shocks and only those larger than 3%, for instance. This estimate gives us something similar to a fiscal multiplier. To test this, we resort to an adaptation of our baseline method. First, in our ‘treatment model’, we re-weight the sample the same way did before, using a binary treatment variable. In our ‘outcome’ model, however, we use a continuous treatment, that is, the size of the shock. This is performed within each treatment band of interest of our baseline estimation: all contractionary shocks, and those larger than 1.5% and 3% of GDP.

Table 1.3 presents the results for the instantaneous and long-run ‘multipliers’. The long-run coefficients indicate, for example, that a shock of 2% of GDP will reduce GDP in around 3% after 15 years. One interesting result is that the multipliers for shocks larger than 1.5% and 3% of GDP are very similar in both short- and long-runs. However, the most important result is that the multipliers for these sufficiently large shocks are significantly different than the one when considering all fiscal contractions; using a qui-square test, we can reject the hypothesis that they are statistically equal with a 5% significance level. This reinforces the idea that

32For the treatment itself and for its leads.
the size of the shock matters, not only due to persistence issues, as indicated in our baseline estimations, but also for potential non-linear proportional effects on the economy.

### 1.4.5 Initial examination of channels

A detailed examination of the channels through which these long-run effects operate is beyond the scope of this paper. Taking advantage of readily available data, however, we perform a first approximation to check the effects on the two main aggregate inputs: capital stock and labor. Figure 1.11 suggests that austerity shocks larger than 1% of GDP (using our baseline dataset) are associated with a consistent and statistically significant negative effect on the stock of capital (as measured by the PWT 10.0).

Table 1.3: ‘Multipliers’ - by size shock

<table>
<thead>
<tr>
<th></th>
<th>&gt;0% GDP</th>
<th>&gt;1.5% GDP</th>
<th>&gt;3% GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instantaneous (after 1 year)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiplier</td>
<td>-0.07</td>
<td>-0.24</td>
<td>-0.23</td>
</tr>
<tr>
<td>P-value = &gt;0% GDP</td>
<td>-</td>
<td>0.00</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Long-run (after 15 years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiplier</td>
<td>-0.51</td>
<td>-1.46</td>
<td>-1.45+</td>
</tr>
<tr>
<td>P-value = &gt;0% GDP</td>
<td>-</td>
<td>0.00</td>
<td>0.03</td>
</tr>
</tbody>
</table>

*Note:* A qui-square test is used to test the null hypothesis that the multiplier is equal to the one when all contractionary shocks are considered. + indicates statistical significance at 10%.
Figure 1.11: Effect by size - Stock of Capital

Note: Dots indicate estimated coefficients. The bars indicate a 95% confidence interval.

The effects on the labor market are less clear: in figure 1.12, larger shocks seem associated with a decrease in the ratio of the employed populated (also calculated based on PWT 10.0 data). This measure, although with advantages in some dimensions (do not rely on different definitions of unemployment and incorporate changes in the population actively searching for work, for instance), also has clear drawbacks, such as a change in demographics over fifteen years. Moreover, results for other measures, such as the short and long-run unemployment rates and the labor force participation as measured by the OECD, as presented in the appendix, do not present a clear picture.
1.4.6 Simpler Difference-in-Differences method

Another relevant exercise is to check if the results are too sensitive to our method. On the one hand, the baseline method is chosen as it is the most appropriate to estimate the effects of interest here, given the arguments presented in section 1.2. In this sense, it is expected that the estimated effects depend on the method. On the other hand, if the results are reverted with the use of other methods, although the baseline results should not be discarded, one would need to analyze in greater detail the assumptions made in our baseline method and why the results differ.

In this subsection, thus, we perform the analysis with a simpler estimation: instead of weighting the sample using IPW, we control for all the variables in a standard difference-in-differences setup:

\[
\Delta y_{i,t+h} = \alpha^t + \beta^s E_{i,t} + \theta X_{i,t} + \epsilon_{i,t+h}
\]

(1.2)
where $\alpha^i$ are country dummies and $X$, a vector with all the control variables, including those used in both the “treatment” and “outcome” models in the AIPW estimator$^{33}$. 

As can be seen in figure 1.13, the results are, in general, in line with the estimations using the AIPW method, the main differences being the smaller coefficient for shocks larger than 1.5% of GDP and the larger confidence interval for estimations of the shocks larger than 3% of GDP. The effects of the types of shocks are very similar to our baseline estimations.

Figure 1.13: Simpler DiD

Note: Dots indicate estimated coefficients. The bars indicate a 95% confidence interval. Actual shocks are those that took place in time $t$, expected or not.

1.4.7 “Cleaner” controls - A local projections approach to DiD

An increasingly recognized problem in studies that resort to some form of differences-in-differences estimation is the bias that emerges once one moves away from a “2X2” setup - that is, two periods (pre and post-treatment) and two status (treated or never treated) (e.g., Callaway and Sant’Anna (2021), De Chaisemartin and d’Haultfoeuille (2020) and Goodman-Bacon (2021)). In our case, one can illustrate an important potential bias by reminding that the regression that estimates the effect of an austerity shock in time $t$ on output in time $t + k$ has as controls countries that also had shocks between $t + 1$ and $t + k - 1$. In situations in which the treatment effects are heterogeneous and dynamic, as in our case, the bias is clear: the observations used as controls are also under the influence of shocks.

The controls are: debt (% GDP), GDP gap (as measured by HP filter), real GDP growth (current and one lag), a dummy for an episode of fiscal consolidation in the previous year, long-term and short-term interest rates, current account (% GDP), change in the investment to GDP ratio, real private loan growth, CPI inflation rate, a cyclical component of GDP, country fixed effects, two lags of change in GDP, and leads of shocks that occur from time $t$ up to time $h$. 

$^{33}$
There are different ways of trying to reduce this bias. The method suggested by Dube et al. (2022) seems particularly interesting and adequate for our purposes given the endogenous nature of the treatment time. In this subsection, we follow, their approach by excluding from the control sample countries that were “treated” between \( t + 1 \) and \( t + k \) when estimating the effect of treatment in \( t \) on output at \( t + k \).\(^{34}\) This is performed with our baseline setting (section 1.3), that is, on top of performing propensity-score matching and controlling for future shocks of the treated countries.

Although this approach has the advantage of providing control units that are not under the influence of austerity, it comes with the relatively high cost of significantly decreasing the number of observations for each estimation. This might lead to a less smooth sequence of coefficients and a wider confidence interval. In our case, the smaller the threshold for the minimum shock size, the stricter the rule on controls will be.\(^{35}\) We focus, therefore, on the higher threshold of shocks larger than 3% of GDP so that we can have an adequate number of observations. Results for both GDP and capital stock are displayed in figure 1.14. As can be seen, even in this much stricter scenario, results persist, indicating significant negative effects of austerity shocks over long periods.

\(^{34}\)For instance, assume several countries have austerity shocks in 1990. To calculate the average effect of these episodes after 10 years, the control sample will consist only of countries that did not have an episode between 1990 and 2000. Similarly, to calculate the effects after 5 years, the control sample would consist of countries that did not experience an episode between 1990 and 1995.

\(^{35}\)That is, for a smaller threshold, we have a larger number of shocks, and thus the number of countries that can be used as controls in a 15-years window is very reduced.
1.4.8 Expansions

The goal of this paper is to analyze the long-run effects of austerity shocks. However, differently from the existing literature, by focusing on the actual negative fiscal shocks and not assuming that positive shocks are symmetrical, we can also perform an initial assessment of the effects of expansionary fiscal measures. These shocks are much rarer in the existing narrative datasets, amounting to only nine cases in our baseline one (Alesina, Favero, et al. (2019a)), and, therefore, these results must be interpreted with all the due caveats and should be seen only as a first approximation to the issue.

Using the same regression as in section 1.3 and both our baseline dataset (figure 1.15) and its extended version (figure 1.16), we find that expansionary shocks tend to have positive long run effects on GDP.
Figure 1.15: Effect of fiscal expansions - baseline

Note: Dots indicate estimated coefficients. The bars indicate a 95% confidence interval.
1.5 Conclusion

After a time of diminished interest in fiscal policy during the so-called Great Moderation in advanced economies, the past two decades saw an emerging interest in fiscal research, deriving from the challenges most economies faced since the Global Financial Crisis. Despite several efforts, which greatly improved our knowledge about the topic, a few important gaps persist. This paper aimed at addressing one in particular: the long-run effects of austerity policies.

The idea that countries are still being affected by the most recent austerity wave that followed the financial crisis is widespread in public opinion. This impression might have encouraged the emergence of a literature that links austerity with several effects, including those that tend to have persistent impacts, from public health, to political instability and democracy erosion (e.g., Fetzer (2019), Baccaro et al. (2021), Ponticelli and Voth (2020), Guriev and Papaioannou (2022), Rajmil et al. (2020)). Regarding its economic impact, however, the evidence is limited to short-run effects focused, in general, to a maximum of five years, even on its more aggregated level, such as output or capital stock.

Note: Dots indicate estimated coefficients. The bars indicate a 95% confidence interval.
Employing a method that ‘re-randomize’ the allocation of austerity episodes in a local projections setup and accounting for the fact that multiple shocks occur in the time horizon of interest, our results indicate that relatively large austerity measures have detrimental effects on GDP even after 15 years. This result is robust to extensions in the fiscal shocks used as controls, to different measures of GDP, to alternative narrative datasets, to the exclusion of individual shocks and countries, to the implementation of simpler regression methods, to the use of ‘cleaner’ controls, and to a different definition of shocks (only actual shocks). Moreover, there is robust evidence that austerity shocks have significant negative effects on capital stock. There is also some indication, although less robust, of negative effects on the labor market and that spending cuts are more detrimental to GDP than tax increases.

This paper fills a relevant gap in the literature by: (i) examining the long-run effects of fiscal policy, employing techniques that are appropriate for such estimations; (ii) focusing exclusively on contractions and not assuming symmetry with expansions; (iii) allowing different effects for different shock sizes, both in proportional terms and related to its persistence over time. These two last points are particularly relevant as the term ‘austerity’ is of public interest and it seems important that economists engage in the broader conversation with a similar understanding of the term: contractionary fiscal policy of significant size. Arguing, a priori, that standard fiscal multipliers are sufficient to assess the impact of austerity episodes is misleading, do not contribute to our understanding of the topic and is not very useful for policy orientation. Finally, when it comes to the time horizon of the estimation, our study contributes to the growing literature on the persistent effects of demand shocks by being the first to analyze the the long-run impact of fiscal shocks. In this context, our estimations present additional evidence that demand shocks may have significant long-run effects.
CHAPTER 2
FOREIGN DIRECT INVESTMENT, CAPITAL OWNERSHIP, AND ECONOMIC DEVELOPMENT

2.1 Introduction

Foreign investment is frequently a matter of public interest in developing countries, being used as a parameter of the government’s economic management success: a low inflow tends to be understood as a sign that the economy is not performing well and that its future is worrisome. The logic, implicit most of the time, is that foreign investment does not only reflect the current state of the economy but is a central element in promoting growth. This position is based on the standard introductory-level economic reasoning that capital will flow to where it is relatively scarcer and, consequently, its remuneration tends to be larger; if this does not happen, it must be due, allegedly, to high risks in the domestic economy.

However, even among critics of this mainstream reasoning, the expected effect of foreign capital on the domestic economy is far from consensual. According to Dani Rodrik, “[o]ne dollar of FDI is worth no more (and no less) than a dollar of any other kind of investment” (Moran (2005)). This view differs from that of Ha-Jon Chang, for instance: “[t]he home country appropriates the bulk of the benefits from a transnational corporation (...) the nationality of a firm is still key to deciding where its high-grade activities, such as R&D and strategizing, are going to be located (...) it would be very naïve to design economic policies on the myth that capital does not have national roots” (Chang (2012)). Part of the seemingly conflicting positions on the matter can be attributed to the multitude of angles from which it can be addressed. Looking at the effects of foreign firms’ entrance into one particular sector in a developed country, for instance, will provide some evidence on one specific way capital ownership can matter, but might tell very little about, for instance, the question this paper aims at addressing: how the presence of foreign capital can impact economic development on the long-run, particularly in underdeveloped countries.

The idea that ownership matters for long-run growth is not new. In H. W. Singer (1950), for instance, the concept that the terms of trade of primary commodity producers would tend
to deteriorate over time - which would become the core of the seminal Prebisch-Singer hypothesis - emerges as one particular potential effect of investment from developed economies in underdeveloped ones. Given the predominance of foreign investment in exports sectors, dominated by primary goods in these less developed economies, H. W. Singer (1950) argues that the productive units associated with these investments acted as enclaves in the host country, not promoting structural changes. Moreover, the productivity gains in these sectors were not absorbed domestically but sent abroad via profits or through the worsening of trade terms. Not least important, H. W. Singer (ibid.) points to the opportunity cost of such capital inflow for the host economy, which could reinforce the existing comparative advantages and discourage dynamic production complexification. To the static view of trade that focuses on short-term productivity gains from foreign investment, the author argues that “[w]e must compare, not what is with what was, but what is with what would have been otherwise” (p. 476).

In a more recent work, Amsden (2001) discusses the convergence path that a group of developing countries took after World War II and places capital ownership differences at the center of the argument of why some of these economies continued to catch-up after the 1980s and others stagnated. The basic idea proposed is that foreign companies invest less in innovation and that those affiliates often crowd-out domestic firms in sectors with larger potential for productivity increase. The work from Amsden (ibid.) is an important reference for the paper and will be resumed in section 2.2.

The vast majority of the recent literature related to our question focuses on short-term effects of foreign capital inflow as foreign direct investment (FDI henceforth). Although the goal of this paper is to study the long-run effects of foreign capital stock, given the relevance of this FDI literature and the fact that its inputs can offer us elements to think about our question of interest, most of section 2.2 is dedicated to reviewing these works, focusing in identifying channels through which foreign capital might affect the economic structure of developing economies in the long-run. A brief comment on motives and strategies by multinational companies is also added to the section as it can highlight, from a different perspective, some of the potential consequences of the presence of those firms.

In section 2.2, thus, I present some theoretical and historical inputs related to the potential effects of capital ownership on economies. By connecting different strands of the literature, the goal is to present a coherent hypothesis of how capital nationality might matter for the long-run economic development.
In section 2.3, I move to an empirical investigation of the hypothesis by checking the effects that the stock of foreign capital in 1980 had on the development of 65 countries over almost four decades. The main results, robust to a number of specifications and controls, including those common in the long-run growth literature (e.g., institutional quality, cost of investment, geographical distribution), indicate that larger foreign capital presence in developing countries was associated with lower economic growth and a basket of exports less specialized and with a larger share of low-tech goods. The results are inverted to high-income economies, for which the effects are positive on GDP growth and export specialization. These estimations are only a first approximation to the empirical examination of the question; notwithstanding, to the best of my knowledge, this is the first paper to perform such an empirical exploration.

These results are in line with the hypothesis proposed here, that indigenous capital might be important for economic development. In particular, combining the empirical results with the theoretical discussion of the effects of foreign capital entrance, it is possible to conjecture that, in the case of developing economies, foreign capital ownership might have reinforced the static comparative advantages of the host countries, crowded-out local firms (due to increased competition for credit and skilled labor) that could invest in proprietary innovations while increased demand in backward sectors.

Besides this introduction, the paper contains three other sections. In section 2.2, the FDI literature is reviewed with the goal of presenting the main channels through which foreign capital can affect developing economies. As mentioned, also in section 2.2 the main argument by Amsden (2001) is presented in order to further substantiate the hypothesis presented and motivate the empirical test performed in section 2.3. Section 2.4 discusses the empirical results, proposes an interpretation in light of the theoretical arguments presented, and concludes the paper.

2.2 Foreign Direct Investment and a visit to the “Rest”

2.2.1 How FDI can affect the host economy

Foreign Direct Investment is related not only to capital ownership, but also to productive and managerial control. If a foreign agent invests in a firm in another country but does not exert any managerial role, the investment is considered purely financial.¹

¹Different institutions have slightly distinct ways of measuring it, but, in general, FDI reflects acquisitions of at least 10% of the voting stock of a resident firm by a non-resident investor.
There are several theoretical channels through which the entrance of Foreign Direct Investment can affect the host economy. Since the resurgence of FDI in the late 1980s, the most prominent channel in political and academic spheres has been knowledge transfer; that is, the idea that multinational firms can bring productive knowledge upgrades to the host economy. In practical terms, such knowledge transfers can emerge from partnerships between the affiliate and domestic companies, from local firms ‘observing’ new products brought by the multinational, and via the labor market (rotation of workers between firms, connections between workers sharing some specific knowledge, and spin-offs, for instance). These transfers can be of two types, horizontal or vertical. The former happens when the entrance of a multinational firm in a given sector promotes an increase in ‘knowledge’ and productivity in firms of the same sector, while the vertical case takes place when the affiliate entrance in a particular activity boosts the performance of firms in other, related activities – particularly in those that produce inputs used by the affiliate.

Firms tend to protect intellectual capital that provides them some market power while encourage productivity gains in suppliers so that their costs can be reduced; that is, multinational corporations (MNCs) would tend particularly to promote vertical transfers. Assuming stronger vertical linkages, there is no direct advantage for the host economy if the suppliers’ productivity gains are absorbed entirely by the affiliate via lower prices, given that the productivity increase will result exclusively in larger profits for the MNC.

The last point cited above is related to a second channel through which foreign firms’ entrance can affect the host economy: pecuniary externalities. In contrast to knowledge spillovers, pecuniary externalities take place via market transactions. These externalities can be related to backward or forward linkages. When an MNC’s operation boosts demand for inputs, creating the conditions for the production of new intermediate goods or allowing suppliers to take advantage of economies of scale, a backward linkage occurs. If the operation of the MNC reduces the costs or improves the quality of inputs for other firms and sectors, it is said to have created forward linkages.²

A third important channel through which FDI can impact local economies is the reallocation of resources. The idea is that MNCs’ entrance would increase competition in the local

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²These examples of pecuniary spillovers are positive; however, as might be clear, this need not be the case. If the MNC behave as an enclave and import most of its inputs, for example, the demand for local inputs can be reduced, which, following the same reasoning used to argue for positive leakages, tends to increase inputs prices and decrease their variety, affecting negatively also other firms and sectors.
market for inputs and goods, promoting productivity enhancing effects within and between firms. Within local firms, the increase in competition might force companies to focus on goods whose production is relatively more efficient and to promote improvements that reduce their gap to the technological frontier (Aghion et al. (2009)); these productivity increases operate at an ‘intensive margin’ (Alfaro and Chen (2018)). In contrast, the reallocation of resources between-firms works at an ‘extensive margin’. MNC’s entrance will, on the one hand, increase factor competition, increasing costs, and, on the other hand, decrease domestic firms’ products prices due to higher competition in the goods market. Both ‘extensive margin’ effects raise the productivity threshold required for domestic firms’ survival, which forces some domestic firms to exit, augmenting the overall productivity in the economy by increasing the weights of the most productive firms in aggregate output and by liberating resources to the most productive units.

Finally, the classical argument relating Foreign Direct Investment and the host country’s economy is the accumulation of production factors, which would be more important the poorer the host country is. The focus tends to be on capital accumulation, which is seen as the limiting factor in underdeveloped economies. The ‘augmentation’ of labor via human capital, however, has gained increased importance. The latter can be affected by FDI if, for instance, multinational firms invest more in employee training (assuming that the skills learned are not specific to the firm itself).

Before we look at the empirical evidence on these mechanisms, another theoretical exploration is relevant: which circumstances affect the probability that the effects are positive or negative.

2.2.2 When FDI can affect the host economy

The general idea behind most of the conditions for the host economy to benefit from FDI is the same: the economy must have good competitive capacities (Moran et al. (2007)), which tends to be associated with a given level of ‘absorptive capabilities’. In other words, foreign firms’ entrance tends to work as a competitive shock, which either harms the local economy and pushes local firms out of the market or stimulates domestic companies to become more

3These effects seem to assume that (i) resources are binding, which might be the case more for capital than for labor in underdeveloped countries; and (ii), that the MNC and local firms produce substitutable goods.

4There is another channel that relates FDI and host economy performance: macroeconomic volatility. This, however, seems to be a less important channel, both in the FDI literature and for our particular questions.
productive. What determines which of the cases will follow is the economy’s capacity to respond to increased competition.

One important condition is the amount of human capital, or skilled labor, in the host economy before the FDI entrance. For the transfer of knowledge to happen, be it vertical or horizontal, a minimum set of labor capabilities is needed. A minimum amount of skilled labor is also relevant for pecuniary externalities to reach their full potential given that the expansion of sectors backward or forward, particularly in sectors with higher technological content, requires this type of labor. If human capital is low, the host country might not be able to absorb the knowledge at all; if skills are too concentrated in a small portion of workers, the multinational company might absorb most of it, forcing other firms that use this labor out of the market.

A second aspect central to the effects of MNCs’ entrance into the host country is the local financial market. In this case, too, there are a number of reasons for it. One is that for backward linkages to take place, some initial capital will tend to be used by those firms that produce inputs. A second reason is to ensure that the entrance of an MNC does not make available capital scarcer, an issue particularly problematic for underdeveloped countries. This might generate a crowding-out effect, preventing local firms from taking advantage of externalities. Still, a third reason for the relevance of well-developed financial markets in the host economy is facilitating the reallocation of capital from less to more productive companies.

These two elements (human capital and financial market) are the most important in the literature regarding characteristics of the host country determining the effect of FDI on growth. From them, and the idea that most benefits arise from the reallocation of resources, other related conditions emerge, such as labor market flexibility, low regulatory barriers, and easy entrance and exit of firms (Harrison and Rodriguez-Clare (2010)). In some accounts, the broad idea of ‘institutions’ also appears as an element of ‘absorptive capabilities’, and, thus, as a relevant

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5 For instance, Alfaro, Chanda, et al. (2010) present a model in which this channel is explicit. In it, final goods are produced by combining intermediate goods that can be either domestic or foreign; these intermediate goods are produced in a competitive market using skilled and unskilled labor and a range of differentiated inputs. These differentiated inputs (a second upstream industry layer) are produced in a monopolistic competition environment. To operate in the intermediate input sector, one must develop a new variety of intermediate input, which requires upfront capital – and this is where financial markets can be crucial. In the model language, the increase in the varieties of intermediate inputs encouraged by the MNC entrance and allowed by a sufficiently developed local market leads to positive backward and forward leakages.

6 Financial markets development can also impact FDI entrance. On the one hand, developed financial markets attract more international firms as they can finance larger portions of the investment locally; on the other hand, exactly because foreign firms can finance locally, it tends to decrease the inflow of capital.
condition for the effect of FDI on the host economy (e.g., Durham (2004), Jude and Levieuge (2017)).

2.2.3 Empirical evidence

In terms of empirical findings on the impact of FDI on the host economy’s productivity and growth, the net effects are, in general, ambiguous.

There is robust evidence that MNCs tend to have higher productivity than domestic firms in the same sector, even after controlling for the fact that FDI tends to flow to the more productive firms (see Arnold and Javorcik (2009) for Indonesia, for instance). However, a vast literature, sparked by the work of Aitken and Harrison (1999), indicates that while FDI raises productivity in plants that receive the investment, it reduces in others, tending to generate negative or insignificant net (macro) effects for developing countries. There is also evidence that FDI does not tend to crowd in domestic investment in underdeveloped countries, actually crowding out in some periods and regions, particularly in Latin America (Agosín and Machado (2005)).

Meyer and Sinani (2009) present a hypothesis, supported by a meta-analysis of empirical works, that the effect of foreign firms’ entrance is not only conditional but non-linear: FDI generates positive effects for economies at the extremes of a development index. Three main factors would be determinants for such a result: income level, human capital, and institutional development. The presence of non-linearities also appears in Jude and Levieuge (2017), in which the authors find that for an ‘institutional index’, there is a threshold below which FDI has no positive effect.

Harrison and McMillan (2003) analyze French multinationals in Cote d’Ivoire and find that (i) domestic firms are more credit-constrained, and (ii) foreign firms borrowing domestically (in the host country) exacerbates this constraint. That is, multinational firms tend to finance most of their investment locally, which leads to a crowding-out of credit to local firms. In a similar paper, using data from 38 countries, mostly with high and middle income, Harrison, Love, et al. (2004) find the opposite, that FDI reduces credit constraints of local firms; that is, foreign firms crowd-in domestic enterprises. To reconcile these different results, the authors argue that, in general, FDI tends to increase domestic credit supply; however, in the case of countries with underdeveloped financial markets with significant market imperfections, multinational entrance
may tighten financial constraints (this conciliatory explanation is also found in Harrison and Rodriguez-Clare (2010), for instance).

In a seminal work, Borensztein et al. (1998) examine FDI flow from OECD countries to underdeveloped economies from 1970 to 1989. The authors find that FDI has a positive effect only if the level of human capital (measured by years in school) is above a given threshold; for very low levels, the effect of the FDI on growth is negative. The threshold, equivalent to a male population above 25 years with 0.52 years of secondary schooling on average, was satisfied by 46 out of 69 countries in the authors’ sample. When the authors test the level of human capital needed for foreign investment to have a larger effect on growth than domestic investment, the threshold becomes stricter, with only 29 countries meeting it.

Xu (2000) analyzes technology diffusion from FDI using US multinational enterprises data from 1966 to 1994. The author finds that for developed countries as hosts, FDI increases growth and is as important as international trade for technology spillovers. However, for underdeveloped economies, there is no positive technology transfer. The author finds that technology transfer is positively correlated with human capital and that there is also a threshold above which the host country must be to benefit from technology absorption. This threshold is much higher than the one found by Borensztein et al. (1998), between 1.4 and 2.4 years of male secondary school attainment, not being achieved by the majority of underdeveloped countries in his sample.

There is also evidence that FDI can reinforce path-dependency in human capital. Te Velde and Xenogianii (2007), using a sample of 110 countries from 1970 to 2005, find that the impact of FDI on human capital formation depends on the initial skill level of the country: only economies with larger human capital would tend to have their skill level increased with an inflow of FDI. According to the authors, this is in line with some predictions from the new trade theory and the idea that with liberalization in an environment of imperfect technology transfers countries will specialize following their initial conditions: those with lower educational levels in low-skill intensive production, while those with larger human capital and innovation rate in the production of high-skill intensive goods.

According to Alfaro, Chanda, et al. (2010), most of the studies find no horizontal spillovers from the entrance of MNEs in the case of developing countries. More recently, Iršová and Havránek (2013) perform a meta-analysis of 52 empirical studies (all post-2000) with data from 45 countries and also find that, on average, the entrance of foreign investment does not generate horizontal spillovers.
In the case of vertical externalities, the results tend to be more positive. Havranek and Irsova (2011) analyze 57 studies (post-2001) with observations from 47 countries and find an average positive backward spillover from FDI – that is, foreign investment in a given sector tends to increase productivity in domestic firms that produce inputs to this sector -., and a small but still positive effect on forward sectors.

Alfaro and Chen (2018), using firm-level data from 2002 to 2007 for over 30 countries, indicate that two-thirds of aggregate productivity gains from MNCs’ entrance are related to between-firm selection and reallocation. The entrance of a multinational firm increased productivity cutoff for survival and loss of market-share by reminiscent local firms. The loss of market share and revenue indicates a net negative effect on domestic firms after an MNC entrance\(^7\); this result is heterogeneous, however, with industries relatively more intensive\(^8\) in R&D and skilled-labor suffering a smaller loss of market, which the authors interpret as evidence that those industries have a larger scope for productivity upgrading.

Alfaro and Chen (ibid.) also test two channels of within-firm productivity improvement. The authors find evidence that multinational entrance will force local firms to stop producing some goods, which they interpret as evidence that domestic firms will focus on products that they have relatively larger productivity. They also present evidence that multinational entry will lead to an increase in innovation by domestic firms, although by a small magnitude. It is interesting, however, that the effect is significantly heterogeneous among firms with different productivities; the largest effects are on the 50 percent less productive firms, being negative for the 25 percent more productive.

Thus, for underdeveloped countries, it seems that the evidence is that MNCs’ entrance will: (i) increase competition, driving some firms out of the market; (ii) increase market concentration with loss of individual domestic firms’ revenue; (iii) tend to generate a ‘hysteresis’ in the human capital levels, forcing the specialization of low-skill countries in low-skill industries and; (iv) promote specialization on ‘core-advantage’ goods by domestic firms that manage to stay in the market, particularly those less productive companies.

Moreover, in terms of conditions affecting the impact of foreign firms’ entrance, we have that: (i) it does not generate benefits if the skills of the labor force are too low in the host

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\(^7\) As pointed by the authors, one can argue that, in terms of Kosova (2010), this captures only the static net effect.

\(^8\) Above the median.
country; and (ii) the more developed the financial system, the more beneficial FDI would be - given that it would prevent credit constraints to local firms, and provide credit that allows firms to better absorb externalities.

2.2.4 The Multinational Corporation

To think about the longer-term effects of foreign firms’ presence in the host economy, it seems important to understand the multinationals’ motivations. From a firm's standpoint, why would it be better to produce – the same goods already produced, parts of these goods, or new ones - in another country? In general terms, the answer must be an expected larger profit than if not operating in that region. The question then becomes how a foreign firm is able to offset the potential advantages of local firms (such as better knowledge of the market, legal and political systems, language, culture, lower communication and transportation costs, etc.) and enter into the market.

Hymer (1960) proposed a classical explanation, according to which, firms engage in FDI because some assets would be more productive under foreign control. FDI decision would involve, then: (a) the ownership of an asset; (b) the production location; and (c) the choice of whether to keep the asset internal to the firm. Examples of each of these elements are given by Desai (2009) “[f]irms can invest abroad to serve a market directly; to gain access to inputs, raw materials, or labor; to increase operational efficiency; or simply to keep competitors from acquiring strategic assets”. The study by Alfaro and Chen (2014) reinforces these motives, finding that the focus of MNCs’ offshore production is market-seeking and input-sourcing while the focuses of headquarters are on knowledge-intensive activities (R&D, management, and services).

Thus, in this view, the genesis of FDI is the investor’s possession of some ‘special’ asset. The absorption of this asset - be it intermediate inputs, organizational techniques, specific know-how, or technology incorporated into capital goods, for instance - is at the core of the idea that FDI can help host economies to modernize, a motive even more important than the classical physical capital accumulation. However, as seen in the previous sections, the absorption of such assets is not trivial. The reasoning for that, as put by Alfaro (2017), is that “foreign firms will seek to use this special asset or technology to their advantage and exploit the cost advantage or monopoly power derived from it over indigenous producers. This might result in the transfer of rents away from host country firms, which may have negative long-term effects on the indigenous base of the economy.” (p. 435)
2.2.5 Revisiting “The Rest”

Most of the theoretical and empirical insights presented so far focus on the short-term effects of multinational companies’ entrance into the host economy. As already mentioned, this is an important focus, and it is not surprising that it has attracted a large amount of research in the recent wave of globalization. However, this approach seems to lack a broader scope of analysis necessary to study the relationship between firms’ ownership and economic development, a long-term process.

Among a number of important contributions to the discussion of latecomer’s development, the work of Alice Amsden, particularly the book *The Rise of “the Rest”* (2001), is central to the hypothesis analyzed in this paper. This is because the core of the author’s argument overlaps with the question we are interested. According to her account, the countries of ‘the Rest’ (China, India, Indonesia, South Korea, Malaysia, Taiwan, Thailand, Argentina, Brazil, Chile, Mexico, and Turkey) were able to develop because by the end of World War II they had accumulated manufacturing experience in low-tech sectors. That is, those nations would have started to ‘rise’ relying on other countries’ commercialized technology to establish modern industries, but without any proprietary innovations. However, as they developed, the limitations of this path became increasingly apparent. The key to the continuity of the catch-up process relies precisely on knowledge production, which, according to Amsden (2001), was related, in these historical cases, to the firms’ ownership profile.

According to her argument, economic development involves directing capital (human and physical) out of rent-seeking, agriculture, and commerce, and into manufacturing. One of the latter’s key features that makes it essential for development is the centrality of knowledge-based assets – a set of skills that allows its owner to produce and distribute a product at above market prices or below market costs.

The way to promote this increase in manufacturing in a market economy would be to make it more profitable. A common manner to do so is through import tariffs and subsidies, which were combined in import substitution policies in most countries in the ‘rest’. However, if successful, this policy could only be temporary: with development, wages tend to increase, and unless local markets’ protections are also augmented, profitability in the manufacturing sector tends to decline. The options in the long-term would be, thus, either to reduce real wages or to increase productivity. Assuming that the latter is preferable, the challenge is to increase the amount of knowledge in circulation in the economy. According to Amsden (ibid.), however,
knowledge is particularly hard to access, given that properties of technologies cannot be fully documented, including managerial skills that are tacit rather than explicit. These characteristics are reinforced by firms, which keep those knowledge-based assets as proprietary as possible to guarantee technological rents. Firms, thus, have no incentive to sell such assets. And even when technology is sold, only the codified part of it is, requiring skills on the buyers’ part to implement it.

The ‘rest’ would have been able to ‘rise’, compensating skill deficits, with a model governed by an innovative control mechanism: a set of institutions that imposed discipline on economic behavior. The central aspect was reciprocity: subsidies were given to make manufacturing profitable, but recipients were monitored according to performance standards.9

The debt crisis in the 1980s in Latin America and 1990s in East Asia would have been, according to Amsden (2001), in large part consequence of an overexpansion of this model. What is more relevant for us is that it revealed a difference between two groups of countries within ‘the rest’. Korea, Taiwan, China, and India invested more in their own national proprietary skills during this development period after World War II, which helped those countries sustain national ownership in mid-technology industries and invade high-technology sectors based on national leaders. This pattern helped these countries resume growth after the crisis and generated engines for the new catch-up phase. The other countries, particularly those in Latin America and Turkey relied more on foreign know-how over the period, did not advance on sectors with higher technological content, and never resumed a consistent catch-up dynamics after the debt crisis. Amsden (ibid.) argues that this difference is rooted precisely in the prevalence of domestic firms in the former group, and of multinational enterprises in the latter one.10

9 Besides these incentives to the private sector, government direct intervention, particularly in infrastructure investment, was important to increase physical capital and ensure demand for the emerging sectors.

10 In industry segments with low entry costs (e.g., processing of imported inputs in pharmaceuticals or certain forms of electronic assembly), MNCs did not constitute an entry barrier to local firms and probably involved some knowledge transfer. However, the most important high-tech sectors have large sunk costs, so that the first-mover advantage is high and firms initially established tend to crowd-out other enterprises in the future. This would be important historically because Latin America was one of the first regions to receive multinationals in those sectors, given its proximity with the United States, and its type of industrialization, labeled as of emigré type - initiated by migrants from developed countries, and later by multinational firms. In other countries that developed faster after 1960, the industrialization experience was related to colonization. This would have ended up being an advantage given that the decolonization process enabled them to stay with their productive structure but without foreign ownership. This process would have happened in different forms in China, India, Korea, and Taiwan, for instance – all countries that managed to grow fast after the second World War, resume growth after the 1990s crises, and move to a higher technological productive structure.
The analysis provided by Amsden (2001) converges with most of the literature reviewed before regarding some of the potential advantages to the host country of an experienced multinational firm: short-term efficiencies and potential long-term spillovers. However, it highlights with persuasive historical evidence some long-term negative effects that most literature either ignores or did not evaluate econometrically so far. The potential main disadvantage of relying on foreign capital is at the core of accumulation: the inability to acquire full-set entrepreneurial skills and rents, given the historical fact that MNCs tend to invest less in knowledge-based assets overseas than at home.

2.3 Estimations

In the previous sections, I presented, on the one hand, channels indicated by the FDI literature through which foreign capital can affect the host economy in the short-run, and, on the other hand, arguments of its potential long-run effects, particularly the hypothesis presented by Amsden (ibid.) that relates capital nationality to the comparative growth of East Asia and Latin America since the 1980s. In this section, and having in mind this theoretical discussion, I design an empirical strategy to test if, and, to some extent, how, the presence of foreign capital affects long-run economic development. The test is based on the following regression:

$$\Delta y_i = \beta_0 + \beta_1 FDI_i + \beta_2 GDP_i + \beta_3 X_i + \epsilon_i$$  (2.1)

where $\Delta y_i$ is the change in the variable of interest between $t$ and $t - x$. For GDP per capita, it is the accumulated growth rate\(^{11}\); for other indicators of economic development that are in share terms, such as the sectorial composition of the economy, or in index terms, such as exports diversification and complexification, human capital, and total factor productivity, I look at the change in percentile points. A list of the variables and their sources can be found in the appendix.

Our main independent variable is $FDI_i$, the stock of FDI inflow as a percentage of GDP of country $i$ at the initial period $(t - x)$. I interpret the variable as a proxy for the share of foreign capital in the economy. Following the usual procedure of the literature on long-run growth and convergence (e.g., Acemoglu, Johnson, et al. (2001) and Ciccone and Jarociński (2010)), I control for the GDP per capita at time $t - x$ and for measures of institutions quality, human

\(^{11}\)The difference in log terms.
capital, cost of investment, and geographical distribution. I also test three other controls that might be related to the stock of foreign capital in the economy and that could have an impact on the long-run economic growth: the share of commodities and of low-tech manufactures on the export basket and income inequality.

For institutional quality, we use the rule of law index of the World Bank Worldwide Governance Indicators. This variable is frequently used in the literature\(^{12}\) as a proxy for expropriation risk, which, in its turn, has been used as an indicator of institutional quality (Acemoglu, Johnson, et al. (2001)). The geographical distribution is given by the latitude of the country and the cost of investment is given by the variable “Price level of capital formation”, from the PWT 10.0. The variable of income inequality, obtained in the World Inequality Database (WID), is the pre-tax Gini index.

For the baseline estimation, \(t = 2019\) and \(t - x = 1980\). As robustness, I also use five-year averages\(^{13}\) of those variables in order to avoid capturing a year with unusual behavior.

The initial period, 1980, is chosen both due to data availability and for theoretical reasons. In practical terms, for a number of countries, UNCTAD supplies information on FDI stock from 1980.\(^{14}\) The theoretical reasons are twofold: i) to test long-run effects on growth and avoid reverse causality, in line with the literature that tests the effects of institutions, for instance, I use the initial condition of interest as the independent variable; and ii) the process of divergence in the economic growth path within developing countries would have started mainly in the 1980s, in part, as hypothesized by Amsden (2001) and tentatively tested here, due to differences in capital nationality at that moment.

Table 2.1 presents some descriptive statistics of our observations by regions; a complete list by country can be found in the appendix. As can be seen, in terms of economies that were underdeveloped in 1980, African and Middle East countries had the largest share of foreign capital in 1980, and Asian countries, the lowest. In terms of accumulated growth between 1980 and 2019, the worst performance is the one from Sub-Saharan countries, followed closely by Latin America and Caribbean economies. Regarding high-income countries, the distribution is

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\(^{12}\)See, for instance, Globerman and D. Shapiro (2002), Daude and Stein (2007), and Méon and Sekkat (2004).

\(^{13}\)That is, 2019-2015 and 1984-1980, respectively.

\(^{14}\)There is also data of FDI inflow from 1970; however, the estimations using the inflow to extend the stock seem inadequate, although UNCTAD (2019b) performs such exercise when no direct information about the stock is available: inflows are relatively high, which leads to a rapid fall in the stock in the estimated periods; moreover, a depreciation rate should be accounted for and thus we would need a longer FDI inflow dataset before 1980.
Table 2.1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Countries</th>
<th>Accumulated growth</th>
<th>Foreign K (%GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low and Middle-income countries</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East Asia and Pacific</td>
<td>7</td>
<td>152.8%</td>
</tr>
<tr>
<td>Europe and Central Asia</td>
<td>2</td>
<td>90.1%</td>
</tr>
<tr>
<td>Latin America and Caribbean</td>
<td>11</td>
<td>37.2%</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>6</td>
<td>56.4%</td>
</tr>
<tr>
<td>South Asia</td>
<td>4</td>
<td>129.9%</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>14</td>
<td>35.7%</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>68.6%</td>
</tr>
<tr>
<td><strong>High-income countries</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East Asia and Pacific</td>
<td>5</td>
<td>90.7%</td>
</tr>
<tr>
<td>Europe and Central Asia</td>
<td>13</td>
<td>63.7%</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>1</td>
<td>75.7%</td>
</tr>
<tr>
<td>North America</td>
<td>2</td>
<td>58.3%</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>70.2%</td>
</tr>
</tbody>
</table>

*Note: Accumulated growth is the real GDP per capita increase from 1980 to 2019 at national prices given by the Penn World Table 10.0. Foreign K stock (%GDP) is the stock of FDI as a percentage of GDP in 1980 given by UNCTAD.*

more homogeneous, with the exception of East Asia and Pacific, which is biased by extreme values of foreign capital in Hong Kong.

There are two main goals of the empirical exercise. The primary one is to test if the presence of foreign capital impacted the long-run growth of developing economies; based on the hypothesis presented above, a negative, statistically significant coefficient would be expected. A secondary one, however, is to check if foreign capital ownership had a different effect on developed countries; considering the arguments presented, it would be expected a positive or non-significant effect in the case of high-income economies. To test these two objectives, though, we have to look at the effects on each country group. In the next subsection, I will restrain the analysis to economies classified by the World Bank in 1980 as low or middle-income ones. Subsection 2.3.2 presents the results for high-income economies.

### 2.3.1 Low and middle-income countries

Table 2.2 reports Ordinary Least Regression regressions based on equation (2.1) of the main variable of interest, accumulated GDP growth, against the share of foreign capital in the economy in 1980. I run estimations with individual controls and a regression with all the ones that are individually statistically significant plus the initial income level.

The estimations indicate negative effects of foreign capital stock in the long-run growth of developing economies. The coefficients are statistically significant and economically meaningful;
the only two specifications for which the results are non-significant are the ones with income inequality and share of low-tech manufacture on exports as the unique controls. The signals of the other variables are in line with what is expected: negative for the initial GDP per capita, the share of commodities on exports, and income inequality, and positive for the rule of law index. As presented in the appendix, the results are robust to the use of a five-year average for the variables (instead of the single years of 1980 and 2019), with the difference that the result is statistically significant even when controlling only for income inequality or share of low-tech manufacture exports.

Table 2.2: OLS Regressions

<table>
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<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
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<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Capital Stock</td>
<td>-1.07*</td>
<td>-1.11*</td>
<td>-1.39*</td>
<td>-1.04*</td>
<td>-1.08*</td>
<td>-0.89*</td>
<td>-0.97</td>
<td>-0.72</td>
<td>-1.26*</td>
</tr>
<tr>
<td></td>
<td>(0.50)</td>
<td>(0.38)</td>
<td>(0.24)</td>
<td>(0.38)</td>
<td>(0.49)</td>
<td>(0.42)</td>
<td>(0.59)</td>
<td>(0.57)</td>
<td>(0.30)</td>
</tr>
<tr>
<td>Initial GDP per capita</td>
<td>-16.16</td>
<td>-30.82*</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>(13.44)</td>
<td>(14.13)</td>
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<tr>
<td>Human Capital</td>
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<td></td>
<td>(28.67)</td>
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<tr>
<td>Rule of Law</td>
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<td></td>
<td>51.31*</td>
<td></td>
<td>82.31*</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(14.43)</td>
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<td>(23.31)</td>
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<tr>
<td>Latitude</td>
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<td></td>
<td>96.48</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>(76.67)</td>
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<tr>
<td>Price of Investment</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>-46.43</td>
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<td></td>
<td></td>
<td></td>
<td>(38.75)</td>
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<tr>
<td>Share Commodities X</td>
<td></td>
<td>-0.87+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.84</td>
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<tr>
<td></td>
<td></td>
<td>(0.49)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.82)</td>
<td></td>
</tr>
<tr>
<td>Income Inequality</td>
<td></td>
<td></td>
<td></td>
<td>-268.07*</td>
<td></td>
<td></td>
<td>-34.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(108.62)</td>
<td></td>
<td></td>
<td>(123.01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share low-tech X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.72*</td>
<td></td>
<td>1.13</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.69)</td>
<td></td>
<td>(0.97)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Except for the rule of law variable, which is a 5 year average of the index from 2010 to 2015, all variables are their levels in 1980. The latitude is given by an index from 0 to 1. Share Commodities X is the share of commodities in the export basket in 1980. Income inequality is measured as the pre-tax Gini index. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%.

To explore some channels that could explain the aggregated effects on GDP, I regress other variables of interest; the results are presented in table 2.3. The statistical significance of the effects is conditional on the controls, but three main results tend to be robust. One is that countries with a larger share of foreign capital in 1980 tend to have a more diversified export basket in 2019 (as measured by different indexes: Gini, Theil, and HHI). At first, it is not straightforward what this diversification means in terms of development; however, as well documented in the literature (see Cadot et al. (2011) and Hoyos et al. (2021), for instance), there is an inverted U-shaped curve between exports diversification and income: as low-income countries develop,
they diversify their exports; at some point, however, they specialize again, but in goods with higher value added. As can be seen in column (2), even controlling for initial GDP, countries with higher FDI in 1980 specialized less in the following four decades.

A second result that tends to be robust is that countries with a larger stock of foreign capital in 1980 developed a less complex export basket over time (as measured by the EXPY). Finally, the initial level of foreign capital stock is associated with a larger share of low-tech exports over time.

Combining these results, it is possible to hypothesize that a channel through which foreign capital ownership might have harmed economic growth in these countries has been by preventing export specialization and anchoring these economies in the production of a broad spectrum of low-tech goods. Again, and as can be seen in the appendix, results using five-year averages are the same, with an increased statistical significance.

Table 2.3: OLS Regressions - Other variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<tbody>
<tr>
<td>Human Capital</td>
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<td>0.01</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.04</td>
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<tr>
<td></td>
<td>(0.06)</td>
<td>(0.05)</td>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Agr (% GDP)</td>
<td>2.77</td>
<td>1.23</td>
<td>0.12</td>
<td>-0.62</td>
<td>-1.56</td>
<td>2.37</td>
</tr>
<tr>
<td></td>
<td>(2.06)</td>
<td>(1.51)</td>
<td>(2.44)</td>
<td>(1.12)</td>
<td>(2.43)</td>
<td>(3.15)</td>
</tr>
<tr>
<td>Man (% GDP)</td>
<td>-2.66*</td>
<td>-2.05</td>
<td>-0.54</td>
<td>-1.67</td>
<td>-0.36</td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td>(1.23)</td>
<td>(1.40)</td>
<td>(1.11)</td>
<td>(1.15)</td>
<td>(1.16)</td>
<td>(1.22)</td>
</tr>
<tr>
<td>Serv (% GDP)</td>
<td>-0.78</td>
<td>-0.33</td>
<td>-0.11</td>
<td>0.11</td>
<td>0.13</td>
<td>-0.19</td>
</tr>
<tr>
<td></td>
<td>(0.63)</td>
<td>(0.48)</td>
<td>(0.46)</td>
<td>(0.38)</td>
<td>(0.31)</td>
<td>(0.58)</td>
</tr>
<tr>
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<td>-0.78+</td>
<td>-0.89+</td>
<td>-0.72</td>
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<td></td>
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<td>(0.42)</td>
<td>(0.47)</td>
<td>(0.43)</td>
<td>(0.73)</td>
</tr>
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<td>Gini (X)</td>
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<td>-0.17*</td>
<td>-0.19*</td>
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<tr>
<td></td>
<td>(0.11)</td>
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<td>Theil (X)</td>
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<td>-0.77</td>
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<td></td>
<td>(0.62)</td>
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<td>(0.50)</td>
<td>(0.59)</td>
<td>(0.64)</td>
<td>(0.73)</td>
</tr>
<tr>
<td>HHI (X)</td>
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<td>-6.89+</td>
<td>-7.42+</td>
<td>-5.95</td>
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<td>(3.97)</td>
<td>(3.44)</td>
<td>(4.13)</td>
<td>(4.34)</td>
<td>(4.91)</td>
</tr>
<tr>
<td>Share high-tech (X)</td>
<td>1.95</td>
<td>3.07</td>
<td>2.99</td>
<td>3.24</td>
<td>3.39</td>
<td>1.82</td>
</tr>
<tr>
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<td>(1.46)</td>
<td>(1.97)</td>
<td>(1.88)</td>
<td>(1.95)</td>
<td>(2.23)</td>
<td>(1.42)</td>
</tr>
<tr>
<td>Share Commodities (X)</td>
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<td>0.44</td>
<td>-0.44</td>
<td>-1.68</td>
<td>-0.65</td>
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<tr>
<td></td>
<td>(4.48)</td>
<td>(3.45)</td>
<td>(3.59)</td>
<td>(3.18)</td>
<td>(2.77)</td>
<td>(4.64)</td>
</tr>
<tr>
<td>Share low-tech (X)</td>
<td>4.96*</td>
<td>4.24*</td>
<td>3.72*</td>
<td>2.78+</td>
<td>2.64+</td>
<td>3.82+</td>
</tr>
<tr>
<td></td>
<td>(2.43)</td>
<td>(1.67)</td>
<td>(1.75)</td>
<td>(1.40)</td>
<td>(1.40)</td>
<td>(1.97)</td>
</tr>
<tr>
<td>TFP</td>
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<td>-0.32</td>
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<td></td>
<td>(0.61)</td>
<td>(0.40)</td>
<td>(0.43)</td>
<td>(0.49)</td>
<td>(0.38)</td>
<td>(0.55)</td>
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</table>

Note: Coefficients for the independent variable of interest, stock of foreign capital as a share of GDP. Column (1) controls for the rule of law index; column (2) controls for initial GDP; column (3) for the share of commodities on exports; column (4) controls for initial income inequality; column (5) controls for the share of low-tech manufactures on exports; and column (6), controls for initial GDP, rule of law, share of commodities on exports, share of low-tech goods on exports, and income inequality. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%.
2.3.2 High-income countries

The main focus of this paper is to check the effect of foreign capital stock on the long-run growth of underdeveloped countries. However, a secondary hypothesis that emerges from the theoretical analysis performed here is that the effects are different in high-income countries, that, for instance, have the capacity to compete with foreign firms and absorb knowledge spillovers. This hypothesis can also be tested using a sample of 22 countries classified as having a high-income in 1980; the list of countries can also be found in the appendix.

Table 2.4: OLS Regressions - Other controls - High Income countries

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign Capital Stock</td>
<td>0.09</td>
<td>0.11*</td>
<td>0.13*</td>
<td>0.11+</td>
<td>0.13*</td>
<td>0.13*</td>
<td>0.20*</td>
<td>0.20*</td>
<td></td>
</tr>
<tr>
<td>(0.05)</td>
<td>(0.05)</td>
<td>(0.04)</td>
<td>(0.06)</td>
<td>(0.04)</td>
<td>(0.06)</td>
<td>(0.05)</td>
<td>(0.06)</td>
<td>(0.09)</td>
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</tr>
<tr>
<td>Initial GDP per capita</td>
<td>-42.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-89.05*</td>
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<tr>
<td>(33.82)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(40.23)</td>
<td></td>
</tr>
<tr>
<td>Human Capital</td>
<td>-18.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>(23.63)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Rule of Law</td>
<td>20.07*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.14</td>
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<td>(8.38)</td>
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<td></td>
<td></td>
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<td>(18.75)</td>
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<tr>
<td>Latitude</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price of Investment</td>
<td></td>
<td>-62.53</td>
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<td></td>
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<td>(76.38)</td>
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<td></td>
</tr>
<tr>
<td>Share Commodities X</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.54+</td>
<td></td>
</tr>
<tr>
<td>(0.15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.29)</td>
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</tr>
<tr>
<td>Income Inequality</td>
<td></td>
<td></td>
<td>-8.53</td>
<td></td>
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<td></td>
<td>-161.05</td>
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</tr>
<tr>
<td>(74.38)</td>
<td></td>
<td></td>
<td></td>
<td>(128.45)</td>
<td></td>
<td></td>
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<tr>
<td>Share low-tech X</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>-1.32+</td>
<td></td>
</tr>
<tr>
<td>(0.69)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1.46)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Except for the rule of law variable, which is a 5 year average of the index from 2010 to 2015, all variables are their levels in 1980. The latitude is given by an index from 0 to 1. Share Commodities X is the share of commodities in the export basket in 1980. Income inequality is measured as the pre-tax Gini index. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%.

As can be seen in table 2.4, the results are in line with such hypothesis: for high-income countries, the stock of foreign capital tended to have a positive - albeit small - effect on the long-run growth. Almost all the controls are statistically non-significant, probably due to the larger homogeneity of the sample. The exceptions are the rule of law, which is positive as expected, and the share of low-tech manufactures on exports, which have a negative coefficient. It is interesting to note that this latter result is the opposite of what is found for developing countries (table 2.2): for high-income countries, economies which had a larger share of low-tech manufacture exports in 1980 grew less in the following four decades.
Analyzing the effects on the variables that can indicate channels through which the aggregate effect takes place, a different and, to some extent, inverted picture also emerges, as compared to the impact in underdeveloped economies: there is some evidence that higher levels of foreign capital stock in 1980 tended to be related, first, to increases in the share of high-tech goods in the export basket and the inverse for low-tech goods; and, second, to a more specialized basket of exports (larger Gini, Theil, and HHI indexes). There is also some (weaker) evidence of a sectoral effect: positive on manufacturing and negative on services and agriculture. Once again, the results are robust to the use of five-year averages, as can be seen in the appendix.

It is interesting that the results align well with the hypothesis proposed before based on different strands of the literature. It is important, however, to keep in mind that the sample for high-income countries is particularly small, and the confidence in the results should be proportional to this limitation.

Table 2.5: OLS Regressions - Other variables - High income countries

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<th>(6)</th>
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<td>Human Capital</td>
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<td>-0.00</td>
<td>0.02*</td>
<td>0.02*</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
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<td>(0.01)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.01)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Agr (% GDP)</td>
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<td>-86.86*</td>
<td>-100.83*</td>
<td>-96.60*</td>
<td>-109.71*</td>
<td>-90.24*</td>
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<tr>
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<td>(11.77)</td>
<td>(4.73)</td>
<td>(15.01)</td>
<td>(9.57)</td>
<td>(12.66)</td>
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<tr>
<td>Man (% GDP)</td>
<td>0.13</td>
<td>0.31</td>
<td>0.43</td>
<td>0.82</td>
<td>1.32*</td>
<td>2.17*</td>
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<td>(0.52)</td>
<td>(0.93)</td>
<td>(0.28)</td>
<td>(0.78)</td>
<td>(0.38)</td>
<td>(0.29)</td>
</tr>
<tr>
<td>Serv (% GDP)</td>
<td>-0.07</td>
<td>-0.26*</td>
<td>0.00</td>
<td>-0.13</td>
<td>0.10</td>
<td>-0.20</td>
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<td>(0.09)</td>
<td>(0.07)</td>
<td>(0.06)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.17)</td>
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<td>0.02</td>
<td>0.01</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.02)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Gini (X)</td>
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<td>0.01+</td>
<td>0.01</td>
<td>0.02*</td>
<td>0.03*</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.01)</td>
<td>(0.00)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Theil (X)</td>
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<td>0.03+</td>
<td>0.02</td>
<td>0.06*</td>
<td>0.08</td>
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<tr>
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<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>HHI (X)</td>
<td>0.05</td>
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<td>0.06+</td>
<td>0.04</td>
<td>0.14*</td>
<td>0.15</td>
</tr>
<tr>
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<td>(0.03)</td>
<td>(0.06)</td>
<td>(0.03)</td>
<td>(0.04)</td>
<td>(0.06)</td>
<td>(0.15)</td>
</tr>
<tr>
<td>Share high-tech (X)</td>
<td>0.05*</td>
<td>0.00</td>
<td>0.04*</td>
<td>0.03</td>
<td>0.01</td>
<td>-0.09</td>
</tr>
<tr>
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<td>(0.01)</td>
<td>(0.03)</td>
<td>(0.01)</td>
<td>(0.02)</td>
<td>(0.04)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Share Commodities (X)</td>
<td>-0.29</td>
<td>0.37</td>
<td>-0.28</td>
<td>-0.18</td>
<td>-0.83</td>
<td>-1.31</td>
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<tr>
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<td>(0.24)</td>
<td>(0.57)</td>
<td>(0.25)</td>
<td>(0.26)</td>
<td>(0.50)</td>
<td>(0.98)</td>
</tr>
<tr>
<td>Share low-tech (X)</td>
<td>-0.21*</td>
<td>-0.07</td>
<td>-0.21*</td>
<td>-0.14*</td>
<td>-0.16+</td>
<td>0.08</td>
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<td>(0.11)</td>
<td>(0.03)</td>
<td>(0.06)</td>
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<td>(0.21)</td>
</tr>
<tr>
<td>TFP</td>
<td>0.02*</td>
<td>0.04+</td>
<td>0.03+</td>
<td>0.03+</td>
<td>0.06*</td>
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</tr>
<tr>
<td></td>
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<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.02)</td>
<td>(0.03)</td>
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</table>

Note: Coefficients for the independent variable of interest, stock of foreign capital as a share of GDP. Column (1) controls for the rule of law index; column (2) controls for initial GDP; column (3) for the share of commodities on exports; column (4) controls for initial income inequality; column (5) controls for the share of low-tech manufactures on exports; and column (6), controls for initial GDP, rule of law, share of commodities on exports, share of low-tech goods on exports, and income inequality. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%. 
2.3.3 Robustness

Besides adding different controls, another important robustness check is to analyze the sensitivity of the results to specific countries. This is a particularly important concern given that the sample is relatively small and it is possible that some countries with extreme levels of FDI stock or accumulated GDP growth are biasing the results. To test this, I run regressions based on equation (2.1) excluding one country at a time. The estimations are performed in both its “saturated” form (controlling for initial GDP, rule of law, income inequality, and the shares of commodities and low-tech manufactures on exports), and with only the rule of law index (as it is the only control that is significant both individually and with the other controls).

The results of the exercise with our baseline sample of low and middle-income countries are displayed in figure A.11. As can be seen in the figure on the left, the estimated coefficient is strongly robust to the exclusion of any particular country. In terms of statistical significance, the exclusion of Liberia increases the confidence interval and the estimation becomes non-significant at 10% in the “saturated” form - it remains significant when controlling only for the rule of law. On the right of figure A.11, I perform the same exercise but in a sub-sample already excluding Liberia. As can be seen, coefficients are again robust, although statistically significant is conditional on the controls.

Figure 2.1: Robustness check for low and middle-income countries

![Figure 2.1](image_url)

**Note:** Dots indicate estimated coefficients. The bars indicate a 90% confidence interval.

The same exercise is performed for the sample of high-income countries. As shown in figure 2.2, Hong Kong is an outlier, decreasing the positive aggregated coefficient’s size and statistical
significance. Excluding that economy, the positive impact of FDI stock in the long-run economic growth of rich economies becomes larger and highly significant.

Figure 2.2: Robustness check for high-income countries

Overall, these results, combined with the use of different controls in the previous subsections, suggest that the effects of foreign capital in the long-run economic growth - negative in the case of low and middle-income countries, and positive for high-income ones - are significantly robust. I also test the robustness of the effects on the group of other variables (exports composition, etc.) of the exclusion of these outliers; as can be seen in the appendix, in both cases the results persist, and in the case of high-income countries, become even more significant (statistically and in terms of economic meaning).

2.4 Discussion and Concluding remarks

The idea that capital ownership might be important for economic development has been in a long trend of discredit. On theoretical grounds, the canonical policy recommendations, stemming from the more widely accepted economic theories, would be to allow capital to circulate freely and to open the economies to international trade. This would allow factors’ remuneration to equalize and economies to explore their comparative advantages, increasing aggregate production. This shift has also been met by political changes, such as the shift towards liberalism in the West, the fall of an alternative capital ownership arrangement represented by the Soviet
Union, and, finally, the advance of globalization. In developing countries, which are relatively scarce in capital, this general view was translated into a common sense that foreign capital is essential to economic development: not only because these economies need capital in “quantitative” terms, but also due to the belief that foreign capital would be qualitatively different by incorporating higher technology. The main assumption is, then, that this technology embedded in the foreign capital would spill over to the various sectors of the host economy and increase its productivity.

The theoretical and empirical evidence presented in section 2.2 indicates that foreign capital entrance tends to positively affect the host economy in specific circumstances, particularly if the incumbents’ firms in the latter have the tools to react to such entrance. That is, an MNC’s entrance behaves as a competitive shock, and if the established companies can compete with it by increasing their productivity, the whole economy tends to benefit, at least in the short run. In less developed countries, where indigenous firms have worse conditions to compete, the idea that technological upgrading will happen is, thus, questionable. This might occur in economies with very low levels of development, as Meyer and Sinani (2009) point out, given that basic improvements can be accomplished by the mere presence of a multinational company in a region. However, for middle-income countries, whose technological upgrading relies on more active use of ‘absorptive capabilities’, the idea that technology will spill over from the foreign company to the rest of the economy seems questionable. Moreover, the “competitive shock” represented by a multinational firm is specific to a sector and has, thus, heterogeneous effects on the economy, both statically and over time.

Some firm-level empirical evidence indicates a productivity increase after the entrance of foreign firms in a given country. This, however, should not be confused with knowledge spillover and technological upgrading. The productivity gains, in the case of underdeveloped countries, seem to stem from (i) local firms focusing on the production of those commodities they are relatively more efficient, and (ii) larger and more efficient production of non-specialized inputs demanded by the MNC. In both cases, the positive effect on productivity is apparent; however, they also have in common another aspect: they reinforce the country’s specialization on its static comparative advantage. And, thus, its potential negative dynamic effects on the host

15In recent years, there has been some indications of a retreat in free trade ideology, as evidenced by an increase in tariffs in the US and more explicit discussions about industrial policy. These, however, are still short-term movements, and less motivated by economic theoretical arguments than by political motivations.
country's development should also be clear. By constraining indigenous firms to produce less complex goods, innovation production and dissemination\textsuperscript{16} would be reduced, as well as demand for skilled labor, which also affects its supply over time, as the evidence of path-dependency presented by Te Velde and Xenogiani (2007) indicates.

Using a sample of 44 economies classified as having low or middle-income in 1980, I find robust evidence that a larger stock of foreign capital is associated, in these developing economies, with a lower accumulated GDP growth over almost 40 years. Moreover, a larger stock of foreign direct investment is associated with a larger share of low-tech goods in the export basket, which also tends to be less specialized and with a lower level of complexity.

It is possible to interpret these results in light of the large FDI literature as evidence of the necessity of pre-conditions in the host economy for positive effects of foreign capital, and of the predominance of vertical knowledge transfers and backward pecuniary externalities given that MNCs tend to produce final goods when in developing economies. These effects tend to have a positive impact in the short-run, but might generate detrimental dynamic consequences, with local manufacturers specializing in producing inputs whose productivity gains might be transferred to the MNCs via lower prices due to monopsonistic power of these firms. These results are robust to a number of controls often adopted in the literature to explain long-run growth, such as institutional quality, cost of investment, and geographical distribution.

The paper also presents some evidence supporting the idea that foreign capital can be positive for more developed economies. In those countries, higher initial levels of foreign capital stock tended to be related to a more specialized basket of exports, which is also less concentrated on low-tech goods.

A number of improvements and extensions are important to consolidate the results and better understand its channels; to start with, an alternative and more complete measure of foreign capital stock and a deeper investigation of the lack of specialization of exports in developing economies with larger foreign capital. The goal of this paper has been to retake an idea that has a long history by presenting theoretical, econometric, and historical evidence: that capital nationality matters for long-run economic development. The entrance of foreign firms tends to be positive in some circumstances, as indicated. However, the transition from middle levels of development into high ones requires production based on knowledge-based assets, which are

\textsuperscript{16} As mentioned, it is likely that some improvement related to better technology reaches backward sectors, but it tends to be contained there and most of its gains to be absorbed by the MNC.
firm-specific. A predominance of foreign firms at this intermediate level of development can crowd out indigenous firms in those industries, reducing domestic income via lower profits (no technological rents) and wages (lower overall productivity and persistence of duality in the labor market), and precluding the endogenous growth of such knowledge-based assets, reinforcing static comparative advantages.
CHAPTER 3

SOURCES OF INFLATION AND THE EFFECTS OF BALANCED BUDGETS AND INFLATION TARGETING IN DEVELOPING ECONOMIES

3.1 Introduction

Why do economies with large amounts of hidden unemployment and underemployment experience inflationary pressures? Standard economic theory relates inflation to deviations of the actual unemployment rate from its ‘natural rate’. But the notion that labor constraints and deviations from a natural rate of unemployment generate inflation and limit economic growth in developing countries would seem hard to defend.

We see inflation as deriving from social conflict, inertia related to formal and informal indexation, and sectoral interactions between demand and supply side forces. Incomes in the informal sector are demand determined, shocks to aggregate demand influence relative incomes, and shifts in relative incomes influence wage setting in the formal sectors of the economy.

Relative wages have a strong normative element, and wage pressures develop in the formal sectors as workers react to shocks and try to preserve ‘fair’ relative wages. Wage inflation in the formal sectors does not, however, restore the previous relative wages: nominal wage gains in the formal sectors raise incomes in the informal sector pari passu, maintaining the relative incomes that were at odds with prevailing social norms. Thus, in the absence of policy intervention inflationary expectations may build up and lead to an explosive dynamics. Inflation-targeting monetary policy can keep inflation at a desirable rate, but at the expense of exchange rate appreciation and a shift in economic activities towards nontradable sectors.

Wage norms and informal indexation are central to this process, but social norms evolve endogenously, and this path dependency allows structural transformation and economic development. The gradual elimination of wage premia in the formal sector and underemployment in the informal sector need not provoke high inflation. Large shocks to relative incomes, by contrast, can be inflationary, and if our argument is correct, the standard prescriptions for macroeconomic policy are misguided.
The period from the early 1980s to the turn of the century saw the gradual establishment of a hegemonic macroeconomic agenda of balanced government budgets, inflation targeting and liberalized goods and capital markets. In the European Union the prescriptions are enshrined in the Stability and Growth Pact for fiscal policy and the explicit specification of the primary objective of the ECB as maintaining price stability. But even when not part of an official set of guidelines and objectives, these principles have guided policy in many countries over the last 20-40 years, developed as well as developing. The most recent OECD Survey on Brazil, for instance, is quite explicit. Following an assessment of the current state of the economy, the survey outlines its main messages. The first of these states that: “[s]tabilising public debt and ensuring that inflation remains close to the target are key macroeconomic priorities” (OECD (2018): p. 12). The recommendations, repeated in widely different circumstances, have been echoed by national economic institutions and increasingly influence policy making.

Inflation targeting is often described as successful, despite challenges of implementation in emerging and developing economies. Even when combined with balanced budgets, however, inflation targeting has often failed to deliver the anticipated improvements in real economic performance; Brito and Bystedt (2010), for instance, find evidence that inflation targeting decreased output growth in emerging economies and did not reduce inflation and output volatility.

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“The primary objective of the ECB’s monetary policy is to maintain price stability. This is the best contribution monetary policy can make to economic growth and job creation.” https://www.ecb.europa.eu/mopo/intro/html/index.en.html

2 The same recommendation to Brazilian policy makers had been made 13 years earlier:

“Of particular importance in the macro area are the inflation targeting framework for monetary policymaking and the Fiscal Responsibility legislation” (OECD (2005): p. 13).

3 According to Fraga et al. (2003) (p. 32).

“The performance of inflation targeting regimes around the world has been positive. Average inflation in both emerging markets and developing economies has come down after the adoption of the inflation targeting regime. However, emerging market economies (EMEs) have had a relatively worse performance. (...) inflation targeting in these countries is a more challenging task than in developed ones.”
This is no accident, we argue. A combination of balanced budgets and inflation targeting can amplify fluctuations and lead to slow economic growth and premature deindustrialization.\textsuperscript{4} The commodity boom of the early 2000s exemplifies the dangers of the policy mix. Rising commodity prices relaxed both government-budget and balance-of-payments constraints for many middle-income countries and allowed an expansion of aggregate demand. Incipient inflationary pressures were addressed using monetary policy, and the resulting appreciation of the exchange rate carried additional short-term political benefits by increasing people’s real purchasing power.\textsuperscript{5} The negative effects of the policy showed up later. An overvalued exchange rate contributed to deindustrialization and a large expansion of the nontradable sector. When the boom in commodity prices came to an end, exchange rates depreciated, inflation increased, and the economies went into recession with a less developed productive structure. The macroeconomic policy prescriptions had contributed to a classical Dutch disease.

The experiences of many Latin American countries fit this pattern. The commodity boom boosted their economies both directly and indirectly via increased fiscal capacity (converted into higher public sector employment, cash transfers and public investment) (IMF (2018)).\textsuperscript{6} The expansion was particularly strong in the natural resource and nontradable sectors, notably commerce and construction, while the manufacturing sector shrank from 16.4\% in 2003 to 13.3\% in 2012.\textsuperscript{7} The Brazilian case, which is described in greater detail in section 3, illustrates our argument. The region is not unique, however, and the analytical framework in this paper has, we believe, wider applicability. Many developing economies outside Latin America also have a high dependence on primary commodity exports - 102 countries were in this condition in the

\textsuperscript{4}Rodrik (2013) applies the concept of premature industrialization to countries whose manufacturing sector has declined at income levels much lower than those at which developed countries began to deindustrialize - that is, the economies become specialized in (low-skill) services before having undergone a profound experience of industrialization.

\textsuperscript{5}In developing economies interest rates often influence inflation primarily through their effects on the exchange rate. The Brazilian (1994-1999), Argentine (1991-2002) and Mexican (1989-1994) price stabilization programs are illustrative (although extreme) cases of the use of exchange rates to stop inflation.

\textsuperscript{6}These developments were pronounced in Ecuador, Bolivia, Argentina, Peru, Brazil, Colombia and Paraguay.

\textsuperscript{7}Latin America and Caribbean. World Bank data, available at: https://data.worldbank.org/indicator/NV.IND.MANF.ZS
period 2013-2017 (UNCTAD (2019a))\(^8\); Ghana, for instance, followed policies of sound finance and inflation targeting and experienced a similar process of deindustrialization.\(^9\)

We do not suggest that the problems associated with overvalued exchange rates have gone unrecognized.\(^10\) Many economists have warned of its dangers, and the recognition is not confined to academics. What became known as the ‘Washington consensus’ (Williamson (1990)) included competitive exchange rates as one of its ten policy prescriptions, although in a later discussion, Williamson (2004) suggested that already by 1990, the consensus had shifted away from seeing competitive exchange rates as a priority.\(^11\) IMF studies, including Savastano et al. (1997)), have also pointed to potential conflicts in developing countries between inflation targeting and a concern for external competitiveness. The authors note that none of the standard models of inflation “commands support comparable to that obtained by natural rate models in industrial countries” (p. 31-32), and this as well as other problems make them question “the adoption of a framework akin to IT” in developing countries in the near term (p. 38). But despite these warnings and notes of caution, inflation targeting has been increasingly adopted, also by developing economies, and exchange rate concerns have been largely ignored.

The fiscal dimension of the standard policy recommendations has also come in for criticisms, many of which our analysis is in line with. Austerity policies – often motivated by the alleged dangers of public debt – can do and have done immense damage. European policies after the 2008 financial crisis is a case in point, and fiscal consolidation in commodity exporters hurt the economies when the boom came to an end and recession was already approaching. A focus on balanced budgets effectively promotes a procyclical policy and exacerbates macroeconomic instability with detrimental effects on long-term growth.\(^12\)

\(^8\)Mainly in Africa, Middle East, and East Asia (UNCTAD (2017))

\(^9\)A vast literature considers possible relations between industrialization, technological change and economic development; see, e.g. Rodrik (2013), Haraguchi et al. (2017), and Dosi and Nelson (2010).


I fear I indulged in wishful thinking in asserting that there was a consensus in favor of ensuring that the exchange rate would be competitive, which essentially implies an intermediate regime; in fact, Washington was already beginning to edge towards the two corner doctrine, which holds that a country must either fix firmly or else it must float ‘cleanly’.

\(^12\)The determination of the average fiscal stance and the long-run government debt ratio in developing economies – as opposed to the cyclicality of fiscal policy – is discussed in Skott (2020)
To summarize, in this paper we present a model of inflation in developing economies. Sectoral specificities and interactions between demand and supply side forces are at the core of the model. If the inflation analysis is correct, second, we show that a policy combination of balanced budgets and inflation targeting may derail economic development.

A brief comment on methodology may be in order. Formal models can help structure and clarify ideas and inform empirical studies. To be useful they must simplify, and the model in this paper is no exception. Our modeling approach, however, may be unfashionable: the absence of intertemporally optimizing representative agents may seem like a glaring deficiency. We make no apologies for this. In our judgment the simplifications we have chosen provide a much better starting point than DSGE models with intertemporal optimization, rational expectations and fluctuations around a steady growth path with a natural rate of unemployment - a framework that is particularly problematic when applied to economies with pronounced sectoral differences and a need for structural transformation.\footnote{Our approach differs from some other alternatives to DSGE models, such as agent-based models. We see our ‘classical’ approach and agent-based models as potentially complementary; one virtue of our analytical strategy, we believe, is the clarity of causal mechanisms.}

The rest of the paper is structured in four sections. Section 2 uses a four-sector model of a developing economy with conflict-driven inflation to examine some implications of balanced budgets and inflation targeting policies. The Brazilian case is outlined in Section 3 which also includes a discussion of differences and similarities between our account and other inflation theories and interpretations of Brazil’s experience. Section 4 discusses policy implications and offers a few concluding comments and observations.

### 3.2 The model

#### 3.2.1 Overview

The model includes four sectors: a commodity sector producing a pure export good, two formal sectors, one producing a tradable and one producing a nontradable good, and an informal sector producing a nontradable good.

We use the term informal as a short-hand for activities with substantial underemployment and low incomes. Most of these activities are informal in a legal sense, but it is not the legal status, ‘formality’ \textit{per se}, that is important; the formal registration of street vendors would not change the reality of their situation. The informal sector in middle income countries typically

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\footnote{Our approach differs from some other alternatives to DSGE models, such as agent-based models. We see our ‘classical’ approach and agent-based models as potentially complementary; one virtue of our analytical strategy, we believe, is the clarity of causal mechanisms.}
includes a myriad of precarious urban activities, many of them in services. The sector is large in those countries and has much lower productivity and average incomes than formal sectors; summarizing ‘five facts about informality’, La Porta and Shleifer (2014) find the evidence to be broadly consistent with the dual view of informality associated with Lewis and classical development theory.

The output of the informal sector is nontradable, but a sizable part of nontradables, particularly in services and commerce, is produced by a formal sector. The distinction between formal and informal nontradable sectors therefore can be important.

3.2.2 Assumptions

Production and pricing

The formal sector is composed of two subsectors, a tradable and a nontradable one. Both sectors use capital and labor. Capital stocks are given in the short-run and labor is the only variable input

\[ M = F^M(L_M) \]

\[ S = F^S(L_S) \]

\( M \) and \( S \) denote the output of tradable and nontradable goods; \( L \) is employment with subscripts denoting the sector.

Nominal wages are predetermined in both formal sectors, and the marginal product of labor and the markup are taken as constant in the benchmark version of the model (these assumptions are relaxed in section 2.8). Thus, prices become predetermined too, and changes in demand are met by quantity adjustments. Normalizing labor productivities to one, we have

\[ M = q_M L_M = L_M \]  \hspace{1cm} (3.1)

\[ S = q_S L_S = L_S \]  \hspace{1cm} (3.2)

and
\[ p_M = \frac{w_M}{(1 - \pi_M)q_M} = \frac{w_M}{1 - \pi_M} \]  

(3.3)

\[ p_S = \frac{w_S}{(1 - \pi_S)q_S} = \frac{w_S}{1 - \pi_S} \]  

(3.4)

where \( \pi_i \) denotes the profit share in sector \( i \).

The **resource sector** produces a pure export good, which we shall refer to as ‘commodities’; the output of this sector may include oil, minerals and some agricultural goods. For simplicity it is assumed that no domestic inputs are involved in its production. This assumption is clearly extreme, but the qualitative analysis is unaffected as long as export shocks have little effect on the allocation of domestic inputs of labor and capital to this sector. In other words, we are capturing the exogenous rents that characterize resource-based activities. The value of exports in foreign currency \( (Z) \) is exogenous.

The **informal sector**, finally, produces a nontradable good and uses labor as the only input. Workers that fail to find jobs in the formal sectors move to the informal sector which is characterized by hidden unemployment and underemployment. Thus, if \( N \) denotes the total labor force, we have

\[ L_A = N - L_S - L_M = (N - S - M) \]  

(3.5)

The average income in the informal sector is given by

\[ w_A = \frac{p_A A}{L_A} \]  

(3.6)

where \( A \) is output in the informal sector and \( p_A \) its price level.

**Demand**

The two nontradable sectors produce pure consumption goods. The domestically produced tradable good, by contrast, can be used for either investment or consumption. It is assumed that all investment goods are produced domestically; results do not change qualitatively if this assumption is relaxed (see section 2.8). Total investment is the sum of investment in the two formal sectors and is determined by their levels of output (corresponding to the utilization rates of capital) and the real rate of interest \( (r) \),

\[ I = I(M, S, r) \]  

(3.7)
All wages and informal sector incomes are spent on consumption while only a portion \((1 - s)\) of profits is consumed. The revenues from commodities go partly to the government and partly to the private sector. We assume that a portion \(\epsilon\) of the revenues is spent on public and private consumption and that the state receives a fixed proportion of the revenues.

Algebraically, nominal private consumption \((C)\) and government consumption \((G)\) are given by:

\[
\begin{align*}
C &= p_A A + (1 - \pi_S)p_S S + \pi_S p_S S(1 - s) + (1 - \pi_M) p_M M \\
    &\quad + \pi_M p_M M (1 - s) + (1 - \beta) \epsilon EZ \\
G &= \beta \epsilon EZ
\end{align*}
\]

where \(E\) is the nominal exchange rate and \(\beta\) the share of resource revenues going to the state. For simplicity, we leave out taxation of incomes in the non-resource sectors and assume that government spending is determined by taxes and royalties from the resource sector; a balanced government budget is obtained if \(\epsilon = 1\) and a fiscal surplus if \(\epsilon < 1\). Given the purposes of this paper, little would be gained by including taxes on wages and profits in the formal sectors.\(^{14}\)

Private and government consumption are split between four goods: two nontradables (formal and informal) and two tradables (domestically produced and imported). The benchmark version of the model assumes that each of the four goods receives a fixed share of total domestic spending on consumption (corresponding to a Cobb-Douglas utility function); the shares of the \(M, S\) and \(A\) sectors are \(\alpha_M, \alpha_S, \alpha_A\), leaving \(\theta = (1 - \alpha_M - \alpha_S - \alpha_A)\) as the share for imports. This demand specification is relaxed in section 2.8.

Net exports \((NX)\) are equal to the sum of resource exports and net exports of modern sector goods. Nominal imports are given as a share \((\theta)\) of domestic nominal consumption; real exports of the tradable \(M\)-good \((X)\) are determined by foreign income and the international competitiveness of the domestic tradable sector. The main determinant of competitiveness in the short-run is the relative price \(p^*_M E/p_M\), and – normalizing the foreign currency price of imported goods to one \((p^*_M = 1)\) and omitting foreign income as an explicit argument – we have that

\(^{14}\)Skott (2021) considers fiscal policy in more detail.
\[ NX = p_M X - E p_M^* IM + EZ \]
\[ = p_M X(\eta) - \theta(C + G) + p_M \eta Z; \quad X' > 0 \]

where
\[ \eta = \frac{E p_M^*}{p_M} = \frac{E}{p_M} \quad (3.10) \]

With a slight abuse of terminology, we shall refer to \( \eta \) as the real exchange rate.

### 3.2.3 Short-run equilibrium

We have the following equilibrium conditions for the \( M, S \) and \( A \) sectors:\(^{15}\)

\[ p_M M = \alpha_M (C + G) + p_M I + p_M X \quad (3.11) \]
\[ p_S S = \alpha_S (C + G) \quad (3.12) \]
\[ p_A A = \alpha_A (C + G) \quad (3.13) \]

Using (3.8)-(3.9) and (3.11)-(3.13) aggregate domestic consumption – private and government – can be written
\[ C + G = \frac{p_M [(1 - \pi_M s)[I(M, S, r) + X(\eta)] + \eta Z\varepsilon]}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} \quad (3.14) \]

From equations (3.11)-(3.12) and (3.14) it follows that
\[ M = \alpha_M \frac{p_M (1 - \pi_M s)[I(M, S, r) + X(\eta)] + \eta Z\varepsilon}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} + I(M, S, r) + X(\eta) \quad (3.15) \]
\[ S = \alpha_S \frac{p_M (1 - \pi_M s)[I(M, S, r) + X(\eta)] + \eta Z\varepsilon}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} \quad (3.16) \]

The short-run solution defined by equations (3.15)-(3.16) is economically meaningful if the Keynesian stability conditions are satisfied. The standard intuition still applies for this two-sector system: stability requires investment to be relatively insensitive to variations in output, now taking into account the interactions between the two sectors (see Appendix A for details).

As shown in Appendix B, if \( M^* \) and \( S^* \) denote the short-run equilibrium solutions, we have

\(^{15}\)The investment and export variables \( (I \text{ and } X) \) are in real terms. With multiple consumption goods, however, private and public consumption \( (C + G) \) are defined in nominal terms.
\[
\begin{align*}
\frac{\partial M^*}{\partial Z} > 0; & & \frac{\partial S^*}{\partial Z} > 0 \\
\frac{\partial M^*}{\partial \eta} > 0; & & \frac{\partial S^*}{\partial \eta} > 0 \\
\frac{\partial M^*}{\partial r} < 0; & & \frac{\partial S^*}{\partial r} < 0
\end{align*}
\]

Intuitively, an increase in commodity revenues stimulates consumption and raises capacity utilization in both sectors. The benchmark specification of demand ensures that a depreciation (a rise in \(\eta\)) boosts demand in the tradable sector, with positive derived effects for nontradables. Analogously, an increase in interest rates has its direct effect (in this case negative) on investment and the demand for tradables, with derived effects for nontradables.

Aggregate income in the informal sector can be determined by (3.13)-(3.14) or alternatively, using (3.12)-(3.13), by noting that

\[
p_A A = \frac{\alpha_A}{\alpha_S} p_S S
\]

The effects of a commodity boom on net exports are ambiguous without restrictions on the various parameters. We have,

\[
\frac{\partial NX}{\partial Z} > 0, \quad \frac{\partial NX}{\partial \eta} > 0, \quad \frac{\partial NX}{\partial r} > 0
\]

A shock to commodity revenues has a direct impact on domestic consumption with derived effects on investment, domestic saving and imports. The effect on net exports can become negative if the consumption rate out of the commodity revenue is high (\(\epsilon\) is large), the import propensity out of consumption is large (\(\theta\) is large) and the sensitivity of accumulation to changes in output is sufficiently high (see Appendix B). The derived effects on imports may also dominate the positive effects of a depreciation on total exports (on \(X(\eta) + \eta Z\)), and the effects of a depreciation on the trade balance are ambiguous.

### 3.2.4 Wage setting and inflation

The levels of money wages in the formal sectors are predetermined in the short-run. But the average income in the informal sector is endogenous, and the rates of wage inflation in the formal sectors cannot be taken as constant.

Combining equations (3.5)-(3.6) and (3.16)-(3.17), the average income in the informal sector is given by
\[ w_A = \frac{p_A A}{N - L_M - L_S} = \frac{\alpha_A(C + G)}{N - L_M - L_S} \]
\[ = \frac{\alpha_A}{N - M - S} \frac{p_M[(1 - \pi_M s)(I + X) + \eta Z \epsilon]}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} \]  

(3.18)

Changes in informal sector incomes need not affect the prices of informal goods: a rise in demand for informal goods can raise the price \( p_A \), or it can reduce the rate of underemployment and raise the level of output \( A \); of course, it can also be some combination of the two. Given the Cobb-Douglas specification of the composition of consumption demand, however, the effects on average incomes in the informal sector are independent of changes in \( p_A \). Thus, even if prices of informal goods stay constant, an increase in informal-sector incomes has repercussions for wage inflation in the formal sectors if workers in these sectors react by pushing to increase their income.

The notion that norms of fairness influence wage setting has a long history in economics. Keynes (1936) famously explained wage stickiness by workers’ resistance to wage cuts that could reduce their relative wages, and Akerlof and Yellen (1990) pointed to wage norms as the source of unemployment among low-wage workers. Experimental and real-world evidence confirms the significance of notions of fairness for wage and price setting (e.g. Kahneman et al. (1986); Bewley (1998)).

Our benchmark specification of wage inflation in the formal sector embodies relative-wage norms: increases in informal-sector incomes generate cost-push pressures on wages in the formal sector. Formally, we assume that

\[ \hat{w}_M = \phi_M \left( \frac{w^f_M}{w_M} \right) + \hat{p}^e; \quad \phi_M(1) = 0, \quad \phi'_M > 0 \]  

(3.19)

\[ \hat{w}_S = \phi_S \left( \frac{w^f_S}{w_S} \right) + \hat{p}^e; \quad \phi_S(1) = 0, \quad \phi'_S > 0 \]  

(3.20)

where \( \hat{p}^e \) is the expected inflation rate. The ‘fair wages’ \( w^f_M \) and \( w^f_S \) are determined by the average incomes and wages in other sectors, that is

\[ w^f_M = f^M(w_A, w_S) \]  

(3.21)

\[ w^f_S = f^S(w_A, w_M) \]  

(3.22)
With a fixed markup, wage inflation maps directly into price inflation. Successful inflation targeting therefore requires that actual wages equal fair wages; that is, the following conditions must be met:

\[
\begin{align*}
    w_M &= w^f_M = f^M(w_A, w_S) \\
    w_S &= w^f_S = f^S(w_A, w_M)
\end{align*}
\]  

(3.23) (3.24)

We assume that the fair wages in the formal sectors exceed average incomes in the informal sector. A non-negative wage premium is in line with the classical assumption of elastic labor supply to the modern sectors in Lewis (1954), and a strictly positive wage premium has empirical and theoretical support. Firms willingly pay a wage premium because it increases productivity: as in Akerlof and Yellen (1990) and other efficiency wages models, a perception of unfair wages can generate adverse effects on productivity via collective action, including strikes, or by hurting ‘morale’ and reducing the ‘effort’ of individual workers.\(^{16}\)

### 3.2.5 Inflation targeting with constant fairness norms

Given the specification of wage setting, a positive shock to \(w_A\) generates inflationary pressures in the formal sectors. For given values of the predetermined wage levels \(w_M\) and \(w_S\), equations (3.19)-(3.20) imply that wage inflation is a strictly increasing function of \(w_A\),

\[
\begin{align*}
    \frac{\partial \hat{w}_M}{\partial w_A} &> 0 \\
    \frac{\partial \hat{w}_S}{\partial w_A} &> 0
\end{align*}
\]

There are asymmetries between the two sectors, however.

Consider first the effects of wage inflation in the formal nontradable sector. If wages and prices in the tradable sector stay constant, an increase in the prices of nontradable goods will not ignite a process of continuing inflation: nominal spending on private and public consumption is independent of the price level in the nontradable sectors (equation (3.14)). An increase in the prices of nontradable goods therefore has no direct effect on total informal-sector incomes.

\(^{16}\)Efficiency wage arguments for a wage premium in the formal sector can also be nutrition-based (Leibenstein (1957)) or use a traditional utility-based approach to the determination of ‘effort’ (e.g. C. Shapiro and Stiglitz (1984); Bowles (1985)).
However, it reduces real output and employment in $S$, sending workers into the informal activities and reducing the average income in this sector. The contraction in $S$ also has derived negative effects on investment, causing employment in the tradable sector to fall, leading to a further decline in aggregate informal sector income. Adjustments in $w_S/w_A$ in response to a shock to $w_A$ therefore tend to be self-correcting; if an increase in $w_A$ produces a rise in $w_S$, the induced decline in $w_A$ ensures that $w_S/w_A$ will go up, moving towards a restoration of the previous relative wage.

An increase in tradable wages and prices, by contrast, raises the nominal demand for non-tradable goods (equation (3.14)). If investment and the exports of commodities and $M$ goods stay constant, an increase in $w_M$ produces a proportional rise in the average nominal income in the informal sector and leaves the ‘relative wage’ $w_M/w_A$ unchanged. Nominal incomes in the $S$-sector, which (like total informal sector income) are determined by $C + G$, also increase proportionately, generating some combination of increases in $w_S$ and $L_S$.\(^{17}\) As a result of these interactions between an initial rise in $w_A/w_M$ and the ensuing cost-push adjustments in tradable-sector wages and prices – which feed into new increases in nominal demand for the informal good – the $w_A/w_M$ ratio does not return to its former value. Instead, we may get a cycle of persistent and potentially (depending on how expectations are formed) explosive inflation.

Intuitively, this asymmetry between tradable and nontradable prices is related to a standard Keynesian multiplier process. Incomes in the tradable, nontradable and resource sectors all generate consumption demand. A constant fraction of consumption demand goes to the nontradable sector, and this feedback creates a multiplier relation: incomes in the nontradable sector are determined by the product of the multiplier and the ‘outside demand’ from the tradable and resource sectors; this outside nominal demand is influenced by $p_M$.

The two sectors differ in other ways, too. Changes in informal sector incomes may have a strong impact on fair wages in nontradable formal activities that have relatively low wages and that are similar to and compete directly with informal activities; street food, for instance, may compete with formal restaurants and employ workers with similar skill sets. The impact of informal sector incomes on high-wage jobs in tradable sectors, by contrast, will be largely mediated by ripple effects through the wage distribution. The absence of foreign competition in

\(^{17}\) A proportional increase in $w_S$ leaves $L_S$ unchanged but implies that the ratio of fair to actual wages in the $M$-sector is unaffected by changes in $w_M$; a less than proportional increase in $w_S$ implies a rise in $L_S$, which reduces employment in the informal sector, and the average income of informal workers now rises more than proportionately to changes in $w_M$.  

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the nontradable sector, moreover, is likely to make firms less reluctant to grant wage increases, and we would expect to see faster adjustment speeds in the nontradable formal sector than in the tradable one. As a stylized version of these differences, we consider the case in which $\phi_s' \to \infty$.

Suppose that $w_S$ is less than its ‘fair’ value. As argued above, an increase in $w_S$ will raise $w_S/w_A$. If $w_M$ is predetermined (adjusts slowly), $w_S/w_M$ will also increase and with fast adjustment, $w_S$ will converge to $w^f_S$. Formally, we have

$$w_S = f^S(w_A, w_M) = w_M f^S\left(\frac{w_A}{w_M}, 1\right)$$

or

$$\frac{w_S}{w_M} = f^S\left(\frac{w_A}{w_M}, 1\right) = \zeta\left(\frac{w_A}{w_M}\right); \quad \zeta' > 0$$  (3.25)

Using equations (3.19), (3.21) and (3.25) and assuming that the central bank has succeeded in establishing the credibility of the inflation target ($\hat{p}_e = \hat{p}_T$), the condition for $\hat{w}_M = \hat{w}_S = \hat{p}_T$ can now be written

$$f^M\left(\frac{w_A}{w_M}, \zeta\left(\frac{w_A}{w_M}\right)\right) = 1$$  (3.26)

The function on the left hand side is increasing in $w_A/w_M$, and the equation defines a unique solution for the wage ratio,

$$\frac{w_A}{w_M} = \mu$$  (3.27)

Combining equations (3.3), (3.18) and (3.27), we have

$$\mu = \frac{\alpha_A}{N - M - S} \frac{1 - \pi_M\theta}{\theta + s(\alpha_M\pi_M + \alpha_S\pi_S)} (I + X) + \frac{\eta \bar{z}_e}{1 - \pi_M}$$  (3.28)

Central banks cannot control inflation perfectly and instantaneously, even at the best of times. But because of the interactions between wages in the tradable sector and incomes in the informal sector, it becomes imperative to stamp out price acceleration in the tradable sector; conversely, there will be no explosive inflationary cycle, and inflation targeting can be successful as long as central banks keep wage inflation in the tradable sector at the target rate. Thus,

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18 The tradable sector may increase wages but be forced by foreign competition to absorb some of the increase via reduced profit margins. We consider induced changes in profit margins in section 2.8.

19 A focus on the derived inflationary effects of shocks is in line with the ‘consensus view’.
if wage norms are constant and wage inflation in the tradable sector is determined by equation (3.19), successful inflation targeting implies that, on average, equation (3.28) will be satisfied in the medium run, at least approximately.

Ignoring short-run deviations, consider the implications of a ‘perfect’ policy regime under which equation (3.28) holds at all times. Inflation targeting works in this model because monetary policy influences demand in the tradable sector and thereby the relative wage and the inflation rate: there is a direct influence of interest rates on investment (equation (3.7)) and an appreciation caused by a rise in the domestic interest rate reduces exports (equation (3.11)).

Standard interest parity arguments suggest the determination of the nominal exchange rate $E$ by domestic interest rates, foreign interest rates, the expected future exchange rate, and risk considerations. Thus, let

$$E = E(i, i^*, E^e, \tau) \quad (3.29)$$

where $i$ and $i^*$ are domestic and foreign nominal interest rates; $i = r + \hat{p}$. The expected exchange rate $E^e$ and the country risk $\tau$ may change in response to resource booms and other exogenous shocks, whether domestic or international. Subsuming these factors and the exogenous or predetermined values of $i^*, p_M^*/p_M, \hat{p}$ in the shift variable $\rho$, we assume that the real exchange rate is given by

$$\eta = \frac{p_M^*E(r + \hat{p}, i^*, E^e, \tau)}{p_M} = \eta(r; \rho); \quad \eta_r < 0 \quad (3.30)$$

### 3.2.6 Commodity booms, inflation targeting and the Dutch disease

Inflation targeting endogenizes the interest rate, and equations (3.28) and (3.30) in combination with (3.15)-(3.16) determine the levels of output in the two formal sectors, the real interest rate $r$ and the real exchange rate $\eta$. The comparative statics now become quite different from those in section 2.3.

Policy makers still follow principles of sound finance and maintain a non-negative government balance; that is, we assume that $\epsilon \leq 1$ stays constant. But a commodity boom feeds consumption demand, and contractionary monetary policy is needed to keep inflation at the target level. If $r$ and $\eta$ were to remain constant, an increase in $Z$ would raise $M$ and $S$ (section 2.3 and Appendix

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the professional consensus among academic and central bankers is that a central bank should accommodate the direct price-level impact of the shock while calibrating monetary policy so as to avoid further rounds of price increases. (Fraga et al. 2003, p. 32)
B), and $C + G$ would also increase. The average income in the informal sector would go up and inflation would increase.

To prevent the increase in inflation, central banks raise the interest rate $r$ which causes the exchange rate to appreciate ($\eta$ falls). The contractionary effects on $M, S$ and $C + G$ (section 2.3, Appendix B and (3.14)) curtail the rise in $w_A$ and keep inflation at the target rate. The net effect is a contraction in the tradable sector while nontradables expand. Formally, we have (see Appendix C for details)

$$\frac{\partial M}{\partial Z} < 0; \quad \frac{\partial S}{\partial Z} > 0$$

Intuitively, interest rates have to be raised in order to avoid a violation of the prevailing relative-wage norms. The direct effects of higher interest rates fall on the tradable sector: investment falls and the currency appreciates which reduces exports.\(^{20}\) By contrast, the derived effects on the consumption demand for the $S$ and $M$ goods are proportional. The net effect therefore falls more heavily on the $M$ sector, and the differential effects on the two sectors imply that the $M$-sector must decline in order to maintain a ‘fair’ relative wage.

The shifts in the composition of formal-sector output away from tradable goods have dynamic effects on the patterns of investment which also shift towards the nontradable sector. The long-term effects of these shifts are beyond the scope of this paper.\(^{21}\)

### 3.2.7 Money illusion, endogenous norms and path dependency

If the fairness norms were fixed and time-invariant, the analysis in section 2.6 would represent a twist on a common story: high wage demands by ‘insiders’ (in this case workers in the formal sector) can lead to high natural rates of unemployment.

But social norms are sustained by continuous validation; they change gradually when outcomes differ from expectations. Like the role of norms of fairness in wage setting, the recognition of the conventional aspect of norms has a long history, and evidence from social psychology and

\(^{20}\) The commodity boom may reduce country risk and generate an appreciation of the exchange rate. If the appreciation causes a large reduction in the demand for tradable goods, the interest rate could fall, even though the risk-adjusted rate has increased.

\(^{21}\) Another possible impediment to long-run growth is related to net exports. The combination of a boost to aggregate demand and exchange rate appreciation tends to cause unsustainable trade deficits and lead to future contractions. Araujo and Lima (2007) analyze implications of balance of payments constrained growth in a multi-sectoral framework.
behavioral economics support the path dependency of social norms. In the words of Kahneman et al. (1986) (p. 730-1),

the reference transaction provides a basis for fairness judgments because it is normal, not because it is just. Psychological studies of adaptation suggest that any stable state of affairs tends to become accepted eventually, at least in the sense that alternatives to it no longer readily come to mind. Terms of exchange that are initially seen as unfair may in time acquire the status of reference transaction.

The conventional nature of norms can lead to hysteresis in both employment and income distribution in a mature economy, and modified versions of the hysteresis argument carry over to developing ones: the long-run growth rate may be affected by macroeconomic policy in developing economies.\(^{23}\)

Following Kahneman et al. (ibid.) and the behavioral evidence, suppose that the fair wage ratio changes over time in response to differences between actual and fair relative wages, that is, \(\hat{\mu}\) changes in response to differences between \(w_A/w_M\) and \(\mu\). Formally, let

\[
\hat{\mu} = \lambda \left(\frac{\omega}{\mu} - 1\right) \tag{3.31}
\]

where \(\omega = w_A/w_M\).\(^{24}\)

Now consider a trajectory in which the wage ratio \(\omega\) is kept slightly above the fair relative wage (but below one so that the tradable sector can still attract workers). Formally, let \(\omega = \mu + a(1 - \mu)\) where \(a > 0\) is small. Using equation (3.31),

\[
\dot{\mu} = \lambda a(1 - \mu) > 0
\]

\(^{22}\)Economists had made similar observations before ‘behavioral economics’. Hicks (1975) (p. 65), for instance, argued that “no system of wages when it is called into question, will ever be found to be fair. ... [To avoid the system being called into question] the system of wages should be well established, so that it has the sanction of custom. It then becomes what is expected; and (admittedly on a low level of fairness) what is expected is fair.”

\(^{23}\)See Skott (2005) for an analysis of fairness-induced path dependency in mature economies.

\(^{24}\)The symmetric specification in equation (3.31) has the virtue of simplicity but misses an important aspect of norm adjustment: fairness norms are likely to adjust quickly in an upward direction (we quickly feel that pay increases are ‘fair’) but more slowly in a downward direction (it is hard to accept that we deserve less than what we used to get). This asymmetry in the adjustment of norms in combination with downward stickiness in nominal wages can make for inflationary pressures, even if average relative wages are trendless. Thus, policy regimes that aggravate volatility – including balanced budget rules for fiscal policy – tend to produce a higher level of ‘baseline’ inflation.
The fair wage ratio $w_A/w_M$ gradually rises, and the actual ratio rises with it. Putting it differently, the wage premium in the tradable sector is slowly eroded.

Equations (3.19)-(3.20) imply that the discrepancy between fair and actual wages produces wage inflation above the expected rate (which by assumption equals the target rate if the latter is considered credible), and it might seem that expectations cannot remain anchored to the target. Small deviations from fairness will be associated with only minor discrepancies of actual from expected inflation, but natural-rate theory does not permit persistent deviations, no matter how small; expected inflation would increase and inflation would be explosive. Here again, however, the behavioral evidence challenges the standard story.

Norms of fairness attach to both nominal and real magnitudes. There is strong evidence, for instance, that a fall in nominal wages is seen as unfair and that the level of nominal wages exhibits downward stickiness (Akerlof and Yellen (1990); Shafrir et al. (1997)). In more general terms, the fairness of prices or wages is assessed in relation to past nominal values as well as in relation to the current values of other prices and wages, but the weights of the different evaluations are context dependent (Shafrir et al. (ibid.); Kahneman et al. (1986)). Inflation becomes less salient and purely nominal evaluations gain greater weight if inflation rates are low. By the same token, if deviations from established inflation anchors are small, they become less salient and may be ignored. In fact, small deviations between actual and expected inflation are likely to go completely unnoticed. Surveys document limited knowledge of actual inflation rates, and with finite cognitive resources it would not even be sensible for most people to try to keep track of small scale changes in the rate of inflation.

Important aspects of this argument and its implications for wage inflation were anticipated by Rowthorn (1977). Nominal evaluations and the inattention to price inflation become dominant when inflation is low; when inflation is high, by contrast, it becomes costly to ignore price changes and expected price inflation becomes an important determinant of wage inflation. As a

\[ \hat{w}_M = \max\{0, \phi_M(w_f/w_M) + \hat{p}^*\}; \quad \phi_M(1) = 0, \quad \phi_M'(1) > 0 \]  
\[ \hat{w}_S = \max\{0, \phi_S(w_f/w_S) + \hat{p}^*\}; \quad \phi_S(1) = 0, \quad \phi_S' > 0 \]

This extension would not affect the analysis in section 2.5.

\[ ^{25}\text{In order to include this aspect, the inflation equations could be written} \]

\[ \hat{w}_M = \max\{0, \phi_M(w_f/w_M) + \hat{p}^*\}; \quad \phi_M(1) = 0, \quad \phi_M'(1) > 0 \]  
\[ \hat{w}_S = \max\{0, \phi_S(w_f/w_S) + \hat{p}^*\}; \quad \phi_S(1) = 0, \quad \phi_S' > 0 \]

\[ ^{26}\text{Inattention may be ‘rational’; Sims (2003). The substance of this argument – inattention is both sensible and behaviorally plausible – is surely right, even if the ‘rational inattention’ literature exaggerates the strict ‘rationality’ of the inattention.}\]
simple formalization, Rowthorn suggested that inflation will not be taken into account in wage bargaining as long as it stays below some threshold level.

In the present context, these behavioral arguments suggest that as long as the deviation of the actual from target inflation is kept small, expectations can remain anchored at the target level. In short, relative wage norms may be important in developing economies, but the norms are path dependent and minor deviations of actual from expected inflation may go unnoticed or, if noticed, may have no impact on expected future inflation. These behavioral findings have dramatic consequences. Developing economies do not suffer from a high ‘natural rate of underemployment’ whose only remedy is ‘labor market reforms’. Sustained non-inflationary transformation with a gradual elimination of underemployment in the informal sector and a gradual closing of sectoral wage gaps is perfectly possible.

The potential for explosive inflation following a large shock to relative incomes is also clear. A large shock to relative incomes leads to large increases in wage pressures and large discrepancies between actual and target inflation. The ‘inattention threshold’ may be breached, and the scene is set for an accelerationist inflation dynamics. The feedback effects from nominal incomes in the formal sectors to average incomes of informal workers prevents wage inflation in the tradable sector from restoring ‘fair’ relative wages, and although fairness norms will be changing, their speed of adjustment is likely to be much lower than that for inflation expectations.

3.3 Extensions and robustness

3.3.1 Specification of consumption demand

The benchmark specification of consumption assumed constant expenditure shares. This Cobb-Douglas specification of demand with unit elasticities of substitution between any two goods can be questioned. The substitutability between imported and domestically produced tradable goods, for instance, is likely to be higher than that between imported and nontradable goods.

If the assumption of fixed expenditure shares is dropped, changes in the real exchange rate will affect the composition of demand, and another question needs attention. In the benchmark specification, the average income in the informal sector becomes independent of the price of informal goods. This is no longer the case if the expenditure share for informal goods depends

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27 The extension of the fairness argument in section 2.8.2 reinforces this argument.
on relative prices. The informal sector is characterized by underemployment and if $\alpha_A$ depends on relative prices, it matters whether an increase in the demand for informal goods is met by an increase in price or by reductions in underemployment. We focus on the simplest case in which $p_A$ is constant in the short-run and changes in demand are met by quantity adjustments (changes in $A$). By assumption $p_M$ and $p_S$ are predetermined and the relative prices of all three domestic goods will be given in the short-run. A simple continuity argument ensures that the result for fixed $p_A$ will apply also when $p_A$ depends on demand if the dependence is weak or the sensitivity of the expenditure share $\alpha_A$ to changes in relative prices is low.

Now consider the key result in section 2.6: a commodity boom generates a decline in the tradable sector if interest rates are raised to neutralize the inflationary pressures from increased domestic demand. As shown in Appendix D, this result continues to hold if a real appreciation (a fall in $\eta$) (i) reduces (or leaves constant) the share of consumption expenditure going to domestically produced tradable goods (tradable goods and imports are substitutes) and (ii) raises (or leaves constant) the share of spending going to nontradable goods (imports and nontradables are complements). These conditions, which arguably cover the cases that are most plausible empirically, are sufficient, but not necessary, for the result to hold.

Although the result is fairly robust to changes in the specification of consumption demand, there are conditions under which it does not hold. If imports and domestically produced tradable goods are complements and investment and exports are insensitive to changes in the interest rate and the real exchange rate, respectively, then a commodity boom could raise output in the tradable sector and reduce output of nontradables (see Appendix D).

### 3.3.2 Consumption real wages as a determinant of fair wages

The fair wage in the tradable sector may depend on the consumption real wage as well as on relative wages; that is,

$$w^f_M = f^M(w_A, w_S, p)$$

where $p$ is the relevant consumer price index. Workers consume a combination of imported, tradable and nontradable (formal and informal) goods, and the price index is a linearly homogeneous function of the four prices:

$$p = \xi(Ep^*, p_M, p_S, p_A) = \xi(p_M\eta, p_M, p_S, p_A)$$
This extension of the analysis implies that the inflation targeting condition in equation (3.26) can be written as

\[ f^M\left(\frac{w_A}{w_M}, \zeta(\frac{w_A}{w_M}), \xi(\eta, 1, \frac{p_S}{p_M}, \frac{p_A}{p_M})\right) = 1 \]

An appreciation of the exchange rate now increases the consumption real wage and reduces the inflationary pressures. The effect on the nontradable sector continues to be positive, but now the net effect on the tradable sector need not be negative depending on parameters elasticities. Both sectors may expand if the ‘fair wage’ is highly sensitive to changes in the consumer price index and the consumer price index is highly sensitive to changes in the real exchange rate. The result that sector $S$ increases proportionally more than sector $M$, however, continues to hold (see Appendix E).

Including the consumption real wage as a determinant of fair wages has another notable implication. Productivity gains raise real wages and therefore facilitate gradual, non-inflationary reductions in the relative wage of workers in the tradable sector during a process of industrialization; the inflationary effects of declining relative wages can be offset by increasing real wages. Productivity growth cannot, however, offset the inflationary effects of sharp shocks to relative incomes.

### 3.3.3 Intermediate goods

The formal sectors in developing countries often rely on imported intermediate goods. Thus, assume that $\gamma_M$ and $\gamma_S$ units of imports are required as intermediate inputs per unit of output in the tradable and nontradable sectors.

Exchange rate movements now affect prices and/or profit shares in the formal sectors. If the prices stay constant, an appreciation will raise the profit shares, but a positive shock to $Z$ will have the same qualitative effect on $M$ and $S$: with inflation targeting, $S$ must rise and $M$ must fall (see Appendix F).

If the markups on marginal costs are kept constant, both prices and profit shares become decreasing functions of the real exchange rate $\eta$. In this case, it is a sufficient condition for $dS/dZ$ to be positive that $d\frac{p_S}{p_M}/d\eta \geq 0$. But weak effects on $X$ and $I$ allow for the possibility that both $S$ and $M$ may increase (see Appendix F).
If an appreciation (a fall in $\eta$) raises $p_{S}/p_{M}$ ($d\frac{p_{S}}{p_{M}}/d\eta < 0$), then fixed expenditure shares imply a shift in real consumption from $S$ towards $M$. If this shift is sufficiently strong to offset the negative effects of an appreciation on $X$ and rising interest rates on $I$, the outcome can be a fall in $S$.

Intermediate imports also affects net exports. We now have

$$NX = p_{M}X(\eta) - \theta(C + G) - [\alpha_{M}(C + G) + p_{M}(I + X)]\gamma_{M}\eta - \alpha_{S}(C + G)\gamma_{S}\frac{p_{M}}{p_{S}}\eta + p_{M}\eta Z$$

Imported intermediate inputs add negative effects of exchange rate depreciation on net exports; that is, the Marshall Lerner condition will be less likely to hold.\textsuperscript{28}

A depreciation, finally, will put downward pressure on real wages and add inflationary pressures, if the markup on marginal cost is constant and wage demands respond to changes in the real consumption wage.

### 3.3.4 Imported and nontradable investment goods

The benchmark version of the model assumes that all investment goods are produced domestically by the tradable sector. As an alternative, consider a case in which all investment goods are imported. The qualitative effects on the $M$ and $S$ sectors of a shock to commodity exports are unchanged: inflation targeting still implies a contraction in the tradable sector and an expansion of nontradables (see Appendix G).

It should be noted, however, that if capital goods are imported, an increase in interest rates may influence investment, but there will be no effect on the demand for domestically produced goods. Thus, economies with high shares of imported capital goods must rely on exchange rate movements as the mechanism through which monetary policy impacts inflation. These economies will require larger movements in interest and exchange rates in order to keep inflation within the target range following shocks to domestic demand.

If investment goods are domestically produced but partly nontradable, there are no qualitative changes in the short-run without monetary policy. With inflation targeting, however, the qualitative results can be different, depending mainly on the sensitivities of net exports.

\textsuperscript{28}Even in countries with a relative high share of intermediate goods imports, including the Brazilian case analyzed in the next section, there is empirical evidence that the Marshall-Lerner condition holds. See, for example, Gomes and Paz (2005) and Moura and Da Silva (2005).
to exchange rates and of investment and the exchange rate to changes in interest rates (see Appendix G).

3.3.5 Endogenous markups and labor productivity

Markups and profit shares need not be constant. Firms may take advantage of boom times and increase their mark-ups and profit-shares. An increase in profit-shares, in turn, reduces aggregate consumption. Thus, allowing for endogenous markups soften the multiplier effects of shocks to demand. By continuity, however, the qualitative results of the model hold as long as the sensitivity of profit-shares to output is low.

The benchmark model assumed constant labor productivity. Introducing diminishing returns to labor makes the profit share endogenous, even if the markup on marginal cost is constant. Formally, let

$$ p_i = (1 + m) \frac{w_i}{F_i'} $$

where $F_i'(L_i)$ is the production function for sector $i$. The profit share is

$$ \pi_i = 1 - \frac{F_i' L_i}{(1 + m) F_i} $$

The profit share will be constant if the production function has constant elasticity, but increasing (decreasing) in $L_i$ if the elasticity $F_i' L_i / F_i$ is decreasing (increasing) in $L_i$. Having diminishing returns to labor also affects the sensitivity of $w_A$ to changes in $Z$ because of its influence on $L_A$ which is no longer given by $N - M - S$. Again, however, the qualitative effects on $M$ and $S$ of shocks to commodity exports are unchanged, as long as the sensitivity of profit shares to changes in output is low.

3.4 A brief summary of the recent Brazilian experience

3.4.1 Stylized facts

Brazil entered the 21st century with high hopes. The re-democratization process initiated in the 1980s had matured, the hyperinflation of the late 1980s and early 1990s had been squashed, and the dominant view was that by opening the economy and reducing state interference, the country would be put on a trajectory of sustainable growth and gradual catch-up with advanced economies. In terms of macroeconomic policy, the strategy was expressed in a ‘tripod’ rule: floating exchange rates, primary fiscal surplus, and inflation targeting.
The commodity boom added a new element. The Brazilian terms of trade began to improve from 2002, peaking in 2011 and falling again to a local minimum in 2015. As shown in figure 3.1, the net exports of commodities went from US$ 12.9 billion in 2002 to US$ 99 billion in 2011, with the share of commodities on total exports going from 40% to 60% in the same period.\(^{29}\) Surging commodity exports opened up space in the balance of payments to increase imports; over the same period the boost to domestic aggregate demand and an appreciation of the exchange rate led to movements in net exports of non-commodities from a US$ 250 million surplus to a US$ 69.2 billion deficit.

![Figure 3.1: Terms of trade (June 2012=100) and Net exports (US$ Bi. FOB)](image)

Source: IMF and Ministry of Economy, Industry, Foreign Trade, and Services of Brazil. Authors’ calculation.

Two main channels link the increase in revenue from commodity exports to domestic absorption: the increase in private consumption due to the higher income in the sectors directly associated with the exports of commodities, and the increase in government expenditure following the windfall revenue from taxes and royalties. These initial movements were amplified by multiplier effects on consumption and investment.

The period from 2003 to 2011 saw an acceleration of GDP growth, with an average of 3.5% from 2002 to 2014 – and 4.5% between 2007 and 2011 – compared to 2.6% in the previous decade (1992-2001). Private consumption was the fastest-growing component of demand during the commodity boom, both in relative and absolute terms. Aided by rising incomes at the lower end of the income distribution and an expansion of consumer credit, private consumption increased

\(^{29}\)Data from the Ministry of Industry, Foreign Trade, and Services of Brazil - MDIC. Commodities are defined as: Mineral fuels, lubricants and related materials; Food products and live animals; and Non-edible raw materials (except fuel).
from 61.7% of the GDP in 2002 to 64.7% in 2011, reaching 67.4% in 2015. Illustratively, car sales increased by 130% between 2002 and 2011, and the sales of home appliances rose by 242% in real terms. Federal government expenditure also accelerated, reaching an annual average real growth rate of 8% during the ascendant phase of the boom (2003-2010), compared to 5.8% from 1998 to 2002 and 3.6% between 2011 and 2015. Public investment also increased between 2005 and 2010, but the expenditures were largely concentrated in consumption.

The fiscal expansion did not violate balanced budget prescriptions; the federal government maintained continuous primary fiscal surpluses – on average 2.2% of GDP from 2002 to 2011. There is robust evidence that local governments also used the increase in revenues directly and indirectly related to the commodity boom to increase expenditure while preserving fiscal discipline. The average primary surplus of the public sector, which includes federal and local governments, was 3.1% of GDP between 2002 and 2011, and the net public indebtedness fell from 55.8% of GDP in 2002 to 36.4% in 2011.

The growth rates were uneven across sectors. In the years before the intensification of the commodity boom, from 2000 to 2004, the manufacturing sector grew at an annual average rate of 4%, significantly above those of retail (2.6%) and services (2.2%). The ranking was reversed during the ascendant part of the boom years from 2005 to 2011 when the rate of growth of manufacturing sector was 2.3%, and those of retail and services increased to 4.7% and 4%.

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30From 2002 to 2010, private investment grew more rapidly, from 18.2% to 21.8% of GDP, but lost ground from 2011, reaching 19.3% in 2015. Brazilian National Accounts, IBGE.

31Respective sources: FENABRAVE - *National Federation of Motor Vehicle Distribution* and ABINEE - *Brazilian electrical and electronics industry association*.

32Using data from Ministry of Economy, Industry, Foreign Trade and Services of Brazil.

33Federal public investment went from 0.45% of GDP in 2002 to 0.79% in 2010. Total expenditure of the federal government in the same period went from 15.9% of the GDP to 18.2%. Ministry of Economy, Industry, Foreign Trade and Services of Brazil and Observatorio do Política Fiscal - IBRE/FGV.

34The average total federal deficit including interest payments was 3.2% of GDP in the same period. The public debt ratio fell however, which is in line with fiscal policy prescriptions.

35Data from *Banco Central do Brasil*. Orair and Gobetti (2017) provide slightly different numbers; they suggest a reduction in public debt from 60% of GDP in 2002 to 31% in 2013.

36Manufacturing might have benefited from the depreciations of the exchange rate in 1999 and 2002. The increase in manufacturing employment, for instance, is concentrated in 2004 and 2005, and the most positive net exports result since 1997 was achieved in 2006, with a surplus of US$ 14.5 billions. Thus, looking at sectoral data, it is important to bear in mind that effects from previous shocks still operate during the initial years of the commodity boom.

37Identified as other services in the Brazilian national account system, which comprises all usual private services such as education, health, lodging and food services, domestic services, among others.
From 2011 to 2015 the gap is even wider, with manufacturing *decreasing* annually 3.1% while retail and services changed, on average, -0.2% and 0.8%.

Trade contributed to the heterogeneous sectoral development. The real exchange rate appreciated and manufacturing faced intensified international competition. During 2005-2008, more than 22% of the increase in domestic consumption of manufactures was supplied by net imports, compared to only 6.1% in the period 2003-2005. In the cases of durable goods, this share of net imports went from 0% in 2003-2005 to 49.3% in 2005-08 (Bielschowsky et al. 2015). Services, by contrast, are largely nontradable and performed better, as can be seen in terms of profitability and value-added in figure 3.3. Around 6 percentage points of GDP was ‘transferred’ from the manufacturing sector to nontradables between 2004 and 2014. The profit-share of the manufacturing sector decreased from 52.2% in 2004 to 29.9% in 2014, while in nontradables it was relatively stable - a large increase in the profit share in services (from 19.6% to 30.6% in the same period) was offset by its decline in public utilities\(^{38}\) and construction sectors. Investment shows a similar pattern in favor of nontradable activities: according to Miguez (2016), before the intensification of the commodity boom (2001-2004), the average annual growth rate of investment in real terms was -4.2% for the manufacturing sector and -7.5% for a sector combining

\(^{38}\)Electricity, water, sewage.
retail and other services activities; during the boom period (2005-2011), these rates went to 6.6% and 14.6%, respectively.\textsuperscript{39}

Figure 3.3: Nontradable and Tradable sectors - VA (2002=1)

![Graph showing VA (% GDP) for tradable and nontradable sectors from 2000 to 2017.]

Source: Author’s calculation based on IBGE. ‘Nontradables’ consisting of the services sector, retail and construction. In line with the model definition, ‘tradables’ is the manufacturing sector.

Figure 3.4: Nontradable and Tradable sectors - Profitability (2002=1)

![Graph showing profit-share for tradable and nontradable sectors from 2000 to 2017.]

Source: Author’s calculation based on IBGE. ‘Nontradables’ consisting of the services sector, retail and construction. In line with the model definition, ‘tradables’ is the manufacturing sector.

Faster economic growth was reflected in the labor market. Measured unemployment decreased from around 12% in 2002 to less than 5% in 2014, and formalization went from 52% to more than 63% in the same period (Komatsu and Menezes Filho (2015)).\textsuperscript{40} Once again sectoral differences are relevant. The ratio of (formal plus informal) nontradable to tradable employment stayed roughly constant, but there was a significant shift from the informal to the formal non-

\textsuperscript{39}Rugitsky (2017) suggests another source of uneven sectoral performance. Many services have high income elasticities of demand at intermediate income levels, and domestic demand, therefore, shifted towards services as growth rates increased and inequality fell.

\textsuperscript{40}Data for metropolitan areas.
tridable sector (figure 3.5). In terms of the model in section 2, $L_A/L_S$ fell while $L_M/(L_A + L_S)$ was stable. This dynamics, combined with the increase in the share of value added of the non-tradable sectors (formal and informal), displayed in figure 3.3, suggests a reduction in the level of underemployment in the nontradable, informal sector.

The commodity boom and the associated increase in private and government consumption produced inflationary pressures (see figure 3.6). Wages rose significantly, but despite the superior dynamics in the nontradable sector in the period, sectoral relative wages shifted only slightly against manufacturing workers (see figure 3.5). Manufacturing workers managed to raise their nominal wage roughly in step with wage increases in the nontradable sectors. In terms of the model, the relative wage $\frac{w_M}{w_S}$ stayed roughly constant while $\frac{w_M}{w_A}$ decreased slightly. In the nontradable sectors, the increase in wages was passed on to prices, as the profit-share figures indicate. Given international competition, part of wage increases in the manufacturing sector was absorbed by reductions in profitability, accentuating the conflict over the functional income distribution in the sector. The number of total strikes in the economy went from 302 (23,138 hours) in 2004 to 2,050 (111,342 hours) in 2013 (DIEESE 2014, 2005). Besides the market forces, minimum wage policy also had important impacts. With a real increase of 68% between 2004 and 2014, it affected low wage workers and social transfers (including pensions), which are indexed by the minimum wage. The exact weight of each of these effects are not clear, but there is some evidence that the impact via government transfers accounts for about half of its effect on the lowest income levels (Saboia and Hallak Neto (2018)).

After a spike in inflation in 2002-2003 due to capital flight and a steep depreciation on the eve of the presidential election of Lula from the Workers Party (PT), inflation was kept consistently within the target range from 2004 to 2014. Price movements displayed sectoral heterogeneity, however. Inflation in the service sector remained consistently above average inflation, exceeding

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41 The reduction in wage inequality and extreme poverty is an important element of the Brazilian trajectory in the period. For the purposes of this paper, we focus on the relative wages in sectorial terms and their implications for structural change; see Souza and Medeiros (2015) for a critical discussion of the evidence on changes in personal income inequality during this period.

42 These effects of minimum wage increase are more directly analyzed by Neri et al. (2001), Oreiro and D’Agostini (2017), Serrano and Summa (2015), among others.

43 The model assumes that workers do not save, and government transfers to the poor have the same effect on aggregate demand as government spending on goods and services. From a pure aggregate-demand perspective the distinction between transfers to the poor and government consumption therefore becomes irrelevant, and transfers could be seen as incorporated in the model. But transfers also affect relative incomes, an effect that we did not include explicitly in the model.
the target range from 2008 to 2016. High inflation in services was offset by the lower inflation for (non-commodity) tradable goods and the output of state-owned companies, including oil (Petrobras) and electricity (Eletrobras).

The downward pressure on tradable goods prices was a result, to a large extent, of monetary policy. The basic interest rate (SELIC) followed a downward trend from 2002 to 2008, but the premium over international rates (the LIBOR is used here) was kept high despite a significant
reduction in country risk as measured by the EMBI+ index.\textsuperscript{44} A high interest premium encouraged the inflow of international capital, reinforcing pressures from the commodity boom towards exchange rate appreciation in both nominal and real terms. The policy was intensified as inflation pressures increased, particularly between 2010 and 2011, as can be seen from the steep increase in the interest rate differential despite a stable country-risk (figure 3.7).

From 2011 to 2014, macroeconomic policy became erratic. For present purposes, it is sufficient to note that fiscal policy remained expansionary most of the time,\textsuperscript{45} although with changes in its composition, and that monetary policy was loosened briefly in 2012 and early 2013.\textsuperscript{46}

Macroeconomic policy returned to more strict principles of inflation targeting and balanced budgets in 2015. The end of the commodity boom, a deceleration in consumer credit, and lower economic growth meant that balanced budgets now implied fiscal contraction. The liberalization of state-controlled prices and an exchange rate depreciation (following the reversal of terms of trade) produced a spike in inflation in 2015 despite a tightening of monetary policy. Inflation returned to its target in 2017 in the wake of the severe crisis that had reduced real GDP by 6.7% over those two years.

Stagnation since then has left GDP in 2019 well below the level in 2014 - an average annual growth rate of 1.2% between 2017 and 2019 has not made up for the decline during the recession. Many of the social improvements have also been reversed, with a consistent rise in income inequality; extreme poverty reached 13.8 million people in 2019, an increase of 53% since 2014.

3.4.2 Interpretations

Our story

The stylized facts of the recent Brazilian trajectory are consistent with the theoretical framework proposed in section 2. A commodity boom allows an expansion of private and government consumption with a stable or falling debt ratio. The boost in consumption reduces underemployment in precarious occupations, increases the average income in the informal sector and

\textsuperscript{44}The source for the annual Brazilian basic interest rate is the Central Bank of Brazil, and the annual London Interbank Offered Rate (LIBOR) based on U.S. dollars was obtained via the FRED (Federal Reserve Economic Data - St. Louis FED). The EMBI+ index is produced by JP Morgan.

\textsuperscript{45}There was a brief period of fiscal consolidation in 2011.

\textsuperscript{46}The policy adopted in this period reversed some of the previous dynamics, by reducing interest rates and depreciating the exchange rate. Others, however, were reinforced, namely by cutting public investments while keeping balanced budgets. It can also be argued that erratic movements in the economic policy undermined predictability regarding future demand and interest and exchange rates, limiting the potential benefits of the change in monetary policy.
creates wage pressures in the formal sectors. In the Brazilian case the pressures were reinforced by rising minimum wages and policy-induced relaxations of credit constraints. Tight monetary policies counteracted the incipient inflationary tendencies; these policies impacted the manufacturing sector disproportionately as interest rates rose and the exchange rate appreciated. Endogenous profit margins reinforced the effects of higher nontradable inflation on relative prices, and manufacturing experienced a substantial decline in profitability. Falling capacity utilization and profitability meant that investment in the tradable sector also fell.

If our interpretation is correct, macroeconomic policy during the boom years contributed to deindustrialization and left the economy in a fragile position when commodity prices fell. The policy prescriptions also failed when the crisis hit. Attempts to balance the budget aggravated the downturn and prolonged the recession, while reallocations of government spending away from public investment and towards consumption reinforced the shift in favor of the nontradable sectors.

The commodity boom and bust in Brazil exemplify the large external shocks that buffet many developing economies. The standard macroeconomic prescriptions magnify the effects of external shocks with serious adverse implications for economic development. Needless to say, other factors and policies also influence economic development. Education, health and industrial policies can be crucial, and these policies interact with the macroeconomic variables. Guzman
et al. (2018), for instance, stress the complementarity between exchange rate and industrial policies in boosting sectors with positive externalities and high productivity growth; Chang and Lebdioui (2020) point out that macroeconomic stabilization is not sufficient to overcome commodity export dependency, and that revenues from these activities should be used to boost modern sectors and diversify the economic structure.

Staying with the Brazilian example, moreover, the sources of the multidimensional, still ongoing crisis also include corruption scandals, political polarization and class conflict.47

**Other interpretations**

Interpretations aligned with the principles of the New Neoclassical Synthesis literature (Goodfriend and King (1997)) explain the increase in growth rates from 2002 by a combination of (i) solid macroeconomic foundations built and consolidated after 1994 and lasting until at least 2006, with (ii) a favorable international environment and (iii) a demographic dividend from having a high share of the population being of working age (Pessôa (2017), Pessôa (2018); Mesquita et al. (2014)). From 2008, however, credit expansion, public investment and other expansionary policies led to inflationary pressures and crowding-out of private investment.

The crisis, according to this interpretation, was brought about in part by the exhaustion of the consumption-led dynamics based on public expenditure and increasing debt but, more importantly, by the weakening of the ‘macroeconomic foundations’ as a result of fiscal expansion, misguided state intervention, and a lack of reforms that, allegedly, could have increased productivity.48 Similar conclusions can be found in other studies, including the World Bank (2017). The explanation of the rise and fall of the Brazilian economy in Garber et al. (2019) also focuses on aggregate demand, particularly the expansion of household credit which was facilitated by the favorable international environment.

All these accounts, like ours, emphasize the commodity boom and the expansion of aggregate domestic demand. Unlike in our interpretation, however, there is no detailed analysis of the sources of the inflationary pressures and the role of inflation targeting, and sectoral interactions and exchange rate movements are secondary, if relevant at all.

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47 See, for instance, A. Singer (2020)

48 According to this argument productivity enhancing reforms should have been carried out in education, the legal system and the labor market. The misguided intervention involved industrial policy, regulatory interferences in the energy sector and elsewhere, forced reductions in interest rates, and the use of tax exceptions to firms from 2011.
Points of convergence are harder to find between our interpretation and studies that have a New Keynesian Phillips curve (NKPC) at the core. Most econometric studies on Brazilian data find little support for the NKPC (Sachsida (2013); Maka, Barbosa, et al. (2013)).49 The NKPC, nonetheless, is included as a key element of DSGE models that are used to guide both monetary policy and private decisions, including the SAMBA model developed by the Brazilian Central Bank (Braga and Summa (2016)).50 These models, in our view, make assumptions that preclude the essence of the development problem: underemployment and problems of structural transformation disappear from sight in models of cyclical fluctuations around a steady growth path with ‘natural unemployment’.

Strands of the literature that are closer to the (post-) Keynesian tradition also view the expansion of aggregate demand as central to the increase in economic growth, but emphasize exchange rate movements and see cost-push factors as the dominant force behind inflation. There are disagreements within this literature with respect to the limits of the process and the reasons for the downturn. At one extreme, the recession and subsequent stagnation are seen as consequences of the fiscal contraction in 2011 and the ensuing attempts to boost private investment. In these accounts, the sectoral changes were of secondary importance for the macro dynamics, and it is suggested that by reducing cost-push inflation, the exchange rate appreciation had more positive than negative effects. At the other extreme, it is argued that despite positive short-run effects on capacity utilization, a policy regime of fiscal expansion, high interest rates and an overvalued exchange rate was fated to fail in the medium run; adverse effects on the profitability of manufacturing, the level of investment, and the balance of payments would make this regime unsustainable. Serrano and Summa (2015) represents an example closer to the first group; Martins and Rugitsky (2018) is closer to the second.

Other contributions also combine increasing aggregate demand, exchange rate movements and cost-push inflation. Rossi et al. (2020) argue that the constitution of a mass consumer market was a deliberate economic strategy of the PT governments (2002-2016). The idea was that the expansion of domestic demand could play a developmental role via economies of scale and the reduction in underemployment. The failure to meet the objectives, they argue, was due

49Maka and Barbosa (2017) provide a slightly more positive assessment. Testing four types of Phillips curves (accelerationist, new Keynesian, hybrid, and sticky information) for Brazil between 1996 and 2015 and using a larger than usual confidence interval, they could not reject the sticky information version.

50A special issue of the Brazilian Review of Econometrics (November 2015) presents and discusses a number of Brazilian DSGE models, including the SAMBA model.
to limitations of the process itself (the consumption boom based on an appreciated exchange rate) and a lack of complementary policies (capital controls to avoid volatility, for instance).\textsuperscript{51}

Discussing monetary policy, Serrano (2010) suggests that inflation control is ultimately achieved via the exchange rate appreciation caused by high interest rates. The combination of high interest rate and an appreciated exchange rate, however, increases the burden of public debt and the opportunity cost of capital, harms the manufacturing sector and has the potential to deteriorate the external balance. The dangers of an overvalued exchange rate in terms of economic development are also emphasized by Barbosa-Filho (2011).\textsuperscript{52}

Summa (2016) develops a model of distributive conflict and cost-push inflation. Increases in the minimum wage have a direct impact on consumption and on the price of ‘low-skill’ services and, in conjunction with other measures, raised workers’ bargaining power, leading to stronger wage inflation from 2006.

Sectoral distinctions are central to the analysis in Carvalho and Rugitsky (2015), Rugitsky (2017), Brenck and Carvalho (2019), and Loureiro (2020). These studies emphasize linkages between falling wage inequality, economic growth, and inflation in the services sector.\textsuperscript{53} Income growth for the poorest half of the population shifted the consumption pattern to high-tech manufactured goods and nontradables that are intensive in low-skill labor. The shifts, it is argued, generated a deterioration of the trade account, as high-tech manufactured goods were mostly imported, but also boosted the growth rate of low incomes because of the increased demand for low-skill services.\textsuperscript{54}

As should be apparent, our interpretation of the Brazilian experience has elements in common with a number of contributions presented in this subsection. Monetary policy controls inflation in large part through induced movements in the exchange rate as in Serrano (2010); inflation targeting can hurt investment and economic growth, as in Barbosa-Filho (2011); the role of the increase in incomes at the bottom of the distribution can have inflationary effects,

\textsuperscript{51}Dweck et al. (2013) also focus on the possible ‘virtuous cycle’ of demand expansion, economic growth and productivity gains, but seem to present a more positive view of the process until 2013.

\textsuperscript{52}In a similar line, Braga (2011) suggests that inflation between 2000 and 2010 was determined mainly by two elements: exchange rate and commodity prices. In the second half of the period, wage growth also became important, especially for services prices.

\textsuperscript{53}Marconi et al. (2016) also focuses on sectoral patterns, but particularly on the direct capacity of commodity exports to drive technological development.

\textsuperscript{54}Dos Santos et al. (2018) point out that the services inflation in Brazil would be well explained by the effects proposed both by Clark (1940) (services as ‘superior’ goods) and Baumol and Bowen (1965) (services productivity grow less than the rest of the economy).
Other elements of our framework have affinities with the ‘new developmentalism’ (Bresser-Pereira et al. (2014)) and its focus on the relationship between real exchange rates appreciation and development. Last but not least, the centrality of social conflict, inertia related to indexation, and sectoral interactions between demand and supply side forces in our model is largely an influence of the Latin American structuralist tradition.

### 3.5 Conclusion

Conventional macroeconomic policy prescriptions have been centered around principles of sound finance with fiscal policies that aim at keeping public debt low and a monetary policy focused on inflation targeting. These prescriptions are questionable. For advanced economies, structural aggregate demand problems may require sustained fiscal stimulus if full employment growth is to be maintained (e.g. Ryoo and Skott (2013); Summers (2015)), and inflation targeting may simply validate high unemployment and cause great harm if there is no natural rate of unemployment. But the damage from the policy prescriptions can be even greater in developing countries.

Advanced economies have ‘full employment’ as a guidepost for policy, even if the guidepost is highly imperfect. In developing economies the notion of full employment cannot help guide policy. Underemployment is pervasive, and the development problem is all about structural transformation and the expansion of the modern sector. In this setting, the twin pillars of sound finance and inflation targeting can impede the development process and lead to premature deindustrialization.

Behind the pillars lies a presumption that when it comes to macroeconomic policy, ‘the rest’ can be left to the market as long as the government keeps its own house in order (balances its books) and ensures price stability. This presumption is overly optimistic. ‘The rest’ cannot be left to the market. Macroeconomic policies influence the level of aggregate demand as well as the sectoral composition of output and investment, and these variables are crucial for any development strategy.

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55 Interactions between an elastic labor supply and the exchange rate have also been explored, for instance in Porcile and Lima (2010).

56 Bresser-Pereira and Rugitsky (2018) discuss its history. See Ros (2013) for a broad discussion of traditional development theory and its more recent directions.
By questioning inflation targeting we do not suggest that high inflation is desirable. But the New Keynesian Phillips Curve – even with ad hoc augmentations – provides an inadequate platform for understanding inflation; this is the case for advanced economies, but even more so for developing ones. If our argument in this paper is correct, distributional conflict over relative wages are central to inflation in developing economies. Although the modern sector faces an elastic supply of labor, social norms regarding relative wages can create strong inflationary pressures in the formal sector if shocks to domestic demand produce a sharp increase in the average incomes of workers in the informal sector. Inflation is the result of a nexus of demand-determined incomes in the informal sector, relative-wage norms, and cost push inflation in the formal sectors. Crucially, however, fairness norms need not present a significant barrier to long-run development. The path dependency of social norms implies that the expansion of the modern sector and the gradual reduction in the wage premium for formal sector workers can be achieved without provoking high or explosive inflation.

The sources of inflation have implications for the design of aggregate demand policy and the formulation of a successful development strategy. A simple monetarist framework views the long-run rate of growth as exogenous and inflation as the direct result of monetary policy (the growth rate of the money supply), while simple fiscal theories determine the price level to keep the real value of public debt equal to the present value of future primary fiscal surpluses, thus giving fiscal policy a direct influence on inflation. A conflict theory of inflation assigns no such direct effects of monetary and fiscal policy on the price level or the inflation rate. But the lack of direct effects does not imply that it becomes a matter of indifference whether monetary or fiscal policy is used to address inflationary pressures.

A commodity boom, one of the most common shocks to developing economies, may produce short-lived gains but have negative medium and long-run consequences if macroeconomic policy is guided by principles of sound finance and inflation targeting. With a different policy mix the windfall gains from a commodity boom provide an opportunity to speed up the development process without squeezing current consumption or running into balance of payments problems. But to achieve this outcome, policy must be adjusted so as to guide the windfall gains from the commodity boom towards faster expansion of the modern sector rather than immediate consumption.

The overall aim of aggregate demand policy should be the creation of a stable macroeconomic environment that encourages rapid expansion of the modern sector without unsustainable
imbalances, in particular with respect to the balance of payments. A stable environment of this kind has multiple dimensions.

High levels of inflation, first, are not conducive to development, and explosive dynamics that may turn into hyperinflation are dangerous. But if our model is correct, any development process that reduces underemployment will tend to generate inflation. Anecdotally, but quite strikingly, the average annual inflation rate in Korea was above 10% during 30 years of miracle growth from 1960 to 1990, with several spikes above 25%. More systematic studies have found non-linear effects of inflation on economic growth, with thresholds (higher for developing economies) below which inflation has no statistically significant effect on growth (8% according to Sarel (1996); 11-12% according to Kahn and Senhadji (2001); 15% according to Barro (1995); 17% according to Kremer (2013) \(^{57}\), for instance). An influential paper by Bruno and Easterly (1998) even argues that there is no robust evidence of a negative relationship for inflation levels below 40% and that the correlation is actually positive from 1961-1973. This result is corroborated by Pollin and Zhu (2006) who extend the period to 1961-2000 and find a positive relationship between growth and inflation for low-income countries with inflation rates below 15%. Thus, both theory and historical experience suggest a fairly wide target range for inflation. The upper end of the range and the precise definition of the targeted inflation index will depend on country specific factors that influence the inflation risks and the speed with which inflation may gather pace and become explosive. The degree and form of indexation of wages, prices and pensions or other transfers, for instance, affect the inflation risks, while inflation targets can be defined over periods that are longer or shorter than a calendar year and in terms of price indexes that may exclude particular prices or shocks.

The control of inflation, second, should not be left to monetary policy. Average incomes in the informal sector are demand determined and positive shocks to aggregate demand generate inflationary pressures because of these distributional effects. A tightening of monetary policy may reduce aggregate demand and dampen inflation, but the control of inflation is achieved via a squeeze on investment in the modern sectors and an appreciation of the real exchange rate that hurts the competitiveness of the tradable sector.\(^{58}\) Moreover, it is not just overvaluation that

\(^{57}\)The values for Kahn and Senhadji (2001) and Kremer et al (2013) are for developing economies

\(^{58}\)See, for instance, Libman et al. (2019). For evidence that the real exchange rate influences investment. The real exchange rate may be particularly important in middle income countries whose firms compete internationally on price; it may become less important as a country develops and domestic firms are able to compete on quality.
can create problems. The large exchange rate volatility in developing countries has been widely recognized. Fraga et al. (2003), for instance, point out that volatile environments may make it harder for central banks to establish the credibility of inflation targets in these economies. But the problem with volatility runs deeper. There is no reason to expect symmetry between the effects of over and undervaluation of the real exchange rate; Razmi et al. (2012) find a negative effect of real exchange rate volatility as well as a positive long-run effect of undervalued exchange rates for developing countries. Balanced budgets and inflation targeting aggravate the variability of the real exchange rate and of the demand conditions facing the modern sector in developing economies, and the standard policy prescriptions become impediments to growth and structural transformation in these economies, even if overvaluation of the exchange rate is avoided on average. Thus, the primary aim of monetary policy should be to maintain a stable and competitive real exchange rate; going beyond the analysis in this paper, capital controls, foreign exchange interventions and financial markets regulation can be used to complement traditional monetary policy.

The stabilization of aggregate demand and control of inflation, third, falls mainly on fiscal policy which does not have the same direct consequences as changes in interest rates for the competitiveness of the tradable sector and modern-sector investment. Policy should not be guided by a procyclical fiscal rule of balanced budgets. Instead, fiscal policy has a dual task: the prevention of excessive inflation and the stabilization of the demand for modern-sector output at levels that are high enough to stimulate private investment; the stabilization of demand is important, both for the control of inflation and to reduce uncertainty and facilitate longer term planning by firms. The ‘second-generation fiscal rules’ which have been adopted in some mature economies after the crises of 2007-2008 are a step in the right direction (Eyraud et al. 2018). The rules allow greater flexibility and emphasize the use of fiscal policy, including automatic stabilizers, for short-run stabilization. The second-generation rules are still anchored, however, by notions of debt sustainability, and so far developing countries have tended to keep more rigid, balanced-budget types of policies, perhaps because of the simplicity of such rules.

It is important, fourth, to recognize that fiscal policy is multidimensional. It is not only the aggregate level of net expenditure that matters, but also how resources are taken and injected in the economy. The multidimensionality becomes particularly important because government

59 Needless to say, monetary policy has aggregate-demand effects and fiscal policy may influence the exchange rate. In practice the assignment of instruments becomes less clearcut than suggested by this stylized depiction.
spending and taxation have objectives that go beyond demand management for the modern sector and inflation control. Government expenditure, for instance, is needed to support the expansion of modern sectors (education, infrastructure, and innovation promoting activities, for instance), and the alleviation of poverty and reduction of inequality arguably should also be an urgent concern in many developing economies. Our focus on conflict inflation may seem to block reductions in inequality in the short-run. In fact, however, significant short-term improvements for low-income groups are perfectly compatible with sustainable development and may indeed promote the process.

Changes in tax structures and public spending patterns influence relative incomes, and the way in which benefits flow to the poor is likely to affect inflation. Improvements in health services and education, and investment in infrastructure – including sanitation, public transport, electricity and internet services – can be targeted towards low-income groups. These policies have immediate as well as long-term effects, improving living standards and reducing inequalities. They are less likely, however, to set off an inflationary spiral than a general boost to consumption with its derived effects on the market incomes of workers in the nontradable sectors. Moreover, if cash transfers to informal workers are deemed important, taxes on formal workers can be reduced so as to prevent large and highly visible changes in income differentials. If demand control is needed, the expansionary effects can be offset by an increase in taxes on luxury consumption and commodity exports (whenever the commodity prices allow for intramarginal revenues).

Access to public services has been secondary in much of the recent discussion of inequality and welfare policies; the focus instead has been on personal income. Public services, however, can be essential for reducing social inequality. And they are highly valued. The 2013 protests that, in some sense, initiated the recent and still ongoing political instability in Brazil were sparked by opposition to an increase in the cost of public transport. According to Antunes and Braga (2014), the underlying anger was rooted in a combination of stagnating social mobility, particularly among those that had recently moved into the formal market, and a demand for better public services. The protests arguably expressed the sentiment that “the quality of life

60 Saad-Filho (2016) and Currie and Gahvari (2008) present, from different perspectives, arguments for why policies other than cash-transfers might be important. For an assessment of the shift towards cash transfers in welfare policies, see Lavinas (2013), for instance.

61 The long-term effects of improvements in health and education may be obvious, but access to public services like transportation also impact professional (as well as leisure) opportunities; Pereira et al. (2020).
inside the home has improved, but this is not reflected outside” (Haddad 2012, Couto 2014). As Lavinas (2017: p. 86) puts it:

[T]he upward social mobility observed in Brazil in the years spanning 2003-2014 failed to even come close to promoting a true expansion of the country’s middle classes. In Brazil, the market has universalized access to color TVs and fridges among those in the lowest income quintile. Treated water, however, to say nothing of adequate sanitation, remains a luxury, the province of few.

It should be acknowledged, before closing, that the model in this paper has obvious limitations. An important one is the short-run focus of the analysis. Accumulation rates may be relatively insensitive to short-run variations in the utilization rates, but this insensitivity does not carry over to the long-run. Endogenous changes in labor productivity - whether through learning-by-doing or induced changes in R&D - would also need to be included in the analysis of long-run effects of overvalued exchange rates; as is well known, extensions of this kind can produce development traps (e.g. Ros (2013)). Fiscal policy, moreover, has not been discussed in any detail and industrial policy not at all, while balance of payments constraints have been touched on only tangentially. Our discussion of policy implications in this concluding section, finally, has ignored the political economy difficulties related to the implementation of the policies.

Our purpose in this paper has been quite narrow. Combining and modifying ideas from a range of existing work, we have presented a model of inflationary pressures in developing economies. The methodology is different from that of contemporary macroeconomics and, unlike DSGE models, we have focused on underemployment, sectoral differences and the need for structural transformation in developing economies. The model implies that a macroeconomic policy package that combines balanced budgets and inflation targeting can impede the economic development of middle-income countries.

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62 At about the same time a very similar diagnosis emerged, but related to the importance of public services and macro policy for the productive structure of the country: 'Within the factory gates, a continuous improvement in efficiency and productivity. Outside the same gates, unacceptable transaction costs’ (Barros and Giambiagi 2008, p. XII).
APPENDIX A
APPENDIX TO CHAPTER 1

A.1 Pre-trends

In our baseline estimation, we follow the setting proposed by Jordà and Taylor (2016). Figure A.1 indicates that pre-trends might be operating, which might indicate that, even reweighting the sample, some differences remain between treated and untreated units. As a robustness exercise, we run the same estimation but control for one additional lag of GDP growth (in the ‘outcome’ model). Figure A.2 indicates that this reduces significantly pre-trends within a 10-years window (particularly for the shocks that we are most interested in) while the main results persist.
A.2 Overlapping assumption

A.3 Extension

Using the OECD data for the capb (2) and PWT for GDP (1)
Figure A.4: Extension using IMF CAPB and PWT data for GDP - Alesina, Azzalini, et al. (2018)

Figure A.5: Extension OECD CAPB - Alesina, Azzalini, et al. (2018)
A.4 Only actual shocks

Figure A.6: Baseline - Only actual shocks

Figure A.7: By type of shock - Only actual shocks
Figure A.8: Only actual shocks - Robustness - Size

Figure A.9: Only actual shocks - Robustness - Type
A.5 Different fixed effects assumptions

**Figure A.10:** Only actual shocks - By size of shock

![Graph showing GDP (log points) after 15 years vs. minimum size of the shock (% GDP).](image)

**Figure A.11:** Country and Time fixed effects

**Size**

![Graph showing GDP (log points) vs. years after shock.](image)

**Type**

![Graph showing GDP (log points) vs. years after shock.](image)

*Note:* Dots indicate estimated coefficients. The bars indicate a 95% confidence interval.
A.6 Effects on the labor market

Figure A.12: Effect by size - Unemployment rate - OECD data

![Chart showing effect of size on unemployment rate over time.]

Figure A.13: Effect by size - Long-run Unemployment rate - OECD data

![Chart showing effect of size on long-run unemployment rate over time.]

Size of shock (%GDP)
- >0%
- >1.5%
- >3%
Figure A.14: Effect by size - Labor force participation - OECD data
A.7 Multiplier

Figure A.15: Effect of Austerity - Multiplier - Extended Dataset (CAPB)

Note: Dots indicate estimated coefficients. The bars indicate a 90% confidence interval.
Figure A.16: Effect of Austerity - By size of the shock - Multiplier

GDP (log points) after 15 years

Minimum size of the shock (% GDP)

Note: Dots indicate estimated coefficients. The bars indicate a 90% confidence interval.
APPENDIX B
APPENDIX TO CHAPTER 2

B.1 Variables

Change in GDP per capita is the difference in the log of the GDP per capita at national prices given by the Penn World Table (PWT) 10.0. The index of human capital and the total factor productivity (TFP) is also the one provided by PWT 10.0.

The data for the sectoral composition of the economy (Agriculture, Manufacture, Services) comes from the the World Bank.

Estimations of the measures of complexity of exports (EXPY), diversification of exports (Gini, Theil, HHI) and technological share of exports are made by Hoyos et al. (2021) based, respectively, on Hausmann et al. (2007), Cadot et al. (2011), and Lall (2000).
Table B.1: List of low and middle-income countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Foreign K (%GDP)</th>
<th>Growth</th>
<th>Country</th>
<th>Foreign K (%GDP)</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>3.61</td>
<td>25.5%</td>
<td>Mali</td>
<td>12.31</td>
<td>196.6%</td>
</tr>
<tr>
<td>Angola</td>
<td>0.85</td>
<td>2.7%</td>
<td>Morocco</td>
<td>10.33</td>
<td>91.7%</td>
</tr>
<tr>
<td>Argentina</td>
<td>2.55</td>
<td>19.5%</td>
<td>Mozambique</td>
<td>0.23</td>
<td>84.0%</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>2.76</td>
<td>128.0%</td>
<td>Niger</td>
<td>5.29</td>
<td>-25.0%</td>
</tr>
<tr>
<td>Bolivia</td>
<td>11.93</td>
<td>45.1%</td>
<td>Nigeria</td>
<td>1.01</td>
<td>27.9%</td>
</tr>
<tr>
<td>Brazil</td>
<td>9.15</td>
<td>26.0%</td>
<td>Pakistan</td>
<td>2.23</td>
<td>77.1%</td>
</tr>
<tr>
<td>Cambodia</td>
<td>5.28</td>
<td>167.6%</td>
<td>Paraguay</td>
<td>3.91</td>
<td>51.4%</td>
</tr>
<tr>
<td>Chile</td>
<td>35.31</td>
<td>107.5%</td>
<td>Peru</td>
<td>5.35</td>
<td>56.5%</td>
</tr>
<tr>
<td>China</td>
<td>0.35</td>
<td>207.3%</td>
<td>Philippines</td>
<td>3.56</td>
<td>62.6%</td>
</tr>
<tr>
<td>Colombia</td>
<td>2.26</td>
<td>68.6%</td>
<td>Portugal</td>
<td>9.34</td>
<td>69.2%</td>
</tr>
<tr>
<td>Congo</td>
<td>17.06</td>
<td>-4.8%</td>
<td>Republic of Korea</td>
<td>1.74</td>
<td>206.1%</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>5.21</td>
<td>25.0%</td>
<td>Senegal</td>
<td>3.56</td>
<td>38.0%</td>
</tr>
<tr>
<td>Egypt</td>
<td>11.24</td>
<td>114.5%</td>
<td>South Africa</td>
<td>19.02</td>
<td>8.9%</td>
</tr>
<tr>
<td>El Salvador</td>
<td>13.11</td>
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<td>Sri Lanka</td>
<td>4.71</td>
<td>151.6%</td>
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<td>139.6%</td>
<td>Tunisia</td>
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<td>Iran</td>
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<td>24.5%</td>
<td>Turkey</td>
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<td>Jamaica</td>
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<td>21.3%</td>
<td>Uganda</td>
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<td>Uruguay</td>
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<td>Malaysia</td>
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<td>131.6%</td>
<td>Zimbabwe</td>
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B.2 List of countries

Table B.2: List of high-income countries

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<th>Growth</th>
<th>Country</th>
<th>Foreign K (%GDP)</th>
<th>Growth</th>
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<td>Netherlands</td>
<td>12.43</td>
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<td>48.82</td>
<td>New Zealand</td>
<td>10.12</td>
<td>59.50</td>
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<td>615.88</td>
<td>123.33</td>
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<td>60.12</td>
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<td>145.10</td>
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<td>Finland</td>
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### B.3 Using 5 years average

Table B.3: OLS Regressions - 5 years average - Low and middle-income countries

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<tr>
<td>Agr (% GDP)</td>
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<td>Serv (% GDP)</td>
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<td>0.01</td>
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<td>(0.31)</td>
<td>(0.28)</td>
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<td>(0.35)</td>
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<td>(0.27)</td>
<td>(0.36)</td>
<td>(0.32)</td>
<td>(0.62)</td>
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<td>-0.19*</td>
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<td>-0.15</td>
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<td>-1.13+</td>
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<tr>
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<td>(0.63)</td>
<td>(0.64)</td>
<td>(0.57)</td>
<td>(0.64)</td>
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<td>HHI (X)</td>
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<td>-8.56</td>
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<td>(3.21)</td>
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<td>(3.79)</td>
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<td>3.54*</td>
<td>3.23*</td>
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<td>(0.40)</td>
<td>(0.38)</td>
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**Note:** Coefficients for the independent variable of interest, stock of foreign capital as a share of GDP. Column (1) controls for the rule of law index; column (2) controls for initial GDP; column (3) for the share of commodities on exports; column (4) controls for initial income inequality; column (5) controls for the share of low-tech manufactures on exports; and column (6), controls for initial GDP, rule of law, share of commodities on exports, share of low-tech goods on exports, and income inequality. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%.
Table B.4: OLS Regressions - Other controls - 5 years average - Low and middle-income countries

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**Note:** Except for the rule of law variable, which is a 5-year average of the index from 2010 to 2015, all variables are their levels in 1980. The latitude is given by an index from 0 to 1. Share Commodities X is the share of commodities in the export basket in 1980. Income inequality is measured as the pre-tax Gini index. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%.
<table>
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<tr>
<td>Agr (% GDP)</td>
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</table>

Note: Coefficients for the independent variable of interest, stock of foreign capital as a share of GDP. Column (1) controls for the rule of law index; column (2) controls for initial GDP; column (3) for the share of commodities on exports; column (4) controls for initial income inequality; column (5) controls for the share of low-tech manufactures on exports; and column (6), controls for initial GDP, rule of law, share of commodities on exports, share of low-tech goods on exports, and income inequality. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%.
Table B.6: OLS Regressions - Other controls - 5 years average - High-income countries

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*Note: Except for the rule of law variable, which is a 5 year average of the index from 2010 to 2015, all variables are their levels in 1980. The latitude is given by an index from 0 to 1. Share Commodities X is the share of commodities in the export basket in 1980. Income inequality is measured as the pre-tax Gini index. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%.
### B.4 Results for other variables excluding outliers

Table B.7: Low and middle-income countries - Excluding Liberia

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Note: Coefficients for the independent variable of interest, stock of foreign capital as a share of GDP. Column (1) controls for the rule of law index; column (2) controls for initial GDP; column (3) for the share of commodities on exports; column (4) controls for initial income inequality; column (5) controls for the share of low-tech manufactures on exports; and column (6), controls for initial GDP, rule of law, share of commodities on exports, share of low-tech goods on exports, and income inequality. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%.
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Note: Coefficients for the independent variable of interest, stock of foreign capital as a share of GDP. Column (1) controls for the rule of law index; column (2) controls for initial GDP; column (3) for the share of commodities on exports; column (4) controls for initial income inequality; column (5) controls for the share of low-tech manufactures on exports; and column (6), controls for initial GDP, rule of law, share of commodities on exports, share of low-tech goods on exports, and income inequality. Robust standard errors are in parentheses. + indicates statistical significance at 10%; *, at 5%.
APPENDIX C
APPENDIX TO CHAPTER 3

C.1 Keynesian stability conditions

We have

\[ M = F(M, S, Z, \eta, r) = \alpha_M \frac{(1 - \pi_M s)(I(M, S, r) + X(\eta)) + \eta Ze}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} + I(M, S, r) + X(\eta) \]

\[ S = G(M, S, Z, \eta, r) = \alpha_S \frac{p_M (1 - \pi_M s)(I(M, S, r) + X(\eta)) + \eta Ze}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} \]

where

\[ F_1 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_1 + I_1 > 0; \quad G_1 = \Omega(1 - \pi_M s)I_1(M, S, r) > 0 \]

\[ F_2 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_2 + I_2 > 0; \quad G_2 = \Omega(1 - \pi_M s)I_2(M, S, r) > 0 \]

\[ F_3 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_3 > 0; \quad G_3 = \Omega \eta > 0 \]

\[ F_4 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_4 + X' > 0; \quad G_4 = \Omega[(1 - \pi_M s)X'(\eta) + Z \epsilon] > 0 \]

\[ F_5 = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} G_5 + I_3 < 0; \quad G_5 = \Omega(1 - \pi_M s)(I_3(M, S, r) < 0 \]

\[ \Omega = \frac{\alpha_S}{p_S} \frac{p_M}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} \]

Standard Keynesian adjustment assumptions imply that

\[ \dot{M} = \lambda_M [F(M, S, Z, \eta, r) - M] \]

\[ \dot{S} = \lambda_S [G(M, S, Z, \eta, r) - S] \]

where \( \lambda_M \) and \( \lambda_S \) are the adjustment speeds in the two sectors. The Jacobian is given by
\[ J(\sigma_M, \sigma_S) = \begin{pmatrix} 
\lambda_M(F_1 - 1) & \lambda_M F_2 \\
\lambda_S G_1 & \lambda_S(G_2 - 1) 
\end{pmatrix} \]

Stability requires that

\[ \text{Det} J = \lambda_M \lambda_S [(1 - F_1)(1 - G_2) - G_1 F_2] > 0 \]
\[ TR(J) = \lambda_M(F_1 - 1) + \lambda_S(G_2 - 1) < 0 \]

The conditions are satisfied for all positive adjustment speeds \((\lambda_M > 0, \lambda_S > 0)\) if

\[ G_1 F_2 < (1 - F_1)(1 - G_2) \]
\[ F_1 < 1 \]
\[ G_2 < 1 \]

### C.2 Short-run comparative statics – constant interest and exchange rates

We have

\[ M = F(M, S, Z, \eta, r) \] \hfill (C.1)
\[ S = G(M, S, Z, \eta, r) \] \hfill (C.2)

Using the implicit function theorem, it follows that for any exogenous variable \(x\),

\[
\begin{pmatrix}
\frac{\partial M}{\partial x} \\
\frac{\partial S}{\partial x}
\end{pmatrix} = \begin{pmatrix}
1 - F_1 & -F_2 \\
-G_1 & 1 - G_2
\end{pmatrix}^{-1} \begin{pmatrix}
\frac{\partial F}{\partial x} \\
\frac{\partial G}{\partial x}
\end{pmatrix}
\]

\[
= \frac{1}{(1 - F_1)(1 - G_2) - G_1 F_2} \begin{pmatrix}
1 - G_2 & F_2 \\
G_1 & 1 - F_1
\end{pmatrix} \begin{pmatrix}
\frac{\partial F}{\partial x} \\
\frac{\partial G}{\partial x}
\end{pmatrix}
\]

and – using the results in Appendix A for the signs of partials – we get
Turning to net exports, we have

\[ NX = p_M X(\eta) - \theta(C + G) + p_M \eta Z \]

With predetermined investment, \( I = \bar{I} \), the link between consumption \( C + G \) and the level of output in the tradable sector becomes very simple,

\[ M = \frac{\alpha_M}{p_M}(C + G) + \bar{I} + X \]

and

\[ \frac{\partial M}{\partial \eta} = \frac{\partial M}{\partial Z} \]

Hence, using the expressions in Appendix A for the partials \( F_1, F_2, F_3, G_1 \) and \( G_3 \), we have \( F_1 = F_2 = G_1 = G_2 = 0 \) and

\[
\frac{\partial NX}{\partial Z} = \left[ -\frac{\theta}{\alpha_M} \frac{\partial}{\partial Z}\left(\frac{\alpha_M}{p_M}(C + G)\right) + \eta\right] p_M \\
= \left[ -\frac{\theta}{\alpha_M} \frac{\partial M}{\partial Z} + \eta\right] p_M \\
= \left[ -\frac{\theta}{\alpha_M} \frac{F_3(1 - G_2) + F_2 G_3}{(1 - F_1)(1 - G_2) - G_1 F_2} + \eta\right] p_M \\
= \left[ -\frac{\theta}{\alpha_M} \frac{F_3}{1} + \eta\right] p_M \\
= \left[ -\frac{\theta}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)} + \eta\right] p_M > 0
\]

where the inequality follows from \( 0 < \theta < 1 \) and, by assumption, \( \epsilon \leq 1 \) (no fiscal deficit). The term \( s(\alpha_M \pi_M + \alpha_S \pi_S) \) in the denominator is the derived effect on domestic saving following a unit increase in consumption. These derived domestic saving effects are positive, and an increase in commodity revenues therefore generates an increase in net exports when investment is predetermined.
By continuity, the qualitative results are unchanged when the effects on investment of changes in output are weak. Strong investment effects, however, could reverse the result; this possibility is not excluded by the Keynesian stability conditions. Intuitively, a positive commodity shock has a direct impact on domestic consumption with derived effects on investment, domestic saving and imports. The trade balance may deteriorate if the derived effects on investment exceed the derived effects on saving. This possibility is compatible with the Keynesian stability condition which requires that the derived effects on investment must be less than the sum of the derived effects on domestic saving and imports.

Analogous to the case with shifts in commodity exports, the effects of depreciations are ambiguous without additional restrictions. A depreciation increases total exports \(X(\eta) + \eta Z\) but large derived investment effects may cause imports to rise even more.

Using the expression for \((C + G)\) in equation (3.14), the effects of an increase in the domestic interest rate are unambiguously positive,

\[
\frac{\partial NX}{\partial r} = -\theta \frac{\partial (C + G)}{\partial r} > 0
\]

### C.3 Short-run comparative statics – inflation targeting

We have

\[
M = \frac{\alpha_M}{\bar{p}_M} (C + G) + I(M, S, r) + X(\eta)
\]

\[
S = \frac{\alpha_S}{\bar{p}_S} (C + G)
\]

\[
w_A = \frac{\alpha_A}{N - M - S} (C + G)
\]

where

\[
C + G = \frac{\bar{p}_M[(1 - \pi_{Ms})(I + X) + \eta Z \zeta]}{\theta + s(\alpha_M \pi_M + \alpha_S \pi_S)}
\]

The new equilibrium, following the rise in \(Z\), must have an increase in \(S\) and \((C + G)\) (they move together) and a fall in \(M\) compared to the equilibrium before the commodity boom. To see this, we show that a constant \(S\) would lead to a contradiction and that \(S\) must increase.

Assume that \(dZ > 0, dr > 0, d\eta < 0, dS = d(C + G) = 0\). To keep \(w_A\) constant, we now must have \(dM = 0\) in order to keep \(N - M - S\) unchanged. The change in \(M\), however, is given by \(dM = \frac{\alpha_M}{\bar{p}_M} d(C + G) + dI + dX = dI + dX\). Since we know that \(\eta\) has fallen and \(r\) has
risen, \( dX < 0 \) and \( dI = I_M dM + I_S dS + I_r dr < I_M dM \). It now follows that \((1 - I_M) dM < 0\) and we have reached a contradiction; if \( r \) is raised sufficiently to make \( S \) unchanged, then the tradable sector must contract and the result would be a decline in informal sector wages. The new equilibrium must involve a smaller rise in \( r \) which means that the output of the nontradable formal sector must expand.

Inflation targeting is based on the presumption that an increase in the real interest rate will reduce inflation. In the present context, this means that a rise in \( r \) must cause \( w_A \) to fall and that the rise in \( r \) must be smaller than the rise that would give \( dS = 0 \).

The decline in \( M \) follows from the observation that an increase in \( S \) (and thereby in \( C + G \)) must be matched by a fall in \( M + S \) to prevent an increase in the average income in the informal sector.

### C.4 Endogenous expenditure shares

Changes in the real exchange rate is the only source of short-run movements in relative prices if the prices of domestically produced goods are predetermined. The consumption shares depend on relative prices and we assume that imported consumption goods and domestically produced tradable goods are substitutes while imports and nontradables are complements. Formally,

\[
\frac{\partial \alpha_M}{\partial \eta} > 0, \quad \frac{\partial \alpha_S}{\partial \eta} < 0, \quad \frac{\partial \alpha_A}{\partial \eta} = \frac{\alpha_A}{\alpha_S} \frac{\partial \alpha_S}{\partial \eta} < 0 \quad (C.6)
\]

The last inequality says that exchange rate movements have the same proportional effect on the formal and informal nontradables, leaving the ratio \( \alpha_A/\alpha_S \) unchanged.

Inflation targeting implies that a positive shock to \( Z \) is met by a rise in interest rates and a decline in \( \eta \) (an appreciation) that keeps average incomes in the informal sector unchanged. Proceeding along the same lines as in Appendix C, we first show that compared with the pre-shock equilibrium, the output of nontradables must increase. Assume that \( S \) were unchanged. Using equations (C.6) and (C.4)-(C.5) this implies that \( M \) would also have to be unchanged in order for \( w_A \) to stay constant. But using equation (C.3) we have \( dM < 0 \), following the same steps as in Appendix B.

Still following the steps in Appendix B, we can conclude that \( S \) and thereby \( w_A L_A = w_A (N - M - S) \) must increase. To keep \( w_A \) unchanged it follows that \( L_A \) must increase which
– with an increase in $S$ – requires a decline in $M$. Thus, the results are robust to endogenous expenditures shares.

A simple example in which inflation targeting leads to an increase in $M$ and a decline in $S$ can be constructed with $I = \bar{I}, X = \bar{X}, s = 0, \theta$ and $\alpha_A$ constant, $\alpha'_M(\eta) = -\alpha'_S(\eta) < 0$ (since $\alpha_S + \alpha_M = 1 - \theta - \alpha_A$ is constant) and $p_M > p_S$. With these assumptions, we have (using (C.3)-(C.4))

$$-(dM + dS) = \left(\alpha_M \frac{p_M}{p} + \alpha_S \frac{p_S}{p} \right) d(C + G) + \frac{1}{p_M} (C + G) d\alpha_M + \frac{1}{p_S} (C + G) d\alpha_S$$

$$= \left(\frac{\alpha_M}{p_M} + \frac{\alpha_S}{p_S} \right) d(C + G) + (C + G) \left(\frac{1}{p_M} - \frac{1}{p_S}\right) d\alpha_M$$

(C.7)

Using (C.5), the inflation constraint – keeping $w_A$ unchanged - implies that

$$dM + dS = \frac{\alpha_A}{w_A} d(C + G)$$

(C.8)

Combining these equations (C.7)-(C.8), we have

$$-(C + G)(\frac{1}{p_M} - \frac{1}{p_S}) d\alpha_M = \left(\frac{\alpha_M}{p_M} + \frac{\alpha_S}{p_S} + \frac{\alpha_A}{w_A} \right) d(C + G)$$

(C.9)

A positive shock to $Z$ is met by a rise in interest rates, the exchange rate appreciates and $\alpha_M$ increases. Equation (C.9) implies that this must be accompanied by a rise in $(C + G)$. If both $\alpha_M$ and $(C + G)$ increase, then $M$ must also increase (see equation (C.3)) while $M + S$ must fall (see equation (C.8)). Hence, $S$ must fall.

Intuitively, as the exchange rate appreciates, consumption shifts towards $M$ goods (because $\alpha'_M = -\alpha'_S < 0$). This shift reduces total labor demand in the formal sectors (because $p_M > p_S$ and $q_M = q_S$), and an increase in total consumption is needed to keep informal sector incomes constant. But the increase in consumption cannot fully offset the effect of the fall in $\alpha_S$ on the demand for $S$ goods; if it did, we would have had a rise in formal sector employment, and the average income in the informal sector would have increased.

C.5 Consumption real wages as a determinant of fair wages

As in appendix C, we have
\[ M = \frac{\alpha_M}{p_M} (C + G) + I(M, S, r) + X(\eta) \]  
(C.10)

\[ S = \frac{\alpha_S}{p_S} (C + G) \]  
(C.11)

\[ w_A = \frac{\alpha_A}{N - M - S} (C + G) \]  
(C.12)

The new ‘fair wage’ is:

\[ f_M\left(\frac{w_A}{w_M}, \zeta\left(\frac{w_A}{w_M}, \xi(\eta, 1, \frac{p_S}{p_M}, \frac{p_A}{p_M})\right)\right) = 1 \]

which implies that the inflation-targeting condition can be expressed by an inverse relation between \( w_A \) and \( \eta \):

\[ w_A = \frac{\alpha_A}{N - M - S} (C + G) = g(\eta) \]  
(C.13)

with \( g'(\eta) < 0 \)

We can proceed analogously to Appendix C to demonstrate that \( S \) must increase. Assume that \( dZ > 0, dr > 0, d\eta < 0 \) and that \( dS = d(C + G) \leq 0 \). As in appendix C, this would imply a contraction of \( M \) which leads to a contradiction, given that now \( dw_A > 0 \).

Thus, we have \( dZ > 0, dr > 0, d\eta < 0, dw_A > 0, dS = d(C + G) > 0 \). Unlike in the baseline case, however, we cannot rule out an increase in both \( M \) and \( S \). To see this, consider an extreme case in which negative effects on investment and exports of increasing interest rates and an appreciating currency have been excluded; that is, let \( X' = I_r = 0 \). Changes in the interest rate have no direct effects on the demand for \( M \) and \( S \) in this extreme case, and were it not for the influence of the real-exchange rate on the required value of \( w_A \) (equation (C.13)), it would be impossible for inflation targeting to work; inflation targeting now works by allowing a non-inflationary increase in the average income in the informal sector.

The extreme case implies that

\[ dM = \frac{\alpha_M}{\alpha_S} \frac{p_S}{p_M} dS + I_M dM + I_S dS \]

or

\[ dM = \frac{\alpha_M p_S}{\alpha_S p_M} + I_S dS \]  
(C.14)
Both the numerator and denominator are positive, and it follows that both $S$ and $M$ will increase.

For reasonable specifications of the short-run investment function, however, the proportionate increase in $S$ must exceed the proportional increase in $M$, even in the extreme case. To see this, note that

$$\frac{\alpha_M p_S}{\alpha_S p_M} = \frac{M - I - X}{S} \quad (C.15)$$

Combining equations (C.14)-(C.15) it follows that

$$\frac{dM}{M} = \frac{1}{M} \frac{M - I - X + S I_S dS}{1 - I_M}$$

Hence, the condition for $dS/S > dM/M$ can be written

$$\frac{1}{M} \frac{M - I - X + S I_S}{1 - I_M} < 1$$

or

$$M - I - X < M - M I_M - S I_S \quad (C.16)$$

Using a first order Taylor approximation for the investment function, we have

$$I = I_0 + M I_M + S I_S$$

and inequality condition (C.16) can be rewritten as

$$I_0 + X > 0 \quad (C.17)$$

Exports ($X$) are non-negative, and autonomous investment ($I_0$) is positive for any plausible short-run specification of the investment function. Thus, equation (C.17) is satisfied, and the proportionate increase in $S$ will exceed the proportionate increase in $M$.

### C.6 Imports of intermediate goods

If both the markup and labor productivity are constant (with labor productivity still normalized at 1) we have
\[ p_M = (1 + m_M)(w_M + \gamma_M p_M \eta) = p_M(\eta); \quad p_M' \geq 0 \]

\[ p_S = (1 - m_S)(w_S + \gamma_S p_M \eta) = p_S(\eta); \quad p_S' \geq 0 \]

\[ \pi_M = \frac{m_M}{1 + m_M} \frac{1}{1 - \gamma_M \eta}; \quad \pi_M' \geq 0 \]

\[ \pi_S = \frac{m_S}{1 + m_S} \frac{1}{1 - \gamma_S \eta \frac{p_M}{p_S}}; \quad \pi_S' \geq 0 \]

The equilibrium conditions in equations (3.11)-(3.13) still hold, but the expression for \((C+G)\) in equation (3.14) becomes modified. It now reads

\[ C + G = \frac{p_M[(1 - \pi_M s)(1 - \gamma_M \eta)(I + X) + \eta Z \epsilon]}{\theta + \alpha_M[s \pi_M + \gamma_M \eta(1 - s \pi_M)] + \alpha_S[s \pi_S + \gamma_S \frac{p_M}{p_S} \eta(1 - s \pi_S)]} \tag{C.18} \]

The wage in the tradable sector is predetermined, and an unchanged wage ratio requires that \(w_A\) do not change. We have

\[ w_A = \frac{1}{N - M - S} \alpha_A(C + G) \]

and an unchanged \(w_A\) implies that

\[ -d(M + S) = \alpha_A d(C + G) \tag{C.19} \]

Using (3.11)-(3.12) we have

\[ d(p_S S) = \alpha_S d(C + G) \tag{C.20} \]

\[ d(p_M M) = \frac{\alpha_M}{\alpha_S} d(p_S S) + d(p_M I) + d(p_M X) \tag{C.21} \]

**C.6.0.0.1 Case 1: Constant prices** If the prices are constant, an increase in interest rates and the associated appreciation of the exchange rate will reduce the cost of intermediate inputs and raise the profit shares. The increase in profit share, in turn, will have a negative impact on aggregate consumption \((C + G)\); equation (C.18) implies that \(\partial(C + G)/\partial\pi_i < 0\).

Monetary policy now has a more powerful effect on aggregate demand, but a commodity boom still raises \(S\) and reduces \(M\). The proof can proceed as in in Appendix C. If the change in \(S\) were negative, using (C.21), \(M\) would also fall, and (C.19) cannot hold. Thus, \(S\) and thereby
$C + G$ must increase. Equation (C.19) now implies that this increase must be combined with a reduction in $M$.

### Case 2: Constant markups

If markups are kept constant, both prices and profit shares become increasing functions of the real exchange rate. Depending on how relative prices respond to exchange rate shocks, this opens the possibility for results other than a fall in $M$ and an increase in $S$.

If $\frac{d(pS)}{d\eta} \geq 0$, we must have an increase in $S$, but $M$ need not fall. The proof of a rise in $S$ again follows the same recipe. If $dS \leq 0$, we must have $d(pS) < 0, d(C + G) < 0$ and $d(\frac{pS}{pM}) < 0$. Hence,

$$dM = \frac{\alpha_M}{\alpha_S} d(\frac{pS}{pM}) + dI + dX < 0$$

It follows that equation (C.19) cannot be satisfied if $dS \leq 0$.

To see that $M$ need not fall, note that with exogenous values of both investment and exports ($dI = dX = 0$) and $\frac{d(pS)}{d\eta} = 0$, equation (C.21) reduces to

$$dM = \frac{\alpha_M}{\alpha_S} dS$$

Thus, $M$ and $S$ must move in the same direction, and since prices fall, they must both increase in order to satisfy equation (C.19). Intuitively, the average informal sector income $w_A$ is determined by the number of workers and the nominal demand. Thus, if nominal demand fall, a reduction in the number of workers in the informal sector is needed in order to keep the average income unchanged.

If $\frac{d(pS)}{d\eta} < 0$, the results can be different. Again, consider the simple case with $dI = dX = 0$. Now, if $\frac{d(pS)}{d\eta} < 0$, we have

$$dM = \frac{\alpha_M}{\alpha_S} d(\frac{pS}{pM}) = \frac{\alpha_M}{\alpha_S} S d(\frac{pS}{pM}) + \frac{\alpha_M}{\alpha_S} pS dS > \frac{\alpha_M}{\alpha_S} pS dS$$

Using (C.19), the changes in $M$ and $S$ cannot both be negative. Thus, we must have $dM > 0$; depending on the parameters and the magnitude of the decline in $pS$, the change in the output of nontradables can go either way.
C.7 Imported and nontradable investment goods

C.7.0.0.1 Imported investment goods Assume the extreme case in which all $I$ is imported. In this case:

$$p_MM = \alpha_M(C + G) + p_MM$$
$$NX = p/MMX(\eta) - \theta(C + G) - \eta p/MMI + p/MM\eta Z$$

The equilibrium conditions for the $A$ and $S$ sectors (equations (3.12)-(3.13)) are unchanged. For the $M$-sector, however, equilibrium now requires that

$$M = \frac{\alpha_M[(1 - \pi_M s)X + \epsilon\eta Z]}{\theta + s(\alpha_S\pi_S + \alpha_M\pi_M)} + X$$

Proceeding analogously to appendix B, the short-run effects (without inflation targeting) are qualitatively the same as before. They will also be quantitatively the same in the particular case that both profit share and the capital accumulation are predetermined; in other cases, they will be weaker.

Considering the impact of the inflation targeting policy, we now have

$$C + G = \frac{p/MM[(1 - \pi_M s)X + \epsilon\eta Z]}{\theta + s(\alpha_S\pi_S + \alpha_M\pi_M)}$$

The demand for investment goods no longer generates domestic income, but $C + G$ still depends positively on $M, S, Z$ and $\eta$ (and thereby negatively on $r$). Thus, the analysis can proceed as in Appendix C, and the qualitative results are unchanged.

C.7.0.0.2 Nontradable investment goods If investment goods are domestically produced but nontradable, we have

$$p_MM = \alpha_M(C + G) + p_MM$$
$$p_S S = \alpha_S(C + G) + p_S I$$

Aggregate consumption and the no-inflation condition can be written
\[ C + G = \frac{(1 - \pi_S s)p_S I + (1 - \pi_M s)p_M X + \epsilon \eta Z}{\theta + \alpha_S \pi_S s + \alpha_M \pi_M s} \]

\[ \frac{w_M}{\mu} = w_A = \frac{\alpha_A}{N - M - S} \frac{(1 - \pi_S s)p_S I + p_M [(1 - \pi_M s)X + \epsilon \eta Z]}{\theta + \alpha_S \pi_S s + \alpha_M \pi_M s} \]

The relative impact of a commodity boom on \( S \) and \( M \) under inflation targeting now becomes ambiguous. If \( I \) is insensitive to changes in \( r \) while \( X \) is sensitive to changes in \( \eta \), the qualitative results will be as in Appendix C. If these assumptions are reversed and \( I \) is sensitive to changes in \( r \) while \( X \) is insensitive to changes in \( \eta \), the results in Appendix C may also be reversed: inflation targeting may produce an equilibrium with a higher \( M \) and a lower \( S \).

We show these results by considering the two extreme cases, one with \( I \) independent of \( r \) and one with \( X \) exogenous (independent of \( \eta \)).

If \( I \) is independent of \( r \), changes in the interest rate have no direct effect on the demand for domestically produced goods, and inflation targeting works entirely through the effects of the interest rate in the real exchange rate; the analysis of this case is completely analogous to the case with imported investment goods.

If \( X \) is independent of \( \eta \), we can follow the steps in Appendix C. Assume that \( dZ > 0, dr > 0, d\eta < 0, dX = 0, dM = d(C + G) = 0 \). To keep \( w_A \) constant, we now would need to have \( dS = 0 \) in order to keep \( N - M - S \) unchanged. The change in \( S \), however, is given by

\[ dS = \frac{\alpha_S}{ps} d(C + G) + dI = dI \]

Since we know that \( r \) has risen, \( dI = I_M dM + I_S dS + I, dr < I_S dS \). It now follows that \( (1 - I_S) dS < 0 \) and we have reached a contradiction; if \( r \) is raised sufficiently to make \( M \) unchanged, then the nontradable sector must contract, and the result would be a decline in informal sector wages. Thus, the new equilibrium must involve a smaller rise in \( r \) which means that the output of the tradable formal sector must expand. The decline in \( S \) follows from the observation that an increase in \( M \) (and thereby in \( C + G \)) must be matched by a fall in \( M + S \) to prevent an increase in the average income in the informal sector.
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