

Informal Sector, Business Cycles, and Fiscal Policy

by

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PhD Dissertation in Economics

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FEP

December 2016

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Acknowledgements

The completion of this thesis was made possible thanks to the financial support of Bank of Portugal. I thankfully acknowledge the full-time leave the Bank of Cape Verde awarded me. Without it this project would not have been possible as well. I also acknowledge the support of CEF-UP and the conducive atmosphere it created for research.

The outstanding support and guidance of my advisors at School of Economics and Management, University of Porto, deserve a special word of appreciation. Specifically, I am extremely thankful to my advisors Professor Mustafa Alper Çenesiz and Professor Ana Paula Ferreira Ribeiro, for taking a great amount of time with the difficulties of my research journey.

At the University of Porto, I met several colleges to whom I became indebted. These classmates and friends became part of my learning process. Also a special thanks is owed to all the staff at University of Porto. This context made these four years less hard.

Finally, I would like to thank my friends and family. Their encouragement was important. It is to them I owe the most.

Abstract

This thesis covers several issues on fiscal policy behavior, business cycle fluctuations, and labor market outcomes. It goes beyond of the standard axioms by taking the informal economy as a source for shaping economic fluctuations. In fact, several macroeconomic implications of the informal economy link the three, rather independent, essays.

Chapter 2 performs a systematic review of the literature on the cyclical behavior of fiscal policy along three dimensions: (i) the set of theories, (ii) measurement of cyclicity of fiscal policy, and (iii) empirical evidence. We observe that fiscal procyclicality in developing countries is a broad regularity whereas fiscal policy is generally countercyclical or acyclical in more developed countries. We find that 36.3% of developed countries follow countercyclical fiscal policy while only 3.5% of developing countries follow such policy pattern. Credit constraints and political economy factors are usually taken to account for fiscal procyclicality, but empirically they explain such procyclicality only about 33.5% and 30.3%, respectively. We argue that the informal sector may also be an explanation in determining fiscal procyclicality; but, to the best of our knowledge, the literature fails to cover for this relationship.

Chapter 3 provides a set of business cycle regularities on the informal sector. We estimate the size of the informal sector for 105 countries and summarize the findings with 10 stylized facts and 5 corollaries. We arrive at three key conclusions. First, the size of informal sector is procyclical. Second, informal sector is linked to volatility of GDP. Third, informal sector is positively associated to procyclicality of fiscal policy.

Chapter 4 builds a small, open, developing economy DSGE model. It considers three alternative scenarios for financial integration under dual labor market segments. We find that perfectly integrated economies react more smoothly to shocks. We also find that both imperfections on credit markets and the size of the informal sector stand up as sources of volatility in output and increase the degree of procyclical government consumption. The model suggests that external finance premium and the informal sector (which behaves procyclically) work under a complementary relationship.

Chapter 5 concludes and provides policy prescriptions and the path for future research.

Sumário

Esta tese aborda várias questões sobre comportamento da política fiscal, flutuações macroeconómicas e resultados no mercado de trabalho. A tese vai além dos axiomas clássicos, por considerar a economia informal uma fonte da prociclicidade da política fiscal e das flutuações económicas. De facto, várias implicações macroeconómicas da economia informal são comuns a três capítulos independentes.

Capítulo 2 faz uma revisão sistemática da literatura sobre a prociclicidade fiscal em três dimensões: (i) teorias existentes para a prociclicidade fiscal, (ii) medidas da ciclicidade da política fiscal, e (iii) evidências empíricas sobre as teorias existentes. Observamos que a prociclicidade fiscal é uma regularidade extensa nos países em desenvolvimento, enquanto que política fiscal é contracíclica ou acíclica em países desenvolvidos. Enquanto 36.3% dos países desenvolvidos adotam políticas fiscais contracíclicas, apenas 3.5% dos países em desenvolvimento seguem este padrão fiscal. Restrições de crédito e fatores político e institucionais são, geralmente, considerados causas da prociclicidade fiscal, mas empiricamente apenas explicam esta prociclicidade cerca de 33.5% e 30.3%, respectivamente. Argumentamos que o sector informal pode ser, também, uma explicação para prociclicidade fiscal; mas, tanto quanto sabemos, a literatura desconsidera esta relação.

Capítulo 3 fornece um conjunto abrangente de regularidades cíclicas do setor informal. Estimamos a dimensão da economia informal para 105 países e resumimos as conclusões em 10 factos estilizados e 5 corolários. As três principais conclusões são: primeiro, o sector informal é procíclica. Segundo, o sector informal relaciona positivamente com prociclicidade da política fiscal. Terceiro, o sector informal e volatilidade macroeconómica estão positivamente correlacionado.

Capítulo 4 desenvolve um modelo dinâmico de equilíbrio geral estocástico (DSGE) onde se considera três cenários alternativos de integração financeira, sob dois segmentos do mercado de trabalho. Concluimos que economias perfeitamente integradas reagem menos a choques. Tanto imperfeições no mercado de crédito como o sector informal constituem fontes da volatilidade económica e da prociclicidade fiscal. Concluimos, também, que prémio de risco e o sector informal (que é procíclica) são complementares.

Capítulo 5 conclui, sugere recomendações de política e possíveis futuras investigações.

Contents

Biographical information	i
Acknowledgements	ii
Abstract	iii
Sumário	iv
List of figures	viii
List of tables	ix
1 Introduction	1
1.1 Definition of the informal sector	2
1.2 Methods for estimating the size of the informal sector	3
1.3 Informal sector, credit markets, and business cycle	4
1.4 Organization of the thesis	6
2 Procyclical Fiscal Policy in Developing Countries: A Bird's Eye (Re)View	9
2.1 Introduction	9
2.2 Explaining procyclicality of fiscal policy in developing countries	11
2.2.1 Explanations based on credit market imperfections	11
2.2.2 Explanations based on political economy factors	17
2.2.3 Factors playing on the mechanisms for procyclical fiscal policy	19
2.3 Testing for theories	24
2.4 Overview and critical assessment	29
2.4.1 Measurement bias in assessing procyclical fiscal policy	29
2.4.2 Endogeneity and omitted variables	31
2.4.3 Identification problem	33

2.4.4	Additional explanation: the role of the informal sector	33
2.5	Conclusion	35
3	Informal Sector Over The Business Cycle	40
3.1	Introduction	40
3.2	Estimates of the informal economy	42
3.2.1	Model to estimate the size of the informal economy	42
3.2.2	Sample and data filtering	42
3.3	Empirical facts of the informal economy	45
3.3.1	Long run features of the informal economy	45
3.3.2	Informal sector over the business cycle	47
3.4	Persistence	56
3.5	Informal economy and the official business-cycle regularities	63
3.5.1	Informal economy and aggregate fluctuations	64
3.5.2	Informal economy and the cyclicity of macroeconomic aggregates	67
3.5.3	Informal economy and persistence of macroeconomic aggregates	68
3.6	Conclusion	68
4	Financial Integration, Duality in Labor Markets and Business Cycles: A Tale With Microfounded Roots.	70
4.1	Introduction	70
4.2	Related literature	71
4.2.1	Informality, financial integration and economic responses	71
4.2.2	Dual labor markets and search frictions	73
4.3	Model set-up	75
4.3.1	Labor market	75
4.3.2	Households	76
4.3.3	Firms	78
4.3.4	Nash bargaining	79
4.3.5	Government	82
4.3.6	Model closure and equilibrium conditions	82
4.4	Alternative financial market integration	85
4.4.1	Complete asset markets	85
4.4.2	Closed economy	86
4.5	Dynamics of the model	87
4.5.1	Calibration	87
4.5.2	Dynamics	89

4.6	Conclusion	96
5	Conclusions of the thesis	98
5.1	Summary	98
5.2	Limitations, future research, and policy prescriptions	102
5.2.1	Limitations and future research	102
5.2.2	Policy prescriptions	103
Appendix A: Figures		105
A1	Relation between volatility of y and the size of s delivered by LQ.	105
A2	Relation between volatility of y and the size of s delivered by FD.	106
A3	Distribution of correlations between (y_t) and s_t ; y_t and g_t ; s_t and g_t ; and between $(s_t + y_t)$ and g_t delivered by LQ.	107
A4	Distribution of correlations between y_t and s_t/s_t ; y_t and g_t/y_t ; s_t/y_t and g_t/y_t ; and between $(s_t + y_t)$ and $g_t/(s_t + y_t)$ delivered by LQ	108
A5	Distribution of contemporaneous correlations between (y_t) and (s_t) ; (y_t) and (g_t) ; (s_t) and (g_t) ; and between $(s_t + y_t)$ and (g_t) delivered by FD.	109
A6	Distribution of contemporaneous correlations between (y_t) and (s_t) ; (y_t) and (g_t) ; (s_t) and (g_t) ; and between $(s_t + y_t)$ and (g_t) delivered by FD.	110
Appendix B: Derivations		111
B1	First order conditions	111
B2	Economy's resource constraints	112
B3	Wage in the formal sector	113
B4	Unemployment and employments value	114
B5	Employment dynamics	115
B6	Equilibrium conditions	116
B7	Log-Linearized version of the equilibrium conditions	118
B8	The steady state of the model	120
Annex 1: Classification of the countries		139
1.1	Poor Countries	139
1.2	Emerging Countries	139
1.3	Rich Countries	140
Annex 2: Estimates of the size of the informal sector		141
2.1	Poor countries	141
2.2	Emerging countries	146
2.3	Rich countries	153

List of Figures

3.1	HP filter, $\lambda = 100$	44
3.2	Log-Quadratic detrending (LQ)	44
3.3	The size of the informal sector over time (1980 to 2011)	46
3.4	Distribution of correlations between y_t and s_t ; y_t and g_t ; s_t and g_t ; and between $(s_t + y_t)$ and g_t delivered by HP	53
3.5	Distribution of correlations between y_t and s_t/s_t ; y_t and g_t/y_t ; s_t/y_t and g_t/y_t ; and between $(s_t + y_t)$ and $g_t/(s_t + y_t)$ delivered by HP	54
3.6	Relation between volatility of y_t and the size of the informal sector s_t/y_t .	66
4.1	Dynamics of selected variables for alternative levels of financial integration	90
4.2	Dynamics of matches, searches, and vacancy for alternative levels of financial integration	91
4.3	Effects of external finance premium on the dynamics selected variables .	93
4.4	Implication of Financial Integration on selected variables	94
4.5	Implication of the informal sector on the selected variables	95
4.6	Effects of labor income tax on matches and on the size of the informal sector	96

List of Tables

1.1	Selected definitions of the informal sector	2
2.1	Summary of evidence on existing explanations for fiscal procyclicality . .	28
2.2	Theoretical correlations of the selected fiscal variables with business cycle	29
2.3	Bibliometric summary: $\Delta f_t =$ government consumption/spending	37
2.4	Continuation of Table 2.3	38
2.5	Continuation of Table 2.3	39
3.1	Volatility of the selected variables: $\sigma_z =$ <i>standard deviation of variable</i> z_t	48
3.2	Correlation between the selected variables and output (y_t), and output inclusive the size of the informal sector, ($s_t + y_t$)	51
3.3	Correlation of the component of output (y_t) with the informal sector . . .	57
3.4	Autocorrelations of $s_t, y_t, c_t, g_t, \dot{v}_t, x_t, m_t$: $\rho_{(z_{i,t}, z_{i,t-1})} = corr(z_{i,t}, z_{i,t-1})$.	59
3.5	Unit root test	60
3.6	Persistence of s_t and y_t over the phases of cycle	61
3.7	Informal sector and official business cycle facts	64
4.1	Model Summary - Baseline model	84
4.2	Complete asset markets	86
4.3	Closed economy	86
4.4	Summary of the calibration	88
4.5	Summary of the steady state values	89
4.6	Qualitative co-movements of output with selected variables under alter- native financial integration scenarios.	92
5.1	Informal sector and cyclical properties of economic aggregates: stylized facts and corollaries	101

Introduction

The economies of developing countries are characterized by a large informal sector, fragile financial markets and weak institutional framework when compared to developed countries.¹ These features seem to impose a divorce between developing and developed countries, particularly, with regards to business-cycle properties and fiscal policy behavior across the cycle. For instance, as is reported in Chapter 3, below, data support that developing economies are twice or more volatile than developed ones. Also, as is reviewed in Chapter 2, conducting procyclical fiscal policy seems a general practice in developing countries while, in general, such policy is countercyclical or, at worse, acyclical in developed countries. Can the size of the informal sector, imperfections in financial markets, and the poor quality of institutional framework explain this apparent “divorce”?

[Elgin and Uras \(2013\)](#) report that, on average, the informal sector represents roughly 16% of Gross Domestic Product (GDP) in developed countries, whereas its size more than doubles in the emerging economies, representing 38% of GDP in the period 1999-2007. Also, according to [Schneider \(2002\)](#), the informal economy, in the year 2000, represented 41% of official Gross National Income (GNI) in developing countries, 38% in transition countries and 18% in Organisation for Economic Co-operation and Development (OECD) countries. In terms of economic activity (measured as percentage of total employment) [Bacchetta et al. \(2009\)](#) report that the informal sector represents about 10% in developed regions and roughly 60% in developing regions, in the year 2007. While a substantial amount of literature has covered the implications of the informal economy to economic growth (see, *e.g.*, [Loayza \(1999\)](#) and the references therein), very few studies are available on the business cycle properties of the informal sector and even fewer analyze the impacts of the size of the informal sector on the behavior of fiscal variables over the cycle and the official business cycle fluctuations. Therefore, on a financial integration framework, this

¹Here, informality, informal output or informal sector or even, more generally, informal economy are used interchangeably to refer all economic activities that take place outside of government control.

thesis intends to contribute to fulfill this gap. It argues and shows that the informal sector is of first-order importance in determining the business-cycle properties.

1.1 Definition of the informal sector

A first important issue is related to the definition of the informal sector (hidden, parallel, underground, shadow, etc.). Since the mid-twentieth century, the informal dimensions of organizational life have become increasingly recognized as an important topic by researchers (Gouldner (1954), Blau (1957)). The earlier studies (*e.g.*, Hart (1970; 1973)) focused mainly on the informal sector in developing countries. More recently, the informal sector in developed countries has gained an increasing interest among the researchers (Gerxhani (2004)). Although initially it was considered to comprise only residual or marginal activities, the informal sector is currently viewed as one of the central features of economic and social dynamics for any country. The early works have focused mainly on the conceptualization of the informal sector, on its significance and relation to the formal sector (see, *e.g.*, Hart (1970; 1972; 1973), Harding and Jenkins (1989), Hernando (1990), Feige (1990) and Reed (1990)). Nevertheless, the disagreement over the definition of the informal sector has led researchers of several disciplines (*e.g.*, labor economics, sociology, macroeconomics, and statistics) to use different definitions of the informal sector, relying on political, economic, and social criteria and various sub-criteria, including labor market features, tax evasion, regulation, and others. Table 1.1 summarizes the main existing definitions of the informal economy according to economic criteria.

Table 1.1: Selected definitions of the informal sector

Criterion	Definition	Researchers
Labor markets (status of labor)	The sum of all income-earning activities with the exclusion of those that involve contractual and legally regulated employment	Harding and Jenkins (1989), Renooy (1990) and Hart (1972)
Unreported income (tax evasion)	The sum of all taxable money income left unreported with the intention to evade taxes	Fezge (1981), Tanzi (1983), Frey (1989), Cowell (1990), Feige (1990)
Size of activity	Measured as the number of people employed in the informal sector	Sethuraman (1976)
Professional status (informal workers)	The sum of all self employed, family workers and domestic servants	Hart (1970; 1973)
Regulation (registration of an activity)	All establishments which are unregistered and unlicensed	Swaminathan (1991)
National statistics (GNP accounts)	All economic activities non reported to official accounts	Fezge (1981)

The definition used in this thesis is more comprehensive with respect to the criteria.

Chapter 3 estimates the informal sector in terms of official output. Chapter 4 takes informality in terms of total employment and so it employs labor market status, size of activity, regulation, and professional status criteria.

1.2 Methods for estimating the size of the informal sector

The literature provides several methods for estimating the size of the informal economy. Among them, some have had more prominence in the empirical literature, such as direct, indirect and latent variables approaches (for details, see, *e.g.*, [Schneider \(2005\)](#)). The direct approach relies basically on surveys and tax auditing on households and firms. The resulting data are then used within a microeconomic model to estimate the size of the informal sector ([Isachsen and Strøm \(1985\)](#), [Mogensen \(1995\)](#), [Pedersen \(2003\)](#)). The main advantage of this method is that it uses more detailed information about the shadow economy, but it is associated with endogeneity problem (arising from measurement errors, selection bias and simultaneity) and, further, it does not allow for the analysis of the dynamics of the informal sector over time. The indirect approach makes use of macroeconomic theory to estimate the size of the informal economy. In particular, it relies on economic indicators that are supposed to contain information about the informal economy. [Schneider \(2005\)](#) identifies five indicators which are supposed to contain such information: (i) the gap between national expenditure and income (*e.g.*, used by [Park \(1979\)](#), [Petersen \(1982\)](#), [O'Higgins \(1989\)](#)); (ii) the gap between official and actual labor force (see, *e.g.*, [Del Boca \(1981\)](#), [Contini \(1982\)](#), [O'Neill \(1983\)](#)); (iii) volume of transactions as predicted by the quantity theory of money (see, *e.g.*, [Langfeldt \(1982\)](#), [Boeschoten and Fase \(1984\)](#), [Feige \(1996\)](#)); (iv) the currency demand approach which was used by [Cagan \(1958\)](#) and further developed by [Tanzi \(1983\)](#) and others; and (v) the electricity consumption approach developed by [Kaufmann and Kaliberda \(1996\)](#) and a series of works by [Lackó \(1996; 1998; 2000\)](#). For a comprehensive survey and criticism on these approaches, see [Schneider \(2005\)](#) and the references therein. A third approach, the latent variables model, known as dynamic multiple-indicators multiple-causes (DYMIMIC) model (see, for instance, [Frey and Weck-Hanneman \(1984\)](#)), relies on the assumption that there are multiple factors determining the size and the trend of the informal economy. This approach arises in order to overcome one of the fundamental critiques to the direct and indirect approaches: the uniqueness of the determinants of the informal economy. This approach consists of two steps. In a first step a factor model is used to estimate the latent variable (informal economy) and, in a second step, in a structural econometric model framework, the coefficients which establish the relation between latent variables are estimated. However, as with other approaches, it is liable to criticisms:

it lacks a theoretical basis for the inclusion of the indicators as causes (Arias et al. (2007)); it lacks robustness to data transformations, to the units of measurement and to the sample used (Breusch (2005)).² To overcome these weaknesses of DYMIMIC model, for instance, Solomon (2011) makes use of a Real Business Cycle (RBC) model as a theoretical framework to identify the causes and indicators to estimate the size of the informal economy. Still in this vein, Elgin and Oztunali (2012) recognize that the shortcomings transversal to all these models is the ad-hoc econometric specification and the absence of microeconomic foundations. The authors propose a two-sector (formal and informal) dynamic general equilibrium model to estimate the size of the informal economy. Orsi et al. (2014) is another example of this method which relies on Bayesian estimation of a DSGE model with Italian data.

Following Elgin and Oztunali (2012)'s approach, Chapter 3 estimates the size of the informal sector for 105 countries (37 poor, 46 emerging and 22 rich countries). Then, it provides a set of business cycle regularities on the informal sector as well as the relationship between the informal sector with the key economic aggregates.

1.3 Informal sector, credit markets, and business cycle

The 2008 banking crisis and the resulting economic slowdown lay bare the stabilization role of fiscal policy. At the same time, there is a recognition that flexible financial markets would help that stabilization role, as it provides room for fiscal expansion which, in turn, push down unemployment and foster economic growth in the short run. Otherwise, when a negative economic shock impinges on a rigid financial framework, as is the case of developing countries, policymakers are almost forced to orient spending in the same direction as that of the cycle which, in turn, introduces additional volatility to the economy. Indeed, imperfections in the financial markets in developing countries have been strongly blamed for the observed procyclical fiscal policy in developing countries as well as a source for the so-called *small shock, large cycles puzzle* (see e.g., Bernanke et al. (1999) for an overview). The informal activity, however, seems almost ignored in that story or, at least, placed in the background. While costly financing may foster informality, this latter may in turn ward off foreign creditors by weakening the country credibility as well as imposing an increased volatility in macroeconomic aggregates, resulting in increased country risk premium. A similar argument may rely on the result of Eslava et al. (2010). As referred in Bacchetta et al. (2009), firms facing capital shortages are less likely to create formal jobs and so are prone to resort to the informal ones. Conversely, when firms face shortages in high skill labor, they are likely to opt for smaller

²For a detailed analysis of the DYMIMIC approach and its main criticisms, see Dell'Anno (2003).

plant sizes, which potentially damage their ability to access financial markets. So when negative shocks hit the economy, they undergo a decrease in production, investment and spending amplifying the initial contractionary shock. In the same spirit, [Elgin and Uras \(2013\)](#) show that a larger shadow economy size is associated with higher interest rates and financial instability. Indeed, this thesis will show that the informal sector and imperfections in financial markets work under a complementary relationship.

While the role of credit markets on business cycle stabilization is relatively well documented in the literature, the implications of the informal sector are hardly addressed. This can result from the nature of the informality: it can be just an independent activity and so an alternative to formal sector, or it can be an activity that stems from the opportunity provided by formal activities and so may be a complement to formal sector. In either case, the informal economy reduces fiscal policy space by weakening the government's ability to collect tax revenues, as it operates outside taxation framework. [Çiçek and Elgin \(2011\)](#) find evidence supporting a more pronounced procyclicality of fiscal policy in countries with a larger size of the informal economy. [Bacchetta et al. \(2009\)](#) argue that the informal sector may affect the effectiveness of fiscal policy because it is not covered by automatic stabilizers. Therefore, Keynesian prescriptions may be constrained by the size of informality. This thesis will report a positive association between procyclical fiscal policy and the size of the informal sector.

The dynamics of the informal sector across the phases of cycle is explained with two opposite arguments. On the one hand, the countercyclical argument: whenever there is a negative shock in the formal sector, individuals become more involved in the informal sector's activities due to the lack of alternative ways of earning a living ([O'Higgins \(1989\)](#), [Lubell \(1991\)](#)). [Loayza and Rigolini \(2006\)](#) joined this argument by presenting a model where business cycle result from productivity shocks which affect the formal and the informal economy in different ways, generating a countercyclical reaction for the latter. In their model, the informal sector is determined by its relative costs and benefits and the distribution of workers' skills. On the other hand, the procyclical argument considers that a positive shock on the formal economy leads an increase on the demand (direct and indirect) for goods and services produced in the informal sector. In line, [Fortuna and Prates \(1989\)](#) observe that, in developing countries, the prospering period of export of manufactures entail high levels of benefit for entrepreneurs, use of advanced technology, and growth in the scale of production. In addition, it fosters a process of informalization disguised as small independent entrepreneurship ([Gerxhani \(2004\)](#)). Another argument is that, during downturns, only the most productive firms survive and so those operating informally would exit ([Elgin \(2012\)](#)). Empirical literature has supported the procyclical arguments. For instance, [Arias et al. \(2007\)](#) find a positive relationship between the in-

formal and the formal economy over the business cycle. [Schneider \(1998\)](#) reports that, in Germany and Austria, at least two-thirds of the income earned in the informal economy are directly affected in the formal economy leading a positive effect on the formal economy. [Adam and Ginsburgh \(1985\)](#), in a study for Belgium, also find evidence for procyclical movements of the informal sector. [Fiess et al. \(2010\)](#) also find evidence for expansionary episodes as a result of relative demand or productivity shocks to the non-tradable (mostly of informal nature in their model). In accordance, this thesis will deliver a procyclical informal sector either from the empirical exercises or from our theoretical model.

1.4 Organization of the thesis

This thesis rolls over three topics: the cyclicity of fiscal policy in developing countries, business cycle regularities of the informal sector and its relation with key macroeconomic aggregates, and finally, the implications of imperfections in financial markets and the informal sector on business cycle fluctuations, on fiscal policy, and on labor market outcomes. It also explores the interaction between the informal sector and imperfections in credit markets. Therefore, the thesis consists of three stand-alone chapters, in addition to this introduction and a final conclusion.

Chapter 2 reviews the literature on the cyclicity of fiscal policy in developing countries comparing with that in developed ones, together with the literature rationale for the differences. The majority of the literature finds evidence that fiscal policy in developing countries is procyclical, contrasting with countercyclical or acyclical one in developed countries. A first rationale advanced for this procyclicality bias is thanks to [Gavin and Perotti \(1997\)](#). The authors argue that the loss of confidence and the resulting intensification of borrowing constraints, particularly during bad times, are central in determining fiscal procyclicality in Latin America. Alternatively, there are voracity effects arguments ([Tornell and Lane \(1999\)](#)). According to this view, the ability to run large budget surpluses in good times is severely hampered by political pressures that, although being always present, are exacerbated in times of plenty. Therefore, additional fiscal resources in good times are wasted in favor of rent-seeking groups, rather than being saved for smoothing consumption in bad times.

To tackle the literature on this issue Chapter 2 reviews the literature on procyclicality of fiscal policy on three perspectives: summarizes the theories for procyclicality of fiscal policy, reviews alternative methods in the literature to assess cyclicity of fiscal policy, and presents evidence-based literature from testing theories. Relying on signal and statistical significance, evidence of cyclicity of fiscal policy are distributed among acyclical,

countercyclical and procyclical for developed and developing countries.³ We observe that fiscal procyclicality in developing countries is a broad regularity whereas fiscal policy is generally countercyclical or acyclical in the more developed countries. Specifically, while 36.3% of developed countries follow countercyclical fiscal policy, only 3.5% of developing countries follow such policy pattern. Although credit constraints and political economy factors are strongly used to justify fiscal procyclicality in developing countries, evidence-based literature shows that they only explain such procyclicality about 33.5% and 30.3%, respectively. Lastly, we provide a critical overview of the existing literature as well as propose a discussion on why informality may be central in determining cyclical stances of fiscal policy.

Chapter 3 assesses the business cycle features of the informal sector and its relation with the key macroeconomic variables for three groups of countries: rich, developing, and poor countries. While business cycle regularities have been largely studied in the literature with reference to “official” or “observable” output, there is still no unified set of stylized facts of the informal sector that may represent a large part of economic activity, accounting in some countries, for roughly one half to two thirds of observable output. This chapter provides extensive exercises on business cycle facts of the underground sector as well as rationalizes how the informal and the formal sector are evolved. It first presents estimates of the size of the informal economy using a general equilibrium model (GEM) approach, and then provides a comprehensive set of business cycle regularities on the informal sector. Chapter 3 addresses the following questions: 1) does the level of gross domestic product (GDP) of a country matter for the size of the informal sector? 2) Does the size of the informal sector affect the volatility of official output? 3) Does the size of the informal sector move pro or countercyclically? 4) How persistent are the fluctuations of the informal output? 5) Are fluctuations in the underground sector symmetric? 6) Does the underground sector affect the cyclicity of fiscal policy?

Chapter 4 builds a small, open, developing economy DSGE model. It considers three alternative scenarios for financial integration under dual labor market segments (formal and informal). While the informal labor market is frictionless, formal labor market is characterized by search and matching frictions *a la* Diamond-Mortensen-Pissarides and the baseline model is characterized by frictions measured by country risk premium.

Since very early, it was recognized a persistent divisions among workers, working in different labor market segments, with different working conditions, and promotional opportunities (Reich et al. (1973)). Further, currently there is a growing recognition that informality should be viewed not as a marginal or peripheral sector but, instead, as an im-

³While in respect to the size of the informal sector procyclicality (countercyclicality) means positive (negative) relationship with official business cycle (GDP), in respect to fiscal policy variables, procyclicality means that such policy behaves in a way that exacerbate the cycle.

portant component of the whole economy ([Chen \(2005\)](#)). However, the perspectives with which literature has been dealing with informality are not uniform. Among alternatives, Chapter 4 follows the structuralist approach.⁴ Basically, it models a dual labor market in a framework with trading frictions *a la* Diamond-Mortensen-Pissarides in which employment adjusts at the extensive margin. Accounting for trading frictions in labor market allows to identify rules governing the flows between the formal sector, the informal sector and the unemployment pool. Trading frictions, therefore, generate unemployment in the steady state instead of a null-unemployment as in the general equilibrium models based on Walrasian labor markets.

Chapter 4 deals with several issues. First, it looks at the dynamics of the informal sector over the business cycle. This is done in three scenarios of financial integration: a financial autarky model, a model with complete financial markets, and a single asset model. Analyzing the dynamics of an economy at different scenarios of financial integration brings out the role of financial markets on business cycle fluctuations. To complement this exercise, we also look at the responses of the economy for different sizes of external finance premium. The results of both exercises are consistent. Further, this chapter performs a number of exercises, such as the effect of financial integration on cyclicity of fiscal policy, on volatility of output, on vacancies/unemployment, and on the size of the informal sector. To put informality into perspective, this chapter also looks at the effects of the informal sector on the cyclicity of fiscal policy, on volatility of output, on formal matches and on unemployment. The results of these exercises are consistent with the arguments presented in this thesis.

Chapter 5 provides a general conclusion of the thesis. It discusses some limitations of the research as paths for future research, and sketches some policy prescriptions.

⁴Chapter 4 summarizes the three views of informality. For more information see, *e.g.*, [Chen \(2005\)](#), [Hernando \(1990\)](#) and [Maloney \(2004\)](#) for different views on informality.

Procyclical Fiscal Policy in Developing Countries: A Bird's Eye (Re)View

2.1 Introduction

Conventionally, the role of fiscal policy in stabilizing business cycles in developing countries faces some meaningful constraints. While developed countries generally manage to pursue countercyclical fiscal policy by reducing spending or raising taxes during economic upturns and enacting fiscal stimulus during downturns, developing countries seem more prone to follow procyclical policies. This chapter, relying on both theoretical mechanisms and empirical evidence, aims at providing an assessment on fiscal policy behavior in developing countries, contrasting with that in developed countries.

Keynesian models prescribe that fiscal policy should behave countercyclically as to set the level of output as close as possible to its full employment flexible price level. Thus fiscal authorities should increase consumption and/or lower tax rates during downturns and follow the reverse whenever the economy is experiencing a boom. In turn, the classical view (the tax smoothing hypothesis in [Barro \(1979\)](#)) advises for a constant tax rate over the business cycle. In regards to government consumption, however, the theories are weaker: if government and private consumption enter separably in households' utility, the optimal policy should be to smooth government consumption over the business cycle; if, instead, government and private consumption are complements (substitutes) we should observe a procyclical (countercyclical) government consumption over the business cycle. Therefore, while both procyclical, countercyclical, and acyclical government consumption can be prescribed under the classical framework, Keynesian theory only prescribes countercyclical public spending.

After the seminal work of [Gavin and Perotti \(1997\)](#), who first point out the procyclicality phenomenon in Latin America, a growing body of theoretical and empirical literature

has emerged in an attempt to explain why fiscal policy is procyclical in developing countries. Rather than feeding this literature with additional evidence, this work aims to put this theoretical and empirical body on a lens. That is, it aims at reviewing the literature on the cyclical behavior of fiscal policy in developing countries, comparing with that in developed ones, enlightening the literature rationale for the differences. Taking a bird's eye view, we start by reviewing the existing explanations for procyclical fiscal policy and then complement the analysis with related empirical evidence from the literature.

At reviewing the literature on the cyclical behavior of fiscal policy, we identify and select the studies which use adequate fiscal instrument to estimate the cyclical instance of fiscal policy as well as discriminating developing and developed countries. Then, by recording the number of estimates of the cyclical stance of fiscal policy, we set up two samples of estimates: one for developed countries of 160 observations and the other for developing countries of 344 observations.

We observe that fiscal procyclicality in developing countries is a broad regularity, while such policy is generally countercyclical or acyclical in the more developed countries.¹ Specifically, relying on the sample for developed countries, we conclude that 36.3% are countercyclical, while 24.4% are acyclical, summing up 60.6%. The picture is, however, different for developing countries. In a sample of 344 estimates, only 3.5% and 19.6% are, respectively, countercyclical and acyclical, 77% are procyclical (see [Table 2.3](#) below). Still, among the studies which deliver procyclical fiscal policy in both group of countries, 89% (17 out of 19) show that procyclicality is stronger in developing countries. Therefore, these results seem to support the phenomenon termed “when it rains, it pours” by [Kaminsky et al. \(2004\)](#). We argue, however, that at the empirical ground, a deeper analysis is in order, as most of the literature has not properly addressed at least one of three: adequate concept, endogeneity, and identification problem. For instance, [Iizetzki and Végh \(2008\)](#) by using various econometric methods, find overwhelming support that fiscal policy is indeed procyclical in developing countries; but they also find substantial evidence of procyclicality in high income countries. We observe that, among the studies that use policy instrument, only 16.6% have taken into account endogeneity problem.

Similarly, we record the evidence from the selected literature which test the existing theories. We discriminate the existing theories between credit constraints and political economy channels. We conclude that, although theoretically the literature strongly blames credit constraints and political economy factors for the observed procyclical fiscal policy, empirically such channels seem weak in explaining the procyclicality of fiscal pol-

¹We are referring to estimates of fiscal cyclicity resulting either from correlation function or regression based measures. The results are restrict to studies that only use fiscal instruments. Therefore, results based on tax rates are neglected since the literature very rarely use such fiscal policy indicator due to the non-existence of systematic data on tax rates for a large number of countries.

icy. Analytically speaking, in regards to credit channel based explanation, in a sample of 218 results, we conclude that only 33.5% support that relaxing credit constraints provide room for conducting countercyclical fiscal policy, while 56.5% constitute the evidence that such factors have no effect on cyclicity of fiscal policy. Results relying on political economy channel appear to distribute symmetrically among positive, negative, and null effects on fiscal procyclicality (see [Table 2.1](#)). However, these result may exhibit some caveats. While the literature takes credit constraints and political economy as alternative explanations for fiscal procyclicality, we argue that they are not alternative explanations but complementary, being political economy theoretically dominant: if there was no procyclicality during expansion phases, there would not be procyclicality during recessions. Furthermore, developing countries are the default recipients of FDI inflows due to lower labor costs and higher marginal productivity of capital. In spite of that, their fiscal policy mostly behaves procyclically. We end this chapter by bringing informality to this research arena.

In what follows, we first review the existing theories for procyclical fiscal policy in section 2.2. Section 2.3 looks at the evidence for each of these theories, while section 2.4 provides a critical assessment. Conclusion is presented in section 2.5.

2.2 Explaining procyclicality of fiscal policy in developing countries

Why does fiscal policy often presents procyclical behavior in developing countries? Several explanations have been advanced to explain this bias. These explanations follow under two main strands: credit market imperfections, which arise either due to incomplete markets or due to borrowing constraints, and political economy explanations. While credit market imperfections manifest, mainly, during downturns, leading policymakers to a cut in spending and/or to increase taxes, political economy factors act mostly as a phenomenon of good times with room for fiscal profligacy. Putting differently, a strong institutional framework plays a key role in stabilizing business cycle fluctuations by controlling for corruption, by attenuating policy bias and common pool problems. For several reasons, further explored below, developing countries appear to be a working place for these phenomena rather than developed ones.

2.2.1 Explanations based on credit market imperfections

Developing countries are often characterized by fragile financial markets and low financial integration, when compared to industrial economies; moreover, recent progres-

sion was done at a slow path ([Prasad et al. \(2003\)](#)). Such constraint may impinge on the stabilization role of fiscal policy, determining procyclicality, namely, during the negative phases of the cycle.

Indeed, fiscal space and/or external financing are preconditions for political authorities to enact on expansionary fiscal policy. If there are no credit constraints, in the sense that all, private and public, agents have easily and costlessly access to credit, we should observe smooth consumption over the business cycle. In such scenarios fiscal policy behaves as predicted by Barro's tax smoothing model: negative (positive) correlation between deficits (tax revenue) and business cycle. Under credit constraints, however, optimal fiscal policy depends on its effects on aggregate demand and on how it interacts with imperfections in credit markets. If fiscal policies have an expansionary effect on aggregate demand, as predicted by Keynesian models, then it is optimal for fiscal policy to be countercyclical to help households to smooth consumption and firms to carry out new investment when credit constraint is tighter (*e.g.*, subsidizing innovative investment spending during downturns). However, when both government and households are credit constrained, the stabilization role of fiscal policy may become ineffective, giving rise to procyclical behavior rather than a countercyclical one. This procyclicality bias arises either due to the positive comovement between government revenue and business cycle, forcing government to cut in spending, or even to increase taxes, during downturns, to offset the decline in revenue and thus to comply with its (external) obligations (because of the lack of external financing); or, as [Caballero and Krishnamurthy \(2004\)](#) put, if a country faces quantity credit constraints on its borrowing, procyclical fiscal policy may be contractionary. So, fiscal authority may find optimal to conduct a procyclical fiscal policy.

Therefore, linking procyclicality of fiscal policy in developing countries to the worse conditions of financial markets is not empty of rationality. In fact, imperfections in the credit markets are larger in developing countries than in developed ones. For instance, as argued in [Cuadra et al. \(2010\)](#), governments in developed countries issue a wider range of type of assets than governments in developing countries. Furthermore, in contrast to governments in developing countries, governments in developed countries are able to manage a wide range of maturities of non-contingent debt allowing them to keep a constant tax rate over the business cycle. That is, government in developed economies, by managing a wide range of maturities of non-contingent debt, are able to replicate the state-contingent debt, hence achieving a smoother role of fiscal policy. In addition, because developing countries experience higher volatility than developed countries, it is most likely the former to face rising spreads on sovereign debt, making these countries subject to severer credit constraints, particularly, during downturns.

The idea that credit constraints lead to procyclical behavior of fiscal policy arose, perhaps, with the work of [Gavin et al. \(1996\)](#) and that of [Gavin and Perotti \(1997\)](#). By conducting a series of exercises, [Gavin and Perotti \(1997\)](#) observe that fiscal policy in Latin America, in contrast to the industrial economies, has been an economic destabilizing business-cycle factor. The exercises lead the authors to argue that conditions of access to credit markets are the main cause for the empirically sub-optimal fiscal policy observed in Latin America. In turn, [Gavin et al. \(1996\)](#) also observe that, for each dollar increased in the OECD economies, 25 cents is absorbed in the form of a large fiscal surplus, while in Latin America this metric is very small only of about 5 cents. Further, that this stabilizing fiscal response of OECD budgets is the results of a fairly large increase in taxes combined with a very small public spending response, while in Latin America the failure of fiscal surplus is due to a strongly procyclical response of public spending. As [Gavin and Perotti \(1997\)](#), the authors also blame the constraints on Latin America's access to international capital markets for this destabilizing role of fiscal policy. More specifically, the argument is that Latin America region has a precarious relationship with international financial markets which creates frequent need for destabilizing (procyclical) fiscal adjustments, and thus exacerbating cycles. Indeed, the authors show that a one percentage point increase in the US interest rate is associated with an increase in the stripped yield of 2 percentage points in Mexico, 3 percentage points in Argentina, and more than 5 percentage points in Venezuela.

Following these seminal works, a vast amount of theoretical models, embodying some kind of financial frictions, emerge in an attempt to simulate the procyclical pattern of fiscal policy. A subset of these studies (including [Riascos and Végh \(2003\)](#), [Mendoza and Oviedo \(2006\)](#), [Doda \(2007\)](#), and [Sarker \(2009\)](#)) places the lack of a rich menu of financial assets at the core of procyclicality of fiscal policy. For instance, [Riascos and Végh \(2003\)](#) argue that the cyclical behavior of government consumption is entirely consistent with neoclassical fiscal explanations. Accordingly to the authors, all we need is a complete credit market in the sense of Arrow-Debreu. They solve the Lucas-Stokey-Ramsey problem for a small open economy with complete markets, where endogenous government consumption provides direct utility to the households. Under complete markets, the optimal fiscal policy, in the sense of Ramsey planner, is to smooth the public consumption across the state of economy; in turn, under incomplete markets, the optimal pattern of fiscal policy should be procyclical. In fact, with complete markets, they show that the correlation between government consumption and output is zero (consistent with empirical evidence for industrial and G-7 countries; see, *e.g.*, [Talvi and Végh \(2005\)](#)), while with only risk-free debt (used as indicator of incomplete asset markets) this correlation lays between the [0.7-1.0] range. The procyclicality of fiscal policy arises as follows: because

of absence of state contingent claims, in bad times, the economy is unable to borrow as much as it would do under complete markets (with enough state contingent claims), leading private households to consume less. The decline in private consumption will lead to a positive correlation between consumption and GDP. The government, in turn, is not able to smooth consumption and thus consumes more in good times and less in bad times. The combined effects reinforce business cycle fluctuations. However, [Sarker \(2009\)](#) observes that if one introduces the existing trade-off between consumption and leisure in the endowment economy model of [Riascos and Végh \(2003\)](#), then the completeness of financial markets does not matter, because, in any case, the model will deliver a procyclical pattern of both private and public consumption. Thus drawing on [Kaminsky et al. \(2004\)](#)'s results, Sarker presents an extension of [Riascos and Végh \(2003\)](#)'s work to capture the basic features of the business cycle data in developing countries such as procyclical capital flow and countercyclical interest rates. Basically, contrary to incompleteness of credit markets taken by [Riascos and Végh \(2003\)](#), the author considers that the risk premium faced by a country is a positive function of debt and a negative function of output. Thus households and government face higher interest rates whenever borrowing pressures increase and economic recessions take place. Therefore, during bad times any attempt by government to conduct a countercyclical fiscal policy is hampered by the high interest rates and tends to increase this latter even further. This conflict leads to an increase in the tax rate while the government debt declines leading to a procyclical fiscal policy.

The work of [Mendoza and Oviedo \(2006\)](#) and that of [Doda \(2007\)](#) have some aspects in common. While in [Mendoza and Oviedo \(2006\)](#) financial markets are incomplete not only domestically but also in the sense that economy has only access to international contracts in a non-state-contingent way and on which default is rule out, in [Doda \(2007\)](#) incompleteness results from the absence of a domestic financial market and on a framework that only government has access to international capital markets, and in which default is possible. In [Doda \(2007\)](#)'s model, the procyclical fiscal policy arises due to the lack of government's commitment to comply with its external obligations (causing the interest rate to increase, depending on the state of economy); in the [Mendoza and Oviedo \(2006\)](#)'s model, government can only issue non-state-contingent debt such that the smoothing role is unattainable. [Doda \(2007\)](#)'s model is calibrated to Argentina, and shows a procyclical government expenditure and countercyclical labor income tax; the model of [Mendoza and Oviedo \(2006\)](#) does a good job in mimicking some empirical regularities of destabilizing fiscal policy in Mexico. [Guerson \(2003\)](#) joins to this argument by stating that the core element driving procyclical fiscal policy is the possibility of foreign default. Model's mechanism considers that marginal increases in the stock of public debt are accompanied by an increased probability of default which, in turn, pushes up the interest rate. There-

fore, interest rate affects economy either through higher debt service costs or by reducing private investment. Because both effects make the expected aggregate consumption next period to fall, the government optimally avoids fully cushioning a decline in aggregate consumption in low states.

In addition to the previous studies, [Cuadra et al. \(2010\)](#) and [Suzuki \(2015\)](#) follow the seminal study on international lending and sovereign default by [Eaton and Gersovitz \(1981\)](#) to rationalize these stylized facts on fiscal variables in developing countries. In [Cuadra et al. \(2010\)](#) market is incomplete in the sense that there is only one period non-contingent bond. The unenforceability of contracts and the option to default on outstanding debt give rise to country spread, leading to procyclical interest rate.² Thus fiscal authority finds it optimal to rely more heavily on taxation rather than external borrowing to finance public expenditures in bad times, and vice versa in good times. The model does a good job in matching business-cycle properties of Mexican economy. In a similar vein, [Suzuki \(2015\)](#) relies on endogenous default model but in a contrasting framework between developing and developed countries. That is, [Suzuki \(2015\)](#) contrasts the business cycle properties in developed with developing countries, and summarizes four stylized facts for these two group of countries:

- (i) government consumption is extremely volatile when compared with GDP and with private consumption in developing and emerging markets countries, although this is not necessarily the case in developed countries;
- (ii) government consumption is procyclical in developing and emerging market countries, whereas it is acyclical or weakly procyclical in developed countries;
- (iii) government consumption is less procyclical than private consumption in developing and emerging markets countries; and
- (iv) transfer payments are highly volatile and procyclical in emerging market countries, whereas it is countercyclical in developed countries ([Suzuki \(2015\)](#) pp. 252-253).

Relying on these facts and on seminal work by [Eaton and Gersovitz \(1981\)](#), [Suzuki \(2015\)](#) argues that the lack of coercive methods to enforce repayments of debts delivers an optional default to the government, being defaulting option the driver for procyclical fiscal policy. Actually, Suzuki develops two models with and without default option in sovereign borrowings. The defaulting model calibrated to the Argentina economy yields procyclical government consumption and transfer payments, while the non-defaulting model calibrated to the Canadian economy delivers countercyclical transfer payments.

Modeling financial frictions has not been limited to the so-called completeness of financial markets. Indeed, another subset of studies has taken financial frictions as being

²Note that, accordingly to our working concepts, procyclical interest rate means a negative correlation between output and interest rate, *e.g.*, interest rates increases during downturns amplifying downturns.

a limited access to the world capital markets. The premise is that imperfect or costly access to the world capital markets leads fiscal authorities in developing countries to cut in spending and raise taxes during economic downturns. Models accounting to this kind of financial frictions include those of [Aizenman et al. \(2000\)](#), [Caballero and Krishnamurthy \(2004\)](#), [Aguiar et al. \(2005\)](#), [Demirel \(2010\)](#) and [Kuralbayeva \(2013\)](#).

The access to the international credit markets in [Aizenman et al. \(2000\)](#) is determined by the efficiency of the tax system. Because developing countries are characterized by inefficient tax system and volatile tax base, defaulting scenarios and the resulting borrowing constraints emerge. The key model's results is that, under this framework, large recessions will force the government to hit its credit ceiling, leading to increased tax rates when output and tax base decline; this is a fiscal procedure at odds to the tax-rate smoothing in [Barro \(1979\)](#). In [Caballero and Krishnamurthy \(2004\)](#) is the lack of financial depth (supply of funds available to the government and private sectors) that determines the procyclical behavior of fiscal policy. That is, the supply of funds to developing countries is limited to small set of specialist investors (those that have knowledge on political and exchange rate risk, on the degree and types of corruption, and on the corporate and judicial system operating in developing countries). Because public sector competes with private sector in absorbing this limited amounts of fund, fiscal policy is constrained in a way that can overturns standard Keynesian fiscal policy prescriptions. In [Demirel \(2010\)](#), financial frictions are captured by a country risk premium. Demirel shows that whenever the economy faces an adverse shock, in the presence of the country spread, optimal fiscal and monetary policies as well as capital flows are procyclical, while in the absence of country spread, optimal macroeconomic policies and capital flows become countercyclical.

[Aguiar et al. \(2005\)](#) show that a simple model of capital taxation with limited commitment can explain the procyclical behavior of fiscal policy observed in developing economies. Basically, the authors model a developing economy with limited access to financial markets and where a government, unable to commit to tax policy, plays a redistributive role. Government regulates the economy through linear taxes and subsidies levied on several income sources. The economy is populated by two groups: a significant fraction of workers (with inelastic labor supply, risk averse behavior and with no access to financial markets), and a fraction of capitalists that invest in physical capital. In order to maximize the workers' utility, the government insure the workers against intra-period risk by taxing capital income while subsidizing labor in bad times, and, conversely, subsidizing capital while taxing labor income in good times; generating procyclical taxes on capital (*e.g.*, amplifying cycle phases). More specifically, [Aguiar et al. \(2005\)](#) show that if the government lacks the ability to commit to future fiscal policies, the best fiscal policy available exacerbates cycles, while if government could fully commit, the optimal tax

policy plan is done in such a way that the expected capital tax payments are zero, keeping investment constant.

[Kuralbayeva \(2013\)](#) starts by observing that in high-income countries (G-7), real government expenditure is countercyclical, while in developing countries (8 Latin America countries) is procyclical. Further, though the two components of public expenditure (public consumption and public investment) tend to be procyclical in both countries groups, they are far more procyclical in developing countries. Following these observations, the author uses a vector autoregression (VAR) to evaluate the effects of commodity prices shock on public investment and public consumption. The model is estimated with quarterly data from Colombian economy covering period from 1977Q1 to 2011Q2. The author finds that one-standard-deviation shock to the oil prices leads to a significant hump-shaped responses of both public investment and public consumption, in a procyclical fashion. [Kuralbayeva \(2013\)](#) rationalizes these empirical patterns of fiscal policies due to country's conditions of access to international capital markets. The author provides a DSGE model with public investment and public consumption, and explores how the optimal choice of fiscal policy in face of an adverse external shock varies with the degree of access to international capital markets. The simulated results show that it is optimal for developed countries to borrow from abroad to protect public expenditure and to reduce taxes to protect private consumption, while in developing countries it is optimal to adjust internally because of the higher cost of using external funds. Therefore, the access to international capital markets helps developed countries to conduct a countercyclical fiscal policy, while in developing countries optimal fiscal policy should be procyclical due to the higher costs of using external funds.

As we have seen above, credit channel has been at the core of a number of studies that explain procyclicality of fiscal policy observed in developing countries, in opposition to that observed in developed countries. The rationale is that the lack of a rich menu of financial assets and/or lack of access or costly access to capital markets makes expansionary fiscal policy costly or unfeasible. But does this mechanism really works to justify the observed differences? To answer the question, Section 2.3 looks at the existing evidence on credit channel explanations. In what follows we briefly review the political economy motivation for procyclical fiscal policy.

2.2.2 Explanations based on political economy factors

Arguably, as [Talvi and Végh \(2005\)](#) state, if governments in developing countries are aware of the limits to access international credit markets during bad times, it would rationally seek for a larger buffer during expansions, being the policy even more countercyclical, at least during expansions, than in developed countries. Although this argu-

ment attempts to present a mechanism that would enable developing countries to conduct macro-policies in a stabilizing or neutral way, the explanation for the procyclicality of fiscal policy in developing countries goes beyond the failures to access international credit markets. Indeed, [Gavin and Perotti \(1997\)](#) believe that political distortions might be part of the story.

The political distortion is documented, *e.g.*, in [Tornell and Lane \(1999\)](#), as the “voracity effects” from groups of pressure. Developing countries are characterized by multiple powerful groups, weak legal and political institutions, and where property rights in the formal sector are not properly accounted for. Hence, whenever there is a positive shock on the country’s resources or fiscal revenues, the groups compete to get the highest possible share of wealth by demanding more transfers from the government; therefore, this induces higher government spending in good times, leading to a procyclical behavior of government spending. According to [Eichengreen et al. \(1999\)](#), the procyclicality arises due to the lack of mechanisms to coordinate political pressures during expansionary periods. That is, uncoordinated interests towards common resources (mostly during business cycle peaks) tend to internalize the benefits of specific public expenditure programs, but not the full budgetary costs involved. So, each group exerts political pressure in favor of a given expenditure from which it can derive benefits (common pool problem). Since the price of public goods is not adequately set (being set below the market price) and thus does not provide a correct signal to the underlying costs, the lack of mechanisms (as is the case for developing countries) to coordinate for these pressures will give rise to excessive expenditure in booms.

[Talvi and Végh \(2005\)](#) develop an optimal fiscal policy model *a la* [Lucas and Stokey \(1983\)](#) with a political distortion embedded. This distortion works in the sense to press increases of public spending, mostly in times of plenty. Because the tax base is more volatile in developing countries than in developed ones (as observed by the authors), tax smoothing would imply running large budget surpluses in good times together with large budget deficits in bad times. However, tax smoothing falls to emerge because running large budget surpluses in good times is costly in face of political pressures towards public spending. Therefore, optimal fiscal policy can involve lowering taxes in good times to fend off public spending pressures. But, because taxes lead to economic distortions, optimal policy response to positive shocks in the tax base should involve both fiscal instruments: combining a decrease in tax rate with an increase in spending, rather than just a large decrease in the tax rate. As for the results, while for the G-7 countries the correlation between the cyclical components of government consumption and output is negative, for developing countries such correlation is positive.

Other arguments, such as of [Woo \(2009\)](#), take social polarization of preferences as a

coordination failure in collective action. The intuition is that different preferences about fiscal policy give rise to conflicts of interests between policymakers, which propagates to fiscal policy leading to a procyclical pattern. [Woo \(2009\)](#) formalizes this hypothesis by developing a model of fiscal policy in which social polarization of preferences may generate fiscal procyclicality and fiscal volatility. The motivation is that polarized preferences incentive policymakers to carry out their preferred public spending, which may be individually rational, but collectively inefficient for the economy as a whole. Such incentive is stronger during good times, when rising government revenues or newly available resources make their agenda more feasible, leading to procyclical fiscal policies. Indeed [Woo \(2009\)](#) shows that countries with highly polarized societies tend to exhibit more procyclical fiscal policy. In that same spirit, [Ilzetzki \(2011\)](#) proposes a model in which the features of developed countries are captured by a time-consistent benchmark model yielding countercyclical policy. However, in modelling developing countries, several distortions were considered. First, it assumes a political distortion emerging from disagreement over the distribution of public goods between alternative governments. Because the incumbent government knows (or is almost sure) that its successor will benefit an unpreferable political fraction, it saves less and spends more when more tax revenues are available, making fiscal policy procyclical. Second, the model also takes into account that credit constraints and macroeconomic volatility are also causes of procyclicality of fiscal policy in developing countries. The author concludes that political distortion, which results from different preferences between successive governments, can explain the procyclical behavior of fiscal policy in developing countries better than the presence of credit constraints and/or macroeconomic volatility.

[Alesina et al. \(2008\)](#) join to this wisdom. The authors use principal-agent model to explain procyclicality bias in developing countries. The procyclicality of fiscal policy arises because of information asymmetry: voters observe the state of economy but cannot observe how much of tax revenue is appropriated by government as rents. The former face corrupt governments and expect the latter to appropriate part of tax revenues for unproductive public goods. This environment leads to political distortion such that, during a boom, voters demand for higher utility for themselves in the form of lower taxes or better/more public goods. This forces governments into procyclical public spending and even borrowing during expansions.

2.2.3 Factors playing on the mechanisms for procyclical fiscal policy

To provide loans to domestic borrowers (government or private sectors), foreign lenders take in to account not only the private agents' credit risk but also the overall country risk to assess the ability of the domestic borrowers to repay debt. Such risks are linked to inter-

nal factors such as institutional quality, corruption, the workings of the political system. These factors have impacts on the risk premium on domestic loans and, therefore, affect the credit channel, *e.g.*, through relaxing or retracting credit constraints. Moreover, other forms of international financing, namely foreign aid, foreign direct investment inflows as well as others sources of internal financing, *e.g.*, deficit monetization, may relax credit constraints. In this section we review the literature on the role of a set of factors such as: (i) foreign aid and investment inflows, (ii) institutional framework, and (iii) the role of monetary policy on driving procyclical fiscal policy. Moreover, some of these factors also shape political pressures, as is certainly the case of the quality of institutions.

2.2.3.1 Foreign aid and investment inflows

External financial flows provide alternative financing forms for government. Indeed, these flows are substantially linked to developing countries either because of low-income eligibility criteria (foreign aid) or due to the attractiveness of lower labor costs in the global chain production (foreign direct investment). Both flows lead to foreign reserve accumulation to, eventually, support government financing directly or indirectly through the banking system or even to improve the country's credibility in regards to external lenders. For instance [Calderón and Schmidt-Hebbel \(2003\)](#) show that fiscal policy in Latin America and Caribbean is countercyclical under high credibility.

Whether, on the one hand, external flows relax credit constraints and thus enabling countercyclical policies during downturns, they can, on the other hand, also promote procyclical fiscal policies during upturns, if the political economy channel dominates. International capital inflows may create fiscal space for policymakers to conduct fiscal policy discretionarily even if it is sub-optimal for the economy as a whole. For example, [Lledó et al. \(2011\)](#) using a panel data covering period from 1970 to 2008, for 44 sub-Saharan African countries, identify larger fiscal space with lower external debt and the access to concessional financing international aid flows. While [Lledó et al. \(2011\)](#) conclude that these factors are important to diminish procyclical fiscal policy in sub-Saharan African countries, as they relax credit constraints; [Thornton \(2008\)](#) provides evidence that government consumption is more procyclical in countries that are more reliant on foreign aid inflows and that are less corrupt, which may be an evidence that political channel dominates.

[Zhou \(2009\)](#) investigates, empirically, the relation between the cyclicity of fiscal policy and the demand for international reserves in developing countries and how this relationship is affected by political risk and the conditional access to capital markets. The data comprises periods from 1980 to 2005 for 60 developing countries. He finds evidence that demand for international reserves has effect on cyclical stance of fiscal policy.

Specifically the evidence is that in developing countries with low political risk, countercyclical fiscal policy is associated with higher international reserves holdings in bad times. Moreover, this relationship is stronger when countries with low political risk rely heavily on external financing. The intuition is based on [Aizenman and Marion \(2004\)](#)'s model. The model predicts that a country with volatile output, inelastic demand for fiscal spending, inefficient tax collection system and sovereign risk tends to accumulate both international reserves and external debt. While the external debt is used to smooth volatility in output, international reserves are used to smooth consumption when default on external debt occurs. Such precautionary reserve accumulation enables governments to pursue countercyclical fiscal policy during economic downturns.

2.2.3.2 Institutional framework

Democracy with appropriate checks and balances improves macroeconomic management including the room for countercyclical fiscal policy ([Persson et al. \(1997\)](#)). Indeed, the political channel explanations for procyclical fiscal policy operate in a weaker way in the presence of particular rules, regulations or independent institutions that monitor the way budgets are drafted, approved, and carried out. Therefore, it is expected that better institutional environment is able to promote countercyclical fiscal policy.

[Calderón and Hebbel \(2008\)](#) and [Slimane and Tahar \(2010\)](#) provide evidence that countries with poor institutions find difficulty in conducting countercyclical fiscal policy. [Khan \(2011\)](#) examines how institutional quality affects the cyclicity of fiscal policy in 28 Asian countries. He concludes that the higher is the level of corruption in a country, the stronger is the procyclicality of fiscal policy; however, he does not find a clear relationship between democracy and fiscal policy behavior. Truly, the results indicate a positive correlation between fiscal procyclicality and corruption and that procyclicality of fiscal policy is observed mainly in developing and low-income countries, where corruption is more prevalent. Still, similar results are also provided by [Alesina et al. \(2008\)](#) and [Halland and Bleaney \(2011\)](#). [Alesina et al. \(2008\)](#), using annual data from 1960 to 2003 for 83 countries (OECD and non-OECD), find that procyclical fiscal policy is more prevalent in more corrupt countries and that the correlation between corruption and procyclicality is mainly present in democracies. However, the correlation between corruption and procyclicality when the borrowing constraint is taking into account leads ambiguous results. [Halland and Bleaney \(2011\)](#)'s results also show, among several determinants, that corruption and democracy are the most important for procyclicality of fiscal policy in developing countries, but not the combination of corruption and democracy as in [Alesina et al. \(2008\)](#).

Contrasting to the positive effect of corruption on procyclical fiscal policy, [Thornton \(2008\)](#) provides evidence that government consumption is more procyclical in less cor-

rupt and less democratic countries. [Calderón et al. \(2004\)](#) argue that the lack of strong institutions and robust policy rules prevent countries of conducting contractionary policies during booms and expansionary policies during recessions. Indeed, by using a panel data set with 20 emerging-market economies covering from 1990 to 2003, they provide evidence that countries with weak institutions are less able to conduct a countercyclical fiscal policy, since the coefficient on the interaction of the Index of International Country Risk Guide (proxy for institutional quality) with the output gap reveals to be positive and statistically significant. [Calderón and Hebbel \(2008\)](#) complemented and improved the [Calderón et al. \(2004\)](#)'s study by using a larger sample of countries and time periods. They find that countries with “poor” institutions or, as already referred above, with lack of access to international capital markets are unable to conduct countercyclical fiscal policy. Further, they conclude that the effects of institutional factors on the different behaviors of fiscal policy between developing and industrial countries are larger than those associated with financial factors. [Manasse \(2006\)](#) concludes that fiscal rules and fiscal responsibility laws seem to enhance countercyclical policy and that institutional quality has different effects on procyclicality of fiscal policy, depending of phases of cycle.

In addition to the above mentioned factors, there exists a significant difference in budgetary institutions between developing and developed countries. While the former is characterized by weak budget institutions, where numerical targets and formal constraints on spending and fiscal deficit that may exist in paper are not be binding in practice, which breaks new ground for common pool phenomenon described in [Tornell and Lane \(1999\)](#), developed countries have relatively sound budgetary institutions which makes authorities less prone to rent-seeking influences ([Allen \(2009\)](#)). Furthermore, as is argued in [Dabla-Norris et al. \(2010\)](#), weak budget institutions heighten concerns about government creditworthiness and fiscal sustainability, which may exacerbate financing constraints. For instance, while [Gavin and Perotti \(1997\)](#) argue that concerns about creditworthiness and sustainability are central to determining fiscal policy stances, [Alberola et al. \(2006\)](#) provide evidence that actually such concerns play a key role in explaining Latin America's fiscal behavior and the procyclical bias of fiscal policy.

[Dabla-Norris et al. \(2010\)](#) use multi-dimensional indices of the quality of budgetary institutions in 70 low-income countries, from 2000 to 2009, and provide evidence that countries with stronger fiscal institutions have better scope to conduct countercyclical policies. More recently, [Frankel et al. \(2013\)](#), by implementing parametric and non-parametric approaches and using data covering the period from 1984 to 2008 for 94 countries, show that, over the last decade, about a third of developing countries in the world have acquired the ability to conduct countercyclical fiscal policy. The authors attribute this progress to the improvement in the institution quality. Similar results had already

been presented by [Strawczynski and Zeira \(2007\)](#) for the case of Israel, where both government deficit and expenditure have become more countercyclical after 1985. According to the authors, the results are due to improvements in fiscal discipline and in result of the economic stabilization program that occurred during that period. However, [Lledó et al. \(2011\)](#) find that changes in political institutions have no effects on fiscal procyclicality.

2.2.3.3 The accommodating role of monetary policy

While for the most of developing countries central bank financing of deficit is a legal provision giving rise to dependency between fiscal and monetary policies, in developed countries such source of financing is usually prohibited, which reinforces the separation between fiscal/debt management and monetary policy. For instance, using a sample of 152 countries, [Jácome et al. \(2012\)](#) conclude that central bank financing of the budget deficit seem to be inversely correlated to the country's level of development. Specifically, while in most advanced countries, central banks do not finance government expenditures, in a large number of developing countries, short-term financing is allowed in order to smooth out tax revenue fluctuations. These facts seem to put developing countries in a better position to accommodate financing constraints and thus to conduct an expansionary fiscal policy, particularly, under undeveloped financial systems and/or in downturns which decreased tax base.

Additionally, central bank monopolizes the supply of money base to commercial banks and thus controls over credit constraints. Therefore, the likelihood for creating fiscal space either by printing money or by relaxing domestic credit constraints is larger if central government is not accountable and the degree of central bank independence in respect to central government is weak. Contrarily, if a central bank is fully independent from central government, it will be able to put constraints on government borrowing either by printing less money and/or by squeezing the supply of reserves for commercial banks. Moreover, central bank monopolizes the control on interest rates which may be used as a mean to impose costs on deficits.

In general, the literature has shown that the degree of central bank independence affects positively the design of fiscal policy (*e.g.*, [Masciandaro and Tabellini \(1988\)](#), [Castellani and Debrun \(2001\)](#), [Montiel \(2011\)](#)). Indeed, if central government is not accountable, and has some control over the central bank, it may takes advantage of money supply for fiscal profligacy which, further, leads to a non-precautionary saving in time of plenty, leading to procyclical fiscal policy.

It is instructive to note that the common pool phenomenon is more prone to arise whenever government is unaccountable and central bank is dependent and so having scope for policy discretion and overspending in upturns. However, the channel by which central

bank dependence and/or central bank deficit financing shapes the cyclical stance of fiscal policy seems a literal gap. Instead, the literature has focused on the following: (i) relation between central bank independence and budget deficits (see *e.g.*, [De Haan and Zelhorst \(1990\)](#), [Karras \(1994\)](#), and [Brown and Yousefi \(1996\)](#)) to conclude that central bank independence imposes constraints on budget deficits; (ii) on the link between money growth and budget deficits (see *e.g.*, [De Haan and Zelhorst \(1990\)](#), [Karras \(1994\)](#), and [Brown and Yousefi \(1996\)](#)) to conclude that there is not a significant relationship between budget deficit and money growth (monetary authority does not monetize deficits); (iii) on the relation between inflation and foreign debt (see *e.g.*, [Assibey-Yeboah and Mohsin \(2012\)](#) and [Edwards and Tabellini \(1991\)](#)) which provides evidence in the sense that debt is monetized by the central bank in developing countries. Therefore, a clear cut off making explicit the channel by which monetary policy affects the cyclicity of fiscal policy remains to access.

2.3 Testing for theories

We have reviewed in section 2.2 a wide range of factors which, direct or indirectly, have effects on the cyclical behavior of fiscal policy. But, is there evidence that these factors really work as to bias fiscal policy behavior? Basically, to answer this question, the literature relies on a two step approach. First, defining a measure for assessing the cyclical stance of fiscal policy, and then, second, relying on cross-country specification, testing whether cyclicity is related with the underlying factors. The assessment of the cyclical stance of fiscal policy relies, usually, on a pair of macroeconomic series: a business cycle indicator and a fiscal policy indicator. Generally, the literature takes real growth rate series or filtered series from Hodrick-Prescott (HP) or Band-Pass (BP) filtering techniques as a cycle indicator. For the assessment of the cyclical behavior fiscal policy two technical approaches are available: correlation and regression-based approach. The latter is done by regressing a fiscal policy indicator on a business-cycle indicator and on a set of control variables as represented in [Equation \(2.1\)](#)

$$\Delta f_t = \delta + \beta_f \Delta y_t + \rho f_{t-1} + \sum_{j=1}^M \alpha_j x_{j,t} + \phi T_t + \varepsilon_t, \quad (2.1)$$

were f_t (generally in log) is the fiscal policy indicator, y_t (generally in log) is the business-cycle indicator, $x_{j,t}$ is a control j among M controls variables, T refers to time trend, and ε_t is the error term. Δ is the difference operator, and δ , β_f , ρ , α_j and ϕ are parameters to be estimated. The parameter of the interest is β_f . With exception of taxes and budget surplus, a statistically significant and positive estimate of β_f $\left[\hat{\beta}_f \right]$ is, generally, taken as

an indication of procyclicality of such fiscal policy instrument and, if negative, is taken as an indication of countercyclical fiscal policy. It is acyclical if $\hat{\beta}_f$ is not statistically different from zero. As for taxes and budget surplus, procyclicality imposes that negative changes occur in expansions and positive changes in recessions (a statistically significant and negative value for $\hat{\beta}$), and vice versa for countercyclicality.

Alternative to Equation (2.1) is the simple correlation function. While the empirical correlation measures the degree of co-movement between a fiscal policy and business cycle indicator (e.g., change in real GDP), $\hat{\beta}_f$ from Equation (2.1) measures changes in fiscal policy which are explained by changes in the business cycle indicator, *ceteris paribus*. Having estimated the cyclicity of a given fiscal policy $[\hat{\beta}_f]$, the second step takes cross-country specification to test whether such cyclicity measure is related with underlying factors. Formally, testing explanations for procyclicality of fiscal policy takes the following general cross-sectional form

$$\hat{\beta}_{f,i} = f(\psi'; e_{1,i}, \dots, e_{k,i}; \beta'W), \quad (2.2)$$

where $\hat{\beta}_{f,i}$ is the estimate of cyclicity obtained from Equation (2.1) for a given fiscal policy indicator $[f]$ and for an individual (country) $[i]$. Therefore, $\hat{\beta}_{f,i}$ is a function of k explanations $[e_1, \dots, e_k]$, a k coefficients-parameters $[\psi']$ associated to each explanation $[e]$, and a vector of controls $[W]$ including its associated coefficients $[\beta']$. For example, under a linear form for Equation (2.2), evidence supports explanation e_1 , if the associated coefficient $[\psi_1]$ has the expected signal and is statistically significant.³ Studies relying on this two step approach include Lane (2003), Caballero and Krishnamurthy (2004), Thornton (2008), Woo (2009), and Halland and Bleaney (2011).

For instance, in Woo (2009), $k = 1$ and e_1 is a measure for social polarization. Taking income inequality as a measure for social polarization $[e_1]$, the author finds a statistically significant $\hat{\psi}_1 = 0.020$, evidencing a positive association between fiscal procyclicality and social polarization. In Caballero and Krishnamurthy (2004), $k = 1$ as well and e_1 is a measure for financial depth (private credit), and the indicator for cyclical fiscal policy is the correlation between the cyclical component government expenditure and the cyclical component of GDP $[\rho_{\{G_{EHP}, y_{HP}\}}]$. Either OLS or IV estimates lead the authors to conclude that financial depth $[e_1]$ has negative effect on the degree of procyclicality of fiscal policy. The test on a more comprehensive set of explanations $[k = 4]$ is thanks to Thornton (2008). Using data for the period from 1960 to 2004 for 37 low-income African countries, Thornton provides evidence that government consumption is more procyclical in those African countries that are more reliant on foreign aid inflows $[e_1]$ and that are less corrupt $[e_2]$, and that it is less procyclical in countries with more unequal income

³One should note that the functional form for $\beta_{f,i}$ is also valid for empirical correlation.

distribution [e_3] and that are more democratic [e_4]. Similarly, [Halland and Bleaney \(2011\)](#) find evidence supporting that the effects of corruption and democracy are stronger than that of social inequality or net foreign debt on the cyclicity of fiscal policy. However, the authors make note that the result is not obvious, since the index of corruption is closely correlated with poor credit ratings. In turn, [Lane \(2003\)](#) show that countries with volatile output [e_1] and dispersed political power [e_2] are the most likely to run procyclical fiscal policies.

There is, however, a one-step alternative approach to test theories. This approach relies on a single equation form which estimates jointly the cyclicity of fiscal policy [$\hat{\beta}_f$] and the effect [$\hat{\psi}_j$] of a given explanation [\bar{e}_j]. Following [Alesina et al. \(2008\)](#), we take a more general specification as:

$$\Delta f_{i,t} = \beta_f \Delta y_{i,t} + \rho f_{i,t-1} + \sum_{j=1}^M \beta_j x_{j,(i,t)} + \sum_{j=1}^k \psi_j e_{j,(i,t)} \Delta y_{i,t} + \eta_{i,t}, \quad (2.3)$$

where $\eta_{i,t} = v_t + \alpha_i + \varepsilon_{i,t}$, being v_t and α_i are meant to capture, respectively, time and country effects and $\varepsilon_{i,t}$ is the error term. The parameter ρ measures degree of fiscal policy's persistence and ψ_j captures the effects of explanation j on cyclicity of fiscal policy instrument f , [β_f]. For example, a valid explanation e_j delivers a significant $\hat{\psi}_j$, such that its effect on cyclicity of fiscal policy instrument f is given by $\left[\frac{\partial \Delta f_{i,t}}{\partial \Delta y_{i,t}} = \hat{\beta}_f + \hat{\psi}_j \bar{e}_j \right]$.

[Alesina et al. \(2008\)](#), by using government consumption as a fiscal policy indicator, estimate that the coefficient of interaction between corruption and output gap [$e_1 \Delta y_{i,t}$] is statistically insignificant. However, they find that the estimated coefficient of the interaction among corruption, output gap, and democracy [$e_1 e_2 \Delta y_{i,t}$] is -21.326 [$\hat{\psi}_{1,2} = -21.326$] and statistically significant at 1% significance level. This result leads to the conclusion that procyclicality of government consumption is more pronounced in more corrupt democracies. Similarly, [Calderón and Hebbel \(2008\)](#) and [Slimane and Tahar \(2010\)](#) conclude that countries with poor institutions or/and lack of access to credit markets find difficulty in conducting countercyclical fiscal policies.

[Table 2.1](#), below, records evidence from the selected literature which tests the two selected explanations for procyclical fiscal policy: credit constraints and political economy. Following [Kaminsky et al. \(2004\)](#), who argue that only makes sense to define policy cyclicity in terms of policy instruments which is not subject to business cycle, we only select literature which looks at government consumption (G_C) and government expenditure (G_E) rather than revenue-based variables.⁴ Relying on signal and statistical

⁴Actually, government spending is not a good instrument as it includes transfers and debt service. However, because several studies do not discriminate between government consumption and government spending, we use both of them.

significance, for each explanation captured through a two-step approach (Equation (2.2)) or a one-step approach (Equation (2.3)), we record the amount of results which deliver positive effect (+), negative effect (−), and null effects on procyclicality of fiscal policy (0). For readable purposes, we define independent variable in fourth column (not necessarily as reported in the original study) such that, for instance, a record in the column corresponding to “+” means that an increase in that factor makes fiscal policy more procyclical. Dependent variable (third column) are either β_f coming from the two-step approaches or a fiscal policy indicator used in the one-step approaches as described in Equation (2.3). For instance, $\beta_{f[\Delta G_C, \Delta y]}$ is a measure of fiscal cyclicity by regressing changes in government consumption (ΔG_C) on change in output (Δy). If a series x is, *e.g.*, the cyclical component from HP filter, then we write x_{HP} : for example, $\rho_{[G_{EHP}, y_{HP}]}$ is the correlation between cyclical component of government expenditure and the cyclical component of output as filtered by Hodrick-Prescott method.

The results are compiled according to the two selected channels: credit channel and political economy channel. The last row in Table 2.1 summarizes the amount of results which deliver positive, negative and null effect of a given channel for procyclical fiscal policy. The cells highlighted in yellow are meant to doubt of theory. For example, while some political economy models suggest that democracy, with appropriate checks and balances, improves macroeconomic management including the room for countercyclical fiscal policy (Persson et al. (1997)), others argue (see *e.g.*, Lane (2003)) that democracy, involving multiple veto points in the process of policy-making, may lead to procyclical fiscal policy. Indeed, results checking the effect of democracy on procyclicality of fiscal policy are twofold. While 67% (12 out of 18) of the results support the voracity effect prediction, 22% supports that democracy leads to countercyclical fiscal policy, and only 11% yields evidence that democracy has no effect on cyclical instance of fiscal policy. In regards to credit channel, 33.5% of the results supports that relaxing credit constraints provide room for conducting countercyclical fiscal policy, while 56.5% constitute the evidence that such factors have no effect on cyclicity of fiscal policy. Results on political-institutional channel appear to distribute symmetrically among positive (30.3%), negative (37%), and null effect (32.6%) on fiscal procyclicality (see Table 2.1).

Table 2.1: Summary of evidence on existing explanations for fiscal procyclicality

Authors	Time span	Dependent variable	Independent variable ^a	Meth.	Credit channel			Pol. - Instit. channel		
					+	-	0	+	-	0
Halland and Bleaney (2011)	1980-2004	$\beta_{f \Delta G_C, \Delta y}$	Net foreign debt/y	OLS	4		4			
Calderón and Hebbel (2008)	1970-2005	G_E/y	Foreign liabilities/y	OLS			3			
	1970-2005	G_E/y	Domestic credit/y	OLS		2	1			
	1970-2005	G_E/y	Foreign liabilities/y	IV		2	1			
	1970-2005	G_E/y	Domestic credit/y	IV		2	1			
Caballero and Krishnamurthy (2004)	1960-2002	$\rho_{(G_{EHP}, \Delta y)}$	Private credit	OLS		1				
	1960-2002	$\rho_{(G_{EHP}, \Delta y)}$	Private credit	OLS		1				
	1960-2002	$\rho_{(G_{EHP}, \Delta y)}$	Liquid liabilities ^b	IV		1				
	1960-2002	$\rho_{(G_{EHP}, \Delta y)}$	Liquid liabilities	IV		1				
Zhou (2009)	1980-2005	F. reserve/y	β_f	OLS		13	5			
	1980-2005	F. reserve/y	β_f	2SLS		4	6			
Thornton (2008)	1960-2004	$\beta_{f \Delta G_C, \Delta y}$	Net foreign aid inflows/y	OLS	4					
Slimane and Tahar (2010)	1980-2007	ΔG_C	Domestic credit to P.S./y	GMM		1				
	1980-2007	ΔG_C	Financial integration index	GMM		1				
Carneiro and Garrido (2015)	1990-2011	G_{EHP}	Debt/y	OLS	5	12	11			
	1990-2011	G_{EHP}	Reserve/Import	OLS	7	8	13			
	1990-2011	G_{EHP}	Chin-Ito index of capital openness	OLS			28			
	1990-2011	G_{EHP}	Financial depth ($M2/y$)	OLS		17	11			
	1990-2011	G_{EHP}	Volatility (y_{HP}^2)	OLS	1	6	21			
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Debt/y	OLS	2		6			
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Reserve/Import	OLS		4	4			
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Chin-Ito index of capital openness	OLS			8			
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Financial depth ($M2/y$)	OLS			8			
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Volatility (y_{HP}^2)	OLS	5		3			
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Debt/y	2SLS		1	3			
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Reserve/Import	2SLS		2	2			
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Chin-Ito index of capital openness	2SLS			4			
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Financial depth ($M2/y$)	2SLS			4			
1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Volatility (y_{HP}^2)	2SLS	1		3				
Halland and Bleaney (2011)	1980-2004	$\beta_{f \Delta G_C, \Delta y}$	Index of democracy	OLS				8		
	1980-2004	$\beta_{f \Delta G_C, \Delta y}$	Index of corruption	OLS				5		3
	1980-2004	$\beta_{f \Delta G_C, \Delta y}$	GINI index	OLS				6		2
Alesina et al. (2008)	1990-2003	G_{EHP}/y	Index of corruption	IV						1
	1990-2003	G_{EHP}/y	Index corruption × Democ.	IV					1	
	1990-2003	G_{EHP}/y	Index corruption × NonDemoc.	IV						1
	1990-2003	G_{EHP}/y	Index corruption × Political index ^c	IV					1	
Calderón and Hebbel (2008)	1970-2005	$\Delta G_E/y$	Index of democracy	OLS				2		1
	1970-2005	$\Delta G_E/y$	Index of democracy	IV				2		1
	1970-2005	$\Delta G_E/y$	Index political risk	OLS					4	2
	1970-2005	$\Delta G_E/y$	Political index	OLS					4	2
Thornton (2008)	1960-2004	$\beta_{f \Delta G_C, \Delta y}$	GINI index	OLS					4	
	1960-2004	$\beta_{f \Delta G_C, \Delta y}$	Index of corruption	OLS				3		
	1960-2004	$\beta_{f \Delta G_C, \Delta y}$	Index of democracy	OLS					3	
	1960-2004	$\beta_{f \Delta G_C, \Delta y}$	Ind. democracy × Index corr.	OLS						1
Lane (2003)	1960-1998	β_f	Dispersion index	OLS					1	1
Woo (2009)	1960-2003	$\beta_{f \Delta G_E, \Delta y}$	Income inequality (GINI)	OLS				11		
	1960-2003	$\beta_{f \Delta G_E, \Delta y}$	Education inequality	OLS				7		3
	1960-2003	$\beta_{f \Delta G_E, \Delta y}$	Income inequality (GINI)	WLS				10		
	1960-2003	$\beta_{f \Delta G_E, \Delta y}$	Education inequality	WLS				7		3
	1960-2003	$\beta_{f \Delta G_E, \Delta y}$	Income inequality (GINI)	GMM				1		
	1960-2003	$\beta_{f \Delta G_E, \Delta y}$	Education inequality	OLS				3		
	1960-2003	$\beta_{f \Delta G_C, \Delta y}$	Income inequality (GINI)	WLS				1		
	1960-2003	$\beta_{f \Delta G_C, \Delta y}$	Income inequality (GINI)	OLS				1		
	1960-2003	$\beta_{f \Delta G_C, \Delta y}$	Executive constraints index ^d	GMM				2		
	1960-2003	$\rho_{(G_{EHP}, \Delta y)}$	Executive constraints index	OLS						1
	1960-2003	$\rho_{(G_{EHP}, \Delta y)}$	Executive constraints index	OLS						2
Slimane and Tahar (2010)	1980-2007	ΔG_C	Index of democracy	GMM					1	
	1980-2007	ΔG_C	Executive constraints index	GMM					1	
	1980-2007	ΔG_C	Political competition index ^e	GMM					1	
	1980-2007	ΔG_C	Political index	GMM				1		
	1980-2007	ΔG_C	Institutional quality index	GMM					1	
Carneiro and Garrido (2015)	1990-2011	G_{EHP}	Institutional quality index	OLS				1	47	16
	1990-2011	G_{EHP}	Political check and balance	OLS				3	1	24
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Institutional quality index	OLS					20	
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Political check and balance	OLS				1		7
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Institutional quality index	2SLS					1	3
	1990-2011	$\rho_{(G_{EHP}, \Delta y)}$	Political check and balance	2SLS						4
Summary					22/7	73/6	123/21	62/12	87/4	80

^aWhenever is the one-step approach case, as is always the case where dependent variable is fiscal variable rather than fiscal cyclicality, independent variable is multiplied by business cycle indicator; which, in turn, is instrumented when necessary.

^bIt equals currency plus demand and interest-bearing liabilities of banks and other financial intermediaries.

^cIt is a variable which subtracts country's score in an Autocracy index from its score in Democracy index.

^dMeasures the extent to which the executives face political constraints in implementing their policy. It is based on the number of institutionally embedded veto players among various branches of government. A high value indicates greater political constraints. Averaged over 1960–2000. Source: Henisz (2002).

^eRefers to the extent to which alternative preferences for policy formation and leadership roles can be pursued in the political arena.

2.4 Overview and critical assessment

This section aims to provide a critical overview on the reviewed literature. In doing so we focus on: (I) the measure to captures the cyclical behavior of fiscal policy, (II) empirical tests on the existing explanations for procyclical fiscal policy and, last but not least, (III) argue a factor on which the literature has given no insights that the size of the informal sector may also have impacts on procyclical fiscal policy.

2.4.1 Measurement bias in assessing procyclical fiscal policy

Before to look at measurement bias in accessing cyclical stance of fiscal policy, it is convenient to define our conceptual framework with which we interpret the literature as well as what variables should be used to measure the cyclicity of fiscal policy. Following [Kaminsky et al. \(2004\)](#), we took, in the previous sections, **Procyclical fiscal policy** as that exacerbating cycles, **Countercyclical fiscal policy** as that smoothing cycles, and **Acyclical fiscal policy** as that neutral to cycles, *i.e.*, neither exacerbating nor smoothing business cycles. To be specific regarding what variables should be used to find the cyclical stance of fiscal policy, [Table 2.2](#) displays the selected fiscal variables from Table 2 in [Kaminsky et al. \(2004\)](#).

Table 2.2: Theoretical correlations of the selected fiscal variables with business cycle

	g	τ	tr	pb	g/Y	tr/Y	pb/Y
<i>Countercyclical</i>	-	+	+	+	-	+/0/-	+/0/-
<i>Procyclical</i>	+	-	+/0/-	+/0/-	+/0/-	+/0/-	+/0/-
<i>Acyclical</i>	0	0	+	+	-	+/0/-	+/0/-

Source: Table 2 in [Kaminsky et al. \(2004\)](#), p. 16.

where g , τ , tr , and pb are, respectively, government consumption, tax rate, tax revenue, and primary balance. Y is the GDP and x/Y is the x ratio to GDP. Therefore, only government consumption (g) and tax rate (τ) would unambiguously discriminate among the procyclical, countercyclical, and acyclical fiscal policy behavior. The use of the others variables as cyclical indicator for fiscal policy may be misleading, as either any changes may reflect either a procyclical and/or countercyclical and/or acyclical fiscal policy. These cases are identified with $+/0/-$ in [Table 2.2](#).

As shown in [Table 2.2](#), therefore, simply eyeballing to the correlation of some fiscal policy variables with the business cycle may lead us to erroneous conclusions. As [Kaminsky et al. \(2004\)](#) and [Ilzetzki and Végh \(2008\)](#) state, it only makes sense to define policy cyclicity in terms of policy instrument rather than fiscal outcomes. That is, one should take fiscal variables of which changes are subject only to fiscal authority interventions,

rather than those with changes depending on economic activity. To clarify this point, take fiscal balance as an example. As put by [Ilzetzki and Végh \(2008\)](#), even if the path of government consumption and tax rates are independent of the business cycle, we would observe surplus in good times and deficit in bad times because tax base expands in good times and contracts in bad times. Thus one can arrive at the erroneous conclusion that fiscal policy is countercyclical (*i.e.*, following Keynesian prescriptions), when in fact the fiscal authority is following Barro's (1979) neoclassical prescriptions, by engaging in a completely neutral fiscal policy intervention.

Furthermore, as [Kaminsky et al. \(2004\)](#) also argue, the use of a fiscal variable as a ratio of output could yield also to misleading results, since the cyclical instance of fiscal policy may be dominated by the cyclical behavior of output. Taking government consumption to output ratio $[g/Y]$ as an example, the unambiguous indication of the cyclicity of government consumption is only provided by positive signal [+]. Therefore, a negative correlation between changes in output $[Y]$ and changes in the government consumption to output ratio $[g/Y]$ might correspond both to the case of countercyclical, procyclical, or acyclical government consumption. Still, if the result of correlation equals to zero [0], we conclude erroneously that it is acyclical, while it is actually procyclical. In the case of tax revenue to output ratio $[tr/Y]$ and primary balance to output ratio $[pb/Y]$ whatever the result of the correlation, it leads to an ambiguous indication about the cyclical policy behavior.

To clarify this issue, consider a policy instrument f_t and output y_t , such that the ratio is given by f_t/y_t . Consider that at period t , $f_t = 10$ and $y_t = 100$ such that $f_t/y_t = 0.10$, and a change from t to $t + 1$ yielding $f_{t+1} = 12$ and $y_{t+1} = 133,3(3)$ such that $f_{t+1}/y_{t+1} = 0.09$. If f_t is the government consumption, we observe that even though it acts in a procyclical fashion from period t to $t + 1$ ($\uparrow y_{t+1}$ and $\uparrow f_{t+1}$), its ratio to output f_t/y_t follows a countercyclical behavior ($\uparrow y_{t+1}$ and $\downarrow f_{t+1}/y_{t+1}$). Therefore, taking fiscal policy as a proportion of GDP can lead to conclude that fiscal policy acts in a countercyclical way while, actually, it goes in a procyclical direction or vice versa. Even if f_t is constant over time, whenever we take its ratio to output we are forcibly imposing a relation between f_t/y_t and y_t .

However, in the selected literature for this review, we observe that a large number of studies use fiscal outcomes (see *e.g.*, [Caballero and Krishnamurthy \(2004\)](#), [Alesina et al. \(2008\)](#)) as well as fiscal variables as proportion of GDP (*e.g.*, [Calderón and Hebbel \(2008\)](#) and others) to assess the pattern of fiscal policy over the business cycle. As we summarize in [Table 2.3](#) below, even the studies using policy instruments (government consumption or spending), 5.3% (27 results out of 505) of them use policy variables as proportion of GDP. We interpret their results as inconclusive (last column).

For convenience let us present [Table 2.3](#) below. [Table 2.3](#) contains eight columns in addition to those entitled “*Authors*” and “*Time span*”. The third and fourth columns refer to the pair of variables to measure the cyclical stance of fiscal policy and the methodology used, respectively. The column entitled “*Step*” records the number of studies which use one and two-step approaches. If endogeneity problem is taken into account when estimating cyclicity of fiscal policy, we record in the sub-column “*yes*”; otherwise “*no*”. The column entitled “*Table 2.2*” is meant to record if the study uses an adequate variable to capture fiscal policy: “*yes*” if affirmative, otherwise “*no*”. For each study on developed or developing countries we record in “*a*”, “*c*” and “*p*” depending if the results is acyclical, countercyclical or procyclical. The last column “*Check*” is meant to check if the result is according to Keynesian prescriptions (“*K*”), neoclassical theory (“*C*”) or if it is inconclusive (“*inc.*”). In some cases, the results point in the same direction in developed and developing countries. In this case, the record is followed by “*(S)*” to highlight that such result is more strong in a given group of countries. In what follows, we start with the issue of endogeneity in estimating the cyclicity of fiscal policy.

2.4.2 Endogeneity and omitted variables

Measurement bias arises either because we include endogenous variable in the right side of [Equation \(2.1\)](#) or by omitting an important explanatory variable. Technically speaking, measurement bias arises whenever $E_t(z_{t,j}\varepsilon_t) \neq 0$, where E_t is the expectation operator, $z_{t,j}$ is any j right side variables of, e.g., [Equation \(2.1\)](#), and ε_t is the corresponding error term.

About 60.5% (306 out of 505) of our selected results from the literature (see [Table 2.3](#)) takes the cyclical stance of fiscal policy by estimating the parameter of interest β_f in [Equation \(2.1\)](#) or [Equation \(2.2\)](#) (or some other similar version). However, if output reacts to fiscal policy as predicted by Keynesian models, then the OLS estimator yields a biased estimate of β_f . Sixth column in [Table 2.3](#) shows that, among the results coming from regression-based measures, only 32% (98 in 307) have taken into account for the potential endogeneity problem. Therefore, 68% of the measures of cyclicity of fiscal policy likely suffer from endogeneity bias.

The most widespread problem we observe in the literature on estimating cyclicity of fiscal policy is the omission bias. While all the studies have identified, at least, one factor for observed procyclical fiscal policy, particularly, in developing countries, when estimating such cyclicity, very few studies have taken such factor(s) into account. Assuming that the causality goes only from the business cycle to fiscal policy, the cyclicity of fiscal policy is measured by changes in fiscal policy Δf_t due to changes in economic cycles

$\Delta y_t \left[\frac{\partial \Delta f_t}{\partial \Delta y_t} \right]$. So, if a factor, say e_j , plays any effect on the cyclicity of fiscal policy, it should be trough of economic cycles (indirect effect) rather than trough of direct effect. To be more precise, consider we expect that a factor, say e_j , has effect on the cyclicity of fiscal policy f_t . Then, to capture such effect one should estimate the following regression

$$\Delta f_t = \beta_0 + \beta_f \Delta y_t + \lambda \Delta y_t e_{j,t} + \varepsilon_t \quad (2.4)$$

where, to simplify, we omit control variables (including e_j) which have direct effects on fiscal policy. From Equation (2.4) we conclude that $\frac{\partial \Delta f_t}{\partial \Delta y_t} = \beta_f + \lambda \bar{e}_j$, where λ captures the indirect effect of e_j on changes of fiscal variables Δf_t . Therefore, the effect on the cyclicity of fiscal policy depends on the level and signal of factor \bar{e}_j and the parameter λ . We observe, however, that a large portion of the literature has taken, erroneously, the direct effect rather than that working trough business cycle. We are referring studies with adopt the two-step approach by first using Equation (2.1) to estimate cyclicity of fiscal policy and then using Equation (2.2) to test the explanatory power of a factor e_j . To go a little further, suppose one omit $\Delta y_t e_j$ in the Equation (2.4) and estimate the following underspecified equation

$$\Delta f_t = \tilde{\delta} + \tilde{\beta}_f \Delta y_t + \xi_t \quad (2.5)$$

where the error term $\xi_t = \lambda \Delta y_t e_{j,t} + \varepsilon_t$ and tilde above parameters is to emphasize that they come from an underspecified regression. From Equation (2.5), it is obvious that $E_t(\Delta y_t \xi_t) \neq 0$. As is showed in the standard textbook,⁵ $\tilde{\beta}_f = \beta_f + \lambda \tilde{\delta}_1$ where $\tilde{\delta}_1$ is the slope coefficient by regressing of $z_{j,t}$ on Δy_t , $[z_{j,t} = \tilde{\delta}_0 + \tilde{\delta}_1 \Delta y_t]$ with $z_{j,t} = \Delta y_t e_{j,t}$. Therefore, this endogeneity caused by omitted factor/explanation yields a fiscal cyclicity bias of $\lambda \tilde{\delta}_1$. We argue, however, that implicitly in the two-step approach researchers estimate $\partial \Delta f_t / \partial e_j$ rather than $\partial \Delta f_t / \partial \Delta y_t$. That is, perhaps, what is going in their mind is the direct effect of such factors rather than that working trough the business cycle (notice that in the right side of Equation (2.2) we have e_j instead of $\Delta y_t e_j$). Whenever one regress $\hat{\beta}_f$ on a set of factors as in Equation (2.2), $\hat{\psi}_j$ is capturing the bias rather than explanatory power of such factor.⁶ Therefore, in our view, the one-step approach like Equation (2.3) is more appropriated by delivering an unbiased estimate of fiscal policy stance. However, from Table 2.3, we conclude that out of a sample of 306 results using regression-base measures, only 13.4% of such results come from one-step approach. Therefore, 86.6% of the literature result relies on the two-step approach, and so, potentially biased because of omitting important variables.

⁵See *e.g.*, Wooldridge (2015) p. 87.

⁶Of course that we only have measurement bias if, in fact, such factors have explanatory power to the cyclicity of fiscal policy.

2.4.3 Identification problem

Identification problem arises whenever we are unable to identify β_j ; putting differently, whenever we are unable to estimate $\partial\Delta f_t/\partial\Delta y_t$.

Ilzetzi and Végh (2008) analytically show how political distortions like political pressures or rent-seeking activities in good times can give rise to identification problem (see equation 16 p.14 in Ilzetzi and Végh (2008)). In addition, we argue that if there exist electoral effects on fiscal variables, the estimated fiscal procyclicality, β_f , might be just reflecting electoral effect rather than procyclical fiscal policy. For example, suppose one is estimating fiscal policy instance using Equation (2.3). Suppose, further, that for the most countries in the sample, economic peaks coincide with elections periods, and that fiscal authority is neutral to business cycle but it is opportunist in the sense to influence his re-election. Because election-induced business cycles are greater in developing countries (Shi and Svensson (2003), Shi and Svensson (2006)), we might conclude toward procyclical fiscal stance, while, in fact, $\hat{\beta}_f$ is reflecting electoral effects. To the best of our knowledge, however, none of the selected studies has considered such possibility.

2.4.4 Additional explanation: the role of the informal sector

We end this section bringing the role of the size of the informal sector to this research arena. By informal sector or the informal economy or, yet, simply informality we mean all activities that are unregistered and/or unlicensed and hence working outside the controls of the authorities. Although factors in explaining procyclical fiscal policy that we have reviewed have its merits, we believe that the size of the informal sector may be of first-order importance in determining the cyclicity of fiscal policy.

On the one hand, it is widely accepted in the literature that there is a positive association between the size of the informal economy and the fluctuations in aggregate economic activity. On the other hand, the size of the informal sector is larger in developing countries than in developed ones. Having said that, suppose that government spending $[g_t]$ follows the following process: (i) $g_t^L = \bar{g}^L + \beta_f^L y_t^L + b_t^L$, for developing countries (L), and (ii) $g_t^H = \bar{g}^H + \beta_f^H y_t^H + b_t^H$, for developed countries (H). Let \bar{g} , y_t , and b_t be derived, respectively, as autonomous government consumption, country permanent income during a period of time (*e.g.*, a year), and a *buffer box* which accumulates transitory income to provide resources for transitory public spending. On average, the expected value of b_t is zero [$E_T(b_T) = 0, t = 0, 1, 2, \dots T$]. Therefore, everything equal, cyclical stance of fiscal policy in both countries should be equal [$\beta_f^L = \beta_f^H$]. The role of *buffer box* is to accumulate surplus in good times and to provide additional resources for expansionary fiscal policy in bad time. Thus for small decrease in y_t , b_t is able to fulfill its role, by

providing additional resources to stimulate economy. Therefore, we should observe an increase in g_t . However, if the decrease in y_t is very large, b_t may not be able to provide enough resources to stimulate economy, and so forcing g_t to fall. In such scenarios, we observe a procyclical behavior of government consumption [g_t]. We argue, therefore, that the size of the informal sector is the source for that procyclical behavior of government consumption, since, at first instance, it imposes a large volatility on the economy with, in turn, requires additional resources for economic stimulus, for which the *buffer box* [b_t] may not be able for.

In line to the above argument, [Çiçek and Elgin \(2011\)](#) provide evidence supporting that procyclicality of fiscal policy is more pronounced in countries with larger size of the informal sector. [Rigobón \(2004\)](#) argues that shocks that hit developing countries are different from those that hit developed countries. We argue that even if the shocks are the same, due to sizable informality in developing countries, their economies are less resilient and so “leaning in the wind direction”.

Informality also has implications on fiscal policy through tax base variability. For the sake of arguments, suppose that the size of the informal sector increases in economic downturns. Then, the informal economy further shrinks the tax base during downturns and relaxes it further during booms, contributing for the increased volatility of the tax base. For instance, [Talvi and Végh \(2005\)](#) rely on tax base variability to explain the observed procyclical fiscal policy in developing countries.

Besides economic fluctuations, the size of the informal sector reduces fiscal space by weakening the government’s ability to increase tax revenues and thereby the ability to adopt expansionary fiscal policy, as a larger proportion of economic activity takes place in the informal sector which operates outside government’s control. In this regards, we can take the *buffer box* as the government ability to collect taxes, which, in turn, depends negatively on the imperfection of their own economic structure. Such imperfection is larger, the larger is the size of the informal sector.

Still, the way that the formal and the informal sectors relate may determine the behavior of fiscal policy. For example, consider the [Elgin and Uras \(2013\)](#)’s argument that in a framework with large informal economy, a contractionary fiscal policy (tax rise) can stimulate further the size of the informal sector through of transition of activity from formal to the informal sector. Under this circumstance, countercyclical fiscal policy may be constrained by the size of the informal sector, as the goal to fighting informality is, generally, permanently present in policymakers’ agenda in countries with sizable informal sector. The the size of the informal sector, also, may help to fit the so-called expansionary fiscal contraction. In this line, [Eng \(2010\)](#) state that in the presence of the underground activities with strong complementary demand, high tax policy can turn out to be expansionary,

and vice versa. Putting differently, under complementary effect on market consumption, the high-tax induced expansion of the informal sector and the resulting increases in income earned in that sector could accommodate the decline or even increase the private consumption. Hence, fiscal policy could be procyclical in countries with sizable informal sector.

Moreover, it is arguable that informality is strongly linked to the conventional wisdom on credit market imperfections and political economy channels. So, bringing informality to the research arena of the mechanism influencing procyclical fiscal policy is in order.

2.5 Conclusion

This chapter reviews the literature on cyclicity of fiscal policy in developing countries comparing with that in developed ones, together with the literature rationale for the differences. Following [Kaminsky et al. \(2004\)](#), we select only the studies that use fiscal instrument. Because studies that use tax rate are very few in the literature, we only select studies that use government consumption and/or government spending as fiscal policy indicator. We, then, look at the distribution of the estimates of the cyclicity of these fiscal variables among acyclical, countercyclical and procyclical, for developed and developing countries. We also take the distribution of the results which are corrected from endogeneity problem and omission bias as well (see [Table 2.3](#)). We conclude that the view that fiscal policy is procyclical in developing countries contrasting with the countercyclical or acyclical ones in developed countries has reached the mainstream status. That is, the conducting of procyclical fiscal policy in developing countries can be seen as a stylized fact, while such policy is countercyclical or acyclical in developed countries.

In particular, in a sample of 160 estimates of cyclicity of fiscal policy for developed countries, we conclude that 36,3% are countercyclical, while 24.4% are acyclical, summing up 60.6%. The picture is, however, different for developing countries. In a sample of 344 results, only 3.5% of such results are countercyclical. The remaining, 19.6% are acyclical and 77% are procyclical (see [Table 2.3](#)). Still, among the studies which deliver procyclical fiscal policy for both group of countries, we find that 89% (17 out of 19) constitute evidence that procyclicality is more strong in developing countries. Therefore, evidence-based literature seem to support the phenomenon termed “when it rains, it pours” by [Kaminsky et al. \(2004\)](#). Taking developed and developing countries as a whole, we conclude that only 11.3% (53 out of 471) of the results follow Keynesian prescription. Therefore, empirically, the world seems to roll over a weak neoclassical framework. We observe, however, that most of the literature has not addressed properly at least one of the three: concept, endogeneity, and identification problem. Among the studies that use pol-

icy instrument, only 32% have taken into account endogeneity problem, and only 12.5% correct for both endogeneity and omission bias.

Tests on existing explanations are split between credit channel and political economy channel. We conclude that, although theoretically the literature strongly blames credit constraints and political economy for the observed procyclical fiscal policy, empirically such channels seem weak in explaining the procyclicality of fiscal policy. Analytically speaking, in a sample of 218 results for credit channel, we conclude that only 33.5% of these results support that relaxing credit constraints provide room for conducting counter-cyclical fiscal policy, while 56,5% constitute the evidence that such factors have no effect on cyclicity of fiscal policy. Results on political economy channel appear to distribute symmetrically among positive (30.3%), negative (37%), and null effect (32.6%) on fiscal procyclicality (see [Table 2.1](#)). However, in addition to the above mentioned critics, these result may also exhibit some caveats. While the literature takes credit constraints and political economy as alternative explanations for fiscal procyclicality, we argue that they are not alternative explanations but complementary, being political economy theoretically dominant: if there was no procyclicality during expansion phases, there would not be procyclicality during recessions. Further, developing countries are the default recipients of FDI inflows due to lower labor costs and higher marginal productivity of capital. In spite of that, their fiscal policy mostly behaves procyclically. We end this review by identifying gap in the literature: it does not formalize the informal economy in determining the procyclicality of fiscal policy as well as does not explore electoral effect in the data.

Table 2.3: Bibliometric summary: $\Delta f_t =$ government consumption/spending

Authors	Time span	$(\Delta f_t, \Delta y_t)$	Meth.	Step		Endogen.		Table 2.2		Developed			Developing			Check		
				one	two	yes	no	yes	no	a	c	p	a	c	p	K	C	inc.
Gavin and Perotti (1997)	1970-1995	$(\Delta G_E, \Delta y_t)$	Ols		1		1	1		1							1	
	1970-1995	$(\Delta G_E, \Delta y_t)$	Ols		1		1	1							1		1	
	1970-1995	$(\Delta G_C, \Delta y_t)$	Ols		1		1	1				1					1	
	1970-1995	$(\Delta G_C, \Delta y_t)$	Ols		1		1	1							1(S)		1	
Gavin et al. (1996)	1970-1995	$(\Delta G_E, \Delta y_t)$	Ols		1		1	1				1					1	
	1970-1995	$(\Delta G_E, \Delta y_t)$	Ols		1		1	1							1(S)		1	
Caballero and Krishnamurthy (2004)	1960-2002	(G_{EHP}, y_{HP})	Corr.	NA	NA	NA	NA	1			1					1		
	1960-2002	(G_{EHP}, y_{HP})	Corr.	NA	NA	NA	NA	2							2		2	
Kaminsky et al. (2004)	1960-2003	(G_{EHP}, y_{HP})	Corr.	NA	NA	NA	NA	12		8	2	2				2	10	
	1960-2003	(G_{EHP}, y_{HP})	Corr.	NA	NA	NA	NA	12					4		8	12		
	1960-2003	(G_{EBP}, y_{BP})	Corr.	NA	NA	NA	NA	12		6		6				12		
	1960-2003	(G_{EBP}, y_{BP})	Corr.	NA	NA	NA	NA	12					8		4	12		
Riascos and Végh (2003)	1970-1994	$(\Delta G_C, \Delta y)$	Corr.	NA	NA	NA	NA	1		1						1	1	
	1970-1994	$(\Delta G_C, \Delta y)$	Corr.	NA	NA	NA	NA	1								1	1	
	1970-1994	$(\Delta G_C, \Delta y)$	Corr.	NA	NA	NA	NA		1		1						1	
	1970-1994	$(\Delta G_C, \Delta y)$	Corr.	NA	NA	NA	NA		1				1					1
	1970-1994	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	1		1						1	1	
	1970-1994	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	1							1	1	1	
	1970-1994	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA		1		1						1	1
Talvi and Végh (2005)	1970-1994	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	1				1				1	1	
	1970-1994	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	1							1(S)		1	
Suzuki (2015)	1972-2004	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	1		1						1	1	
	1972-2004	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	1							1	1	1	
Kuralbayeva (2013)	1972-2006	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	1				1				1	1	
	1972-2006	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	1							1(S)		1	
	1972-2006	(G_{SHP}, y_{HP})	Corr.	NA	NA	NA	NA	1			1					1	1	
	1972-2006	(G_{SHP}, y_{HP})	Corr.	NA	NA	NA	NA	1							1	1	1	
	77Q1-11Q2	(G_{CHP}, y_{HP})	VAR	NA	NA	1		1							1	1	1	
Summary (#1)				0	6	1	6	70	4	18	6	12	14	0	20(4)	4	66	4

Table 2.4: Continuation of Table 2.3

Authors	Time span	$(\Delta f_t, \Delta y_t)$	Meth.	Step		Endogen.		Table 2.2		Developed			Developing			Check		
				one	two	yes	no	yes	no	a	c	p	a	c	p	K	C	inc.
Panizza and Jaimovich (2007)	1970-2003	$(\Delta G_C, \Delta y)$	OLS		3		3	3		3							3	
	1970-2003	$(\Delta G_C, \Delta y)$	OLS		9		9	9							9		9	
	1970-2003	$(\Delta G_C, \Delta y)$	IV		2	2		2			2						2	
	1970-2003	$(\Delta G_C, \Delta y)$	IV		8	8		8							8		8	
	1970-2003	$(\Delta G_C, \Delta y)$	IV		3	3		3		3						3		8
	1970-2003	$(\Delta G_C, \Delta y)$	IV		8	8		8				8						8
Woo (2009)	1960-2003	$(\Delta G_E, \Delta y)$	OLS		1		1	1				1					1	
	1960-2003	$(\Delta G_E, \Delta y)$	OLS		5		5	5						5(S)			5	
Thornton (2008)	1960-2004	$(\Delta G_C, \Delta y)$	OLS		37		37	37					5		32		37	
Halland and Bleaney (2011)	1980-2004	$(\Delta G_C, \Delta y)$	OLS		2		2	2			2						2	
	1980-2004	$(\Delta G_C, \Delta y)$	OLS		2		2	2							2(S)		2	
	1980-2004	$(\Delta G_C, y_{HP})$	OLS		1		1	1					1				1	
	1980-2004	$(\Delta G_C, y_{HP})$	OLS		1		1	1							1(S)		1	
	1980-2004	(G_C, y)	OLS		1		1	1					1				1	
	1980-2004	(G_C, y)	OLS		1		1	1							1(S)		1	
Slimane and Tahar (2010)	1980-2007	$(\Delta G_C, \Delta y)$	GMM		4	4		4							4		4	
	1980-2007	$(\Delta G_C, \Delta y)$	GMM	9		9		9							9		9	
Calderón and Hebbel (2008)	1970-2005	$(\Delta G_E, \Delta y)$	OLS	3			3		3		3(S)							3
	1970-2005	$(\Delta G_E, \Delta y)$	OLS	3			3		3				3					3
	1970-2005	$(\Delta G_E, \Delta y)$	IV	4		4		4		4								4
	1970-2005	$(\Delta G_E, \Delta y)$	IV	4		4		4		4					4			4
	1970-2005	$(\Delta G_E, \Delta y)$	IV		2	2		2	1	1							2	2
	1970-2005	$(\Delta G_E, \Delta y)$	IV		2	2		2							2		2	2
Lane (2003) ^a	1960-1998	$(\Delta G_E, \Delta y)$	OLS		22		22	22			9	13				9	13	
	1960-1998	$(\Delta G_C, \Delta y)$	OLS		22		22	22			8	14				8	14	
Khan (2011)	1950-2009	$(\Delta G_E, \Delta y)$	OLS	1			1	1				1					1	
	1950-2009	$(\Delta G_E, \Delta y)$	OLS	1			1	1							1(S)		1	
	1950-2009	$(\Delta G_E, \Delta y)$	Corr.	NA	NA	NA	NA	13			6	7				6	7	
	1950-2009	$(\Delta G_E, \Delta y)$	Corr.	NA	NA	NA	NA	14						2	12	2	12	
Summary (#2)				25	136	46	115	170	18	4	31(3)	40	15	5	80(10)	28	142	18

^aThe author does not reports statistic to check the significance. So, we look at the signal of the estimated cyclicity to discriminate between procyclical and countercyclical cyclicity.

Table 2.5: Continuation of Table 2.3

Authors	Time span	$(\Delta f_t, \Delta y_t)$	Meth.	Step		Endogen.		Table 2.2		Developed			Developing			Check			
				one	two	yes	no	yes	no	a	c	p	a	c	p	K	C	inc.	
Mailhos and Sosa (2000)	1955-1998	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	8						8		8			
	75Q1-99Q1	(G_{CHP}, y_{HP})	Corr.	NA	NA	NA	NA	1						1		1			
Arze del Granado et al. (2010)	1987-2007	$(\Delta G_E, \Delta y)$	OLS		3		3	3		1		2				3			
	1987-2007	$(\Delta G_E, \Delta y)$	OLS		6		6	6					3		3		6		
Akitoby et al. (2004)	1970-2002	$(\Delta G_E, \Delta y)$	OLS		51		51	51					25	1	25	1	50		
Strawczynski and Zeira (2007)	1960-2005	$(\Delta G_E, \Delta y)$	OLS		8		8	8							8		8		
	1960-2005	$(\Delta G_E, \Delta y)$	OLS		6		6	6							6		6		
Frankel et al. (2013)	1960-2009	(G_{EHP}, y_{HP})	Corr.	NA	NA	NA	NA	21			17	4				17	4		
	1960-2009	(G_{EHP}, y_{HP})	Corr.	NA	NA	NA	NA	73						6	67	6	67		
Lane (1998)	1960-1995	$(\Delta G_E, \Delta y)$	OLS		1		1		1	1							1		
Alesina et al. (2008)	1960-2003	(G_{CHP}, y_{HP})	IV	2		2			2	1	1						2		
	1960-2003	(G_{CHP}, y_{HP})	IV	2		2			2				2				2		
Lledó et al. (2011)	1970-2008	$(\Delta LG_S, \Delta Ly)$	OLS		1		1	1		1							1		
	1970-2008	$(\Delta LG_S, \Delta Ly)$	2SLS		1	1	1	1		1							1		
	1970-2008	$(\Delta LG_S, \Delta Ly)$	GMM		8	8	8	8		8							8		
	1970-2008	$(\Delta LG_S, \Delta Ly)$	OLS		2		2	2							2		2		
	1970-2008	$(\Delta LG_S, \Delta Ly)$	2SLS		2	2	2	2							2		2		
	1970-2008	$(\Delta LG_S, \Delta Ly)$	GMM		16	16	16	16					3		13		16		
	1970-2008	$(\Delta LG_S, \Delta Ly)$	GMM	12		12		12					4		8		12		
Ilzetzki and Végh (2008)	60Q1-06Q4	$(\Delta LG_E, \Delta y)$	OLS		1		1	1		1							1		
	60Q1-06Q4	$(\Delta LG_E, \Delta y)$	OLS		1		1	1							1		1		
	60Q1-06Q4	$(\Delta LG_C, \Delta y)$	OLS		2	2	2	2			2						2		
	60Q1-06Q4	$(\Delta LG_C, \Delta y)$	OLS		2	2	2	2							2(S)		2		
	1961-2003	$(\Delta LG_E, \Delta y)$	OLS		1	1	1	1		1							1		
	1961-2003	$(\Delta LG_E, \Delta y)$	OLS		1	1	1	1							1		1		
	1961-2003	$(\Delta LG_C, \Delta y)$	OLS		1	1	1	1			1(S)						1		
	1961-2003	$(\Delta LG_C, \Delta y)$	OLS		1	1	1	1							1		1		
	60Q1-06Q4	$(\Delta G_C, \Delta y)$	2SLS		1	1	1	1		1								1	
	60Q1-06Q4	$(\Delta G_C, \Delta y)$	2SLS		1	1	1	1					1					1	
	60Q1-06Q4	$(\Delta G_C, \Delta y)$	GMM		1	1	1	1		1								1	
	60Q1-06Q4	$(\Delta G_C, \Delta y)$	GMM		1	1	1	1							1			1	
	60Q1-06Q4	$(\Delta G_C, \Delta y)$	SE		1	1	1	1			1(S)							1	
	60Q1-06Q4	$(\Delta G_C, \Delta y)$	SE		1	1	1	1							1			1	
	60Q1-06Q4	$(\Delta G_C, \Delta y)$	VAR		1	1	1	1				1						1	
	60Q1-06Q4	$(\Delta G_C, \Delta y)$	VAR		1	1	1	1							1(S)			1	
	Summary (#3)				16	123	51	88	237	5	17	18	9(2)	38	7	148(3)	24	214	5
	SUMMARY= Summary (#1)+Summary (#2)+Summary (#3)				41	265	98	209	477	27	39	55(3)	61(2)	67	12	248(17)	56	422	27

Informal Sector Over The Business Cycle

3.1 Introduction

While business cycle regularities have been largely studied in the literature with reference to “official” or “observable” output, there is still no unified set of stylized facts when the informal (hidden, shadow, parallel, underground, *etc.*) sector or even informal output is also accounted for. Actually, an extensive body of the literature is rather comprehensive regarding the definition and conceptualization of the informal economy.¹ There is, however, a degree of ambiguity in what regards to the dynamics of the informal sector over the business cycle. For instance, some theoretical and empirical studies argue in favor of countercyclical behavior of the informal sector (among them, [Carillo and Pugno \(2004\)](#), [Bowler \(2006\)](#), and [Dell’Anno \(2008\)](#)) while others support a procyclical behavior of the size of the informal economy (including [Giles \(1997\)](#), [Bajada \(2003\)](#), [Kucera and Galli \(2003\)](#), and [Busato and Chiarini \(2004\)](#)).

Furthermore, the informal sector appears as a possible explanation of some phenomenon of the “official” business-cycle, particularly, in developing countries: it is observed that the informal sector is larger in less developed countries ([Schneider et al. \(2010\)](#), [Elgin and Oztunali \(2012\)](#)), which are also characterized by procyclical fiscal policy ([Gavin and Perotti \(1997\)](#), [Ilzetzi and Végh \(2008\)](#)) and a larger “official” economic fluctuations ([Aguar and Gopinath \(2007\)](#)); although with ambiguity, the literature on the informal sector in developed countries points to a positive relationship between the formal and the informal sector, while in less developed countries a negative relationship

¹For a survey, see, *e.g.*, [Gerxhani \(2004\)](#) and the references therein.

appears to be more dominant (Gerxhani (2004), Schneider (2005)).² Schneider (2005) and Elgin and Oztunali (2012) find a declining trend of the underground sector over time. Stock and Watson (2005) found that volatility of the official output in most G7 countries had moderated over the past 40 years. Therefore, validating and systematizing knowledge about these facts are in order.

While it is rather straightforward that country characteristics such as law, institutional rules, education, among others, account for the size of the informal economy, it is also true that the controversy regarding to the business cycle dynamics of the informal sector is, to a large extent, related with the underlying definition of informality. For example, consider the definition based on tax evasion or unreported income.³ It is likely that the amount of tax evasion moves procyclically: it increases during booms while decreases during downturns. Contrarily, a definition based on the firm size may be negatively related with the official business cycle. For example, Sethuraman (1976) claims that firms with less than ten persons employed should be considered part of the informal sector. International Labour Organization (ILO) also associates informality to the size of firms (all those with fewer than 5 or 10 workers, are consider informal). Thus it is reasonable to expect that during booms firms hire more workers to face increases in demand, and, thus, are no longer considered informal.

In this chapter, we first estimate the size of the informal economy using a general equilibrium model (GEM) approach as in Elgin and Oztunali (2012). In fact, we are looking to address the following questions: 1) Does the level of GDP a country matter for the size of the informal sector? 2) How volatile is the size of the informal sector? 3) Does the size of the informal sector moves pro or countercyclically? 4) How persistent are the fluctuations of the informal output? 5) Are fluctuations in the underground sector symmetric across cycle phases? 6) Does the underground sector affect the cyclical stance of fiscal policy and the behavior of the observed output?

In particular, section 3.2 deals with data, detrending methods and provides estimates of the size of the informal sector. Section 3.3 answers the first three questions. Questions 4 and 5 are addressed in section 3.4, and question 6 in section 3.5. Lastly, section 3.6 concludes.

²Consider the arguments that whenever there is a negative shock on the formal sector, individuals become more involved in the informal sector's activities due to the lack of alternative ways of earning a living (Lubell (1991)). Of course this appears to be more prevalent in the poor/developing countries where there is less support from social benefits, sub-minimum wages and poor working conditions. Therefore, it is more likely to a countercyclical behavior of the informal sector in developing countries. In regards to the cyclicity of government consumption, one may relate this fact with the argument that agents in the informal sector undermine tax collection and thus reduce the government's ability to smooth consumption during downturns.

³Among others, Feige (1990) and Schneider (2005) rely on this criteria to characterize the informal sector.

3.2 Estimates of the informal economy

3.2.1 Model to estimate the size of the informal economy

Following [Elgin and Oztunali \(2012\)](#) we estimate the size of the informal economy for each country using a (deterministic) Two-Sector Dynamic General Equilibrium model.⁴ This methodology is inspired particularly by the Lucas Critique (Lucas, 1976) as it relies on the use of microeconomic foundations. In this set up the economy has two sectors of production: a formal denoted by (F), and the informal/shadow denoted by (S). The infinitely-lived household solves

$$\max_{\{C_t, I_t, N_{S_t}, N_{F_t}\}_{t=0}^{\infty}} \sum_{n=0}^{\infty} \beta^n U(C_t) \quad (3.1)$$

$$s.t. \quad C_t + I_t = (1 - \tau_t)\theta_{F_t}K_t^\alpha N_{F_t}^{1-\alpha} + \theta_{S_t}N_{S_t}^\gamma \quad (3.2)$$

$$K_{t+1} = I_t + (1 - \delta)K_t \quad (3.3)$$

$$N_{S_t} + N_{F_t} = H_t \quad (3.4)$$

Economic agents distaste economic fluctuations. Thus we assume that utility function $U(\cdot)$ is strictly concave. The output of the economy (formal and informal) is directed to household consumption (C_t), investment (I_t), and government consumption (G_t) through taxing formal output at a tax rate $\tau_t \in [0, 1]$. [Equation \(3.2\)](#) is the representative household's resource constraint, [Equation \(3.3\)](#) is the law of motion of capital (K_t), and [Equation \(3.4\)](#) is the household's time endowment for the supply of labour in each period t , being N_{F_t} is the amount of time devoted to the formal sector and N_{S_t} is the amount of time devoted to the informal sector. θ_{F_t} and θ_{S_t} are, respectively, the level of productivity in the formal and in the informal sector. Taking the steady state conditions of household's problem and assuming a logarithmic utility of consumption, the model is then calibrated to get out time-varying estimates of the size of the informal sector as a ratio of formal sector: $\frac{s_t}{y_t} = \frac{\theta_{S_t}N_{S_t}^\gamma}{\theta_{F_t}K_t^\alpha N_{F_t}^{1-\alpha}}$.

3.2.2 Sample and data filtering

Here we describe shortly the range of countries as well as the detrending and the filtering procedures used in this work. The sample of countries consists of 105 countries (37 poor, 46 emerging and 22 rich countries).⁵ We follow [Uribe and Schmitt-Grohé \(2016\)](#) to define poor countries as those with average PPP converted GDP per capita is U.S. dollars

⁴See [Elgin and Oztunali \(2012\)](#) for more details of the model and how to achieve the size of the informal sector.

⁵The groups of poor, emerging and rich countries are listed in Annex 1.

of 2005 over the period 1990 to 2009 within the interval $[0, 3.000]$; emerging countries with GDP per capita between 3.000 to 25.000 and rich countries all within the interval $[25.000, \infty]$. Data are in annual frequency from the period 1980 to 2011. The choice of the sample period is to allow us to include the largest number of countries as possible as well as to compare business cycle regularities across-countries. Data come from Penn World Tables (PWT) expressed in national currency and in constant 2005 national prices.⁶ The choice of data in national currency is to avoid the variation of exchange rate in the data.

The business cycle regularities are characterized, in this work, in light of the definition presented by Lucas (1977) and the technical procedure proposed by Kydland and Prescott (1990). That is, business cycle phases are deviations of aggregate real output from its trend. Thus we extract from the raw time series data the cyclical component of a variable Z_t using Hodrick-Prescott (HP) filter. Other methodologies, like First Difference (FD) and Log-Quadratic Detrending (LQ), are used as well. These allow us to check the strength of the regularities found in the data, presented later on.

The procedures are as follows: let Z_t be a times series data, in logs, for $t = 1, 2, \dots, T$. The trend component denoted by τ_t is the one that solves

$$\min_{\{\tau_t\}_{t=1}^T} \sum_{t=1}^T (Z_t - \tau_t)^2 + \lambda \sum_{t=2}^T [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \quad (3.5)$$

where the parameter λ works like a gauge between the cyclical component $(Z_t - \tau_t)$ and the trend component $[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]$. The larger the value of λ , the higher is the penalty for trend component. In line, the log-quadratic detrending is the result of applying the OLS estimator on the equation

$$Z_t = \beta_0 + \beta_1 t + \beta_2 t^2 + \epsilon_t \quad (3.6)$$

where $\beta_0, \beta_1, \beta_2$ are parameters to be estimate and t is time variables. First differencing is achieved by applying the lag operator (L) on raw time series data

$$(1 - L)Z_t = \epsilon_t \quad (3.7)$$

From the equations (3.5), (3.6) and (3.7) the estimates of the cycles are $(Z_t - \hat{\tau}_t)$, $(Z_t - \hat{\beta}_0 - \hat{\beta}_1 t - \hat{\beta}_2 t^2)$ and $(1 - L)Z_t$, respectively. In the same order, the trend component are $\hat{\tau}_t$, $\hat{\beta}_0 + \hat{\beta}_1 t + \hat{\beta}_2 t^2$ an $X_0 + \hat{\theta}t$.⁷

To illustrate how each of these methods performs, we decompose the log of U.S. per capita GDP into trend and cyclical component using HP filter (Figure 3.1) and log-

⁶For a complete description of data see Feenstra et al. (2015)

⁷The trend from first differencing is obtained by assuming a random walk with drift.

quadratic detrending (Figure 3.2) over the period 1950 to 2011. Both methods succeed in identifying a list of recessions (shaded areas) in the U.S.

Figure 3.1: HP filter, $\lambda = 100$

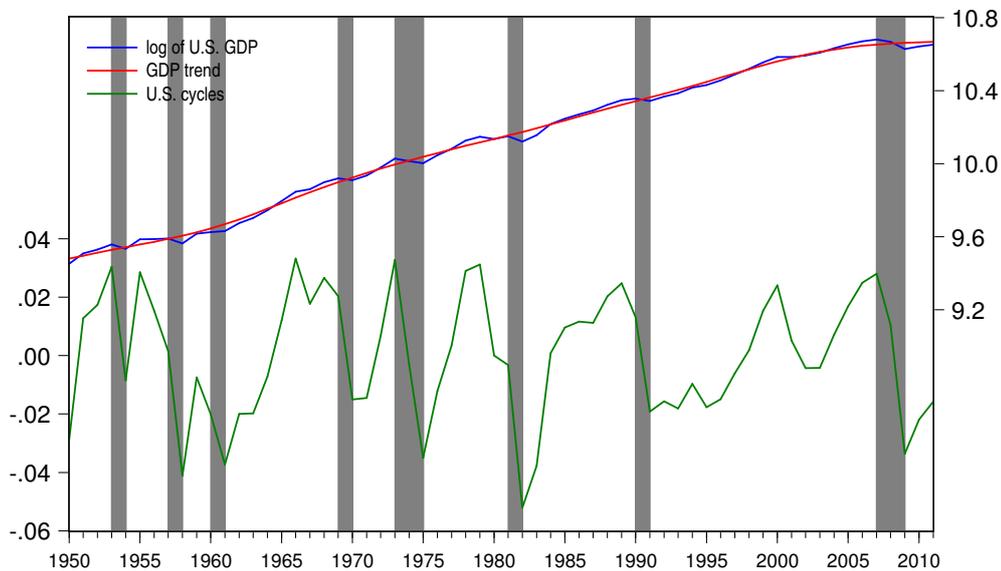
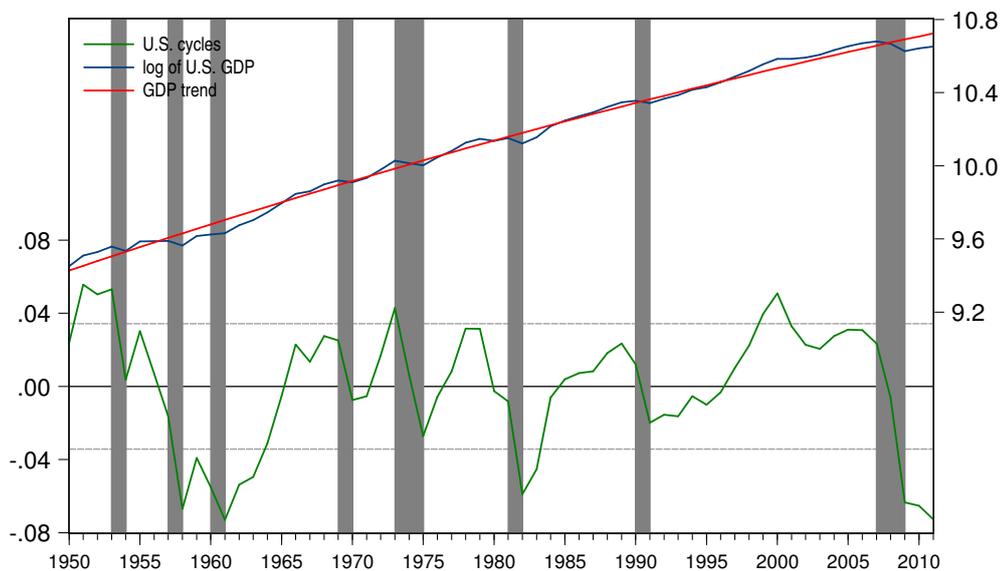


Figure 3.2: Log-Quadratic detrending (LQ)



3.3 Empirical facts of the informal economy

3.3.1 Long run features of the informal economy

As we pointed out above, the controversy regarding the business cycle dynamics of the informal sector stems, to a large extent, from the definition of informality. To put our measure of informality into perspective, we start from the household's resource constraint in [Equation \(3.2\)](#). A causal inspection at that equation allows us to deduce the definition of our measure of the estimated informal economy. It is a more general definition as it includes most of the criteria used to define the informal economy (*e.g.*, status of labor, tax evasion, size of activity). *It is all economic activity that takes place outside of government control.* [Figure 3.3](#) illustrates how the relative size of the informal economy to GDP (s/y) has evolved over time and across-countries. It plots the average of the relative size of the informal economy to GDP for poor, emerging and rich countries over the period 1980 to 2011. U.S. are used as benchmark. [Figure 3.3](#) shows that the relative size of the informal sector to real output is larger in poor than rich countries.

Stylized fact 1. - *The size of the informal sector, in percentage of official output, relates negatively with the level of development. The estimates suggest that the larger the level of development of a country the smaller is the size of the informal sector as % of GDP.*

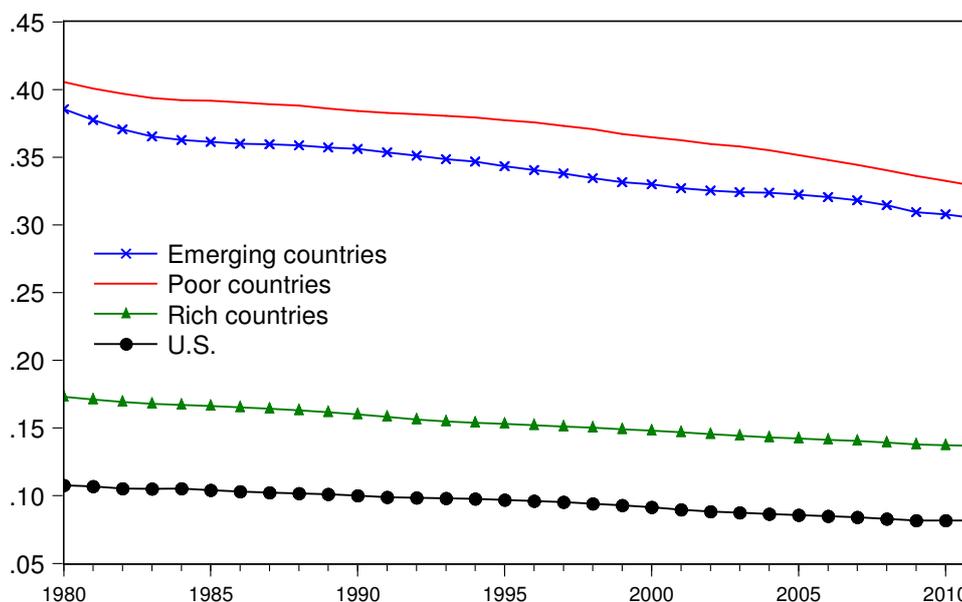
This result holds also in studies using other methods for estimating the size of the informal economy. Among them, studies relying on the *input* and *currency* demand approaches (see *e.g.*, [Schneider and Enste \(1999\)](#)) and on the DYMIMIC approach ([Schneider \(2005\)](#) and [Schneider et al. \(2010\)](#)), find that the size of the informal sector is larger in less developed countries than in developed ones. According to [Renooy \(1990\)](#) the existence of some sort of the underground activity is due to the "opportunity" factors (like individual background, *e.g.*, skill, education, living standard) and geographical factors. It is almost obvious that, in fact, these "opportunity" factors may explain the larger size of the informal economy as % of GDP in poor countries than in rich ones as the share of individuals with feeble background is higher in poor countries. Findings consistent to this argument are presented in [Maurizio \(2014\)](#). The author finds that both formality rate and the speed of the formalization process grow with the educational levels.⁸ In line, [Figure 3.3](#) shows a declining trend of the share of the informal economy to GDP over time.

Stylized fact 2. - *There is a declining trend of the relative size of the informal economy to GDP; the rate of reduction is higher, and rather similar, in poor and emerging coun-*

⁸Formality rate is measured, in [Maurizio \(2014\)](#), as the proportion of non-formal individuals (non-registered wage earners, non-wage earners, unemployed and inactives) in t that become formal in $t + 1$.

tries when compared to rich countries. The estimates suggest that the declining rate of the share of the informal economy to GDP increases from rich to poor countries.

Figure 3.3: The size of the informal sector over time (1980 to 2011)



This fact is also supported by earlier studies of [Schneider et al. \(2010\)](#) who uses DYMIMIC approach (referred there as MIMIC method) to estimate the size of the shadow economy. The larger declining trend in poor and emerging countries compared to that observed in rich countries may be attributed to the policy changes, ranging from employment guarantee schemes (including written contracts and minimum wage regulation) to cash benefits for vulnerable groups and policies to promote formal enterprises. Accordingly to ILO's (2014) report, in the past decade, a number of Latin American countries have developed mechanisms to facilitate transitions of workers from the informal to the formal employment. For instance, mechanisms such as strengthening labour inspection, tax benefits for small and micro-enterprises, social protection, and facilities on registration process for informal firms are outstanding in Brazil and Argentina ([Maurizio \(2014\)](#)), while most of these procedures/mechanisms have already been established in rich countries.⁹

⁹We also explore how the estimated size of the informal economy is related to the size of a country (measured by the size of population). Expectedly, results do not support any relationship between them; apparently facts that attainment the informal economy, like institutional rules, laws and education differ across countries but are rather independent of country's size.

3.3.2 Informal sector over the business cycle

Table 3.1 reports sample standard deviations of selected variables. The variables represent the cyclical components of the official output per capita (y), the informal economy per capita (s), output inclusive the informal economy per capita ($s + y$), private consumption per capita (c), investment (i), government consumption (g), export (x) and import (m), all in per capita terms. The statistics are averaged over poor, emerging and rich countries. Statistics under the heading “All Countries” are achieved by taking the population-weighted average of each statistic across all countries. The cyclical component of each variable (in logs) was obtained by applying alternative detrending/filtering methods: Hodrick-Prescott filter (HP), log-quadratic detrending (LQ) and first differencing method (FD).

First of all, the results of all detrending methods confirm a stylized fact in the literature (see, e.g., [Uribe and Schmitt-Grohé \(2016\)](#)): *less developed countries are more volatile than the developed counterparts*. This fact is more pronounced in the components of aggregate output. Furthermore, results in Table 3.1 are close to those reported by [Stock and Watson \(2002\)](#) with respect to U.S. and to those of [Backus et al. \(1993\)](#) for 10 developed countries.

A striking result is that, both private consumption and government consumption, on average, are more volatile than output under the heading “All Countries.” However, when we consider countries by group, the reading is different: *on average, the volatility of government and private consumption is smaller than that of output in rich countries*. These findings, supported by all filtering methods we use, appears to be according to the permanent income hypothesis or still that the Keynesian prescriptions are working in these countries. Broadly speaking, result highlights that: *output in rich countries is less volatile than that in poor countries; investment stands for the more volatile component of aggregate output; contrarily to poor and emerging countries, governments in rich countries appear to smooth their own consumption as well as allowing/helping households to smooth their consumption as well*. However, looking for U.S., especially as benchmark, these findings do not hold at all.

Table 3.1: Volatility of the selected variables: $\sigma_z = \text{standard deviation of variable } z_t$

	U.S.			All Countries			Poor Countries			Emerging Countries			Rich Countries		
	HP	LQ	FD	HP	LQ	FD	HP	LQ	FD	HP	LQ	FD	HP	LQ	FD
σ_y	1.88	2.60	1.97	2.78	3.65	2.83	3.68	5.30	4.14	3.76	5.35	4.02	2.64	3.98	2.62
σ_s	2.00	2.44	2.26	2.84	3.63	2.87	3.81	5.23	5.27	4.05	5.72	4.27	2.72	4.04	2.67
$\sigma_{(y+s)}$	1.90	2.58	1.99	2.78	3.62	2.83	3.54	4.79	4.02	3.81	5.38	4.06	2.65	3.99	2.62
σ_s/σ_y	1.06	0.94	1.14	1.03	0.99	1.02	1.44	1.04	1.05	1.08	1.08	1.09	1.06	1.03	1.04
σ_c/σ_y	0.95	1.04	0.83	1.38	1.48	1.44	1.64	1.50	1.71	1.67	1.52	1.81	0.91	0.92	0.88
$\sigma_c/\sigma_{(y+s)}$	0.95	1.05	0.83	1.38	1.50	1.44	1.64	1.53	1.71	1.65	1.51	1.80	0.91	0.92	0.87
σ_i/σ_y	3.98	4.46	4.28	3.63	3.49	3.84	5.39	5.17	5.69	4.32	3.98	4.71	3.68	3.25	3.79
$\sigma_i/\sigma_{(y+s)}$	3.96	4.50	4.24	3.62	3.54	3.84	5.34	5.26	5.70	4.33	3.94	4.67	3.66	3.24	3.77
σ_g/σ_y	1.12	1.49	0.92	2.19	2.21	2.19	3.18	3.02	3.21	1.51	1.48	1.85	0.81	0.85	0.81
$\sigma_g/\sigma_{(y+s)}$	1.12	1.50	0.91	2.18	2.24	2.19	3.18	3.08	3.22	1.49	1.47	1.84	0.81	0.85	0.81
σ_x/σ_y	3.29	3.37	2.93	3.23	3.37	3.52	4.34	4.32	4.25	2.55	2.47	2.72	2.08	2.27	2.36
$\sigma_x/\sigma_{(y+s)}$	3.28	3.40	2.91	3.21	3.43	3.53	4.31	4.40	4.26	2.52	2.42	2.70	2.06	2.26	2.34
σ_m/σ_y	3.24	3.40	3.23	4.21	3.99	4.29	3.91	3.84	3.81	3.38	3.23	3.44	2.44	2.33	2.60
$\sigma_m/\sigma_{(y+s)}$	3.23	3.44	3.19	4.19	4.05	4.30	3.89	3.95	3.81	3.33	3.22	3.41	3.42	2.32	2.59

Our focus in this work is on the business cycle facts of the informal sector. The remaining of this section and the following sections try to document the key aspects of the business cycle of the informal sector. Throughout performing this task we will try to explore some mechanisms, with the aim to explain how the informal and the formal sectors are related.

The first fact that emerges from [Table 3.1](#) is that the unofficial output is only slightly more volatile than the official counterpart. Across all detrending methods, on average, the informal sector is 3 to 8 percent more volatile than the official output.

Stylized fact 3. - *The informal output tends to be more volatile than the official output. The informal economy appears to fluctuate slightly more than its formal counterpart, ranging in the interval [3, 8], in percentage terms.*

The volatility of the informal sector should be interpreted in the light of its features. For instance, in a theoretical model of the informal sector, [Renooy \(1990\)](#) documents some distinct features of the informal economy compared to the formal one. Among them are the higher degree of flexibility and low entrance threshold compared to the formal sector. Thus it is likely that, under these features, *ceteris paribus*, the informal output is more volatile than the one under low degree of flexibility and higher entrance threshold. The volatility of the official output including the informal economy, $(\sigma_{(s+y)})$, does not appear to differ from the volatility of output, (σ_y) , on average. The relative volatility, for instance, of consumption with respect to output inclusive the informal economy, $(\sigma_c/\sigma_{(y+s)})$, only presents a maximum difference of 0.03 in only one record. For most of the records (see the fifth and sixth rows in [Table 3.1](#)) the values of that statistic are the same.

To further analysing the cyclical features of the informal economy, [Table 3.2](#) displays the average of contemporaneous correlations across poor, emerging and rich countries. It reports the $corr[s_t, y_t]$, $corr[s_t/y_t, y_t]$, $corr[z_i, y_t]$, $corr[z_i, (y_t + s_t)]$, $corr[z_i/y_t, y_t]$ and $corr[z_i/(y_t + s_t), (y_t + s_t)]$, where z_i stands for the cyclical components of the respective variable. Here, two variables are said procyclical if they move in the same direction, contracyclical if move in the opposite direction and acyclical when we do not identify a clear comovement between them. Therefore, the degree of the co-movement is given by contemporaneous correlation coefficient. The first feature we observe in [Table 3.2](#) is that the absolute size of the informal economy is strongly procyclical. The correlation of real output with the informal economy is close to 1 in all groups of countries. All components of the aggregate output are procyclical, even when we consider the size of the informal sector. For instance, the correlation of private consumption with output ranges within the interval $[0.52, 0.93]$, increasing from poor to rich countries. However, the lower comovement between c_t and y_t seems to be a consequence of higher volatility of private

consumption in poor countries relative to rich ones, rather than consequence of consumption smoothing in poor countries (see [Table 3.1](#)). Government spending is procyclical on average. The striking result is regarding to U.S. where the cyclical component of government spending delivered by LQ and FD are countercyclical. Still, it is noteworthy that government consumption, being more volatile in less developed countries (see [Table 3.1](#)), presents a more pronounced procyclicality in these countries, particularly in the emerging countries (see [Table 3.2](#)). Therefore, the Keynesian prescription seems to work only in the U.S.

Stylized fact 4. - *The absolute size of the informal economy is strongly procyclical. The size of the informal economy moves in the same direction with real output for all countries, independently of the country's income level. The degree of comovement increases from less developed to more developed countries.*

What can explain this homogeneous co-movement and heterogeneous degree of comovement between the informal economy and the real official output across different development levels? While the comovement itself might be related to the definition of informality and its measurement, the degree of comovement is, to a large extent, related to how the type of informality presented in these countries are related to the formal sector. As argued in [Kuehn \(2014\)](#), informality in high-income countries is highly integrated into the formal economy while in less developed countries informality is highly related to labor market issues and most of them working independently of formal sector and supported mostly by low skill individuals. For instance, still referred in [Kuehn \(2014\)](#), in Germany (rich country), among those individuals working full-time in the formal sector, 43% are also working in the informal sector. United Nations Economic and Social Council (2006) documents that 6% of the population in the developed region of the world is living in slums compared with 43% in developing countries. Having said that, if we observe a one-to-one co-movement between the informal and the formal activity in rich countries, we should observe positive correlation but smaller than one in poor countries.

Table 3.2: Correlation between the selected variables and output (y_t), and output inclusive the size of the informal sector, ($s_t + y_t$)

	U.S.			All Countries			Poor Countries			Emerging Countries			Rich Countries		
	HP	LQ	FD	HP	LQ	FD	HP	LQ	FD	HP	LQ	FD	HP	LQ	FD
$\rho_{[s,y]}$	0.97	0.96	0.98	0.96	0.94	0.95	0.80	0.74	0.93	0.96	0.93	0.94	0.98	0.97	0.98
$\rho_{[s/y,y]}$	0.12	-0.36	0.49	-0.04	-0.16	-0.06	-0.07	-0.21	-0.11	0.16	0.05	0.13	0.20	0.09	0.17
$\rho_{[c,y]}$	0.91	0.93	0.88	0.74	0.74	0.72	0.52	0.53	0.53	0.70	0.71	0.68	0.79	0.80	0.72
$\rho_{[c,(s+y)]}$	0.91	0.93	0.88	0.73	0.74	0.70	0.51	0.51	0.53	0.69	0.70	0.67	0.78	0.80	0.72
$\rho_{[c/y,y]}$	-0.30	-0.04	-0.56	-0.13	-0.07	-0.17	-0.24	-0.27	-0.17	-0.00	-0.03	-0.08	-0.39	-0.38	-0.49
$\rho_{[c/(s+y),(s+y)]}$	-0.23	0.16	-0.52	-0.15	-0.06	-0.22	-0.24	-0.21	-0.19	-0.05	-0.07	-0.12	-0.41	-0.40	-0.50
$\rho_{[i,y]}$	0.87	0.90	0.92	0.73	0.72	0.64	0.48	0.45	0.44	0.66	0.66	0.63	0.82	0.81	0.77
$\rho_{[i,(s+y)]}$	0.88	0.90	0.92	0.74	0.73	0.65	0.50	0.46	0.47	0.67	0.67	0.64	0.82	0.81	0.77
$\rho_{[i/y,y]}$	0.79	0.84	0.87	0.54	0.50	0.45	0.31	0.26	0.28	0.51	0.49	0.47	0.68	0.65	0.61
$\rho_{[i/(s+y),(s+y)]}$	0.81	0.85	0.88	0.55	0.51	0.45	0.33	0.28	0.30	0.52	0.49	0.48	0.68	0.63	0.61
$\rho_{[g,y]}$	0.16	-0.09	-0.12	0.31	0.33	0.26	0.28	0.25	0.20	0.36	0.36	0.32	0.17	0.21	0.11
$\rho_{[g,(y+s)]}$	0.15	-0.10	-0.13	0.29	0.32	0.25	0.27	0.28	0.21	0.34	0.32	0.29	0.16	0.20	0.10
$\rho_{[g/y,y]}$	-0.59	-0.61	-0.77	-0.24	-0.17	-0.30	-0.09	-0.08	-0.15	-0.40	-0.40	-0.40	-0.73	-0.72	-0.74
$\rho_{[g/(s+y),(s+y)]}$	-0.58	-0.59	-0.77	-0.25	-0.17	-0.32	-0.11	-0.08	-0.18	-0.44	-0.43	-0.44	-0.74	-0.71	-0.75
$\rho_{[x,y]}$	0.30	0.11	0.55	0.32	0.15	0.31	0.43	0.46	0.37	0.41	0.47	0.38	0.64	0.65	0.68
$\rho_{[x,(s+y)]}$	0.31	0.12	0.55	0.32	0.16	0.31	0.39	0.39	0.33	0.43	0.48	0.39	0.63	0.65	0.68
$\rho_{[x/y,y]}$	0.00	-0.18	0.24	-0.02	-0.16	0.02	0.12	0.11	0.06	-0.03	0.02	-0.04	0.17	0.23	0.32
$\rho_{[x/(s+y),(s+y)]}$	0.02	-0.14	0.25	-0.02	-0.15	0.00	0.12	0.12	0.05	-0.04	0.02	-0.05	0.16	0.22	0.31
$\rho_{[m,y]}$	0.89	0.92	0.89	0.60	0.48	0.56	0.41	0.38	0.38	0.61	0.59	0.57	0.83	0.81	0.78
$\rho_{[m,(s+y)]}$	0.89	0.92	0.89	0.60	0.49	0.56	0.41	0.37	0.38	0.62	0.90	0.58	0.83	0.81	0.78
$\rho_{[m/y,y]}$	0.78	0.85	0.79	0.40	0.25	0.36	0.13	0.08	0.10	0.37	0.33	0.32	0.57	0.53	0.50
$\rho_{[m/(s+y),(s+y)]}$	0.79	0.85	0.80	0.41	0.26	0.36	0.14	0.10	0.11	0.37	0.32	0.32	0.56	0.51	0.50

How about the $\text{corr}[z_i, (s_t + y_t)]$? There is no evidence supporting any difference between $\text{corr}[z_i, y_t]$ and $\text{corr}[z_i, (s_t + y_t)]$. However, when we consider the share of variables, $\text{corr}[z_i/y_t]$, the results changes substantially. Government spending and private consumption as a share of official output, on average, are countercyclical for all countries' group. Given that $\text{corr}[g_t/y_t, y_t] > 0$, this result constitutes the evidence that the percentage changes of g_t , over business cycle, are smaller than the percentage changes in y_t . However, the countercyclical of the share of government spending to GDP is less strong in poor countries or, being even acyclical; evidencing that, actually, g_t is procyclical in those countries. Similar reading is possible in the other selected variables.

To better qualify the relation among variables, [Figures 3.4](#) and [3.5](#) report the distribution of contemporaneous correlation delivered by HP.¹⁰ In each column, from upper left to lower left output of the [Figure 3.5](#), are the correlations between (i) output per capita and the size of the shadow economy per capita, (ii) output per capita and the size government spending per capita, (iii) the size of the shadow economy per capita and the size of government spending per capita and (iv) output inclusive the informal sector per capita and the size of government spending per capita. Statistics of poor countries are denoted by $(x_{P,t})$ in first column. Second column is the statistic of emerging countries $(x_{E,t})$ and the last column contains the statistic of rich countries $(x_{R,t})$. [Figure 3.5](#) displays the same statistics in terms of ratio of the variables to output and output inclusive the informal sector, which allow us to compare the relative changes of variables over the business cycle. The tail of distribution of the statistic for each country's groups and for each selected variables gives us more information than focusing only on the statistics' averages.

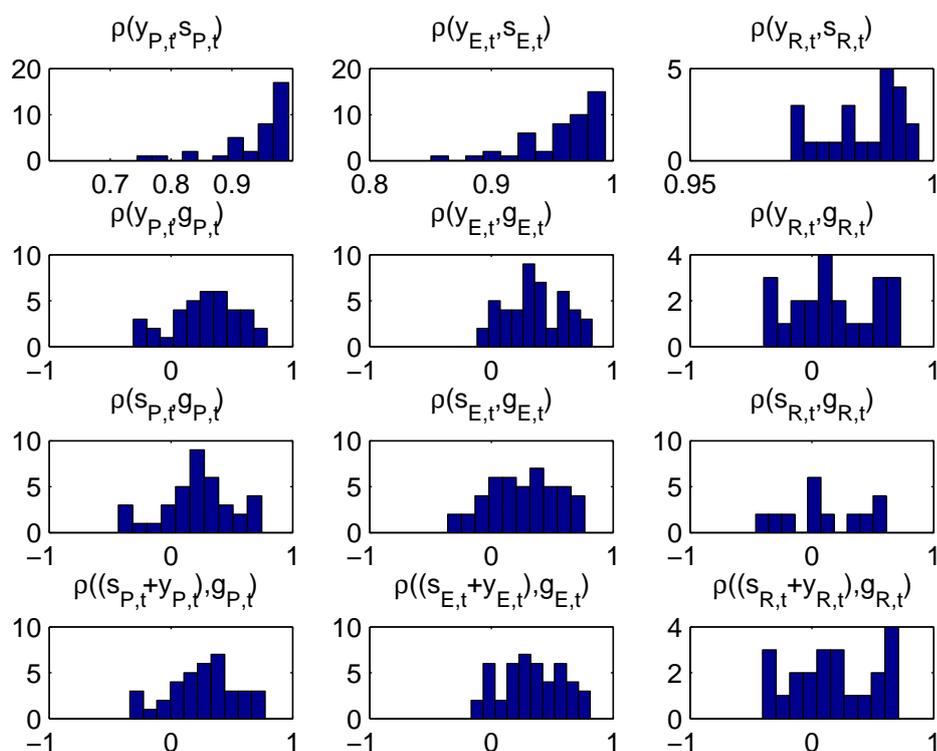
While the values of $\text{corr}[y_t, s_t]$ in [Figure 3.4](#), for all groups of countries, lie in the right-hand side of zero, the values of $\text{corr}[y_t, s_t/y_t]$ present discrepancy over country's group: most of poor countries have values of $\text{corr}[y_t, s_t/y_t]$ in the left-hand side of zero, while in emerging and rich countries the values of this statistic for most of countries lie in the right-hand side of zero. This finding, supported by both methods (see [Figures 4](#) and [6](#) in Appendix A), along with *Fact 5*, constitutes the evidence that, in emerging and rich countries, the percentage changes of the informal sector tend to be larger than the percentage changes of the official output over the business cycle, while in poor countries the percentage changes of the informal sector tend to be smaller than the percentage changes of official output.

Stylized fact 5. - *The size of the informal economy relative to the official output tends to be countercyclical (or anything acyclical) in poor countries while weakly procyclical in emerging and rich countries. Given Fact 5, the percentage changes of the informal sector, in emerging and rich countries, over the business cycle, tend to be larger than*

¹⁰The results of LQ and FD are presented in Appendix A.

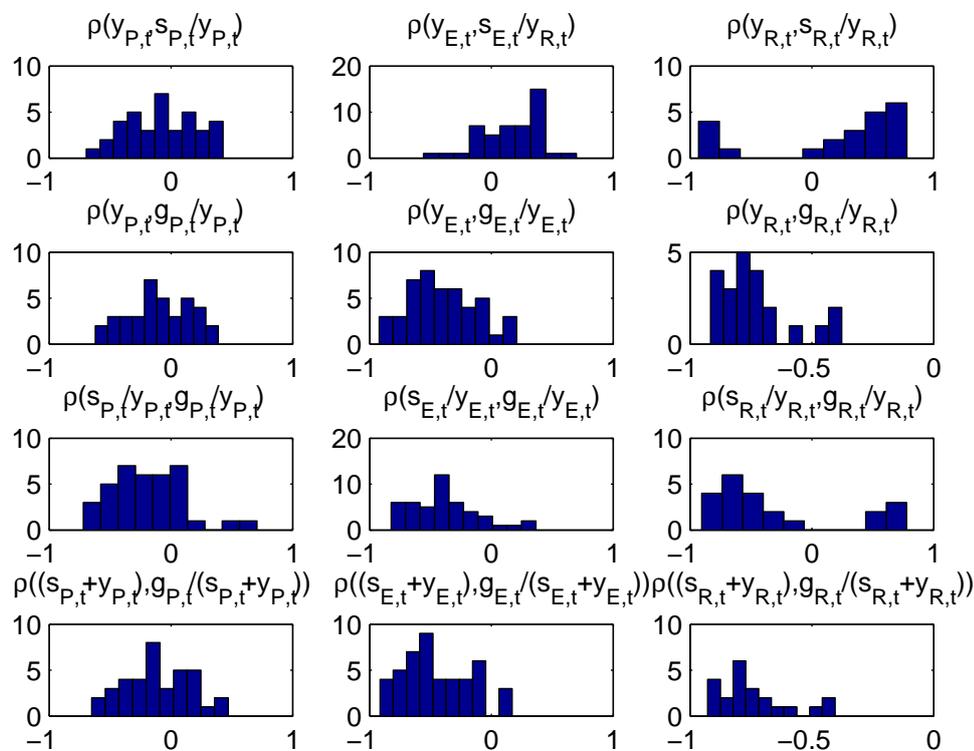
the percentage changes in the official output, while the opposite seems to hold in poor countries.

Figure 3.4: Distribution of correlations between y_t and s_t ; y_t and g_t ; s_t and g_t ; and between $(s_t + y_t)$ and g_t delivered by HP



This finding may be reflecting both the features of business cycle fluctuations in less developed countries comparing to developed ones as well as the type of informality present in each group of countries. Consider the argument linking informality in developed countries of being mainly linked to tax evasion (Kuehn (2014)). In this set up, the informal sector may be complementary to the formal one, while in poor countries the substitution is likely to prevail. In poor countries, most of informality is supported by vulnerable low skill workers, credit-constrained entrepreneurs and self-employed individuals (Ihrig and Moe (2004)). Thus this type of informality is less dependent of official business cycle than the one that emerges from opportunities created by official activities (tax evasion). Putting differently, even though both types of informality move positively with the formal sector, the sort of informality present in poor countries moves at smaller pace than the official output does in poor countries, while the reverse occurs in rich countries.

Figure 3.5: Distribution of correlations between y_t and s_t/s_t ; y_t and g_t/y_t ; s_t/y_t and g_t/y_t ; and between $(s_t + y_t)$ and $g_t/(s_t + y_t)$ delivered by HP



In regards to government consumption, despite of both methods confirm its procyclicality, HP filtering delivers 5 poor (in 37), 4 emerging (in 46) and 7 rich (in 22) countries with countercyclical (or acyclical) government spending. Further, evidence suggests that in most of the countries of the sample government spending and the informal economy move in the same direction.

Stylized fact 6. - *The informal economy is positively correlated with government consumption. The absolute size of the informal economy moves in the same direction with government spending, particularly, in poor and emerging countries. However, in rich countries this fact does not hold at all.*

This fact sheds light on the behavior of government consumption over the business cycle in the three groups of countries as well as the effect of the informal sector for that behavior. Given that government consumption is strongly procyclical in poor and developing countries, together with *Fact 5*, we may anticipate that the larger is the size of the informal sector, the greater is the degree of correlation between official output and government consumption. Furthermore, this result constitute an evidence to the idea that

informality in rich countries is intrinsically linked to the formal one. For example, a consistent explanation for rich countries (particularly for U.S.), is to assume that tax rate has positive effect on the informal economy (tax evasion) and that it is also a substitute of government consumption. So, we should observe a countercyclical government consumption in that framework. In line, [Davis and Henrekson \(2004\)](#) find a positive and significant relation between tax rate and the size of the informal sector in 14 high-income OECD countries. [Malaczewska \(2013\)](#) in a normal form game, analyses the effects of “useful government expenditures”¹¹ on the size of the underground economy. The author concludes that whenever wage in the underground sector is significantly larger than the gross wage in the formal sector, government spending on public goods and services which meet the needs of households makes the informal economy to increase. On the contrary, if wage in the shadow sector is smaller than gross wage in the formal sector, the increase of “useful government spending” leads to a decline in the shadow economy, apparently, because households realize the benefits of paying taxes. Given these findings under the facts that poor (rich) countries are characterized by low (high) wage in the formal sector and higher (attenuated) unemployment rate, while the informal sector is attractive due to the ability to circumvent taxes and sometimes providing high benefits, together with the low (high) quality of public institutions in poor (rich) countries undermines (strengths) the effectiveness of applying the penalties on informality; we conclude that *Fact 6* is consistent to [Malaczewska \(2013\)](#)’s model prediction. That is, in less developed countries even with increases in government spending in providing public goods and services to households, the type of informality (*e.g.*, absorbing low skill workers and self-employment) and the low wage in the formal sector are not enough to compensate the benefits of living informally. Thus we observe an increasing size of informality even with increases in government spending. On the contrary, in rich countries there is high wage in the formal sector which is intensive in high-skill workers; since in those countries, informalities are mainly due evasion then, whenever household/firms realize that tax revenue returns to them in the form of public goods and services, they probably sacrifice part of informality (tax evasion) in favour of tax revenue. This exodus from the informal to the formal sector attenuates the comovement between government spendings and even leading to a negative correlation between them (as is the case for the U.S).

Going a step further, [Table 3.3](#) displays the $corr(s_t, z_t)$ where z_t , again, stands for the components of aggregate output. According to the results presented in [Table 3.3](#), private consumption and the absolute size of the informal economy move in the same direction.

¹¹There are two sorts of government spending in the literature. The so-called wasteful government spending which is the ones that are only used to meet the government needs and the useful government expenditures that are all expenses that contribute to increased social welfare and for the provision of public goods and services.

This result is consistent with economic rationality. That is, income earned in the informal activity could be spend on official market of goods and services.

Stylized fact 7. - *The absolute size of the informal sector is positively correlated with private consumption. The comovement between private consumption and the absolute size of the informal economy is positive; with increased degree from poor to rich countries.*

Busato and Chiarini (2004), in a two sector dynamic general equilibrium model, study the implication of the underground economy on private consumption. The authors argument is that the underground sector offers an *risk sharing opportunity*, through labor reallocation toward that sector. That is, the informal sector expands the budget constraint of households by offering an insurance channel, alternative to financial markets, available to people facing, for example, liquidity constraints. Chiarini and Marzano (2006) test the substitutability effects implicit in model of Busato and Chiarini (2004) and find evidence towards complementarity between the informal sector and private consumption in Italy. Our results also show a positive correlation between the informal sector and the others components of aggregate demand.

3.4 Persistence

Table 3.4 displays the statistics summarizing the persistence of the informal economy, output and the components of output over poor, emerging and rich countries, using the cyclical components computed using the three filtering/detrending methods. Again, we use U.S. as benchmark. The statistic of autocorrelation should be higher (in absolute terms) the greater is the persistence in the behavior of a certain variable over time.

First of all, results for all detrending/filtering methods highlight a larger persistence in rich and emerging countries than in poor countries. This finding is consistent with the findings above, supporting larger volatility of macroeconomic variables in poor countries than in rich countries. The informal economy follows this pattern as well.

Stylized fact 8. - *The informal sector is more persistent in rich countries than in poor countries. Despite of a smaller size of the informal economy relative to GDP in rich countries, the types of informality that exist in these countries are more persistent than those that generally are associated to the poor countries.*

Table 3.3: Correlation of the component of output (y_t) with the informal sector

	U.S.			All Countries			Poor Countries			Emerging Countries			Rich Countries		
	HP	LQ	FD	HP	LQ	FD	HP	LQ	FD	HP	LQ	FD	HP	LQ	FD
$\rho_{[s,c]}$	0.84	0.83	0.84	0.64	0.63	0.62	0.48	0.47	0.29	0.66	0.63	0.65	0.78	0.78	0.71
$\rho_{[s,i]}$	0.93	0.90	0.94	0.68	0.66	0.65	0.52	0.46	0.50	0.69	0.69	0.66	0.84	0.82	0.79
$\rho_{[s,g]}$	-0.00	-0.21	-0.21	0.20	0.19	0.14	0.22	0.21	0.15	0.26	0.22	0.22	0.12	0.14	0.05
$\rho_{[s,x]}$	0.38	0.25	0.59	0.49	0.50	0.46	0.37	0.36	0.30	0.45	0.49	0.40	0.63	0.63	0.67
$\rho_{[s,m]}$	0.91	0.91	0.90	0.62	0.58	0.58	0.41	0.36	0.37	0.63	0.59	0.59	0.83	0.79	0.79

An interesting result regards to the autocorrelation delivered by FD for poor countries. The autocorrelation of GDP and those of its components are negative or close to zero. This is a typical behavior of mean reversion of times series, signaling that business cycles are different across country's levels of development. That is, in developed countries the long-term behavior of business cycle moves slowly like random process as they present more persistence in output and its components. Contrarily, in poor countries after either shocks (nominal or real), the economy, eventually, returns to its "equilibrium" (initial state) faster than in rich countries. Consistent with smoothing behavior, public and private consumption are more persistent in rich countries than poor countries. Investment follows this pattern as well.

Despite of this short concluding remark, a note on the persistence measure is in order. Autocorrelation by itself does not capture possible difference in the behavior of macroeconomic variables on different phases of cycle. For the sake of arguments, consider de definition of recession presented by NBER:

Recession is a significant decline in economic activity spread across the economy, ..., it begins just after the economy reaches a peak of activity and ends as the economy reaches its trough, (Hall et al. (2001), p. 1).

In practice, the NBER procedures first determines the peaks and troughs in each series and then, based on well defined criterion, a common turning point is identified in each series (see *e.g.*, Bry and Boschan (1971)). However, while NBER relies on a set of economic series to identify turning points, in this work we rely on the cyclical component of GDP delivered by HP filter to determine the turning point. That is, our definition underlies the so called "Growth Cycles", such that recession (expansion) is a prolonged period of declining (increasing) growth in the cyclical component of GDP rather than a short interruption of a contraction (expansion). With this definition in mind, the following questions stand out: is the unofficial/official output more persistent in recessions or in expansions? Putting differently, are downturns in the unofficial/official output, on average, more persistent than upturns? How does the informal economy affects, on average, the persistence of the observable output? For example, RBC models resort to AR(1) process ($Z_t = 0.95Z_{t-1} + a_t$) or a random walk process ($Z_t = Z_{t-1} + a_t$) to represent the persistence in technological shocks. In line, we address these issues by resorting to autoregressive model. In what follows, we aim to find the answer for the first question. The second question is addressed in section 3.5.

Table 3.4: Autocorrelations of $s_t, y_t, c_t, g_t, i_t, x_t, m_t$: $\rho_{(z_{i,t}, z_{i,t-1})} = corr(z_{i,t}, z_{i,t-1})$

	U.S.			All Countries			Poor Countries			Emerging Countries			Rich Countries		
	HP	QD	FD	HP	QD	FD	HP	QD	FD	HP	QD	FD	HP	QD	FD
$\rho_{[s_t, s_{t-1}]}$	0.47	0.60	0.25	0.36	0.62	-0.00	0.36	0.57	0.00	0.53	0.69	0.25	0.61	0.74	0.33
$\rho_{[y_t, y_{t-1}]}$	0.57	0.73	0.32	0.45	0.65	0.05	0.39	0.57	0.03	0.53	0.66	0.29	0.61	0.75	0.34
$\rho_{[c_t, c_{t-1}]}$	0.72	0.83	0.56	0.42	0.57	0.08	0.29	0.51	-0.10	0.49	0.63	0.21	0.66	0.77	0.41
$\rho_{[i_t, i_{t-1}]}$	0.48	0.74	0.13	0.33	0.56	-0.03	0.21	0.44	-0.19	0.41	0.57	0.04	0.52	0.64	0.17
$\rho_{[g_t, g_{t-1}]}$	0.75	0.89	0.60	0.44	0.62	0.06	0.35	0.56	-0.05	0.43	0.61	0.09	0.60	0.76	0.32
$\rho_{[x_t, x_{t-1}]}$	0.63	0.76	0.28	0.46	0.60	0.13	0.39	0.54	0.01	0.43	0.63	0.06	0.46	0.70	0.15
$\rho_{[m_t, m_{t-1}]}$	0.56	0.75	0.22	0.36	0.51	0.00	0.33	0.54	-0.00	0.46	0.61	0.09	0.51	0.66	0.14

The autoregressive model to estimate persistence over the business cycle is as follows:

$$\Delta Z_{i,t} = \rho_1 \Delta Z_{i,t-1} D + \rho_2 \Delta Z_{i,t-1} (1 - D) + c_i + \epsilon_{i,t} \quad (3.8)$$

where $\epsilon_{i,t} \sim N(0, \sigma^2)$ and $Z_{i,t}$ represents the natural logarithm (\ln) of the size of the informal economy per capita of a country i in the period t . $\Delta = (1 - L)$ where L is the lag operator. D is a dummy variable which assumes values 0 if economy is moving from a peak to a trough (in recession phase) and 1 otherwise. Thus ρ_1 in Equation (3.8) tries to capture the degree of persistence of the informal economy during expansions and the estimates of ρ_2 measures the persistence during recessions. Similarly, we use the natural logarithm of GDP per capita such that $Z_{i,t} = \ln(GDP)$ per capita. In line to Bry and Boschan (1971), peak and trough are defined as follows: let Z_t denote the logarithm of the real GDP per capita. So, we define a dummy variable DW that assumes value of 1 if year t is a peak of economic activity and 0 otherwise; and a dummy variable UP that assumes value of 1 if year t is a trough of economic activity and 0 otherwise. Therefore, we get peak and trough as follows: $DW = 1$ if $\Delta Z_t > 0$ and $\Delta Z_{t+1} < 0$, and $UP = 1$ if $\Delta Z_t < 0$ and $\Delta Z_{t+1} > 0$.

Before analyzing the results from estimation of Equation (3.8), we should first have a brief discussion of our above strategy. We do not consider short interruption as a transition from expansion to recession or vice versa (Growth Cycles). Thus instead of $\Delta Z D$ and $\Delta Z(1 - D)$ in Equation (3.8), if we consider the cycles delivered by HP filter or L.Q. differencing (say, $Z_f D$), we certainly undergo into spurious result of persistence (may even be greater than unity). This is so, because $Z_f D$ and $Z_f(1 - D)$ are portions/phases of cycles with, respectively, positive and negative trends; such that, they are probably a process integrated of order d with $d \geq 1$. To test our view, Table 3.5 below displays the results of Augmented Dickey-Fuller (ADF) test on the two phases of cycle (recessions and expansions) of the cyclical component of the unofficial output per capita deliver by HP filter ($s_{f_{HP}}$) and the growth rate of the absolute size of the unofficial output per capita ($\Delta \ln(s)$). Expansions and recessions are identified by D and $(1 - D)$, respectively.¹²

Table 3.5: Unit root test

	$s_{f_{HP}} D$	$s_{f_{HP}}(1 - D)$	$\Delta \ln(s) D$	$\Delta \ln(s)(1 - D)$
ADF stat. [†]	0.9723	0.9825	0.0000	0.0000
Max lag	1	1	1	1
Obs	1031	799	540	371

Notes: Null Hypothesis: Unit root (individual unit root process)

[†] The corresponding P-value under the Null

The fixed unobserved heterogeneity among cross-section observation is captured through

¹²Result similar is achieved using official output.

of c_i in Equation (3.8). As we are working with annual data, AR(1) process should be dynamically complete. Results displayed in Table 3.5 support the null under $s_{f_{HP}}D$ and $y_{f_{HP}}(1 - D)$ and reject the null under $\Delta Ln(s)D$ and $\Delta Ln(s)(1 - D)$. Therefore, our view appears to be consistent to the data.

Relying on Hausman test, Table 3.6 reports the results of Equation (3.8), for the growth rate of the unofficial and the official output per capita across all countries, poor, emerging and rich countries. According to evidence reported in this table, upturns of the underground output are more persistent in rich countries than in poor and emerging countries, while downturns are more persistent in poor countries. Still we infer that downturns are more persistent than upturns in poor countries. The opposite is true for emerging and rich countries. The official output follows this pattern as well.

Stylized fact 9. - The informal economy is more persistent during recessions than expansions, in the poor countries. In the poor countries, the challenges of combating the informal sector is particularly larger during recessions, as it is more persistent during that period.

Table 3.6: Persistence of s_t and y_t over the phases of cycle

	All C.	Poor C.	Emerging C.	Rich C.
Unofficial output				
ρ_1	0.2079*** (9.431)	0.0610* (1.687)	0.2814*** (8.202)	0.6559*** (15.54)
ρ_2	0.2406*** (9.280)	0.3200*** (6.759)	0.1986*** (5.427)	0.245*** (5.411)
Hausman Test [†]	0.2098	0.0880*	0.102	0.293
D-W Test [‡]	2.014	2.026	1.965	1.956
Skewness ($s_{f_{HP}}$)	-0.88	-1.35	-0.59	-0.15
Median ($s_{f_{HP}}$)	0.0010	0.0004	0.0028	0.0001
Mean ($s_{f_{HP}}$)	-1.28E-13	-1.37E-13	-1.26E-13	-1.20E-13
Skewness ($\Delta s_{f_{HP}}$)	-1.67	-2.29	-0.96	-0.85
Median ($\Delta s_{f_{HP}}$)	0.0023	0.0023	0.0022	0.0024
Mean ($\Delta s_{f_{HP}}$)	-0.0009	-0.0003	-0.0014	-0.0008
Official output				
ρ_1	0.2990*** (6.867)	0.1783*** (4.909)	0.3931*** (11.71)	0.7320*** (19.08)
ρ_2	0.3732*** (11.10)	0.3868*** (8.658)	0.2314*** (6.613)	0.2055*** (4.813)
Hausman Test [†]	0.734	0.016**	0.001***	0.081*
D-W Test [‡]	2.043	2.083	2.015	2.228

Notes: t-statistic in parentheses. The Null: $\rho_i = 0, i = 1, 2$.

*** Rejection of the Null at 1% level of significance

** Rejection of the Null at 5% level of significance

* Rejection of the Null at 10% level of significance

† The corresponding P-value

‡ The corresponding Durbin–Watson statistic

Relying on the estimates of the persistence over the business cycle, asymmetry in

fluctuations of the underground output seems to be a fact. As the literature argues, if the unofficial output falls below its trend more drastically and severely at shorter time span than when rising above its trend, a contractionary fiscal policy is of larger reaching compared with a drastic and severe upturns in the real underground output. Putting differently, whenever the unofficial output rises lazily and gradually the *complementary effect* of the income earned in the underground sector is moderate and may not be able to undermine the effectiveness of fiscal policy. To the contrary, if the underground output rises drastically and severely at shorter time span compared to when it is falling below its trend, the *complementary effects* are so powerful, undermining the effectiveness of fiscal policy, such that a fiscal contraction can be overwhelmingly offset, or even overturned, by the strong complementary effect of the larger informal sector (Eng (2010)).

The persistence over the course of expansions and recessions of a series gives us the indication of its business cycle symmetry. Alternatively, we can also test the steepness (steeper slope of downturns than upturns) and the deepness (deeper troughs than the height of the peaks) hypothesis (see *e.g.*, Sichel (1993)). While the steepness hypothesis is supported by a negative skewness (and median larger than mean) from, *e.g.*, cyclical component delivered by HP filter (s_{fHP}), evidence of the deepness is supported by negative skewness (and median larger than mean) in the first difference of this same cyclical component (Δs_{fHP}). Therefore, the larger is the degree of persistence of a phase of cycle the greater is its steepness. Thus we contrast the estimated persistences with the estimated skewness coefficients across all countries, poor, emerging, and rich countries.¹³

At some extent, the result displayed in the middle of Table 3.6 appears to oppose to that reported in Eng (2010) and Giles (1997). But, it coincides to that of Bajada (2003) using classical cycles. Particularly, the larger degree of persistence in recessions compared to that of expansions in poor countries is consistent with the larger negative estimated skewness for those countries; suggesting that the fall in the underground output is drastic and deep, while expansion is gradual, and shallow. Results for emerging and rich countries are ambiguous. While estimate of persistence indicates toward spontaneous and severe expansions, the skewness coefficient, though small, is negative suggesting toward steepened downturns in the underground output.

Stylized fact 10. - *The informal sector is asymmetric, particularly, in the poor countries. While, in the poor countries, downturns are drastic, deep and short-lived and upturns is gradual, shallow and prolonged, in emerging and rich countries the reverse appears to hold.*

Despite of the ambiguity with respect to emerging and rich countries, results in Ta-

¹³Our concern is to compare the size and the signal of the skewness with the degree of persistences rather than infer on its statistic significance.

ble 3.6 call for caution in the design of macroeconomic policies as well as in macroeconomic modelling across countries.

3.5 Informal economy and the official business-cycle regularities

So far, we have tried to provide a comprehensive set of business cycle facts of the informal sector. In doing so, we have tried to place them into a literal perspective. The task of this section is to establish a simple empirical test, relating the size of the underground sector with some regularities of official business cycle. Particularly, we are looking at questions as: is the size of the informal sector a candidate to explain fluctuations in the official aggregate activity? Is procyclicality of fiscal policy observed in the poor/developing countries associated to the informal sector? Is there any relation between the size of the informal sector and the persistence of macroeconomic aggregates?

Our main aim here is to infer on the relation between the size of the underground sector and a set of cyclical properties of official business cycle. To this end, we compute the correlation of the relative size of the underground sector with a set of properties of macroeconomic fluctuations. In particular, being z_t standings for a component of the aggregate output, we estimate the correlation between the relative size of the informal sector (s_t/y_t) and volatility of the official output (σ_y), $\rho_{[s/y, \sigma_y]}$; the correlation between s_t/y_t and the relative volatility of z_t to y_t , $\rho_{[s/y, \sigma_z/\sigma_y]}$; the correlation between s_t/y_t and the correlation between z_t/y_t and y_t , $\rho_{[s/y, \rho_{[z/y, y]}]}$; and the correlation between s_t/y_t and the persistence of the official output, $\rho_{[s/y, \rho_{[y_t, y_{t-1}]}]}$, and its components, $\rho_{[s/y, \rho_{[z_t, z_{t-1}]}]}$.

Table 3.7 displays the estimates of those moments and the respective P-values for poor, emerging and rich countries. The estimated moments for the entire sample are under the heading “All countries”. An inspection at each group of countries indicates that properties of macroeconomic fluctuations such as volatility, cyclicity and autocorrelations are not correlated with the size of unobservable output. However, results within each group of countries may be spurious for two motives: small sample problem and small variation in the data as the countries within each group have similar characteristics. Thus we focus our analysis on the entire sample (All Countries).

Table 3.7: Informal sector and official business cycle facts

Fluctuation	All Count.	P. Count.	E. Count.	R. Count.
$\rho[s/y, \sigma_y]$	0.1807* (0.0651)	-0.0342 (0.8407)	0.0861 (0.5693)	0.0928 (0.6811)
$\rho[s/y, \sigma_c/\sigma_y]$	0.1996** (0.0412)	0.1255 (0.4592)	0.0005 (0.9975)	0.3655 (0.0944)
$\rho[s/y, \sigma_i/\sigma_y]$	0.3320*** (0.0005)	0.1692 (0.3168)	0.1916 (0.2021)	0.3510 (0.1092)
$\rho[s/y, \sigma_g/\sigma_y]$	0.3759*** (0.0001)	0.0888 (0.6008)	0.0524 (0.7295)	-0.0914 (0.6857)
$\rho[s/y, \sigma_x/\sigma_y]$	0.3358*** (0.004)	0.2722 (0.1031)	0.1074 (0.4772)	-0.1810 (0.4200)
$\rho[s/y, \sigma_m/\sigma_y]$	0.3155*** (0.0010)	0.2160 (0.1992)	0.1890 (0.4709)	0.0775 (0.7317)
Comovement	=	=	=	=
$\rho[s/y, \rho[c/y, y]]$	0.1354 (0.1683)	0.0306 (0.8573)	0.1047 (0.4883)	0.3202 (0.1462)
$\rho[s/y, \rho[i/y, y]]$	-0.2250** (0.0210)	-0.0395 (0.8166)	0.1038 (0.4925)	0.3818* (0.0795)
$\rho[s/y, \rho[g/y, y]]$	0.4696*** (0.0000)	0.0496 (0.7708)	0.0933 (0.5274)	-0.0480 (0.8320)
$\rho[s/y, \rho[x/y, y]]$	0.0070 (0.9437)	0.3477** (0.0349)	0.0715 (0.6368)	-0.1483 (0.5218)
$\rho[s/y, \rho[m/y, y]]$	0.2440* (0.0121)	0.0303 (0.8588)	0.0421 (0.7831)	0.3726* (0.0877)
Persistence	=	=	=	=
$\rho[s/y, \rho[y_t, y_{t-1}]]$	-0.2036** (0.0372)	-0.0519 (0.7604)	0.1301 (0.3886)	0.0753 (0.7390)
$\rho[s/y, \rho[c_t, c_{t-1}]]$	-0.3667*** (0.0001)	0.1377 (0.4161)	-0.0839 (0.5792)	0.1598 (0.4774)
$\rho[s/y, \rho[i_t, i_{t-1}]]$	-0.2678*** (0.0057)	0.0478 (0.7787)	0.1048 (0.4880)	0.1195 (0.5965)
$\rho[s/y, \rho[g_t, g_{t-1}]]$	-0.2488** (0.0105)	0.1235 (0.4666)	-0.0089 (0.9528)	-0.0775 (0.7319)
$\rho[s/y, \rho[x_t, x_{t-1}]]$	-0.0726 (0.4617)	0.0724 (0.6702)	0.1106 (0.4641)	-0.2149 (0.3369)
$\rho[s/y, \rho[m_t, m_{t-1}]]$	-0.1250 (0.2038)	0.2774* (0.0965)	0.0476 (0.7525)	-0.2518 (0.2583)
N. of obs	105	37	46	22

Notes: P-value in parentheses. The Null: $\rho_{[i,j]} = 0$

*** Rejection of the Null at 1% level of significance

** Rejection of the Null at 5% level of significance

* Rejection of the Null at 10% level of significance

3.5.1 Informal economy and aggregate fluctuations

The top bloc of Table 3.7 contains result of the correlation between the relative size of the informal sector (s_t/y_t) and the volatility of the official output (σ_y). It also displays the correlation between s_t/y_t and the relative volatility of the components of aggregate

output, (σ_z/σ_y) . The volatilities are measured by standard deviation of the cyclical component delivered by HP filter. First of all, we observe a positive and significant correlation between s_t/y_t and σ_y as well as with the relative volatility of all components of aggregate demand.

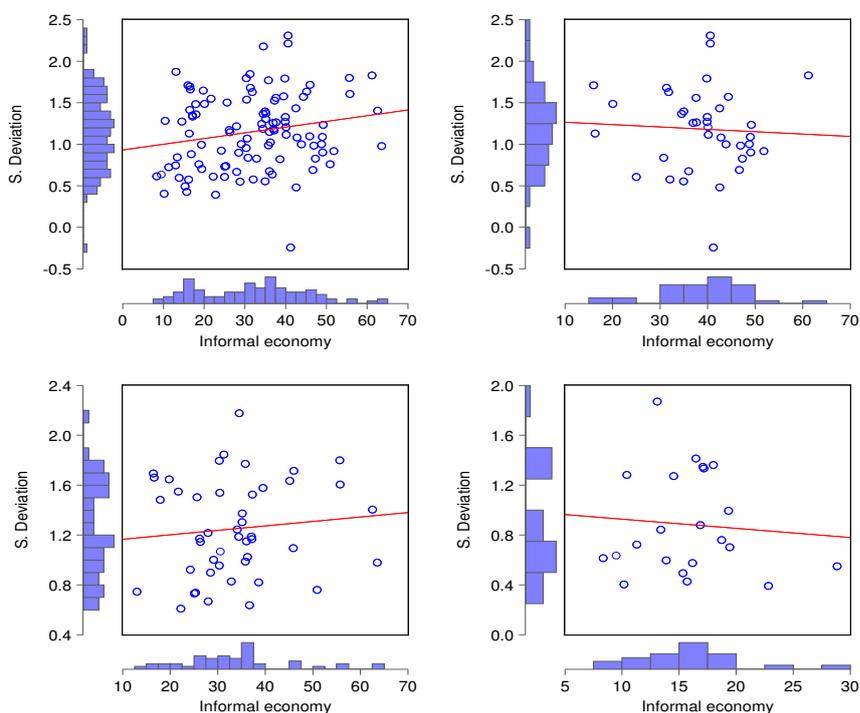
To go a little further, [Figure 3.6](#) plots the logarithm of the standard deviations of the cyclical component of GDP delivered by HP filter against the logarithm of the average size of the informal economy (in % of GDP).¹⁴ From upper left to lower right output, are the results with respect to the full sample (all countries), the group of poor, emerging and rich countries, respectively. Also, in each axis is the distribution of the corresponding variable. As in [Table 3.7](#), there is a mix of reading we might do: *within the group of poor countries there is no evidence supporting any relation between the volatility of GDP and the relative size of the informal economy. In emerging countries, apparently, the two variables are slightly positively related and negatively evolved in rich countries.* The estimated coefficients and the associated P-values for poor, emerging and rich countries are, respectively, $(-0.0028/0.7509)$, $(0.0036/0.4881)$, $(-0.0074/0.7113)$. Therefore, within each group there is no statistic evidence supporting any relation between volatility of output and the size of the informal sector.

Notwithstanding, a word of caution is warranted: inferring the relation between the informal sector and volatility of GDP by linear regression within a group of countries with similar characteristics may be under potential pitfalls. Within each group of countries, the variation in the two variables may not be enough to allow us to ascertain about the relation between them (small sample problem). Furthermore, a simple univariate linear regression may suffer from omitted variable bias (as there have no control variables) and endogeneity bias emerging from simultaneity (as there are factors explaining both informality and formality (volatility)). Despite these latter shortcomings, whenever we focus the analysis on the full sample (all countries) the result changes substantially (see upper left output of [Figure 3.6](#) and the [Table 3.7](#)). The estimated coefficient is 0.0069 corresponding a P-value of 0.0453; meaning that, at 5% significance level, following a 10 percentage point increase in the relative size of the informal sector, the volatility of official sector increases about 0.068%. Therefore, the following corollary emerges:

Corollary 1. *In general, countries with sizeable informal sector tend to experience greater fluctuation in their official economic activity.*

This result is consistent with some regularities of business cycle observed across countries. We have observed, in introducing this work (as well as in *Fact I*), that the informal sector is larger in less developed countries, while fluctuation in the official output is more

¹⁴As we may see in figures 7 and 8 in Appendix A, the results delivered by LQ and FD detrending are similar.

Figure 3.6: Relation between volatility of y_t and the size of the informal sector s_t/y_t


severe in those countries. Additionally, we observe in *Fact 2* a declining trend of informal sector over time, while [Stock and Watson \(2005\)](#) find that volatility of the official output in most G7 countries has moderated over the past 40 years. Empirical literature which provides similar evidence is thanks to [Bajada \(1999\)](#), [Ferreira-Tiryaki \(2008\)](#), [Granda-Carvajal \(2010\)](#) and [Çiçek and Elgin \(2011\)](#), by concluding that countries with sizeable informality pursue increased volatility in their official output.

Literature characterises informality as being, usually, intensive in small size enterprises with the lack of access to credit, labor-intensive and facing high entry costs whenever running to the formal sector. Such features unable these small enterprises to smooth fluctuation in cash in response to a negative shock. Thus they undergo a decrease in production, investment and spending amplifying the initial contractionary shock ([Bernanke et al. \(1994; 1999\)](#)). On the other hand, the household production literature predicts that, in an economy with two sector (formal and informal), during expansion, the time devoted to work will flow from the informal sector to the formal one, while the opposite occur in recessions. This substitutability between the informal and the formal activity will lead to a larger volatility in the latter. This implies that countries with sizeable informal activity experience larges flows in to and out from the formal sector and thus experience an increased volatility in the formal sector ([Benhabib et al. \(1991\)](#)).

3.5.2 Informal economy and the cyclicity of macroeconomic aggregates

The middle block of [Table 3.7](#) contains the estimates of the correlations between s_t/y_t and $\rho_{[z/y,y]}$. The evidence suggests that the relative size of the informal economy (s_t/y_t) is significantly correlated with $\rho_{[i/y,y]}$, $\rho_{[g/y,y]}$ and $\rho_{[m/y,y]}$. The negative correlation between s_t/y_t and $\rho_{[i/y,y]}$ is consistent with the argument featuring the informal sector. That is, the informal sector being small in size, facing credit constraint, is unable to smooth their own investment in endogenous fashion to economic state. Even having external financing, they have access to relative small amounts at high interest rate from, generally, illegal moneylenders ([Loayza \(1999\)](#)). Therefore, the larger the size of the informal sector the larger the inability of an economy to smooth its own investment and so the smaller is the cyclicity of i_t/y_t to y_t .

Corollary 2. *Countries with sizeable underground economy are unable to adjust their own investment levels, particularly in upturns.*

Regarding to government consumption, the following corollary emerges.

Corollary 3. *Countries with sizeable underground economy enhance the likelihood to exhibit a procyclical fiscal policy.*

[Granda-Carvajal \(2010\)](#), using data for 40 countries (17 developing and 23 OECD countries), find a positive, although not statistically significant, relation between s_t/y_t and the cyclicity of government spending ($\rho_{[g,y]}$) for the entire sample and a negative correlation for highly industrialized economies. Our results are similar with respect to the signal but yielding a correlation statistically different from zero for the entire sample. Our result is also supported by earlier studies of [Çiçek and Elgin \(2011\)](#). The authors use data for 78 countries to conclude that procyclicality of fiscal policy is more pronounced in countries with a larger size of the underground sector. Therefore, in contrast to [Granda-Carvajal \(2010\)](#), our finding is accordingly to [Eng \(2010\)](#) arguments for procyclicality of fiscal policy. That is, under larger underground activities, floating asymmetrically, with strong complementary demand, a contractionary policy may have expansionary effects, and vice versa. Summing up, the larger is the size (or the relative size to GDP) of the informal sector the larger are, in the same direction, the changes of g_t relative to y_t .

The cyclicity of share of import (m_t/y_t) is positively and statistically different from zero correlated with the informal sector. In fact, this result holds even in rich countries, at 10 percent significance level.

Corollary 4. *Countries with sizeable underground economy enhance the likelihood to boost imports in a procyclical fashion.*

The relation between the underground activities and the imports of goods and services is under-explored in the literature. The above finding supports the ideas that part of imports is used as input in the underground sector. [Davies and Thurlow \(2010\)](#) argue that policies favoring the formal sector may have differential impacts on the underground activities. The authors conclude that trade liberalization, even though “hurts” the informal producers, favors informal traders, who benefit from lower import prices. In fact, while trade liberalization has long been a fact in rich countries, only recently such policy is being adopted in less developed countries. Generally, if the underground market-premium is greater than the risk premium in the official market, the informal traders have incentive to overinvoicing the imports and sells on the informal market the amount corresponding to the overinvoiced portion, spending less local currency for the same amount of import. In this set-up, informality has a positive effect on imports.

3.5.3 Informal economy and persistence of macroeconomic aggregates

As we state in section 3.4, under larger fluctuation we expect a smaller persistence of macroeconomic aggregates. Putting differently, on the underground economy perspective, if it relates positively with fluctuations in macroeconomic aggregates, then it should relate negatively with the persistence of these aggregates. The empirical evidence displayed in the bottom block of [Table 3.6](#) supports that countries with a greater underground sector tends to exhibit smaller persistence in its macroeconomic variables. All correlations are negative and statistically significant, except for exports and imports.

Corollary 5. *Countries with sizeable underground economy enhance the likelihood to exhibit smaller persistence in their macroeconomic variables.*

Therefore, relying on *Corollary 5*, the informal sector prevents countries to smooth their economic aggregates over the business cycle.

3.6 Conclusion

Using a large dataset covering 37 poor, 46 emerging and 22 rich countries, this chapter provides a set of facts regarding the cyclical features of the informal sector. As we listed these facts, we contrast them with the existing literature and try to touch upon some mechanisms that may constitute a fertile ground for future research. At the heart of this chapter is the premise that the underground sector has some implications on the regularities of official business cycle as well as on the effectiveness of macroeconomic policy. The phenomenon of the informal sector has been a challenge for researchers.

This challenge consists not only for being an informality but also for being difficult to find a comprehensive, adequate and accurate measurement and definition of the informal activity. Analysing the channels by which the informal sector evolves to the formal economy depends in large extent to its definition and measurement. We hope that the facts highlighted throughout this chapter contribute to the existing literature of business cycle regularities of the informal sector as well as casting light to some mechanisms by which these two sectors are interconnected.

Financial Integration, Duality in Labor Markets and Business Cycles: A Tale With Microfounded Roots.

4.1 Introduction

There is a growing interest in analyzing the effects of informality on macroeconomic aggregates. This interest is particularly pervasive for developing economies where the informal economy accounts for a large share of economic activities.¹ Models accounting for the size of the informal economy have provided a relatively better performance than those abstracting from such activities (see *e.g.*, [Benhabib et al. \(1991\)](#), [Busato and Chiarini \(2004\)](#), and [Bosch and Esteban-Pretel \(2012\)](#)). Further, a range of macroeconomic effects has been identified and attributed to the informal activity, namely the effects on volatility of economic aggregates, tax base or fiscal spaces, financial instability, sovereign default risk and public indebtedness.²

Despite the fact that intra-country macroeconomic effects of the informal economy is relatively well documented, literature offers little in the context of global markets. [Bacchetta et al. \(2009\)](#) are an exception by arguing that the existence of a sizeable informal sector constraints developing countries from fully benefiting from their integration into the world economy. This work falls on this strand of research. We develop a small

¹For a survey on the estimates of informality as labor market inputs see, *e.g.*, [Bacchetta et al. \(2009\)](#). In regards to informality as percentage of GDP see, *e.g.*, [Schneider and Enste \(1999\)](#) and [Elgin and Oztunali \(2012\)](#).

²References supporting these effects include [Ferreira-Tiryaki \(2008\)](#) and [Granda-Carvajal \(2010\)](#) by concluding that countries with a sizable informal economy exhibit higher variability in output, consumption and investment. [Turnovsky and Basher \(2009\)](#) and [Vogel \(2012\)](#) argue toward a restraining effect of informalities on tax base, while [Elgin and Uras \(2013\)](#) find evidence supporting a positive relation between the informal sector and financial instability, sovereign default risk and public indebtedness.

open economy model featuring search and matching frictions *a la* Diamond-Mortensen-Pissarides. With developing countries in mind, we allow for a large frictionless informal labor market. Instead, formal labor market is characterized by search and matching frictions generating involuntary unemployment. In this set up we study the interaction between financial integration, formal and the informal labor markets.

The existence of credit market imperfections together with a sizable informal labor market pose several questions regarding to business cycles and on the effectiveness of government policies. On the one hand, credit market imperfections magnifies economic fluctuations through of the so-called *financial accelerator* (see, *e.g.*, [Bernanke et al. \(1994\)](#)) and affect the ability of a country in conducting optimal fiscal policy, particularly in recessions (see *e.g.*, the classic work of [Gavin and Perotti \(1997\)](#)). On the other hand, informality not only has effects on economic cycles as also restrains tax base and increases sovereign default risk ([Elgin and Uras \(2013\)](#)). So, financial frictions and informality, being two phenomena of developing countries, can help to fix the so-called *small shock, large cycles puzzle* as well as to explain the sub-optimal fiscal policy observed, particularly, in less developed countries.

Indeed, we find that both credit market frictions and the size of the informal sector weaken the ability of a country to cope with adverse shocks. That is, both informality and the lack of financial integration stand for as sources of economic volatility. However, economic volatility appears to be more due to informality than to credit market frictions. We find that the larger is external finance premium, the higher is the size of the informal sector. Also, both external finance premium and the size of the informal sector constrain the implementation of optimal fiscal policies. Further, the results suggest that, in the presence of a sizable informal sector, some labor market policy intervention alone might be counterproductive.

To achieve these results, this chapter encompasses six sections, including this introduction. Section 4.2 reviews the related literature. Section 4.3 outlines the model and 4.4 describes two alternatives for financial integration. The dynamics of the model is presented in section 4.5, and section 4.6 concludes.

4.2 Related literature

4.2.1 Informality, financial integration and economic responses

While the conventional story on the consequences of the informal sector for fluctuations in economic activity has its roots under two mechanisms (the buffer and booster role), in an open economy, financial markets dictates to what extent households insure

toward country-specific risk and capital flows across borders. So, the first natural question is: how do informality and financial integration interact? Establishing a connection between these two phenomena is straightforward: the informal sector is a hidden activity, not taxed and unable to cope with labor legislation, and therefore, it adds to information asymmetries. Because foreign lenders only observe formal activity, they underestimate the financial and operational power of these firms and so place out the risk premium. Also, a cause-effect might work in the opposite direction: credit-constrained borrowers experience difficulty to achieve a proper size to fully exploit economies of scales which, in turn, would demand for a larger share of high-skilled labor. So, the lack of access to credit leads firms to operate as small scale entrepreneurs with low-skilled labor such that the informal employment stand out as a beneficial cushion. Therefore, we should observe a negative relation between informality and financial integration. Indeed, this is what we document in this chapter.

A second question has to do with how these phenomena affect the economic responses to total factor productivity (TFP) shocks. Regarding to credit-market conditions, a range of distinct results has been derived from the classical international business cycle models with capital flows across international borders. For instance, [Evans and Hnatkovska \(2007\)](#) argue towards a non-monotonic relationship between the degree of financial integration and the size of fluctuations in macroeconomic aggregates; [Azariadis and Pissarides \(2007\)](#) show that a greater access to foreign capital markets amplifies the response of domestic unemployment rate of disturbances in the TFP relative financial autarky; [Çenesiz and Pierdzioch \(2010\)](#) distinguish an amplifier effect in the short-run and a buffer effect in the medium-run of capital mobility on employment of TFP shocks; in [Baxter and Crucini \(1994\)](#) the degree of financial integration does not matter if shocks in TFP are temporary. Others studies such as those of [Sutherland \(1996\)](#), [Senay \(1998\)](#), and [Buch et al. \(2005\)](#) have drawn on a variant of the dynamic sticky-price general equilibrium model developed by [Obstfeld and Rogoff \(1995\)](#) to conclude that the impact of financial integration on the volatility of output and consumption depend on the nature of shocks. In a similar vein, [Çenesiz and Pierdzioch \(2008\)](#) introduce a friction in labor market which yielded a reduced magnitude effects of financial integration.

In order to overcome these nonuniform findings, factors such as country size, the degree of economic diversification, and sudden changes of capital inflows have been identified as intervening factors in the relationship between macroeconomic volatility and financial integration. For instance, in a similar spirit to the *financial accelerator* arguments, [Caballero and Krishnamurthy \(2001\)](#) build a model featuring emerging markets whereupon firms face internal and external borrowing constraints. These authors argue that these firms are unable to cope adequately with adverse shocks, and so, this magnifies

the initial severity of these shocks.

However, all these studies are silent with respect to the consequences on and of the informal sector business cycle. As is argued in [Bacchetta et al. \(2009\)](#) the informal jobs may attract particular types of capital inflows related to the existence of a large low-wage labor pool. Furthermore, the authors provide evidence suggesting a negative relation between economic openness and the incidence of the informal employment.

4.2.2 Dual labor markets and search frictions

Following the classical Harris-Todaro framework ([Todaro \(1969\)](#); [Harris and Todaro \(1970\)](#)), the dynamics of informality have been tackled as a disadvantaged sector. More recently, however, there is a recognition that informality should be viewed not as a marginal or peripheral sector but as a basic component of the total economy ([Chen \(2005\)](#)). Another stream of the literature, namely, the legalist and the voluntarist approaches see informality, respectively, as a way to avoid the costs of formalization including these of registration and license ([Hernando \(1990\)](#)), and as a voluntary nature of the entry into the informal self-employment, particularly during economic upturns, in order to escape taxation and regulation ([Maloney \(2004\)](#)). Lastly, there is a structuralist approach, where the formal and the informal activities are intrinsically linked. According to this view, formal firms seek to increase competitiveness by reducing their input costs, including labour costs. So, aiming to extract profit, these firms promote informal production and employment relationships with subordinated economic units and workers ([Chen \(2005\)](#)). The National Commission for Enterprises in the Unorganized Sector in India calls this phenomenon as the *informalization* of the formal sector ([Batini et al. \(2010\)](#)). [Maurizio \(2014\)](#), however, shows that, among the new formal workers, over the 2000s, around 60% in Argentina and 54% in Brazil were working informally in the same job.

While a substantial body of the literature has tackled informality from sectoral perspective, few has tackled it from a non-marginal activity view point. For instance, [Conesa et al. \(2002\)](#) build a RBC model with an informal sector and show that as workers switch intensively from the formal to the informal sector the volatility of investment and the recorded output increase. In contrast, [Batini, Nicoletta and Levine, Paul and Lotti, Emanuela \(2009\)](#) attach the lower output volatility to the fact that the informal wages adjusts more quickly to shocks than formal wages. Similar stabilization benefit attached to informality are founded by [Busato and Chiarini \(2004\)](#). The authors develop a two sector DGE model with two technologies where the workers can split its time-work intensively in the two sectors. Among others, the model predicts that informality allows for consumption and income smoothing.

Focusing on developing countries, [Fiess et al. \(2010\)](#) model a two sector labor market

where the formal sector (tradable) may be affected by wage rigidities and the informal self-employment sector (non-tradable) faces credit constraints to entry. Times series data from Brazil, Colombia, and Mexico are used to test model predictions. Fiess et al. confirm that demand or productivity shocks to the non-tradable sector give rise to procyclical informal employments. Still on developing countries, [Bosch and Maloney \(2008\)](#) analyze the cyclical properties of worker flows in Brazil and Mexico and provide a rich empirical ground which we reproduce here:

First, the unemployment rate is countercyclical essentially because job separations of informal workers increase dramatically in recessions. Second, the share of formal employment is countercyclical because of the difficulty of finding formal jobs from inactivity, unemployment and other informal jobs during recessions rather than because of increased separation from formal jobs. Third, flows from formality into informality are not countercyclical, but, if anything, pro-cyclical ([Bosch and Maloney \(2008\)](#)).

Drawing on these empirical results [Bosch and Esteban-Pretel \(2012\)](#) build, and simulate a two-sector search and matching labor market model in which firms have the choice of hiring workers legally or illegally, allowing for substitution between the formal and the informal contracts within similar job types. Using data from Brazil, the model performs well in matching the cyclical properties found in [Bosch and Maloney \(2008\)](#).

In this chapter we follow the structuralist approach. Basically, we model a dual labor market in a framework with trading frictions *a la* Diamond-Mortensen-Pissarides in which the employment adjusts at the extensive margin. While [Zenou \(2008\)](#) argues that the search and matching frictions are the main factors for the emergence of informality, [Bosch and Esteban-Pretel \(2012\)](#) rationalize the presence of both the formal and the informal workers within a firm through two effects: *meeting effect* and *offer effect*.³ Contrasting with the traditional view, [Hansen \(1985\)](#) notes that most of the employment fluctuations arise at the extensive margin rather than at the intensive margin.

Accounting for trading frictions present within the formal and/or the informal labor markets allows to identify mechanisms governing the flows among the formal sectors, the informal sectors and the unemployment pool. Trading frictions, therefore, generate unemployment in the steady state instead of a null-unemployment as in the general equilibrium models based on Walrasian labor markets. Furthermore, the flows and the transition rates of workers are key determinants of macroeconomic fluctuations on the search matching set up, while in the classical labor market is the intensive margin mechanisms

³Meeting effect is the increased number of meetings between firms and workers, through of vacancy creation, due to economic expansions. In turn, offer effect is the result of increased use of formal contracts, to take advantage of a positive productivity shocks.

that determine changes in the labor market outcomes. Frictions in the labor market (may) absorb the effects of credit-market conditions on labor market outcomes (see *e.g.*, results in [Çenesiz and Pierdzioch \(2008\)](#)). Informal jobs and capital inflows are two phenomena that characterize developing market economies. Thus the following model combines these two features and looks at the results of their interactions.

4.3 Model set-up

In what follows we briefly describe a small open-economy DSGE model where agents face two labor market segments (formal and informal). The profile of labor market segments and the three agents in the economy, households, firms, and government, are described bellow.

4.3.1 Labor market

Following recent trend in modeling labor market, *e.g.*, as in [Zenou \(2008\)](#), we take labor market adjustments along the extensive rather than intensive margin. The formal labor market is characterized by search and matching frictions and the informal labor market is perfectly competitive. The representative households consist of a mass of 1. Of this mass, n_t^F is the fraction of household members working in the formal labor market, n_t^S is the fraction of workers in the informal labor market, and u_t is the unemployment rate. Thus the unemployment rate at period t reads as

$$u_t = 1 - n_t^F - n_t^S. \quad (4.1)$$

The search frictions in the formal labor market can be captured by the following matching function:

$$m_t = m[s_t, v_t] = \sigma_m [s_t]^\mu [v_t]^{1-\mu}, \quad (4.2)$$

where s_t and v_t denote, respectively, the total number of the unemployed job-seekers and vacancies, and m_t is the total number of matches per period. σ_m is a measure of the efficiency of the matching process and μ is the elasticity of matches with respect to job-seekers. Therefore, the matching process is a positive function of the number of job-seekers and vacancies posted. In each period t , there is a probability of $\mathcal{P}_{\theta_t}^V = \frac{m_t}{v_t} = \sigma_m \theta_t^{-\mu}$ of successfully filling a vacancy, where $\theta_t = \frac{v_t}{s_t}$ is a measure of market tightness. Similarly, a job-seeker has a probability of $\mathcal{P}_{\theta_t}^U = \frac{m_t}{s_t} = \sigma_m \theta_t^{1-\mu}$ of finding a formal job. The law of motion of the formal workers depends on a constant, exogenous, job

destruction rate $[\rho]$ and on new matches, such that

$$n_t^F = [1 - \rho]n_{t-1}^F + m_t = [1 - \rho]n_{t-1}^F + \mathcal{P}_{\theta_t}^V v_t. \quad (4.3)$$

The matching process is meant to capture the search frictions in an environment on which all workers and firms are ex-ante identical. The search for a formal job in $[t + 1]$, $[s_{t+1}]$, is an increasing function of current unemployed workers, u_t , and of the job destruction $[\rho n_t^F]$ in the formal labor market such that the current job-seekers' dynamic is given by

$$s_t = u_{t-1} + \rho n_{t-1}^F = 1 - [1 - \rho]n_{t-1}^F - n_{t-1}^S. \quad (4.4)$$

The informal labor market faces no frictions. Whoever decides to work informally finds a job depending on his productivity and his reservation wage. We assume that only the unemployed workers have the possibility to search for a job in the formal labor market. Therefore, the workers informally engaged must first become unemployed and then search for a formal job.

4.3.2 Households

A composite consumption good $[c_t]$ enters concavely into the households' preferences, described by the following discounted lifetime expected utility function as

$$E_0 \sum_{t=0}^{\infty} \beta^t U[c_t], \quad (4.5)$$

where, $\beta \in [0, 1]$ is the discount factor and E_0 is the mathematical conditional expectation given currently available information. The instantaneous utility function, $U[\cdot]$, is represented by

$$U[c_t] = c_t^{1-\gamma} / (1 - \gamma), \quad (4.6)$$

where γ is a measure of the degree of relative risk aversion. A household member can either be working in the formal or in the informal labor market, earning, respectively, a real wage of w_t^F and w_t^S ; if unemployed, the household member receives a constant unemployment benefit of w^U . Furthermore, the representative households own capital $[k_t]$ that depreciates at a rate of $\delta \in [0, 1]$ and evolves over time as

$$k_t = i_t + [1 - \delta]k_{t-1}, \quad (4.7)$$

where i_t stands for the gross investment.

We consider a benchmark small open economy facing a single big economy (the rest of the world, ROW) with a constant real interest rate $[r^*]$. Domestic agents, however,

face a country risk premium $[f(d_t^f)]$ that is defined as a spread over the foreign interest rate. This financial framework is in line with the presumption that under an imperfect enforcement of international obligation, a country risk premium (country spread) is set up by international creditors to compensate the risk of defaulting on a financial contracts. Indeed, there is evidence favoring debt-sensitive interest rate in emerging countries (see, *e.g.*, [Akitoby and Stratmann \(2008\)](#)). Thus as in [Schmitt-Grohé and Uribe \(2003\)](#), we set the interest rate faced by domestic agents $[r_t^d]$ as a function of foreign debt, which is described as follows:

$$r_t^d = r^* + f(d_t^f) = r^* + \xi \left[\exp^{[d_t^f - \bar{d}]} - 1 \right], \quad (4.8)$$

where d_t^f is the debt, ξ and \bar{d} are constant parameters. So, being r_t^k a variable denoting the rental rate of capital, the representative household's inter-temporal budget constraint is given by

$$\begin{aligned} d_t^f &= [1 + r_{t-1}^d]d_{t-1}^f - [1 - \tau^W]w_t^F n_t^F - w_t^S n_t^S - w^U u_t + c_t + i_t \\ &- r_t^k k_{t-1} - \Pi_t^f + \Phi(k), \end{aligned} \quad (4.9)$$

where the function $\Phi(k)$ is meant to capture capital adjustment costs. We set $\Phi(k) = \frac{\phi}{2}[k_t - k_{t-1}]^2$. The constant tax rate on labor income and the firm's profit are denoted, respectively, by τ^W and Π_t^f . Agents are also subject, at all dates, to the solvency constraint of the form

$$\lim_{j \rightarrow \infty} E_t \left(d_{t+j}^f / \prod_{s=0}^j [1 + r^* + f(d_s^f)] \right) \leq 0, \quad (4.10)$$

such that the representative household's problem can be described by the following Lagrangian function

$$\begin{aligned} \mathcal{L}_t^H &= E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \left[n_t^F [c_t^F]^{(1-\gamma)} \right] / (1-\gamma) \right. \\ &+ \left[n_t^S [c_t^S]^{(1-\gamma)} \right] / (1-\gamma) \\ &+ \left[(1 - n_t^F - n_t^S) [c_t^u]^{(1-\gamma)} \right] / (1-\gamma) \\ &+ \lambda_{1,t} [d_t^f - [1 + r_{t-1}^d]d_{t-1}^f + [1 - \tau^W]w_t^F n_t^F + w_t^S n_t^S + w^U u_t \\ &- n_t^F c_t^F - n_t^S c_t^S - u_t c_t^u - k_t + [1 - \delta]k_{t-1} + r_t^k k_{t-1} + \Pi_t^f - \Phi(k)] \\ &+ \lambda_{2,t} [n_t^F - (1 - \rho)n_{t-1}^F - \mathcal{P}_{\theta_t}^U [1 - (1 - \rho)n_{t-1}^F - n_{t-1}^S]] \\ &+ \left. \lambda_{3,t} \left[\lim_{j \rightarrow \infty} E_t \left(d_{t+j}^f / \prod_{s=0}^j [1 + r^* + f(d_s^f)] \right) \right] \right\}, \end{aligned} \quad (4.11)$$

where $\lambda_{1,t}$, $\lambda_{2,t}$ and $\lambda_{3,t}$ are Lagrange multipliers. c_t^F , c_t^S and c_t^u denote, respectively,

formal, informal and the unemployed members consumption of the representative households. By integrating the households' heterogeneity into a representative agent framework, the first order necessary conditions with respect to c_t and k_t of the household's maximization problem provide the following Euler equation:

$$1 = \beta E_t \left[\frac{c_{t+1}^{-\gamma} [1 - \delta + r_{t+1}^k + \phi(k_{t+1} - k_t)]}{c_t^{-\gamma} [1 + \phi(k_t - k_{t-1})]} \right] \quad (4.12)$$

Equation (4.12) shows that a positive change in consumption at any time period t must, optimally, have a benefit equal to the cost of decreasing, in $[t + 1]$, the same discounted value of consumption of one unit of investment. The partial derivative with respect to d_t^f delivers

$$\lambda_{1,t} = \beta [1 + r_t^d] E_t \lambda_{1,t+1}, \quad (4.13)$$

where country spread enters to penalize current consumption.

4.3.3 Firms

In this economy an internationally tradable homogeneous composite good is produced. This homogeneous composite good is the result of a concave combination of three inputs: capital $[k_t]$, formal labor $[n_t^F]$ and the informal labor $[n_t^S]$. While output and formal labor are subject to taxation, the informal labor is not taxed as it is unobserved by the official authority. Accordingly, the production technology for a firm is described by a constant return to scale production function

$$y_t = a_t k_{t-1}^{\alpha^k} [n_t^F]^{\alpha^F} [n_t^S]^{\alpha^S}, \quad (4.14)$$

where y_t is the internationally tradable composite good and a_t captures the total factor productivity (TFP). The parameters α^k , α^F and α^S are, respectively, the share of capital, formal and the informal labor inputs on output.

As for costs, while searching for informal job is costless, posting a vacancy in the formal labor market brings a cost of κ . Moreover, while firms pay w_t^F to formal labor which is set through of Nash bargaining, the informal labor is paid a wage of w_t^S that result from competitive informal labor market equilibrium. The maximization of the firm's profit $[\Pi^f]$ is subject to the law of motion of formal employment given by Equation (4.3). Thus we write the problem of a firm as

$$\begin{aligned} \Pi_t^f = & \max_{\{n_t^S, n_t^F, k_{t-1}\}} \left\{ [1 - \tau^F] y_t - \kappa v_t - [1 + \tau^N] w_t^F n_t^F - w_t^S n_t^S \right. \\ & \left. - r_t^k k_{t-1} + \beta E_t \Lambda_{t,t+1} \Pi_{t+1}^f \right\}, \end{aligned} \quad (4.15)$$

$$s.t. \quad n_t^F = [1 - \rho]n_{t-1}^F + \mathcal{P}_{\theta_t}^V v_t,$$

$$s.t. \quad y_t = a_t k_{t-1}^{\alpha^k} [n_t^F]^{\alpha^F} [n_t^S]^{\alpha^S},$$

where τ^N stands for payroll tax and τ^F is the corporate tax. $\beta E_t \Lambda_{t,t+1}$ is the stochastic discount factor such that $E \Lambda_{t,t+1} = E_t \left[\frac{\lambda_{1,t+1}}{\lambda_{1,t}} \right]$. By rewritten the law of motion of formal employment for a firm, the firm's problem can be read in terms of Lagrangian function as

$$\max_{\{n_t^F, n_t^S, v_t^S, k_{t-1}\}} \mathcal{L}_t^{\Pi^f} = \Pi_t^f + \Gamma_t [n_t^F - [1 - \rho]n_{t-1}^F - \mathcal{P}_{\theta_t}^V v_t]. \quad (4.16)$$

The first order conditions with respect to the informal labor gives the wage of the informal labor

$$w_t^S = [1 - \tau^F] \frac{y_t}{n_t^S} \alpha^S. \quad (4.17)$$

Similarly the rentability of capital is

$$r_t^k = [1 - \tau^F] \frac{y_t}{k_{t-1}} \alpha^k \quad (4.18)$$

The optimal quantity of vacancies satisfies $\Gamma_t = -\kappa / \mathcal{P}_{\theta_t}^V$. That is, at the optimum, the marginal value of a formal worker for a firm, $[\Gamma_t]$, must be equal to the symmetric of the cost of posting a vacancy divided by the probability to fill in this vacancy $[-\kappa / \mathcal{P}_{\theta_t}^V]$. Using this optimal condition for vacancy, the equilibrium condition in regards to formal work is given by:

$$\begin{aligned} \frac{\kappa}{\mathcal{P}_{\theta_t}^V} &= [1 - \tau^F] \frac{y_t}{n_t^F} \alpha^F + [-\kappa - \Gamma_t \mathcal{P}_{\theta_t}^V] \frac{\partial v_t}{\partial n_t^F} \\ &- [1 + \tau^N] w_t^F - [1 - \rho] \beta E_t \Lambda_{t,t+1} \Gamma_{t+1} \\ &= [1 - \tau^F] \frac{y_t}{n_t^F} \alpha^F - [1 + \tau^N] w_t^F + \Delta E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right], \end{aligned} \quad (4.19)$$

where $\Delta = [1 - \rho] \beta$. Therefore, in the absence of frictions $[\kappa = 0]$, wage augmented by payroll tax on the formal labor equals to the marginal product of formal labor net of tax. Whenever there is no government nor frictions $[\kappa = \tau^F = \tau^N = 0]$ wage equals marginal product of formal labor - competitive labor demand function.

4.3.4 Nash bargaining

While wage in the informal labor market is fully flexible, in the formal labor market it is determined by a Nash bargaining. Thus for this purpose, we first derive the representative household's marginal utility of having a member that, in period t , changes

his employment status from unemployed to employed in the formal sector $\left[\mathcal{U}_{t,n_t^F}^F\right]$. This household's marginal value is strictly increasing with respect to the wedge between the wage net of labor income tax and unemployment benefits as well as to the expected value of still being employed next period. That is, the unemployment benefits lost by a matched worker will be replaced by a formal wage net of tax augmented of the expected value of still being employed next period. Accordingly, it reads:

$$\begin{aligned}\mathcal{U}_{t,n_t^F}^F &= \frac{\partial \mathcal{L}_t^H}{\partial n_t^F} = \lambda_{1,t} [(1 - \tau^W)w_t^F - w^U] \\ &+ \Delta E_t[1 - \mathcal{P}_{\theta_{t+1}}^U]\mathcal{U}_{t+1,n_{t+1}^F}^F.\end{aligned}\quad (4.20)$$

We next derive the marginal value for a firm that in period t hires a formal worker as follows⁴

$$\begin{aligned}\mathcal{V}_{t,n_t^F}^F &= \frac{\partial \mathcal{L}_t^{\Pi^f}}{\partial n_t^F} = [1 - \tau^F] \frac{y_t}{n_t^F} \alpha^F - [1 + \tau^N]w_t^F \\ &+ \Delta E_t \Lambda_{t,t+1} \left[\mathcal{V}_{t+1,n_{t+1}^F}^F\right].\end{aligned}\quad (4.21)$$

Thus taking $0 < \eta < 1$ as work's bargaining power, the Nash bargaining solution is the wage $[w_t^F]$ that solves the following problem:

$$\mathcal{N}_t^F = \max_{\{w_t^F\}} \left[\eta \log \mathcal{U}_{t,n_t^F}^F + [1 - \eta] \log \mathcal{V}_{t,n_t^F}^F \right], \quad (4.22)$$

where $\mathcal{U}_{t,n_t^F}^F$ and $\mathcal{V}_{t,n_t^F}^F$ are defined in equations (4.20) and (4.21), respectively. The first order condition yields

$$\eta[1 - \tau^W]\mathcal{V}_{t,n_t^F}^F = [1 - \eta][1 + \tau^N] \left[\frac{\mathcal{U}_{t,n_t^F}^F}{\lambda_{1,t}} \right]. \quad (4.23)$$

The term $\left[\frac{\mathcal{U}_{t,n_t^F}^F}{\lambda_{1,t}}\right]$ is the household's marginal value, in terms of unit of consumption goods, of having an additional member employed formally. A worker is indifferent between being formally employed and receiving a reservation wage of w_t^F (the minimum value of real wages to make a worker willing to work) augmented by the discounted value of being employed next periods or being unemployed receiving an unemployment benefit, w^U . Similarly, a firm is indifferent between filling a vacancy by hiring a worker under a pay-off equal to its real reservation wage of \bar{w}_t^F (the maximum value of real wage willing to pay to a formal worker) or keeping the vacancy unfilled. Therefore, the Nash

⁴Comprehensively, the marginal social welfare $\left[S_{t,m}^{H,F}\right]$ that results from a match m_t is the sum of the marginal value of the matched household and the marginal value of the respective firm, such that $S_{t,m}^{H,F} = \mathcal{U}_{t,n_t^F}^F + \mathcal{V}_{t,n_t^F}^F$.

bargaining solution is an interior solution over the wedge between firm and household's real reservation wage, being the real location determined by the household's bargaining power. So, as $\eta \rightarrow 0$, the Nash bargaining solution approaches to the household's real reservation wage, such that

$$w_t^F = \eta \bar{w}_t^F + [1 - \eta] \underline{w}_t^F. \quad (4.24)$$

Consistently, abstracting from the dynamics of wages over time, we can think of an household's real reservation wage and unemployment benefits as two consumption bundle over an indifference curve, such that moving from one consumption bundle to the other has no marginal effects for households. An identical rationality may be applied on firm's decision. Thus on this conceivable framework, households and firms face $\left[\frac{\mathcal{U}_{t,n_t^F}^F}{\lambda_{1,t}} \right] = \left[\mathcal{V}_{t,n_t^F}^F \right] = 0$. Therefore, the [equations \(4.20\)](#) and [\(4.21\)](#) become, respectively:

$$\underline{w}_t^F = \left[\frac{w^U}{1 - \tau^W} \right] - \left[\frac{\Delta}{1 - \tau^W} \right] E_t [1 - \mathcal{P}_{\theta_{t+1}}^U] \Lambda_{t,t+1} \left[\frac{\mathcal{U}_{t+1,n_{t+1}^F}^F}{\lambda_{1,t+1}} \right]. \quad (4.25)$$

$$\bar{w}_t^F = \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t}{n_t^F} \alpha^F + \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \left[\mathcal{V}_{t+1,n_{t+1}^F}^F \right]. \quad (4.26)$$

where \underline{w}_t^F and \bar{w}_t^F are, respectively, the households' and firms' real reservation wages as defined above. From [Equation \(4.19\)](#) we may conclude that $\mathcal{V}_{t,n_t^F}^F = \left[\frac{\kappa}{\mathcal{P}_{\theta_t}^V} \right]$. So, plugging [equations \(4.25\)](#) and [\(4.26\)](#) into [\(4.24\)](#) and taking into account the first order condition in [Equation \(4.23\)](#), we derive the real wage as a function of households bargaining power:

$$\begin{aligned} w_t^F &= \eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t}{n_t^F} \alpha^F + [1 - \eta] \left[\frac{w^U}{1 - \tau^W} \right] \\ &+ \eta \kappa \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \left[\frac{\mathcal{P}_{\theta_{t+1}}^U}{\mathcal{P}_{\theta_{t+1}}^V} \right] \end{aligned} \quad (4.27)$$

As expected, the real wage is a positive function of marginal productivity of labor, unemployment benefits and the labor market tightness. Therefore, the higher unemployment benefits are the greater is the opportunity cost for workers, and so, they preserve for a higher formal real wage. Further, a job-seeker behaves more aggressively regarding real wage whenever he expects to easily find another job opportunity. In turn, wage claimed is inversely related to the probability of a firm filling a formal vacancy. Lastly, by using

equations (4.19) and (4.27) we write the dynamic of employment over time as

$$\begin{aligned} \theta_t^\mu &= [1 - \eta] \frac{\sigma_m}{\kappa} \left[(1 - \tau^F) \frac{y_t}{n_t^F} \alpha^F - \left(\frac{1 + \tau^N}{1 - \tau^W} \right) w^U \right] \\ &+ \Delta E_t \Lambda_{t,t+1} [1 - \eta \mathcal{P}_{\theta_{t+1}}^U] \theta_{t+1}^\mu \end{aligned} \quad (4.28)$$

4.3.5 Government

Government has three sources of fiscal revenues: labor income taxes $[\tau^W]$, payroll taxes $[\tau^N]$ and taxes levied on produced-output $[\tau^F]$. We assume that government expenditures do not contribute, directly, to either production or to household utility. Government, however, consumes g_t and rebates all remaining revenues to households in the form of a constant unemployment benefits $[w^U]$ such that its deficit equals to zero at every period of time $[def_t^g = 0]$. So, the government's intertemporal budget constraints is

$$def_t^g = g_t + w^U u_t - \tau^F y_t - [\tau^W + \tau^N] w_t^F n_t^F = 0. \quad (4.29)$$

4.3.6 Model closure and equilibrium conditions

Following [Zenou \(2008\)](#) we assume that the unemployed pool is a prior state for formal job-seeking: the workers employed informally must first become unemployed and then search for job in the formal labor market. [Zenou \(2008\)](#) argues the adequacy of this assumption because, in developing countries, a large fraction of jobs are found through word-of-mouth communication and social networking.⁵ We add that, in developing countries, there is usually a large fraction of low-educated level and unskilled workers with no means to search for job in the formal labor market. Therefore, they need first to engage in training programs to become qualified and, then, apply to existing vacancies in the formal market.⁶

[Zenou \(2008\)](#) assumes that the workers in the unemployment pool never go to the informal sector because the unemployed workers are always better than the informal workers. We, however, relax this assumption by allowing mobility in both directions. Accordingly, we define the equilibrium mobility condition assuming that the household's value in the unemployment pool $[\mathcal{U}_t^u]$ is the accumulated intertemporal pay off of the informal labor augmented by a switching cost (or benefits) of moving from formal sector to

⁵An alternative argument still is presented by [Zenou \(2008; p. 341\)](#) ... *formal and informal sectors are usually not located in the same part of the city. So one has first to move to the location where formal jobs are, and then, while unemployed, searches for a formal job.*

⁶For example, the World Bank through its Education and Employment Division of the Population and Human Resources Department has conducted programs of vocational-technical education in Developing Countries.

the informal sector. Therefore, we set the switching cost as follows:

$$M_{t,S}^F = \Xi + \psi E_t[w_{t+1}^F - w_t^F]. \quad (4.30)$$

This switching cost differs from that in [Zenou \(2008\)](#) in two ways. First, Ξ rather than be strictly positive as in [Zenou \(2008\)](#), it is an equilibrium outcome. A positive value for Ξ means that the workers in the unemployment pool never move to the informal sector, while a negative value for Ξ means that workers in unemployment pool may have benefit to move to the informal sector. Indeed, equilibrium condition yields a negative value for Ξ . The expected changes on formal labor wage $[\Delta w_{t+1}^F]$ dictates to what extent the two sector are connected. If $\psi > 0$ times changes in the formal wages $[\psi \Delta w_{t+1}^F]$ is higher than Ξ in absolute value, then the worker in unemployment pool will keep as unemployed in that sector and only look for formal hires. If $\psi \Delta w_{t+1}^F$ is lower than Ξ in absolute value, then a worker in the unemployment pool will move to the informal sector and start to work informally. Thus we write the mobility condition as

$$\frac{\mathcal{U}_t^u}{\lambda_{1,t}} = E_t \sum_{s=0}^{\infty} [\beta^s \Lambda_{t,t+1} w_{t+s}^S + M_{t+s,S}^F] = w_t^S + \Xi + \beta E_t \Lambda_{t,t+1} \left[\frac{\mathcal{U}_{t+1}^u}{\lambda_{t+1}} \right] \quad (4.31)$$

where $\frac{\mathcal{U}_t^u}{\lambda_{1,t}}$ stands for the household's value for unemployment in units of consumption good. Thus we compute the value for an unemployed work $[\mathcal{U}_t^u]$ and the value of that employed in the formal sector $[\mathcal{U}_t^e]$. These are done by making use of [Equation \(4.20\)](#) and by taking into account that $\mathcal{U}_{t,n_t^F}^F = \mathcal{U}_t^e - \mathcal{U}_t^u$. So, we write

$$\mathcal{U}_t^e = \lambda_{1,t} [1 - \tau^W] w_t^F + \beta E_t \left[[1 - \rho] \mathcal{U}_{t+1,n_{t+1}^F}^F + \mathcal{U}_{t+1}^u \right] \quad (4.32)$$

$$\mathcal{U}_t^u = \lambda_{1,t} w_t^U + \beta E_t \left[[1 - \rho] \mathcal{P}_{\theta_{t+1}}^U \mathcal{U}_{t+1,n_{t+1}^F}^F + \mathcal{U}_{t+1}^u \right] \quad (4.33)$$

Finally, by using household's budget constraint together with government's budget constraint and the firm's profit we get the resource constraint for our laboratory economy as follows:

$$y_t = c_t + g_t + i_t + \kappa v_t + t b_t + \frac{\phi}{2} [k_t - k_{t-1}]^2, \quad (4.34)$$

where $t b_t = [1 + r_{t-1}^d] d_{t-1}^f - d_t^f$ denotes the balance of trade for the domestic economy. The equilibrium conditions consist of a system of twenty one equations in twenty one endogenous variables. [Table 4.1](#), below, summarizes the equilibrium conditions for our baseline model.

Table 4.1: Model Summary - Baseline model

E4.1	Matches	$m_t = \sigma_m [s_t]^\mu [v_t]^{1-\mu}$
E4.2	Output	$y_t = a_t k_{t-1}^\alpha [n_t^F]^\alpha [n_t^S]^\alpha$
E4.3	Formal empl. dynamics	$n_t^F = [1 - \rho] n_{t-1}^F + \mathcal{P}_{\theta_t}^V v_t$
E4.4	Market tightness	$\theta_t = \frac{v_t}{1 - [1 - \rho] n_{t-1}^F - n_{t-1}^S}$
E4.5	Prob. fill. a vacancy	$\mathcal{P}_{\theta_t}^V = \sigma_m \theta_t^{-\mu}$
E4.6	Prob. find. a job	$\mathcal{P}_{\theta_t}^U = \sigma_m \theta_t^{1-\mu}$
E4.7	Euler eq. consumption	$1 = \beta [1 + r^* + f(d_t^f)] E_t \Lambda_{t,t+1}$
E4.8	Capital dynamics	$k_t = i_t + [1 - \delta] k_{t-1}$
E4.9	Euler eq. capital	$[1 + \phi(k_t - k_{t-1})] = \beta E_t \Lambda_{t,t+1} \left[1 - \delta + [1 - \tau^F] \frac{y_{t+1}}{k_t} \alpha^k + \phi(k_{t+1} - k_t) \right]$
E4.10	Informal wage	$w_t^S = [1 - \tau^F] \frac{y_t}{n_t^S} \alpha^S$
E4.11	Formal wage	$w_t^F = \eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t}{n_t^F} \alpha^F + [1 - \eta] \left[\frac{w^U}{1 - \tau^W} \right] + \eta \kappa \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \theta_{t+1}$
E4.12	Employment dynamics	$\theta_t^\mu = [1 - \eta] \frac{\sigma_m}{\kappa} \left[(1 - \tau^F) \frac{y_t}{n_t^F} \alpha^F - \left(\frac{1 + \tau^N}{1 - \tau^W} \right) w^U \right] + \Delta E_t \Lambda_{t,t+1} [1 - \eta \mathcal{P}_{\theta_{t+1}}^U] \theta_{t+1}^\mu$
E4.13	Switching costs	$M_{t,S}^F = \Xi + \psi E_t [w_{t+1}^F - w_t^F]$
E4.14	Mobility conditions	$\frac{u_t^u}{c_t^{-\gamma}} = w_t^S + \Xi + \beta E_t \Lambda_{t,t+1} \left[\frac{u_{t+1}^u}{c_{t+1}^{-\gamma}} \right]$
E4.15	Employment value	$\mathcal{U}_t^e = [1 - \tau^W] c_t^{-\gamma} w_t^F + \beta E_t [(1 - \rho) [\mathcal{U}_{t+1}^e - \mathcal{U}_{t+1}^u] + \mathcal{U}_{t+1}^u]$
E4.16	Unemployment value	$\mathcal{U}_t^u = w^U c_t^{-\gamma} + \beta E_t [(1 - \rho) \mathcal{P}_{\theta_{t+1}}^U [\mathcal{U}_{t+1}^e - \mathcal{U}_{t+1}^u] + \mathcal{U}_{t+1}^u]$
E4.17	Debt dynamics	$d_t^f = [1 + r_{t-1}^d] d_{t-1}^f - [1 - \tau^W] w_t^F n_t^F - w_t^S n_t^S - w^U u_t + c_t + i_t - r_t^k k_{t-1} - \Pi_t^f + \frac{\phi}{2} [k_t - k_{t-1}]^2$
E4.18	Gov. consumption	$g_t = [\tau^W + \tau^N] w_t^F n_t^F + \tau^F y_t - w^U u_t$
E4.19	Aggregate res. const.	$y_t = c_t + g_t + i_t + \kappa v_t + t b_t + \frac{\phi}{2} [k_t - k_{t-1}]^2$
E4.20	Job-searchers	$s_t = 1 - [1 - \rho] n_{t-1}^F - n_{t-1}^S$
E4.21	TFP shock	$\ln a_t = \beta_a \ln a_{t-1} + \sigma_\varepsilon \varepsilon_t$

4.4 Alternative financial market integration

The single-asset economy (the baseline model) we have described previously is characterized by an external risk premium to capture financial frictions that are present, particularly, in developing countries. In what follows we describe two alternative frameworks for financial integration: one where agents have access to a complete set of Arrow-Debreu contingent claims and the other featuring a closed economy.

4.4.1 Complete asset markets

Let $b_{t,t+1}^f$ denote the amount of assets purchased by households in period t to deliver a unit of good in particular state of period $t+1$, and $p_{t,t+1}$ denoting a pricing kernel such that the period- t price of a random outcome $b_{t,t+1}^f$ in period $[t+1]$ is given by $E_t p_{t,t+1} b_{t,t+1}^f$.⁷ Thus households' wealth in period t , in terms of asset holding, is given by $b_{t,t}^f$. In this economy, agents are also subject, at all dates and under all contingencies, to a no-Ponzi-game constraint of the form

$$\lim_{j \rightarrow \infty} E_t p_{t,t+j} b_{t,t+j}^f \geq 0, \quad (4.10')$$

where $p_{t,t+j} \equiv p_{0,1} \times p_{1,2} \times \dots \times p_{t+j-1,t+j}$, with $p_{t,t} \equiv 1$, denotes the pricing kernel such that $E_t p_{t,t+j} b_{t,t+j}^f$ is the period- t value of a portfolio $b_{t,t+j}^f$ with a random payment in period $[t+j]$. The partial derivatives from the household's maximization problem with respect to b_{t+1}^f delivers the following Euler equation:

$$\lambda_{1,t} p_{t,t+1} = \beta \lambda_{1,t+1}. \quad (4.35)$$

Therefore, while the access to a complete set of Arrow-Debreu contingent claims enables agents to diversify risks for every state, in the one-asset economy model, as we saw in previous section, portfolio diversification hold only on average (see [Equation \(4.13\)](#)).

The economy is small and open to the rest of the world. This counterpart is similar to the home economy, inclusive the access to the menu of internationally traded assets. Taking the starred letters to denote foreign variables, the first order condition of foreign households problem with respect $b_{t,t+1}^*$ yields

$$\lambda_{1,t}^* p_{t,t+1}^* = \beta \lambda_{1,t+1}^*. \quad (4.35^*)$$

Because of free capital mobility, asset's price equals across-countries for all dates and states, $[p_{t,t+1} = p_{t,t+1}^*]$. Under the assumption that foreign and domestic households

⁷One should note that $E_t p_{t,t+1} b_{t,t+1}^f$ can be seen as the expected amount of imported goods for a particular state of period $[t+1]$, given the information available at period t .

have the same constant subjective discounted factor $[\beta]$, equations (4.35) and (4.35*) can be rearranged in order to get $\lambda_{1,t} = \xi_0 \lambda_{1,t}^*$, where $\xi_0 = \frac{\lambda_{1,0}}{\lambda_{1,0}^*}$ is meant to determine the relative size of domestic marginal utility of consumption with respect to its foreign counterpart. Because the focus is on productivity shocks within a small open economy, we taken foreign variables as exogenously given and time invariant. As a result we get $\lambda_{1,t} = \xi_0 \lambda_{1,t}^* = \psi_0$. Therefore, the access to a complete asset markets allows households to fully insure themselves against domestic risk, facing only foreign aggregate risk which is nil, here, by hypothesis. Table 4.2 displays the two non sharing equilibrium equations with respect to the previous presented single-asset economy model.

Table 4.2: Complete asset markets

E4.7'	Euler eq. consumption	$c_t^{-\gamma} = \psi_0$
E4.17'	Asset holdings	$E_t p_{t,t+1} b_{t,t+1}^f = b_{t,t}^f + [1 - \tau^W] w_t^F n_t^F + w_t^S n_t^S + w^U u_t - c_t - i_t + r_t^k k_{t-1} + \Pi_t^f - \frac{\phi}{2} [k_t - k_{t-1}]^2$

4.4.2 Closed economy

While in the previous presented economic models households can partial or fully diversify country specific risk by implementing an optimal consumption plan, in closed economy they have no such possibility. Here, households cannot borrow and lend internationally.⁸ Therefore, the economic agents can only accumulate capital with the savings of its own residents.

The households' problem remains the same as described by Lagrangian function in Equation (4.10) with two additional restrictions $d_{t+1}^f = d_t^f = 0$. The equilibrium conditions differ only with respect to the Euler equation for consumption (due to the impossibility of implementing all consumption plans) and the resource constraint of the economy (due to the impossibility to absorb foreign savings). Table 4.3 also displays the two non-sharing equations with respect to the one-asset economy model.

Table 4.3: Closed economy

E4.7''	Euler eq. consumption	$c_t^{-\gamma} = \lambda_{1,t}$
E4.17''	H. budget constraint	$c_t + i_t = [1 - \tau_t^W] w_t^F n_t^F + w_t^S n_t^S + w^U u_t + r_t^k k_{t-1} + \Pi_t^f - \frac{\phi}{2} [k_t - k_{t-1}]^2$

⁸This is essentially a financial autarky. Because our model features only a tradable good, once we assume financial autarky ($d_t^f = 0$), the model becomes a closed economy framework.

4.5 Dynamics of the model

In this section we lay out the dynamics of the model. We are interested on the dynamics of the informal sector over the business cycle as well as its impact on the overall economic volatility. We are also interested in how financial frictions, as measured by EFP (or say, country risk premium, ξ), affect the volatility and the dynamics of the model. The quantitative simulation and calibration strategy are presented in the following sections.

4.5.1 Calibration

The calibration strategy is meant to match annual business cycle frequency in developing countries. Drawing on the conventional business cycle literature we set the subjective discount factor $[\beta]$ equal to 0.96 and depreciation rate $[\delta]$ equal to 0.1.

To assign values to the production function parameters, we rely on [Gollin \(2002\)](#) and [Bernanke and Gürkaynak \(2001\)](#) who show that factor shares in developing countries are, generally, similar to those of developed countries, whenever we take into account the self-employing sectors. Indeed, regardless of income *per capita*, the former finds a labor share ranging from 0.68 to 0.80, on an average of 0.758. Thus we take a capital share $[\alpha^k]$ equal to 0.28. The labor shares $[\alpha^F, \alpha^S]$ are set accordingly to the size of the informal employment $[\bar{n}^S]$. We set \bar{n}^S accordingly to the average size in the literature. For instance, [Bacchetta et al. \(2009\)](#) conclude that there is a large variation of the informal employment across countries; reporting (with a decreasing trend) a relative size of the informal employment around of 60 percent for developing countries. So, we set $\bar{n}^S = 0.56$. This choice leads us to arrive at $\alpha^S = 0.4383$, for an unemployment rate $[\bar{u}]$ of 8 per cent.⁹

In regards to the matching process, there are five parameters to which we need to assign values: the bargaining power parameter $[\eta]$, the elasticity of matches with respect to job seekers $[\mu]$, the matching efficiency parameter $[\sigma_m]$, the vacancy costs parameter $[\kappa]$, the separation rate $[\rho]$, and two cost parameters for the mobility condition, the fixed switching costs $[\Xi]$ and the expected formal wage-dependent switching cost parameter $[\psi]$.

As is conventional in the literature, we assume that firms and workers share equal fraction of surplus of matches, by setting $\eta = 0.5$. Moreover, we set $\mu = \eta$ satisfying the so-called [Hosios \(1990\)](#) condition. While the matching efficiency parameter $[\sigma_m]$ reflects to what extent the units of formal labor markets are matched, for a given externality that

⁹According to International Labor Organization (ILO), the unemployment rate in developing countries over the last two years is 5.5%. However, our choice of 8% is consistent to that of 7.2% chosen by [Albrecht et al. \(2009\)](#) and the reference therein of 6.1% for Mexico, 5.5 for Brazil and 13% for Colombia.

each one exerts on the others, the vacancy costs parameter $[\kappa]$ reflects frictions generating equilibrium unemployment. Exogenously, we set $\sigma_m = 0.5$. By making use of [equations \(4.19\) and \(4.27\)](#) we arrive at $\kappa = 0.2332$, yielding an equilibrium ratio of recruiting costs to output of 1.9 per cent which is slightly above to that of 1.2 percent that [Satchi and Temple \(2009\)](#) obtains for Mexico and that of 1 percent for US economy in [Andolfatto \(1996\)](#). Following related literature, we set $\rho = 0.1$. The fixed mobility costs parameter $[\Xi = -0.1539]$ is an equilibrium outcome, derived by managing [equations \(4.31\), \(4.32\) and \(4.33\)](#). The formal wage-dependent switching costs parameters $[\psi = 0.7527]$ is set to reflect formal wage relative to informal one.

Drawing on [Kugler and Kugler \(2009\)](#) and [Gordon and Li \(2009\)](#), the fiscal instruments are set such that $\tau^F = 0.3$, $\tau^W = 0.35$ and $\tau^N = 0.15$. The persistence $[\beta_a]$ and the variance $[\sigma_e]$ of the productivity shocks are set 0.52 and 1, respectively. \bar{d} is set to match the observed average trade-balance-to-output ratio of -0.05 in developing countries. The remaining parameters as capital adjustment costs $[\phi = 0.028]$, external finance premium (EFP) $[\xi = 0.000742]$ and the relative risk aversion parameter $[\gamma = 2]$ are borrowed from [Schmitt-Grohé and Uribe \(2003\)](#). [Table 4.4](#) below summarizes the calibrated values for the parameters and [Table 4.5](#) displays the implied steady state values.

Table 4.4: Summary of the calibration

Parameter	Value	Description
β	0.96	Discount factor
δ	0.10	Capital depreciation rate
r^*	0.0417	World interest rate
α^k	0.2800	Capital share
α^S	0.4383	Informal labor share
η	0.50	Households bargaining power
μ	0.50	Elasticity of matches to searches
κ	0.4739	Vacancy costs
σ_m	0.50	Efficiency of matches
Ξ	-0.1539	Switching costs
ψ	0.7527	Formal wage-dependent switching costs
ρ	0.10	Separation rate
τ^F	0.30	Corporate tax
τ^W	0.35	Labor income tax
τ^N	0.15	Payroll tax
ϕ	0.028	Capital adjustment costs
ξ	0.000742	External Finance Premium
γ	2.00	Intertemporal elasticity of substitution
β_a	0.52	Persistence of TFP shock
σ_e	1.00	Variance of TFP shock

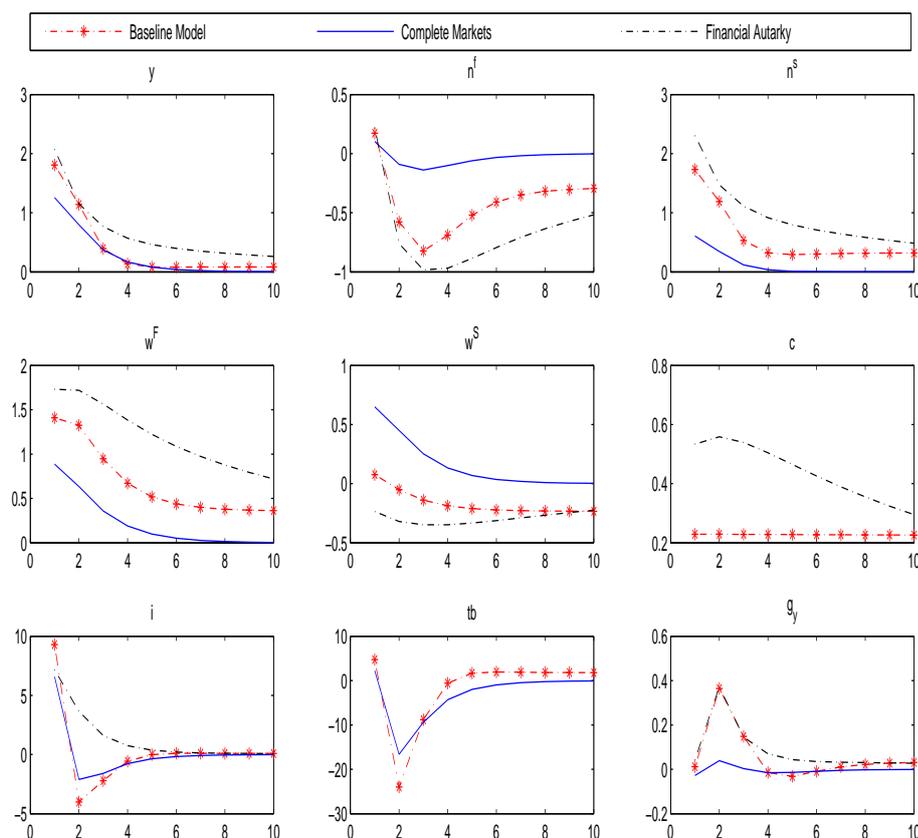
Table 4.5: Summary of the steady state values

Description	Notation	(1)
Wage share	$[w^F n^F + w^S n^S] / y$	0.455
Unemployment rate	u	0.080
Formal employment	n^F	0.360
Informal employment	n^S	0.560
Investment to output ratio	i/y	0.138
Vacancy costs to output ratio	$\kappa v/y$	0.019
Consumption to output ratio	c/y	0.530
Trade balance to output ratio	tb/y	-0.049
Government consumption to output ratio	g/y	0.362

4.5.2 Dynamics

Figure 4.1 below illustrates the dynamics of the three economic models. The figure plots the dynamics of the selected variables when the economy is hit with a positive technology shock. The variables are expressed in percentage deviation from the steady state values. A positive productivity shock leads to rise in output, investment, consumption, and formal wage in all markets. A deterioration of trade balance (as percentage of output) takes place as well. In regards to the cyclicity of government consumption $[\rho_{g_t, y_t}]$, although we find that it is procyclical in both scenarios of financial markets (single-asset economy, complete asset markets, and closed economy), we observe that the degree of procyclicality increases from complete asset markets to closed economy. That is, the degree of procyclicality is, respectively, 20% and 23% higher in single-asset economy and in closed economy than the cyclicity of government consumption in economy with complete asset markets. This result sheds light on the argument that developing countries are often constrained by fragile financial markets and low financial integration that may impinge with the stabilization role of fiscal policy, determining procyclicality of fiscal policy.

Figure 4.1: Dynamics of selected variables for alternative levels of financial integration

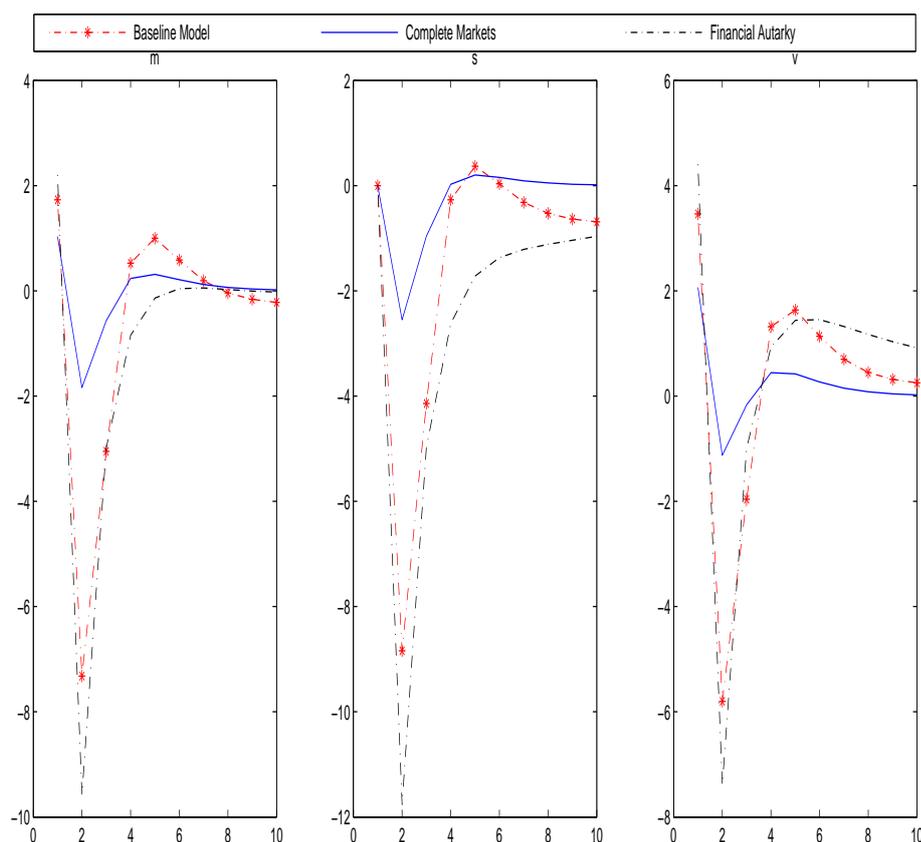


Contrarily to the view of buffer role of informality or that taking informality as an inferior segment rationed out of formal labor market, we find a procyclical informal employment and a countercyclical formal one. These results strongly collaborate with the findings in [Bosch and Maloney \(2008\)](#). Indeed, the authors report that formal (informal) employment are strongly countercyclical (procyclical) in Brazil and Mexico. Particularly, they conclude that the countercyclicity of formal employment is due to the difficulty of finding formal jobs from the informal sector during recessions rather than because of increased separation from formal jobs; and a procyclical rather than countercyclical jobs flows from formal to the informal sector. Similar results can be found in [Fiess et al. \(2010\)](#) and [Bosch and Esteban-Pretel \(2012\)](#). Both papers report procyclical informal sector.

[Figure 4.2](#) displays the dynamics of matches [m], unemployment (searches, [s]) and formal vacancies [v]. The first result that emerges from the figure is the larger volatility of the variables in the Single Asset and Financial Autarky models than that observed in the Complete Asset model. This result can be also inferred from [Figure 4.1](#) and confirmed in the [Table 4.6](#). It calls us for the importance of credit market conditions for the fluctuations in economic activity.

The second observation is that, as in developed countries, unemployment is countercyclical. Further, while formal vacancies are procyclical (leading to the so-called *meeting effect*), the number of matches are countercyclical. The contemporaneous correlations of vacancies with output are 0.0296, 0.4492 and 0.1238 for the Single Asset, Complete Asset and Financial Autarky models, respectively. In the same order, the correlation between matches and output are -0.4692, -0.1310 and -0.3653. These statistics suggest there is some informal mechanism at work. That is, the flows of workers out of the unemployment pool operate mainly through of the informal mechanism (*e.g.*, informal employment relationship through of sub-contracting arrangements such as part-time and temporary jobs) rather than formal one. Again, the results are consistent with procyclical flows of workers from formality into informality observed by [Bosch and Maloney \(2008\)](#) in Brazil and Mexico.

Figure 4.2: Dynamics of matches, searches, and vacancy for alternative levels of financial integration



[Table 4.6](#) summarizes the main statistics of the models. The top block of the [Table 4.6](#) reports the qualitative co-movements (sign of correlations) of output with a selected variable i for the three alternative financial integration. (1), (2) and (3) refer, respectively,

model 1 (Single Asset model), model 2 (Complete market model) and model 3 (Financial Autarky model). As is standard in business cycle literature, investment and consumption are procyclical. Informal jobs are procyclical and formal jobs are countercyclical. Trade balance to output ratio is countercyclical in all markets, supporting the idea that imports exceeds exports during expansions and vice versa in downturns.

The bottom block of [Table 4.6](#) displays the standard deviation of output and the relative standard deviation with respect to output of the selected variables. In line with the predictions of credit market related-literature, we find a positive relation between credit market imperfections and fluctuations in output (see the first column). One Asset model is 52 percentage point more volatile than Complete Asset model. Also, Financial Autarky economy is approximately twice as volatile as the Complete Asset economy.

Table 4.6: Qualitative co-movements of output with selected variables under alternative financial integration scenarios.

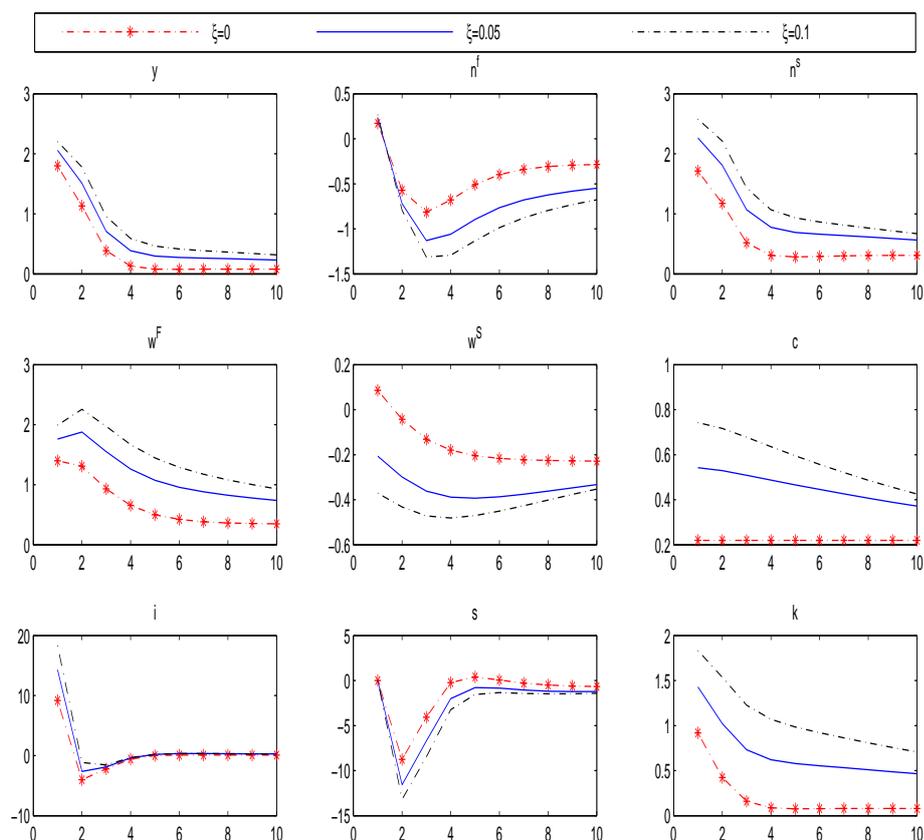
	(1)	(2)	(3)
$\rho_{[y_t, n_t^F]}$	—	—	—
$\rho_{[y_t, n_t^S]}$	+	+	+
$\rho_{[y_t, w_t^F]}$	+	+	+
$\rho_{[y_t, w_t^S]}$	—	+	—
$\rho_{[y_t, c_t]}$	+	NA	+
$\rho_{[y_t, i_t]}$	+	+	+
$\rho_{[y_t, tb_t/y_t]}$	—	—	NA
$\rho_{[y_t, g_t]}$	+	+	+

Volatilities								
	σ_{y_t}	$\sigma_{n_t^F}/\sigma_{y_t}$	$\sigma_{n_t^S}/\sigma_{y_t}$	$\sigma_{w_t^F}/\sigma_{y_t}$	$\sigma_{w_t^S}/\sigma_{y_t}$	$\sigma_{c_t}/\sigma_{y_t}$	$\sigma_{i_t}/\sigma_{y_t}$	$\sigma_{g_t}/\sigma_{y_t}$
(1)	2.34	1.54	1.83	2.01	1.21	1.17	4.30	1.17
(2)	1.54	0.15	0.54	0.76	0.55	NA	4.51	1.02
(3)	2.74	0.94	1.31	1.55	0.38	0.56	3.00	1.11

To go a little further, we explore the implication of financial frictions on the dynamics of the model. We take the EFP $[\xi]$ as a measure of financial integration (disintegration) such that the larger is ξ the lower (higher) is the financial integration (disintegration). For this purpose, discretionarily, we use three different values for ξ : $\xi = 0$, $\xi = 0.05$, and $\xi = 0.1$. [Figure 4.3](#) illustrates the key dynamics of the selected variables. The star-dashed lines are the dynamics for a country perfectly integrated (with no EFP $[\xi = 0]$), and the solid and dot-dashed lines are the dynamics under a spread of 0.05 and of 0.1, respectively.

We observe that, as the country premium increases, the economic responses to TFP shocks become larger. We can make a connection between Single Asset and Financial Autarky models with small size economy. So, small economies are subject a large fluctuations on their macroeconomic aggregates, because they face larger EFP.

Figure 4.3: Effects of external finance premium on the dynamics selected variables

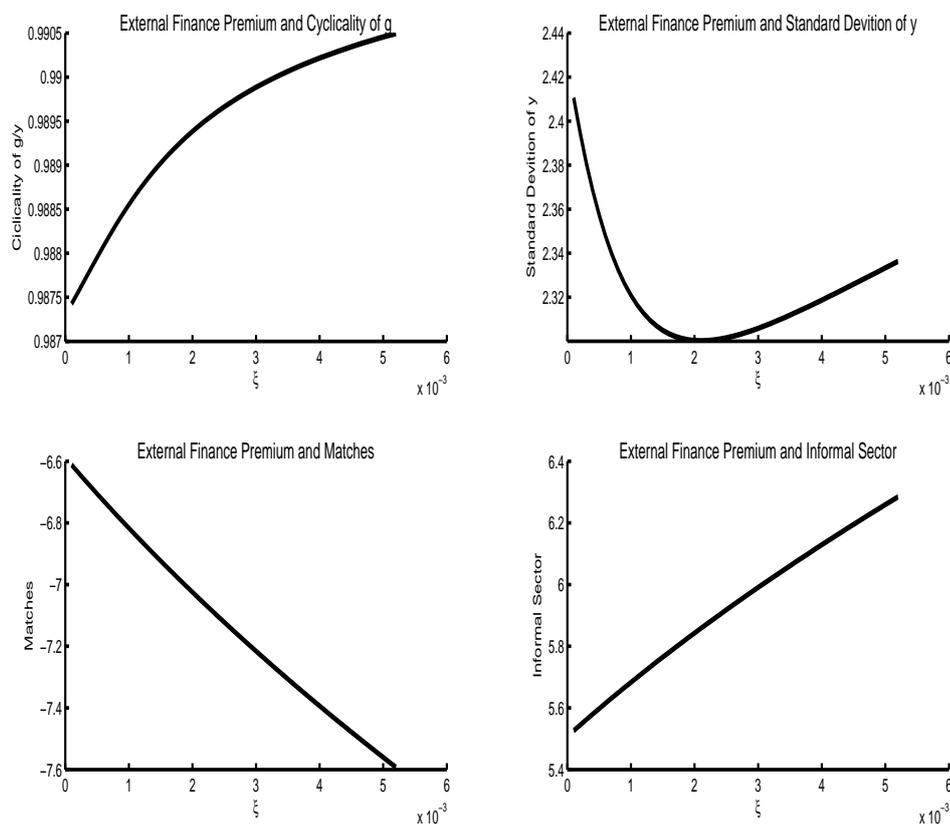


Notwithstanding, a word of caution is warranted. According to our baseline model we present early, the economic volatility can stem from two sources: from imperfections in credit market measured by EFP and/or from the size of the informal sector. Figure 4.4, from upper left to lower right, reports the relation between financial integration, measured by EFP [ξ], and cyclicity of government consumption net of transfers [$\rho_{(g,y)}$], the relation between EFP and the standard deviation of output [σ_y], the relation between EFP and formal matches [m], and the relation between EFP and the size of the informal sector [n^S].

Starting from the lower right output, we observe a negative relationship between financial integration and the informal sector. That is, the larger is financial integration (lower size of ξ) the lower is the response of the informal sector to TFP shock. The size of the informal sector here is measured as the accumulated responses of the informal sector to TFP shocks for different size of ξ (ranging ξ from 0.0001 to 0.005242). This finding is in line to the argument we present early that credit-constrained borrowers take informality as a beneficial cushion. Still this argument is line with the lower left output of Figure 4.4, where we observe a positive relation between formal matches and financial

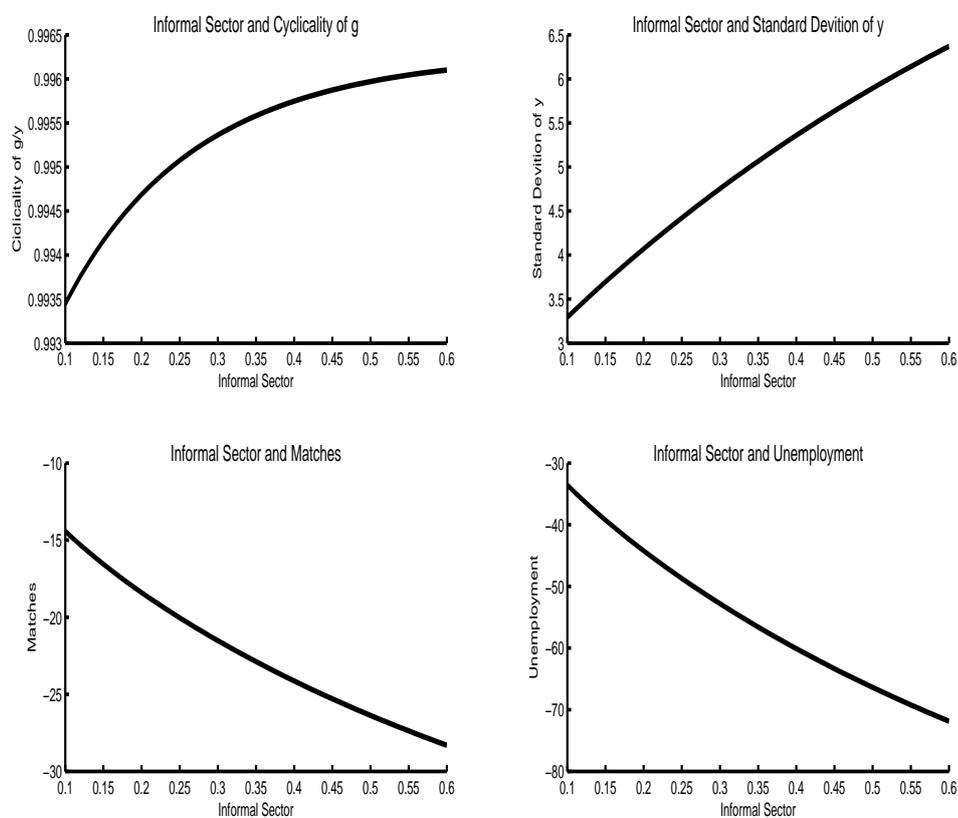
integration. In others words, the prevalence of the informal mechanism over the formal ones is larger with worse credit markets conditions. We, however, find a nonmonotonic relation between EFP and volatility of output (see the upper right of Figure 4.4)

Figure 4.4: Implication of Financial Integration on selected variables



To analyze the importance of the steady state size of the informal sector, Figure 4.5 displays the relationship between the steady state size of the informal sector and the selected variables. The Figure 4.5 shows a monotonically increasing relation between the size of informality and the procyclicality of government consumption on the one hand, and the size of informality and volatility of output, on the other hand. Eng (2010) argue that existence of a sizable informal sector might explain why fiscal policy is procyclical in developing countries. Granda-Carvajal (2010) and Ferreira-Tiryaki (2008) conclude that countries with a sizable informal economy exhibit higher variability in output, consumption and investment. Both matches and unemployment are negatively related with the informal sector. That is, the informal sector strengthens the countercyclical behavior of formal matches and unemployment rate. Bacchetta et al. (2009) rely on Eslava et al. (2010)'s results to argue that less developed financial markets may hamper a more dynamic process of the formal job creation and prevent higher transition rates from the

Figure 4.5: Implication of the informal sector on the selected variables

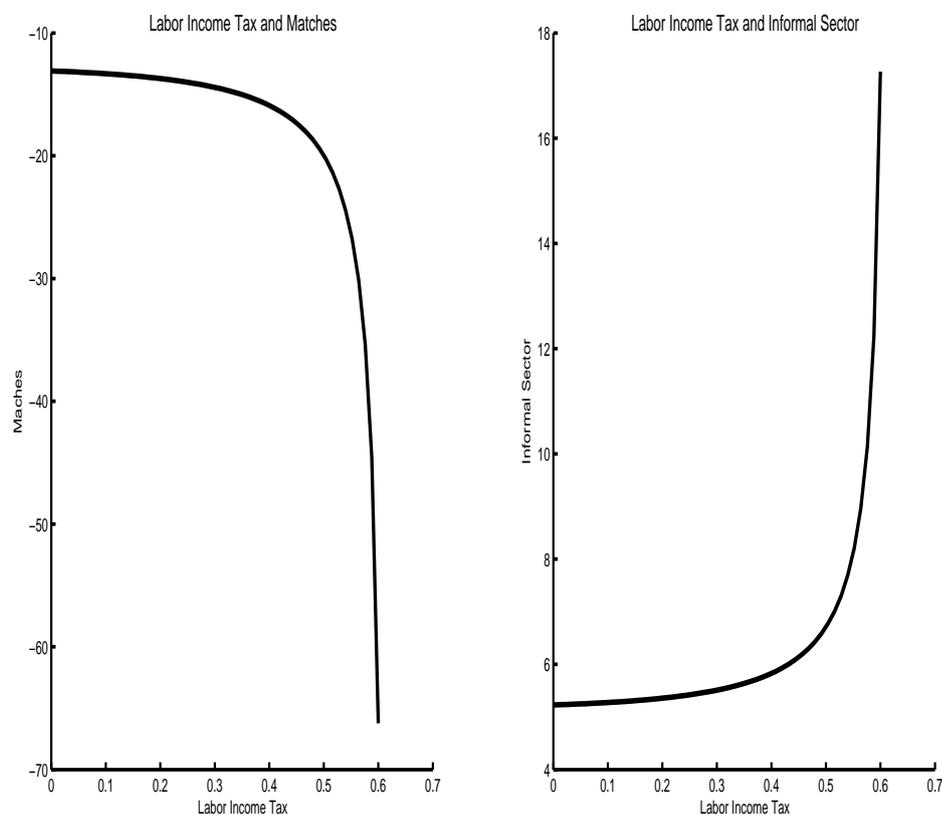


informal to the formal economy, such that the informal labor market and financial market dynamics enter a complementary relationship. Our results, therefore, appear to be consistent with that argument.

We end this section by shedding light on the effects of labor market policies on the formal (matches) and the informal labor input. The size of the informal sector poses challenges in terms of achieving the desired level of fiscal revenues as it increases the sensitivity of tax bases to tax rate changes. Putting differently, the government's ability to generate additional revenues is severely constrained when there is an informal sector. A positive change in tax rate will trigger an incentive for non taxable sector which, in turn, reduces tax base. To explore this argument, we use the model to analyze the effects of labor income tax $[\tau^W]$ on the informal sector and formal matches. Figure 4.6 displays the responses of matches and the informal labor input to labor income tax. We change τ^W and see to the accumulated responses of matches and the informal employments. First, we observe that matches and the informal sector relate inversely and symmetrically. Second, from a tax rate lager than 40%, the informal sector response go up explosively and formal matches response go down explosively. This result confirms the above argument and is

strictly linked to the well-known Laffer curve. We can infer from Figure 4.6 that tax rate larger than 60% has no effect on tax revenue.

Figure 4.6: Effects of labor income tax on matches and on the size of the informal sector



4.6 Conclusion

In this chapter we develop a model of a small open-economy with dual labor markets. The formal labor market is characterized by trading frictions *a la* Diamond-Mortensen-Pissarides in which labor adjusts at the extensive margin. The informal sector is frictionless.

Our exercises lead us to conclude that credit market conditions play an important role on economic responses to productivity shocks. Indeed, the results show that the worse are credit markets conditions, as measured by country risk premium, the larger are the responses of economic aggregates. Therefore, a perfectly integrated economy responds more smoothly to shocks than that with limited access to credit markets. We also find that risk premium and the informal sector work under a complementary relationship. The results suggest both that informality and country risk premium hamper firms to hire formal

workers.

By allowing the flows of workers in both directions between the two labor markets, this chapter delivers a procyclical informal sector. That is, informality expands in periods of expansions and shrinks when recessions take place. Similar to the results for country risk premium, we find that an economy with a sizable informal sector experiences larger volatility in output. Further, we find that both credit markets imperfections and the informal sector stand up as a source of the procyclical behavior of fiscal policy observed, particularly, in developing countries. We end by concluding that a sizable informal sector poses challenges for labor market policies interventions as such policies alone might discourage formal hires and motivate informality.

Conclusions of the thesis

5.1 Summary

This thesis addresses some questions for which more research is still warranted: procyclicality of fiscal policy in developing countries, business cycle regularities of the informal sector, and differentiation in business cycle features across country development level. On the one hand, while imperfections in credit markets and weak political and institutional frameworks have a long tradition in explaining the procyclicality of fiscal policy, the informal sector has played little (or no) role in that story. On the other hand, while business cycle theories diverge on their assumptions about economic fluctuations, virtually all of them focuses only on formal economic activity. Thus this thesis aims to show that informality may play an important role in accounting for fiscal procyclicality, business cycle fluctuations and labor market outcomes.

The thesis consists of three stand-alone chapters. First, it focus on the cyclicity of fiscal policy in developing countries in contrast to that in developed countries. Second, it assesses the business cycle regularities of the informal sector and its relation with key macroeconomic aggregates. Third, it analyses the implications of the informal sector and financial integration on business cycle fluctuations, on fiscal policy, and on labor markets outcomes.

A common factor to all these chapters is the informal sector. While in the first chapter we propose a discussion on why the informal sector may be central to determining cyclical stances of fiscal policy, in the second and third chapters the informal sector is at the core of analysis. The main conclusion of this thesis could be summarized chapter-by-chapter as follows.

After a general introduction in Chapter 1, Chapter 2 surveys the literature on procyclicality of fiscal policy in developing countries, comparing with that in developed countries on three aspects: first, it reviews the theories for procyclicality of fiscal policy; second,

it summarizes the alternative methods in the literature to assess the cyclicity of fiscal policy; and third, it appraises the empirical literature and the tests of the several alternative theories. At reviewing the evidence on cyclicity of fiscal policy, we only select the literature which looks at policy instrument (government consumption (GC) and/or government expenditure (GE)) rather than outcome variables. In addition, tax rates is a good indicator to measure the cyclicity of fiscal policy. However, because the literature has no a systematic estimates of the cyclicity of tax rates, such variable is neglected in this review.

Relying on signal and statistical significance, evidence of cyclicity of fiscal policy is assigned to acyclical, countercyclical and procyclical categories for developed and developing countries. We conclude that the view that fiscal policy is procyclical in developing countries contrasting with the countercyclical or acyclical ones in developed countries has reached the mainstream status. That is, the conduction of procyclical fiscal policy in developing countries can be seen as a stylized fact, while such policy is countercyclical or acyclical in developed countries. In a sample of 160 estimates of cyclicity of fiscal policy for developed countries, we find that 36,3% are countercyclical, while 24.4% are acyclical. In developing countries, the picture is, however, different: in a sample of 344 estimates of cyclicity of fiscal policy, only 3.5% are countercyclical. The remaining, 19.6% are acyclical and 77% are procyclical. Still, among the studies which deliver procyclical fiscal policy for both group of countries, 89% (17 out of 19) constitute evidence that procyclicality is more strong in developing countries. Taking developed and developing countries as a whole, we conclude that only 11.3% (53 out of 471) of the empirical estimates follow Keynesian prescription.

With regards to credit channel based explanations, in a sample of 218 results we find that 33.5% support that relaxing credit constraints provide room for conducting countercyclical fiscal policy, while 56,5% constitute the evidence that such factors have no effect on cyclicity of fiscal policy. Results on political-institutional channels appear to distribute symmetrically among positive (30.3%), negative (37%), and null effect (32.6%) on fiscal procyclicality.

We observe that most of the literature has not addressed properly at least one of three crucial methodological challenges: concept of procyclicality of fiscal policy, endogeneity, and identification problem. Among the studies that focus on policy instruments, only 32% have taken into account endogeneity problem, and only 12.5% correct for both endogeneity and/or omission bias. While the literature takes credit constraints and political economy as alternative explanations for fiscal procyclicality, we argue that they are not alternative explanations but complementary, being political economy theoretically dominant: if there was no procyclicality during expansion phases, there would not be pro-

cyclicality during recessions. Further, developing countries are the default recipients of foreign direct investment inflows due to lower labor costs and higher marginal productivity of capital. In spite of that their fiscal policy mostly behaves procyclically. We end by arguing that informality may also be a feasible explanation in determining fiscal procyclicality; but, to the best of our knowledge, the literature fails to address this link.

Chapter 3 assesses business cycle features of the informal sector and its relation with key macroeconomic variables. We first estimate the size of the informal sector covering 37 poor, 46 emerging and 22 rich countries using a deterministic dynamic general equilibrium (DGE) model, and then we provide a comprehensive set of business cycle regularities of the informal sector in macroeconomic context.

The main findings are summarized throughout of Chapter 3 in the form of Stylized Facts (from *Stylized Fact 1* to *Stylized Fact 10*) and 5 corollaries. These latter synthesize the implications of the underground sector on the key economic aggregates. In particular, the Chapter 3 concludes that while the absolute size of the informal sector is procyclical in both group of countries, the relative size of the informal economy to GDP is counter-cyclical (if anything acyclical) in poor countries and weakly procyclical in rich countries. The informal economy is less persistent than real output either in downturns or upturns. Evidence points to a positive effect of informality on procyclicality of fiscal policy, on fluctuations in overall economic activity; and a negative effect on investment and on the persistence of macroeconomic aggregates. These and further conclusions are summarized on [Table 5.1](#) bellow.

As the facts are listed, they are contrasted with the exiting literature and try to touch upon some mechanisms that constitute a fertile ground for future research. Moreover, we believe that further research should be directed to the estimation of the informal economy. For instance, the DGE model on which we rely to estimate the informal economy assumes balanced budget for the government and depend at some extent to the estimates of the informal economy presented by [Schneider et al. \(2010\)](#). In spite of these shortcomings, the stylized facts constitute a further input to the existing literature.

Chapter 4 accesses the dynamics of the informal sector over the business cycle as well as its impact on the overall economic volatility. It also analyzes how financial frictions, measured by the external finance premium, affect the volatility and the dynamics of an economy. These tasks are accomplished by calibrating the model to match annual business cycle frequency in developing countries. Specifically, in Chapter 4 we develop a small, open, developing economy model, financially integrated, with dual labor markets. The formal labor market is characterized by search and trading frictions *a la* Diamond-Mortensen-Pissadires in which labor adjusts at extensive margins. The informal sector in frictionless.

Table 5.1: Informal sector and cyclical properties of economic aggregates: stylized facts and corollaries

Facts/Corol.	Statements
Fact 1	The size of the informal sector, in percentage of official output, relates negatively with the level of development.
Fact 2	There is a declining trend of the relative size of the informal economy to GDP; the rate of reduction is higher, and rather similar, in poor and emerging countries when compared to rich countries.
Fact 3	The informal economy tends to be more volatile than official output.
Fact 4	The absolute size of the informal economy is strongly procyclical.
Fact 5	The size of the informal economy relative to official output tends to be countercyclical in poor countries while procyclical in emerging and rich countries.
Fact 6	The informal economy is positively correlated with government consumption.
Fact 7	The absolute size of informal sector is positively correlated with private consumption.
Fact 8	The informal sector is more persistent in rich countries than in poor countries.
Fact 9	The informal economy is more persistent during recessions than expansions, in poor countries.
Fact 10	Informal sector is asymmetric, particularly, in poor countries.
Corollary 1	Countries with sizeable informal sector tend to experience greater fluctuation in their overall economic activity.
Corollary 2	Countries with sizeable underground economy are unable to adjust their own investment levels, particularly in upturns.
Corollary 3	Countries with sizeable underground economy enhance the likelihood to exhibit a procyclical fiscal policy.
Corollary 4	Countries with sizeable underground economy enhance the likelihood to boost import in a procyclical fashion.
Corollary 5	Countries with sizeable underground economy enhance the likelihood to exhibit smaller persistence in their macroeconomic variables.

The exercises performed in Chapter 4 lead, therefore, to several conclusions: first, the analysis finds that credit markets conditions play an important role in economic responses to total-factor productivity shocks. Indeed, the results show that the worse is the credit markets conditions, measured by external financial premium, the larger are the responses of economic aggregates to total factor productivity shocks. Therefore, a perfectly integrated economy behaves more smoothly to shocks than that with limited access to credit markets. We also find that the worse are credit market conditions the larger is the size of the informal sector. Still, the results suggest that both informality and external financial premium hamper firms to hire formal workers.

By allowing the transitions of workers in both directions in the two labor market segments, Chapter 4 delivers a procyclical informal sector. That is, informality expands in periods of expansions and shrinks when recessions take place. We find that, similar to external financial premium, an economy with a sizable informal sector experiences large volatility in output. Furthermore, both credit market imperfections and the size of the informal sector stand up as a source for procyclical behavior of fiscal policy observed par-

ticularly in developing countries. We end by noting that a sizable informal sector poses challenges for labor market policies interventions as such policies alone might discourage formal hires and motivate informality.

5.2 Limitations, future research, and policy prescriptions

Based on the exercises conducted throughout the three main chapters (2, 3 and 4), this section aims at discussing some limitations of the thesis and highlights some avenues for possible future research.

5.2.1 Limitations and future research

The literature review conducted in Chapter 2 examines a collection of pieces of the literature on procyclicality of fiscal policy, comparing developing and developed countries, at different points in time. It relies on the assumption that every such piece of the literature contains a valid theory and that, when it comes with empirical evidence, such evidence is not fuzzy. Thus the limitation of Chapter 2 is the complete reliance on previously published research and on the methodology used by these studies. Therefore, Chapter 2 is not preoccupied with the critical discussion of the existing theories and their importance over time on procyclicality of fiscal policy. For example, while some political economy models suggest that democracy, with appropriate checks and balances, improves macroeconomic management including giving room for countercyclical fiscal policy ([Persson and Svensson \(1987\)](#)), others argue (see *e.g.*, [Lane \(2003\)](#)) that democracy, involving multiple veto points in the process of policy-making, may lead to procyclical fiscal policy. With all its complexity and difficulties, political economy model deserve more attention in the future.

Chapter 3 estimates the size of the informal output. The main limitation of the approach we carry out in this chapter is that it assumes a balanced budget for the government and it depends on an initial value for which we use the estimates available in [Schneider et al. \(2010\)](#). The empirical evidence provided in Chapter 3 is a simple test on the relation between the size of the informal sector and some characteristics of macroeconomic fluctuations and the relation between the size of the informal sector with the cyclicity of government consumption. Therefore, Chapter 3 does not discriminate, empirically, the channels by which the informal sector link to the official business cycles characteristics and the cyclicity of government consumption.

Chapter 4 succeeds in matching several theoretical and empirical strands of literature. But it also has its limitations. The assumption that the informal segment of labor markets is competitive may be strong because several researches argue that informal workers

engage mainly through friendships and family relationships. If so, the wage in the informal sector is not determined uniquely by marginal productivity but, instead, affected by the degree of the relation between employer and employed. Furthermore, Chapter 4 consider domestic productivity shocks, but most of the developing countries rely largely on imported technologies as sources of new productive knowledge. Generally, such international technology transfer imply movement of people; but the analysis of such externalities is out of reach of the model.

Finally, a common omission to all these chapters is the lack of the discussion of the informal financial markets. We are aware that such markets play an important role on the issues covered in this thesis. Assessing the role of informality of the financial sector on macroeconomic policies and business cycle fluctuations should be high on the future research agenda.

5.2.2 Policy prescriptions

The results found in this thesis point for, at least, three policy recommendations: promoting the formalization of both workers and firms, strengthening financial markets, and the improvement of institutional framework in developing countries. These reform policies are likely to help countries to cope with adverse shocks, to conduct countercyclical fiscal policy as well as giving room for higher potential growth.

Successful formalization policies should take into account, in some extent, the reasons why firms and workers choose the formal or informal sector and the transitional cost faced by these economic units from the informal sector to the formal one. Furthermore, formalization policies should be design in accordance with the typology of informality and adapted to country context. For example, policies that reduce formalization costs and improved access to financial markets may be more effective for fighting against the informal unregistered firms, while improving regulatory enforcement and inspections may work better for combating against tax evasion. The literature has devoted much on this issue. An extensive discussion on how to encourage formalization of economic units can be founded in [Kenyon \(2007a;b\)](#) and [ILO \(2006; 2007\)](#)'s report.

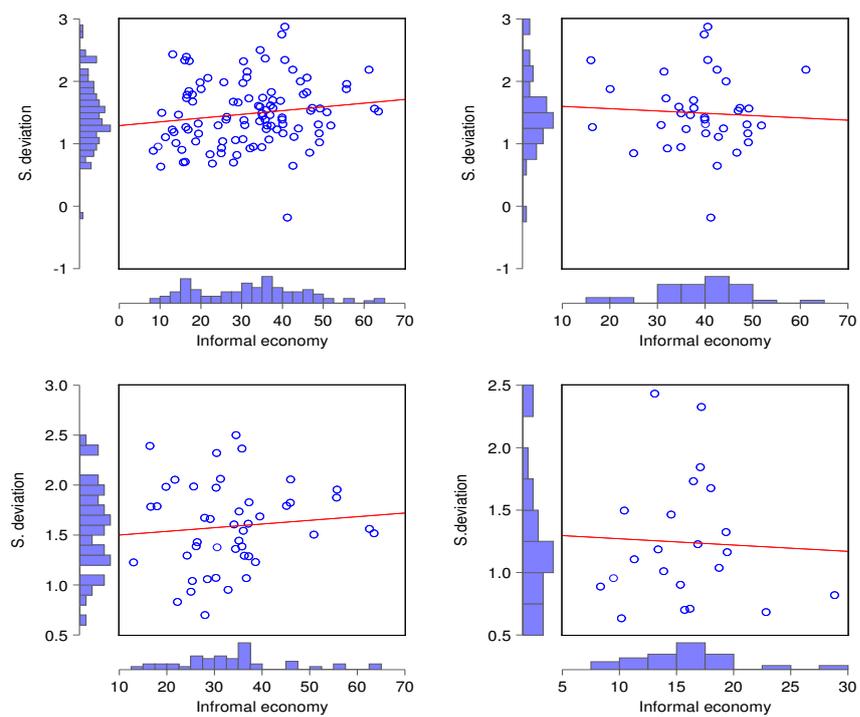
While formalization policies should be carried out along with policy initiatives for local development structures, achieving a robust financial markets and strong institutional framework, such as legal and regulatory framework that facilitates the enforcement of financial contracts, loan recovery, and the realization of collateral, are intrinsic tasks. Because developing countries are largely bounded to urban based-banks which organized their supplier of credit primarily to the wealthier population and larger corporations, alternative financial institutions should be developed to overcome this malfunctioning of financial market. These alternative financial institutions promote competition between

banking and other financial sector which improve the efficiency of intermediation and resilience of financial markets. Government able to issue state contingent debt and managing the maturity structure of noncontingent debt are widely accepted in the literature that may be welfare-improving and as safe way to repair the malfunctioning of financial market in developing countries (for an overview, see, *e.g.*, [Angeletos \(2002\)](#), [Buera and Nicolini \(2004\)](#) and [Brooke et al. \(2013\)](#)).

Appendix A: Figures

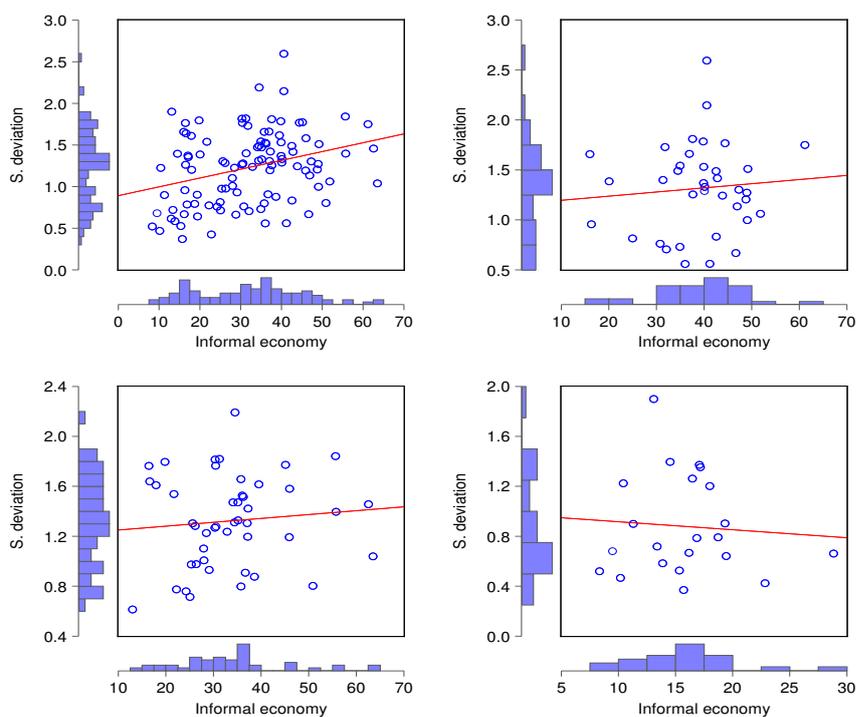
A1 Relation between volatility of y and the size of s delivered by LQ.

Figure 1: Relation between volat. of y delivered by LQ and the size of s .



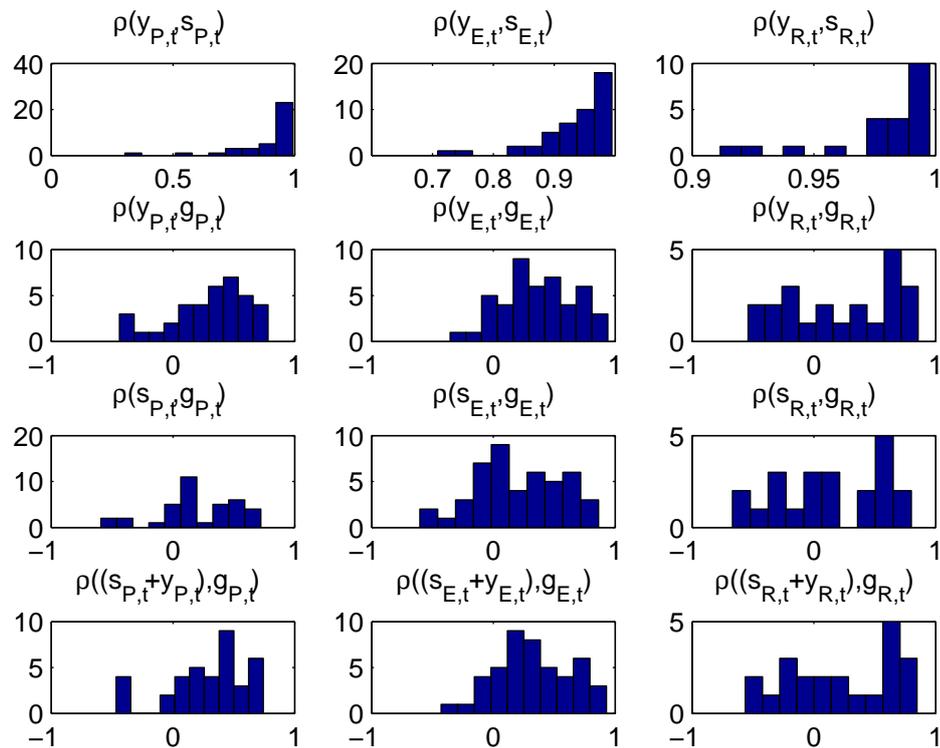
A2 Relation between volatility of y and the size of s delivered by FD.

Figure 2: Relation between volat. of y delivered by FD and the size of s .



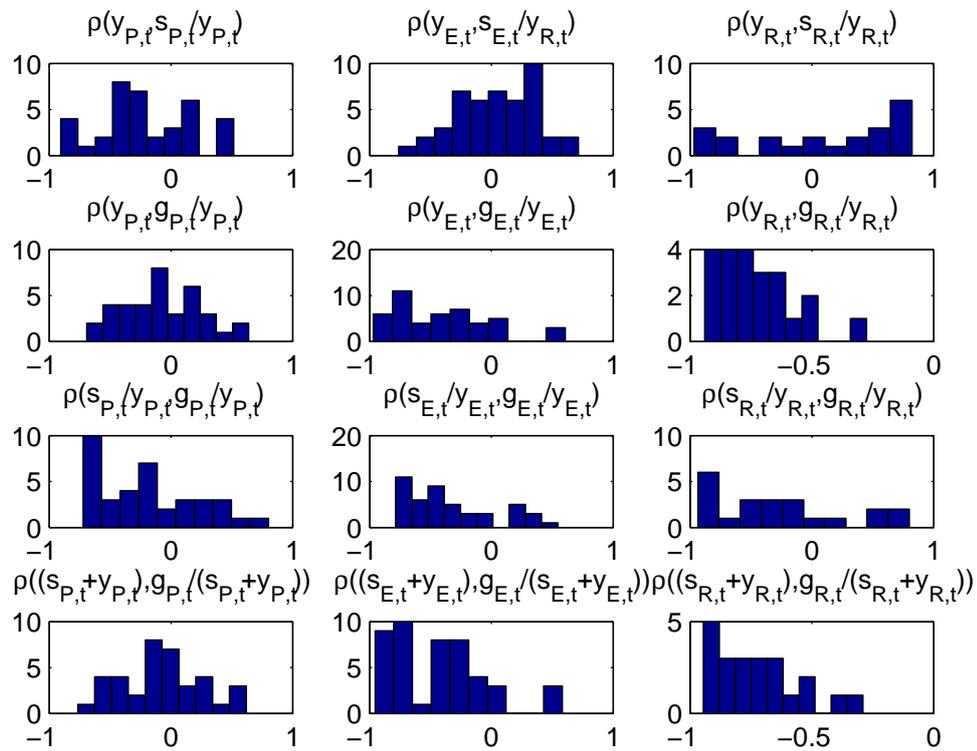
A3 Distribution of correlations between (y_t) and s_t ; y_t and g_t ; s_t and g_t ; and between $(s_t + y_t)$ and g_t delivered by LQ.

Figure 3: Distribution of C. correlations between (y_t) , and s_t ; y_t and g_t ; s_t and g_t ; and between $(s_t + y_t)$ and g_t delivered by LQ.



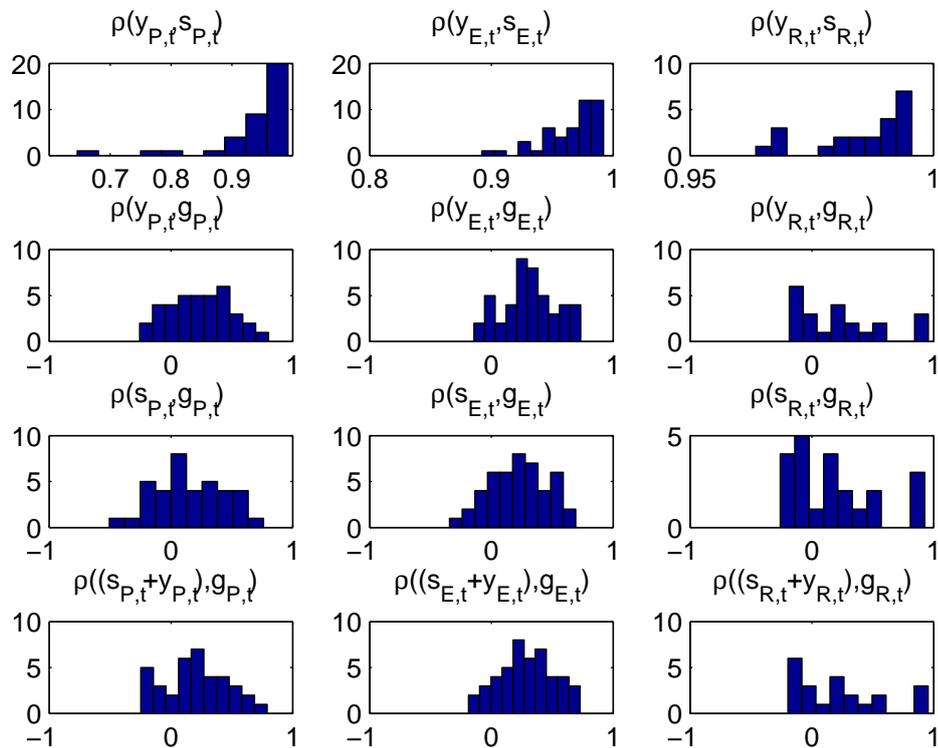
A4 Distribution of correlations between y_t and s_t/s_t ; y_t and g_t/y_t ; s_t/y_t and g_t/y_t ; and between $(s_t + y_t)$ and $g_t/(s_t + y_t)$ delivered by LQ

Figure 4: Distribution of C. correlations between y_t , and s_t/s_t ; y_t and g_t/y_t ; s_t/y_t and g_t/y_t ; and between $(s_t + y_t)$ and $g_t/(s_t + y_t)$ delivered by LQ.



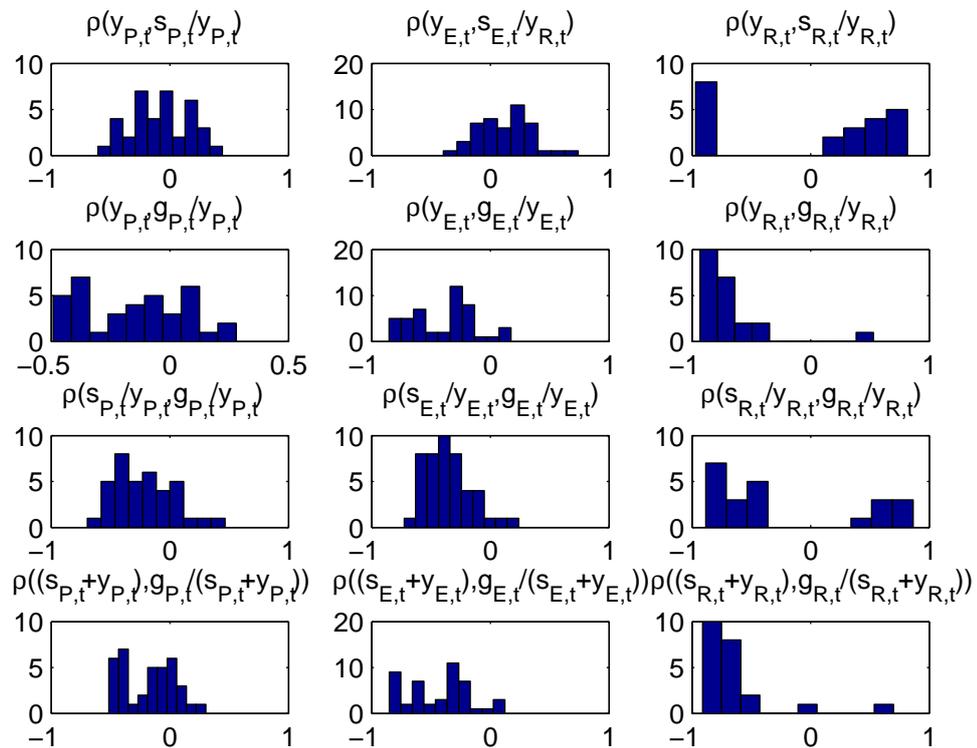
A5 Distribution of contemporaneous correlations between (y_t) and (s_t) ; (y_t) and (g_t) ; (s_t) and (g_t) ; and between $(s_t + y_t)$ and (g_t) delivered by FD.

Figure 5: Distribution of contemporaneous correlations between (y_t) and (s_t) ; (y_t) and (g_t) ; (s_t) and (g_t) ; and between $(s_t + y_t)$ and (g_t) delivered by FD.



A6 Distribution of contemporaneous correlations between (y_t) and (s_t) ; (y_t) and (g_t) ; (s_t) and (g_t) ; and between $(s_t + y_t)$ and (g_t) delivered by FD.

Figure 6: Distribution of contemporaneous correlations between (y_t) and (s_t) ; (y_t) and (g_t) ; (s_t) and (g_t) ; and between $(s_t + y_t)$ and (g_t) delivered by FD.



Appendix B: Derivations

B1 First order conditions

By integrating the households' heterogeneity into a representative agent framework, the Lagrangian function described by [Equation \(4.11\)](#) becomes

$$\begin{aligned}
 \mathcal{L}_t^H &= E_0 \sum_{t=0}^{\infty} \beta^t \left\{ c_t^{(1-\gamma)} / (1-\gamma) \right. \\
 &+ \lambda_{1,t} [d_t^f - [1 + r_{t-1}^d] d_{t-1}^f + [1 - \tau^W] w_t^F n_t^F + w_t^S n_t^S + w^U u_t \\
 &- c_t - k_t + [1 - \delta] k_{t-1} + r_t^k k_{t-1} + \Pi_t^f - \Phi(\cdot)] \\
 &+ \lambda_{2,t} [n_t^F - (1 - \rho) n_{t-1}^F - \mathcal{P}_{\theta_t}^U [1 - (1 - \rho) n_{t-1}^F - n_{t-1}^S]] \\
 &\left. + \lambda_{3,t} \left[\lim_{j \rightarrow \infty} E_t \left(d_{t+j}^f / \prod_{s=0}^j [1 + r^W + f(d_s^f)] \right) \right] \right\}, \tag{1}
 \end{aligned}$$

The first order conditions with respect to the controls $[c_t, k_t, d_t^f, n_t^F]$ are:

□ With respect to c_t

$$c_t^{-\gamma} = \lambda_{1,t} \tag{2}$$

□ With respect to k_t

$$[1 + \phi(k_t - k_{t-1})] = \beta E_t \Lambda_{t,t+1} [1 - \delta + r_{t+1}^k + \phi(k_{t+1} - k_t)] \tag{3}$$

□ With respect to d_t^f

$$1 = \beta E_t \Lambda_{t,t+1} [1 + r_t^d] \tag{4}$$

□ With respect to n_t^F

$$\lambda_{2,t} = \lambda_{1,t} [(1 - \tau^W)w_t^F - w_t^U] + \beta E_t \lambda_{2,t+1} [(1 - \rho)[1 - \mathcal{P}_{\theta_{t+1}}^U]] \quad (5)$$

B2 Economy's resource constraints

□ Recall households' constraint given by [Equation \(4.9\)](#)

$$\begin{aligned} d_t^f &= [1 + r_{t-1}^d]d_{t-1}^f - [1 - \tau^W]w_t^F n_t^F - w_t^S n_t^S - w^U u_t + c_t + i_t \\ &\quad - r_t^k k_{t-1} - \Pi_t^f + \Phi(\cdot), \end{aligned} \quad (6)$$

□ The government's deficit defined in the [Equation \(4.29\)](#)

$$def_t^g = g_t + w^U u_t - \tau^F y_t - [\tau^W + \tau^N]w_t^F n_t^F = 0. \quad (7)$$

□ We define the demand for foreign assets as follows

$$tb_t = [1 + r_{t-1}^d] d_{t-1}^f - d_t^f \quad (8)$$

where tb_t denotes the balance of trade for the domestic economy.

□ Using [Equation \(8\)](#) into [Equation \(7\)](#) we get

$$\begin{aligned} tb_t &= [1 - \tau^W]w_t^F n_t^F + w_t^S n_t^S + w^U u_t - c_t - i_t \\ &\quad + r_t^k k_{t-1} + \Pi_t^f - \Phi(\cdot), \end{aligned} \quad (9)$$

□ Recall the definition for firm's profit

$$\Pi_t^f = [1 - \tau^F]y_t - \kappa v_t - [1 + \tau^N]w_t^F n_t^F - w_t^S n_t^S - r_t^k k_{t-1}, \quad (10)$$

□ Plugging [Equation \(10\)](#) into [Equation \(9\)](#) yields

$$\begin{aligned} tb_t &= [1 - \tau^W]w_t^F n_t^F + w^U u_t - c_t - i_t + [1 - \tau^F]y_t \\ &\quad - \kappa v_t - [1 + \tau^N]w_t^F n_t^F - \Phi(\cdot), \end{aligned} \quad (11)$$

□ Recall that government's deficit is null at every period of time [$def_t^g = 0$]. Subtracting its expression into the right side of [Equation \(11\)](#), the terms cancel out yielding the country's resource constraints as

$$y_t = c_t + g_t + i_t + \kappa v_t + tb_t + \frac{\phi}{2} [k_t - k_{t-1}]^2, \quad (12)$$

B3 Wage in the formal sector

WAGE IN THE FORMAL MARKET

□ Remember that

$$\Delta = [1 - \rho]\beta$$

□ From the first order condition in [Equation \(4.22\)](#) we get

$$\begin{aligned} \eta[1 - \tau^W]\mathcal{V}_{t,n_t^F}^F &= [1 - \eta][1 + \tau^N] \left[\frac{\mathcal{U}_{t,n_t^F}^F}{\lambda_{1,t}} \right] \\ \Rightarrow \left[\frac{\mathcal{U}_{t,n_t^F}^F}{\lambda_{1,t}} \right] &= \left[\frac{\eta}{1 - \eta} \right] \left[\frac{1 - \tau^W}{1 + \tau^N} \right] \mathcal{V}_{t,n_t^F}^F \end{aligned} \quad (13)$$

□ Making use of [equations \(4.24\)](#), [\(4.25\)](#) and [\(4.26\)](#), we proceed as follows

$$\begin{aligned} w_t^F &= \eta\bar{w}_t^F + [1 - \eta]w_t^F. \\ &= \eta \left[\left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t^F}{n_t^F} \alpha^F + \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \left[\mathcal{V}_{t+1,n_{t+1}^F}^F \right] \right] \\ &+ [1 - \eta] \left[\left[\frac{w^U}{1 - \tau^W} \right] - \left[\frac{\Delta}{1 - \tau^W} \right] E_t [1 - \mathcal{P}_{\theta_{t+1}}^U] \Lambda_{t,t+1} \left[\frac{\mathcal{U}_{t+1,n_{t+1}^F}^F}{\lambda_{1,t+1}} \right] \right] \end{aligned} \quad (14)$$

Note that $\left[\mathcal{V}_{t+1, n_{t+1}^F}^F \right] = \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right]$.

Thus using the relation in [Equation \(14\)](#), we proceed as follows

$$\begin{aligned}
 w_t^F &= \eta \left[\left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t^F}{n_t^F} \alpha^F + \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right] \right] \\
 &+ [1 - \eta] \left[\frac{w^U}{1 - \tau^W} \right] \\
 &- [1 - \eta] \left[\left[\frac{\Delta}{1 - \tau^W} \right] E_t [1 - \mathcal{P}_{\theta_{t+1}}^U] \Lambda_{t,t+1} \left[\frac{\eta}{1 - \eta} \right] \left[\frac{1 - \tau^W}{1 + \tau^N} \right] \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right] \right] \\
 &= \eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t^F}{n_t^F} \alpha^F + \eta \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right] \\
 &+ [1 - \eta] \left[\frac{w^U}{1 - \tau^W} \right] - \eta \left[\frac{\Delta}{1 + \tau^N} \right] E_t [1 - \mathcal{P}_{\theta_{t+1}}^U] \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right] \\
 &= \eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t^F}{n_t^F} \alpha^F + \eta \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right] \\
 &+ [1 - \eta] \left[\frac{w^U}{1 - \tau^W} \right] - \eta \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right] \\
 &+ \kappa \eta \left[\frac{\Delta}{1 + \tau_t^N} \right] E_t \Lambda_{t,t+1} \left[\frac{\mathcal{P}_{\theta_{t+1}}^U}{\mathcal{P}_{\theta_{t+1}}^V} \right] \\
 &= \eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t^F}{n_t^F} \alpha^F + [1 - \eta] \left[\frac{w^U}{1 - \tau_t^W} \right] \\
 &+ \kappa \eta \left[\frac{\Delta}{1 + \tau_t^N} \right] E_t \Lambda_{t,t+1} \left[\frac{\mathcal{P}_{\theta_{t+1}}^U}{\mathcal{P}_{\theta_{t+1}}^V} \right] \tag{15}
 \end{aligned}$$

B4 Unemployment and employments value

□ UNEMPLOYED AND EMPLOYMENT VALUE

From [Equation \(4.33\)](#) we have

$$\mathcal{U}_t^u = \lambda_{1,t} w^U + \beta E_t \Lambda_{t,t+1} [\mathcal{U}_{t+1}^u] \tag{16}$$

Taking into account that $\mathcal{U}_{t, n_t^F}^F = \mathcal{U}_t^e - \mathcal{U}_t^u$ and that $\mathcal{P}_{\theta_{t+1}}^U = 0$ for a matched worker; from [Equation \(4.20\)](#) we have

$$\begin{aligned}
 \mathcal{U}_t^e &= \lambda_{1,t} [(1 - \tau^W) w_t^F - w^U] + \Delta E_t [\mathcal{U}_{t+1}^e - \mathcal{U}_{t+1}^u] + \mathcal{U}_t^u \\
 &= \lambda_{1,t} (1 - \tau^W) w_t^F + \Delta E_t [\mathcal{U}_{t+1}^e - \mathcal{U}_{t+1}^u] + \beta E_t [\mathcal{U}_{t+1}^u] \\
 &= \lambda_{1,t} (1 - \tau^W) w_t^F + \beta E_t \left[[1 - \rho] \mathcal{U}_{t+1, n_{t+1}^F}^F + \mathcal{U}_{t+1}^u \right]. \tag{17}
 \end{aligned}$$

Similarly

$$\begin{aligned}
 \mathcal{U}_t^u &= \mathcal{U}_t^e - \mathcal{U}_{t,n_t^F}^F \\
 &= \lambda_{1,t}(1 - \tau^W)w_t^F + \beta E_t \left[[1 - \rho]\mathcal{U}_{t+1,n_{t+1}^F}^F + \mathcal{U}_{t+1}^u \right] \\
 &\quad - \lambda_{1,t} \left[(1 - \tau^W)w_t^F - w^U \right] - \Delta E_t [1 - \mathcal{P}_{\theta_{t+1}}^U] \mathcal{U}_{t+1,n_{t+1}^F}^F \\
 &= \lambda_{1,t}w^U + \beta E_t \left[[1 - \rho]\mathcal{P}_{\theta_{t+1}}^U \mathcal{U}_{t+1,n_{t+1}^F}^F + \mathcal{U}_{t+1}^u \right]
 \end{aligned} \tag{18}$$

B5 Employment dynamics

□ EMPLOYMENT DYNAMICS

From [equations \(4.19\)](#)

$$\frac{\kappa}{\mathcal{P}_{\theta_t}^V} = (1 - \tau^F) \frac{y_t}{n_t^F} \alpha^F - [1 + \tau^N]w_t^F + \Delta E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right], \tag{19}$$

We get

$$w_t^F = \left[(1 - \tau^F) \frac{y_t}{n_t^F} \alpha^F - \frac{\kappa}{\mathcal{P}_{\theta_t}^V} + \Delta E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right] \right] \left[\frac{1}{1 + \tau^N} \right], \tag{20}$$

Plugging this into [equations \(4.27\)](#)

$$\begin{aligned}
 &\eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t}{n_t^F} \alpha^F + [1 - \eta] \left[\frac{w^U}{1 - \tau^W} \right] \\
 &+ \eta \kappa \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \left[\frac{\mathcal{P}_{\theta_{t+1}}^U}{\mathcal{P}_{\theta_{t+1}}^V} \right] \\
 &= \left[(1 - \tau^F) \frac{y_t}{n_t^F} \alpha^F - \frac{\kappa}{\mathcal{P}_{\theta_t}^V} + \Delta E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right] \right] \left[\frac{1}{1 + \tau^N} \right]
 \end{aligned} \tag{21}$$

Multiplying both sides by $[1 + \tau^N]$ we have

$$\begin{aligned}
 &\eta (1 - \tau^F) \frac{y_t}{n_t^F} \alpha^F + [1 - \eta] \left(\frac{1 + \tau^N}{1 - \tau^W} \right) w^U \\
 &+ \eta \kappa \Delta E_t \Lambda_{t,t+1} \left[\frac{\mathcal{P}_{\theta_{t+1}}^U}{\mathcal{P}_{\theta_{t+1}}^V} \right] \\
 &= [1 - \tau^F] \frac{y_t}{n_t^F} \alpha^F - \frac{\kappa}{\mathcal{P}_{\theta_t}^V} + \Delta E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right]
 \end{aligned} \tag{22}$$

Rearranging the terms we get

$$\begin{aligned} \frac{\kappa}{\mathcal{P}_{\theta_t}^V} &= [1 - \eta] (1 - \tau^F) \frac{y_t}{n_t^F} \alpha^F - [1 - \eta] \left(\frac{1 + \tau^N}{1 - \tau^W} \right) w^U \\ &+ \Delta E_t \Lambda_{t,t+1} \left[\frac{\kappa}{\mathcal{P}_{\theta_{t+1}}^V} \right] - \eta \kappa \Delta E_t \Lambda_{t,t+1} \left[\frac{\mathcal{P}_{\theta_{t+1}}^U}{\mathcal{P}_{\theta_{t+1}}^V} \right] \end{aligned} \quad (23)$$

Taking into account that $\mathcal{P}_{\theta_t}^V = \sigma_m \theta_t^{-\mu}$, we write employment dynamics as

$$\begin{aligned} \theta_t^\mu &= [1 - \eta] \frac{\sigma_m}{\kappa} \left[(1 - \tau^F) \frac{y_t}{n_t^F} \alpha^F - \left(\frac{1 + \tau^N}{1 - \tau^W} \right) w^U \right] \\ &+ \Delta E_t \Lambda_{t,t+1} [1 - \eta \mathcal{P}_{\theta_{t+1}}^U] \theta_{t+1}^\mu \end{aligned} \quad (24)$$

B6 Equilibrium conditions

□ EQUILIBRIUM CONDITIONS FOR BASELINE MODEL

Matches

$$m_t = \sigma_m [s_t]^\mu [v_t]^{1-\mu}. \quad (E1)$$

Output

$$y_t = a_t k_{t-1}^{\alpha^k} [n_t^F]^{\alpha^F} [n_t^S]^{\alpha^S}. \quad (E2)$$

Motion for formal employment

$$n_t^F = [1 - \rho] n_{t-1}^F + \mathcal{P}_{\theta_t}^V v_t. \quad (E3)$$

Market tightness

$$\theta_t = \frac{v_t}{1 - [1 - \rho] n_{t-1}^F - n_{t-1}^S}. \quad (E4)$$

Probability of filling a vacancy

$$\mathcal{P}_{\theta_t}^V = \sigma_m \theta_t^{-\mu}. \quad (E5)$$

Probability of finding a formal job

$$\mathcal{P}_{\theta_t}^U = \sigma_m \theta_t^{1-\mu}. \quad (E6)$$

Euler equation for consumption

$$c_t^{-\gamma} = \beta \left[1 + r^W + \xi \left(e^{[d_t^f - \bar{d}]} - 1 \right) \right] c_{t+1}^{-\gamma}. \quad (\text{E7})$$

Motion for capital

$$k_t = i_t + [1 - \delta]k_{t-1}. \quad (\text{E8})$$

Euler equation for capital

$$[1 + \phi(k_t - k_{t-1})] = \beta E_t \Lambda_{t,t+1} \left[1 - \delta + [1 - \tau^F] \frac{y_{t+1}}{k_t} \alpha^k + \phi(k_{t+1} - k_t) \right]. \quad (\text{E9})$$

Informal wage

$$w_t^S = [1 - \tau^F] \frac{y_t}{n_t^S} \alpha^S. \quad (\text{E10})$$

Formal wage

$$\begin{aligned} w_t^F = & \eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{y_t}{n_t^F} \alpha^F + [1 - \eta] \left[\frac{w^U}{1 - \tau^W} \right] \\ & + \eta \kappa \left[\frac{\Delta}{1 + \tau^N} \right] E_t \Lambda_{t,t+1} \theta_{t+1}. \end{aligned} \quad (\text{E11})$$

Employments dynamics

$$\begin{aligned} \theta_t^\mu = & [1 - \eta] \frac{\sigma_m}{\kappa} \left[(1 - \tau^F) \frac{y_t}{n_t^F} \alpha^F - \left(\frac{1 + \tau^N}{1 - \tau^W} \right) w^U \right] \\ & + \Delta E_t \Lambda_{t,t+1} [1 - \eta \mathcal{P}_{\theta_{t+1}}^U] \theta_{t+1}^\mu. \end{aligned} \quad (\text{E12})$$

Switching costs

$$M_{t,S}^F = \Xi + \psi E_t [w_{t+1}^F - w_t^F]. \quad (\text{E13})$$

Mobility conditions

$$\frac{\mathcal{U}_t^u}{c_t^{-\gamma}} = w_t^S + \Xi + \beta E_t \Lambda_{t,t+1} \left[\frac{\mathcal{U}_{t+1}^u}{c_{t+1}^{-\gamma}} \right]. \quad (\text{E14})$$

The value of an unemployed status

$$\mathcal{U}_t^e = [1 - \tau^W] c_t^{-\gamma} w_t^F + \beta E_t \left[[1 - \rho] [\mathcal{U}_{t+1}^e - \mathcal{U}_{t+1}^u] + \mathcal{U}_{t+1}^u \right]. \quad (\text{E15})$$

The value of an employed status

$$\mathcal{U}_t^u = w^U c_t^{-\gamma} + \beta E_t \left[[1 - \rho] \mathcal{P}_{\theta_{t+1}}^U [\mathcal{U}_{t+1}^e - \mathcal{U}_{t+1}^u] + \mathcal{U}_{t+1}^u \right]. \quad (\text{E16})$$

Deb dynamics

$$d_t^f = [1 + r_{t-1}^d]d_{t-1}^f - [1 - \tau^W]w_t^F n_t^F - w_t^S n_t^S - w^U u_t + c_t + i_t - r_t^k k_{t-1} - \Pi_t^f + \frac{\phi}{2} [k_t - k_{t-1}]^2 \quad (\text{E17})$$

Government consumption

$$g_t = [\tau^W + \tau^N] w_t^F n_t^F + \tau^F y_t - w^U u_t. \quad (\text{E18})$$

Aggregate resource constraint

$$y_t = c_t + i_t + g_t + \kappa v_t + \frac{\phi}{2} [k_t - k_{t-1}]^2 + t b_t. \quad (\text{E19})$$

Job-searchers

$$s_t = 1 - [1 - \rho] n_{t-1}^F - n_{t-1}^S. \quad (\text{E20})$$

TFP shocks

$$\ln a_t = \beta_a \ln a_{t-1} + \sigma_\varepsilon \varepsilon_t. \quad (\text{E21})$$

B7 Log-Linearized version of the equilibrium conditions

□ LOG-LINEARIZED VERSION OF THE EQUILIBRIUM CONDITIONS

Let \bar{x} be the steady state value of a variable x_t and a "hat" ($\hat{\cdot}$) over x_t denoting the percentage deviation from that steady state such that $\hat{x} = \log(x_t) - \log(\bar{x})$. Then, the log-linear version of equations (E1) to (E19) can be write as:

$$(E1) \simeq \hat{m}_t = \mu \hat{s}_t + (1 - \mu) \hat{v}_t.$$

$$(E2) \simeq \hat{y}_t = \hat{a}_t + \alpha^k \hat{k}_{t-1} + \alpha^F \hat{n}_t^F + \alpha^S \hat{n}_t^S.$$

$$(E3) \simeq \hat{n}_t^F = [1 - \rho] \hat{n}_{t-1}^F + \frac{\bar{P}_\theta^V \bar{v}}{\bar{n}^F} [\hat{P}_{\theta_t}^V + \hat{v}_t].$$

$$(E4) \simeq \hat{v}_t = \frac{\bar{\theta}}{\bar{v}} \hat{\theta}_t - \frac{\bar{\theta}}{\bar{v}} \bar{n}^F [1 - \rho] [\hat{\theta}_t + \hat{n}_{t-1}^F] - \frac{\bar{\theta}}{\bar{v}} \bar{n}^S [\hat{\theta}_t + \hat{n}_{t-1}^F].$$

$$(E5) \simeq \hat{\mathcal{P}}_{\theta_t}^V = -\mu\hat{\theta}_t.$$

$$(E6) \simeq \hat{\mathcal{P}}_{\theta_t}^U = (1 - \mu)\hat{\theta}_t.$$

$$(E7) \simeq -\gamma\hat{c}_t = \beta\xi\bar{d}\hat{d}_t - \gamma\hat{c}_{t+1}.$$

$$(E8) \simeq \hat{k}_t = \frac{\bar{i}}{\bar{k}}\hat{i}_t + [1 - \delta]\hat{k}_{t-1}.$$

$$\begin{aligned} (E9) &\simeq -\gamma\hat{c}_t + \phi\bar{k} [\hat{k}_t - \gamma\hat{c}_t] - \phi\bar{k} [\hat{k}_{t-1} - \gamma\hat{c}_t] \\ &= -\beta\gamma(1 - \delta)E_t\hat{c}_{t+1} \\ &\quad + \alpha^k\beta(1 - \tau^F)\frac{\bar{y}}{\bar{k}} [E_t\hat{y}_{t+1} - \hat{k}_t - \gamma E_t\hat{c}_{t+1}] \\ &\quad + \beta\phi\bar{k} [E_t\hat{k}_{t+1} - \gamma E_t\hat{c}_{t+1}] - \beta\phi\bar{k} [\hat{k}_t - \gamma E_t\hat{c}_{t+1}]. \end{aligned}$$

$$(E10) \simeq \bar{w}^S [\hat{w}_t^S + \hat{n}_t^S] = [1 - \tau^F]\alpha^S \left[\frac{\bar{y}}{\bar{n}^S} \right] \hat{y}_t.$$

$$\begin{aligned} (E11) &\simeq \bar{w}^F [-\gamma\hat{c}_t + \hat{w}_t^F + \hat{n}_t^F] \\ &= [1 - \eta] \left[\frac{w^U}{1 - \tau^W} \right] [-\gamma\hat{c}_t + \hat{n}_t^F] \\ &\quad + \eta\alpha^F \left[\frac{\bar{y}}{\bar{n}^F} \right] \left[\frac{1 - \tau^F}{1 + \tau^N} \right] [\hat{y}_t - \gamma\hat{c}_t] \\ &\quad + \bar{\theta}\eta\kappa \left[\frac{\Delta}{1 + \tau^N} \right] [-\gamma E_t\hat{c}_{t+1} + E_t\hat{\theta}_{t+1} + \hat{n}_t^F]. \end{aligned}$$

$$\begin{aligned} (E12) &\simeq \mu\hat{\theta}_t + \hat{n}_t^F - \gamma\hat{c}_t \\ &= A \left[\frac{\bar{y}}{\bar{\theta}\mu\bar{n}^F} \right] [\hat{y}_t - \gamma\hat{c}_t] - \frac{B}{\bar{\theta}\mu} [\hat{n}_t^F - \gamma\hat{c}_t] \\ &\quad + C [\hat{n}_t^F + \mu E_t\hat{\theta}_{t+1} - \gamma E_t\hat{c}_{t+1}] \\ &\quad - C\bar{\mathcal{P}}_{\theta}^U [\hat{n}_t^F + \mu E_t\hat{\theta}_{t+1} - \gamma E_t\hat{c}_{t+1} + E_t\hat{\mathcal{P}}_{\theta_{t+1}}^U] \\ &\quad + D[\hat{n}_t^F + \mu E_t\hat{\theta}_{t+1} - \gamma E_t\hat{c}_{t+1}]. \end{aligned}$$

where $A = [1 - \eta]\alpha^F\frac{\sigma_m}{\kappa} \left[\frac{1 - \tau^F}{1 + \tau^N} \right]$, $B = [1 - \eta]\frac{\sigma_m}{\kappa} \left[\frac{w^U}{1 + \tau^W} \right]$, $C = \eta \left[\frac{\Delta}{1 - \tau^W} \right]$, and $D = [1 - \eta] \left[\frac{\Delta}{1 + \tau^N} \right]$.

$$(E13) \simeq \hat{M}_{t,S}^F = -\xi \left[\frac{\bar{w}^F}{\bar{M}_{t,S}^F} \right] E_t\hat{w}_{t+1}^F + \xi \left[\frac{\bar{w}^F}{\bar{M}_{t,S}^F} \right] \hat{w}_t^F.$$

$$(E14) \simeq \bar{\mathcal{U}}^u \hat{\mathcal{U}}_t^u = \bar{w}^S \bar{c}^{-\gamma} [-\gamma \hat{c}_t + \hat{w}_t^S] + \bar{c}^{-\gamma} \bar{s} [-\gamma \hat{c}_t + \hat{s}_t] \\ + \beta E_t \hat{\mathcal{U}}_{t+1}^u.$$

$$(E15) \simeq \hat{\mathcal{U}}_t^e = \bar{c}^{-\gamma} [1 - \tau^W] \left[\frac{\bar{w}^F}{\bar{\mathcal{U}}^e} \right] [-\gamma \hat{c}_t + \hat{w}_t^F] + \beta [1 - \rho] E_t \hat{\mathcal{U}}_{t+1}^e \\ + \beta \rho \left[\frac{\bar{\mathcal{U}}^u}{\bar{\mathcal{U}}^e} \right] E_t \hat{\mathcal{U}}_{t+1}^u.$$

$$(E16) \simeq \hat{\mathcal{U}}_t^u = -\gamma \bar{c}^{-\gamma} \left[\frac{w^U}{\bar{\mathcal{U}}^u} \right] \hat{c}_t + \beta [1 - \rho] \bar{\mathcal{P}}_\theta^U \left[\frac{\bar{\mathcal{U}}^e}{\bar{\mathcal{U}}^u} \right] E_t \left[\hat{\mathcal{P}}_{\theta_{t+1}}^U + \hat{\mathcal{U}}_{t+1}^e \right] \\ + \beta E_t \hat{\mathcal{U}}_{t+1}^u - \beta [1 - \rho] \bar{\mathcal{P}}_\theta^U E_t \left[\hat{\mathcal{P}}_{\theta_{t+1}}^U + \hat{\mathcal{U}}_{t+1}^u \right].$$

$$(E17) \simeq \hat{y}_t = - \left[\frac{\bar{d}^f}{\bar{y}} \right] \hat{d}^f + \left[\frac{\bar{d}^f}{\bar{y}} \right] [\xi \bar{d}^f + 1 + \bar{r}^d] \hat{d}_{t-1}^f \\ + \left[\frac{\bar{c}}{\bar{y}} \right] \hat{c} + \left[\frac{\bar{g}}{\bar{y}} \right] \hat{g} + \left[\frac{\bar{i}}{\bar{y}} \right] \left[k_{t+1} - (1 - \delta) k_t \right].$$

$$(E18) \simeq \bar{g} \hat{g}_t = [\tau^F + \tau^N] \bar{w}^F \bar{n}^F [\hat{w}_t^F + \hat{n}_t^F] + \tau^F \bar{y} \hat{y}_t + w^U \bar{u} \hat{u}_t.$$

$$(E19) \simeq \bar{y} \hat{y}_t = \bar{t} \bar{b} \hat{b}_t + \bar{c} \hat{c}_t + \bar{v} \hat{v}_t + \bar{g} \hat{g}_t + \kappa \bar{v} \hat{v}_t.$$

$$(E20) \simeq \bar{s} \hat{s}_t = -(1 - \rho) \bar{n}^F \hat{n}_{t-1}^F - \bar{n}^S \hat{n}_{t-1}^S.$$

$$(E21) \simeq \hat{a}_t = \beta_a \hat{a}_{t-1} + \hat{\varepsilon}_t.$$

B8 The steady state of the model

The informal employment size ($\bar{n}^S = 0.56$) is taken from the literature. Then, we determine the formal employment size such that $\bar{n}^F = 1 - \bar{n}^S - \bar{u}$, where $\bar{u} = 0.08$ is set to match unemployment rate in middle-income countries. One of the main feature of matching function is an accounting relationship stating that, in equilibrium, the total flows in and out of unemployment pool must be equal. So, in the steady state we should observe $\bar{m} = \rho \bar{n}^F$. From Equation (4.4) we get the steady state of searches as $\bar{s} = \bar{u} - \bar{m}$. Then, using Equation (4.2) we arrive at $\bar{v} = \left[\frac{\bar{m}}{\sigma_m \bar{s}^\mu} \right]^{\frac{1}{1-\mu}}$. Now we are able to get $\bar{\mathcal{P}}_\theta^U = \frac{\bar{m}}{\bar{s}}$, $\bar{\mathcal{P}}_\theta^V = \frac{\bar{m}}{\bar{v}}$ and the market tightness $\bar{\theta} = \frac{\bar{v}}{\bar{s}} = \frac{\bar{\mathcal{P}}_\theta^U}{\bar{\mathcal{P}}_\theta^V}$.

The vacancy costs parameter is computed as follows: the Equation (4.19) in the steady state yields

$$\begin{aligned}
 \frac{\kappa}{\bar{\mathcal{P}}_\theta^V} &= (1 - \tau^F) \frac{\bar{y}}{\bar{n}^F} \alpha^F - (1 + \tau^N) \bar{w}^F + \Delta \left[\frac{\kappa}{\bar{\mathcal{P}}_\theta^V} \right], \\
 \Rightarrow \left[\frac{1 - \Delta}{\bar{\mathcal{P}}_\theta^V} \right] \kappa &= (1 - \tau^F) \frac{\bar{y}}{\bar{n}^F} \alpha^F - (1 + \tau^N) \bar{w}^F \\
 \Rightarrow \kappa &= \left[(1 - \tau^F) \frac{\bar{y}}{\bar{n}^F} \alpha^F - (1 + \tau^N) \bar{w}^F \right] \left[\frac{\bar{\mathcal{P}}_\theta^V}{1 - \Delta} \right] \\
 \Rightarrow \kappa &= \left[\frac{(1 - \tau^F) \bar{\mathcal{P}}_\theta^V}{(1 - \Delta)} \right] \frac{\bar{y}}{\bar{n}^F} \alpha^F - \left[\frac{(1 + \tau^N) \bar{\mathcal{P}}_\theta^V}{(1 - \Delta)} \right] \bar{w}^F \quad (25)
 \end{aligned}$$

Let us now using [Equation \(4.27\)](#) in its steady state version:

$$\begin{aligned}
 \bar{w}^F &= \eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{\bar{y}}{\bar{n}^F} \alpha^F + \left[\frac{1 - \eta}{1 - \tau^W} \right] w^U \\
 &+ \eta \left[\frac{\Delta}{1 + \tau^N} \right] \left[\frac{\bar{\mathcal{P}}_\theta^U}{\bar{\mathcal{P}}_\theta^V} \right] \kappa \quad (26)
 \end{aligned}$$

Substituting expression for κ and taking $w^U = \Psi \bar{w}^F$, with $0 < \Psi < 1$, yields.

$$\begin{aligned}
 \bar{w}^F &= \eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{\bar{y}}{\bar{n}^F} \alpha^F + \left[\frac{1 - \eta}{1 - \tau^W} \right] \Psi \bar{w}^F \\
 &+ \eta \left[\frac{\Delta}{1 + \tau^N} \right] \left[\frac{\bar{\mathcal{P}}_\theta^U}{\bar{\mathcal{P}}_\theta^V} \right] \left\{ \left[\frac{(1 - \tau^F) \bar{\mathcal{P}}_\theta^V}{(1 - \Delta)} \right] \frac{\bar{y}}{\bar{n}^F} \alpha^F - \left[\frac{(1 + \tau^N) \bar{\mathcal{P}}_\theta^V}{(1 - \Delta)} \right] \bar{w}^F \right\} \quad (27)
 \end{aligned}$$

The expression can be simplifying to yields

$$\begin{aligned}
 \bar{w}^F &= \eta \left[\frac{1 - \tau^F}{1 + \tau^N} \right] \frac{\bar{y}}{\bar{n}^F} \alpha^F + \left[\frac{1 - \eta}{1 - \tau^W} \right] \Psi \bar{w}^F \\
 &+ \eta \left[\frac{\Delta}{1 + \tau^N} \right] \left[\frac{(1 - \tau^F) \bar{\mathcal{P}}_\theta^U}{(1 - \Delta)} \right] \frac{\bar{y}}{\bar{n}^F} \alpha^F - \eta \left[\frac{\Delta \bar{\mathcal{P}}_\theta^U}{1 - \Delta} \right] \bar{w}^F \quad (28)
 \end{aligned}$$

Placing the \bar{w}^F terms to the right hand side yields

$$\left[1 - \Psi \left(\frac{1 - \eta}{1 - \tau^W} \right) + \eta \left(\frac{\Delta \bar{\mathcal{P}}_\theta^U}{1 - \Delta} \right) \right] \bar{w}^F = \eta \left(\frac{1 - \tau^F}{1 + \tau^N} \right) \left[1 + \left(\frac{\Delta \bar{\mathcal{P}}_\theta^U}{1 - \Delta} \right) \right] \frac{\bar{y}}{\bar{n}^F} \alpha^F$$

Let be

$$\left[1 - \Psi \left(\frac{1 - \eta}{1 - \tau^W} \right) + \eta \left(\frac{\Delta \bar{\mathcal{P}}_\theta^U}{1 - \Delta} \right) \right] = \Upsilon \quad (29)$$

Then we are able to write

$$\bar{w}^F = \left[\frac{\eta}{\Upsilon} \right] \left(\frac{1 - \tau^F}{1 + \tau^N} \right) \left[1 + \left(\frac{\Delta \bar{\mathcal{P}}_\theta^U}{1 - \Delta} \right) \right] \frac{\bar{y}}{\bar{n}^F} \alpha^F \quad (30)$$

Having \bar{w}^F , we use this into [Equation \(25\)](#) to get κ .

In regards to the production function we proceed as follows. First, we use [equations \(4.12\)](#), and [\(4.18\)](#) to get

$$\frac{\bar{y}}{\bar{k}} = \frac{1 - \beta(1 - \delta)}{\beta\alpha^k(1 - \tau^F)} \quad (31)$$

Second, we use [Equation \(4.14\)](#) to arrive

$$\begin{aligned} 1 &= \left[\frac{\bar{k}}{\bar{y}} \right]^{\alpha^k} \frac{[\bar{n}^F]^{\alpha^F} (\bar{n}^S)^{\alpha^S}}{\bar{y}^{(\alpha^F + \alpha^S)}} \\ &= \left[\frac{\beta\alpha^k(1 - \tau^F)}{1 - \beta(1 - \delta)} \right]^{\alpha^k} \frac{(\bar{n}^F)^{\alpha^F} (\bar{n}^S)^{\alpha^S}}{\bar{y}^{(\alpha^F + \alpha^S)}} \end{aligned} \quad (32)$$

Multiplying both sides by $\bar{y}^{(\alpha^F + \alpha^S)}$, we get

$$\bar{y} = \left[\left[\frac{\beta\alpha^k(1 - \tau^F)}{1 - \beta(1 - \delta)} \right]^{\alpha^k} (\bar{n}^F)^{\alpha^F} (\bar{n}^S)^{\alpha^S} \right]^{\frac{1}{(\alpha^F + \alpha^S)}} \quad (33)$$

Using this definitions for \bar{y} we get

$$\bar{k} = \left[\frac{\bar{k}}{\bar{y}} \right] \bar{y} = \left[\frac{\beta\alpha^k(1 - \tau^F)}{1 - \beta(1 - \delta)} \right] \bar{y}, \quad (34)$$

and, from [Equation \(7\)](#), $\bar{i} = \delta\bar{k}$. We get informal wage from [Equation \(4.17\)](#)

$$\bar{w}^S = [1 - \tau^F] \frac{\bar{y}}{\bar{n}^S} \alpha^S \quad (35)$$

The steady state for government consumption is obtained from [Equation \(4.29\)](#)

$$\bar{g} = [\tau^W + \tau^N] \bar{w}^F \bar{n}^F + \tau^F \bar{y} - w^U \bar{u} \quad (36)$$

In the steady state $\bar{d}^f = \bar{d}$. From [Equation \(4.34\)](#) we get $\bar{t}\bar{b} = \bar{y} - \bar{c} - \bar{g} - \bar{i} - \kappa\bar{v}$. Rearranging this and plugging into the household constraint yields $\bar{t}\bar{b} = r^*\bar{d}$. This accounting relationship states that in the steady state trade surplus of a country must be enough to face external debt. Drawing on [Ju et al. \(2010\)](#)'s data, we set a trade deficit of 5 percent of GDP. Thus we set $\bar{d}^f = -\bar{t}\bar{b}/r^*$. The steady state of c_t is obtained from [Equation \(4.9\)](#), such that

$$\bar{c} = -r^d \bar{d}^f + \bar{y} - \delta\bar{k} - \bar{g} - \kappa\bar{v} \quad (37)$$

The household's steady state value for unemployment $[\bar{u}^u]$ and for employment $[\bar{u}^e]$ is

obtained by taking into account that $\bar{U}_{n^F}^F = \bar{U}^e - \bar{U}^u$. Thus from [Equation \(4.32\)](#), we have

$$\begin{aligned}
 \bar{U}^e &= \bar{c}^{-\gamma} (1 - \tau^W) w^F + \beta \{ (1 - \rho) [\bar{U}^e - \bar{U}^u] + \bar{U}^u \} \\
 &= \bar{c}^{-\gamma} (1 - \tau^W) w^F + \beta(1 - \rho)\bar{U}^e - \beta(1 - \rho)\bar{U}^u + \beta\bar{U}^u \\
 &= \bar{c}^{-\gamma} (1 - \tau^W) w^F + \beta(1 - \rho)\bar{U}^e + [\beta - \beta(1 - \rho)]\bar{U}^u
 \end{aligned} \tag{38}$$

Placing the \bar{U}^e terms to the right hand side yields

$$[1 - \beta(1 - \rho)]\bar{U}^e = \bar{c}^{-\gamma} (1 - \tau^W) w^F + [\beta - \beta(1 - \rho)]\bar{U}^u$$

Similarly, from [Equation \(4.33\)](#), we have

$$\begin{aligned}
 \bar{U}^u &= \bar{c}^{-\gamma} w^U + \beta \{ (1 - \rho) \bar{\mathcal{P}}_\theta^U [\bar{U}^e - \bar{U}^u] + \bar{U}^u \} \\
 &= \bar{c}^{-\gamma} w^U + \beta(1 - \rho) \bar{\mathcal{P}}_\theta^U \bar{U}^e - \beta(1 - \rho) \bar{\mathcal{P}}_\theta^U \bar{U}^u + \beta\bar{U}^u \\
 &= \bar{c}^{-\gamma} w^U + \beta(1 - \rho) \bar{\mathcal{P}}_\theta^U \bar{U}^e + [\beta - \beta(1 - \rho) \bar{\mathcal{P}}_\theta^U] \bar{U}^u
 \end{aligned}$$

Placing the \bar{U}^u terms to the right hand side yields

$$\begin{aligned}
 [1 - \beta + \beta(1 - \rho) \bar{\mathcal{P}}_\theta^U] \bar{U}^u &= \bar{c}^{-\gamma} w^U + \beta(1 - \rho) \bar{\mathcal{P}}_\theta^U \bar{U}^e \\
 \Rightarrow \bar{U}^u &= \frac{\bar{c}^{-\gamma} w^U}{[1 - \beta + \beta(1 - \rho) \bar{\mathcal{P}}_\theta^U]} + \frac{\beta(1 - \rho) \bar{\mathcal{P}}_\theta^U}{[1 - \beta + \beta(1 - \rho) \bar{\mathcal{P}}_\theta^U]} \bar{U}^e
 \end{aligned}$$

Let be $\bar{U}^u = A + B\bar{U}^e$. Now we can use [Equation \(9\)](#) to get

$$[1 - \beta(1 - \rho)]\bar{U}^e = \bar{c}^{-\gamma} (1 - \tau^W) w^F + [\beta - \beta(1 - \rho)] \{ A + B\bar{U}^e \}$$

Let we call $C = \bar{c}^{-\gamma} (1 - \tau^W) w^F + [\beta - \beta(1 - \rho)] A$ and $D = 1 - \beta(1 - \rho) - [\beta - \beta(1 - \rho)] B$. Then we arrive at $\bar{U}^e = C/D$ and $\bar{U}^u = A + BC/D$. The parameter Ξ in the [Equation \(4.31\)](#) is given by $\Xi = [(1 - \beta)\bar{U}^u - \bar{c}^{-\gamma} w^S] / [\bar{c}^{-\gamma}]$. Finally, we set $\psi = w^F/w^S$.

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Annex 1: Classification of the countries

Group of countries classified as poor, emerging and rich countries

1.1 Poor Countries

Burundi (BDI), Benin (BEN), Burkina Faso (BFA), Bhutan (BTN), Comoros (COM), Ghana (GHA), Honduras (HND), Lesotho (LSO), Mali (MLI), Gambia (GMB), Zambia (ZMB), Zimbabwe (ZWE), Cote d'Ivoire (CIV), Cameroon (CMR), Congo Democratic Republic (COD), Central African Republic (CAR), Kenya (KEN), Sri Lanka (LKA), Mongolia (MNG), Mauritania (MRT), Malawi (MWI), Niger (NER), Rwanda (RWA), Senegal (SEN), Sierra Leone (SLE), Togo (TGO), Madagascar (MDG), Mozambique (MOZ), Nepal (NPL), Sudan (SDN), Uganda (UGA), Bangladesh (GGD), China (CHN), Indonesia (IDN), India (IND), Pakistan (PAK), Philippines (PHL).

1.2 Emerging Countries

Albania (ALB), Bulgaria (BGR), Bahrain (BHR), Bolivia (BOL), Botswana (BWA), Chile (CHL), Costa Rica (CRI), Cyprus (CYP), Dominican Republic (DOM), Ecuador (ECU), Fiji (FJI), Gabon (GAB), Greece (GRC), Guatemala (GTM), Hungary (HUN), Iran (IRN), Jordan (JOR), Malta (MLT), Mauritius (MUS), Namibia (NAM), New Zealand (NZL), Panama (PAN), Portugal (PRT), Paraguay (PRY), El Salvador (SLV), Suriname (SUR), Swaziland (SWE), Trinidad and Tobago (TTO), Tunisia (TUN), Uruguay (URY), Argentina (ARG), Colombia (COL), Spain (ESP), Israel (ISR), Korea, Republic of (KOR), Morocco (MAR), Malaysia (MYS), Peru (PER), Syria (SYR), , Thailand (THA), Turkey (TUR), Venezuela (VEN), South Africa (ZAF), Brazil (BRA), Egypt (EGY), Mexico (MEX).

1.3 Rich Countries

Austria (AUT), Belgium (BEL), Switzerland(CHE), Denmark(DNK), Finland (FIN), Hong Kong (HKG), Iceland (IRL) Iceland (ISL), Luxembourg (LUX), Macao (MAC), Netherlands (NLD), Norway (NOR), Singapore (SGP), Sweden (SWE), Australia (AUS), Canada (CAN), France (FRA), United Kingdom (GBR), Italy (ITA), Germany (DEU), Japan (JPN), Iceland, United States (USA).

Annex 2: Estimates of the size of the informal sector

2.1 Poor countries

Table 2: 1 -Informal Economy Estimates, Poor Countries, 1950-1980

year	BDI	BEM	BFA	BTN	CAF	COM	GMB	HND	LSO	MLI	ZMB	ZWE	CIV	CMR	COD	GHA	KEN	LKA
1950																		
1951																		
1952																		
1953																		
1954																		
1955																		
1956																		
1957																		
1958																		
1959																		
1960			0,560								0,482	0,686	0,495	0,396	0,372	0,423	0,354	0,698
1961			0,569								0,480	0,682	0,485	0,399	0,377	0,412	0,352	0,697
1962			0,578								0,479	0,679	0,470	0,402	0,382	0,407	0,356	0,690
1963			0,586								0,479	0,682	0,466	0,404	0,390	0,402	0,359	0,687
1964			0,594								0,482	0,689	0,455	0,406	0,390	0,395	0,361	0,680
1965			0,606								0,486	0,694	0,438	0,406	0,389	0,385	0,365	0,675
1966			0,611								0,480	0,696	0,426	0,403	0,389	0,378	0,369	0,674
1967			0,614								0,472	0,695	0,415	0,398	0,390	0,373	0,367	0,671
1968			0,615								0,461	0,688	0,407	0,395	0,391	0,373	0,364	0,666
1969			0,619								0,451	0,681	0,400	0,392	0,393	0,375	0,358	0,660
1970			0,617					0,590		0,534	0,446	0,676	0,391	0,391	0,390	0,376	0,353	0,649
1971			0,615					0,582		0,533	0,428	0,668	0,381	0,387	0,388	0,374	0,344	0,635
1972			0,598					0,580		0,543	0,417	0,658	0,376	0,380	0,381	0,371	0,337	0,627
1973			0,589					0,582		0,533	0,405	0,648	0,373	0,373	0,376	0,376	0,333	0,618
1974			0,579					0,575		0,529	0,400	0,635	0,368	0,366	0,370	0,377	0,327	0,620
1975			0,560					0,564		0,525	0,388	0,615	0,366	0,363	0,365	0,374	0,323	0,613
1976			0,559					0,560		0,516	0,383	0,603	0,361	0,357	0,362	0,374	0,324	0,605
1977			0,552					0,558		0,511	0,387	0,600	0,354	0,354	0,363	0,374	0,324	0,592
1978			0,550					0,551		0,503	0,393	0,600	0,342	0,347	0,355	0,371	0,320	0,584
1979			0,544					0,534		0,493	0,397	0,610	0,330	0,334	0,357	0,374	0,315	0,555
1980	0,492	0,552	0,527	0,445	0,343	0,337	0,558	0,518	0,418	0,487	0,403	0,617	0,323	0,324	0,354	0,377	0,315	0,541

Table 3: 1 -Informal Economy Estimates, Poor Countries, 1950-1980 (cont.)

year	BDI	BEM	BFA	BTN	CAF	COM	GMB	HND	LSO	MLI	ZMB	ZWE	CIV	CMR	COD	GHA	KEN	LKA
1981	0,483	0,543	0,517	0,445	0,347	0,331	0,554	0,510	0,401	0,480	0,404	0,619	0,319	0,321	0,348	0,380	0,312	0,523
1982	0,472	0,538	0,506	0,437	0,352	0,329	0,556	0,508	0,386	0,472	0,414	0,611	0,316	0,320	0,345	0,386	0,310	0,513
1983	0,462	0,520	0,498	0,428	0,359	0,326	0,560	0,502	0,375	0,468	0,426	0,609	0,314	0,318	0,346	0,391	0,310	0,506
1984	0,452	0,519	0,494	0,414	0,366	0,322	0,562	0,514	0,373	0,469	0,433	0,612	0,315	0,315	0,345	0,398	0,312	0,502
1985	0,442	0,522	0,493	0,406	0,374	0,317	0,565	0,532	0,367	0,464	0,443	0,616	0,319	0,311	0,343	0,404	0,315	0,497
1986	0,436	0,518	0,480	0,402	0,373	0,315	0,571	0,529	0,358	0,463	0,451	0,615	0,324	0,308	0,340	0,407	0,314	0,494
1987	0,430	0,521	0,470	0,398	0,373	0,315	0,577	0,531	0,353	0,455	0,459	0,613	0,329	0,307	0,339	0,410	0,316	0,492
1988	0,426	0,527	0,465	0,391	0,375	0,315	0,570	0,528	0,352	0,449	0,470	0,611	0,334	0,307	0,338	0,414	0,317	0,490
1989	0,418	0,531	0,460	0,382	0,378	0,317	0,552	0,523	0,349	0,442	0,475	0,619	0,340	0,307	0,339	0,415	0,317	0,489
1990	0,420	0,538	0,453	0,376	0,381	0,321	0,538	0,506	0,344	0,436	0,480	0,619	0,351	0,307	0,338	0,415	0,316	0,489
1991	0,422	0,539	0,449	0,372	0,381	0,324	0,527	0,525	0,336	0,430	0,481	0,617	0,360	0,307	0,347	0,414	0,315	0,485
1992	0,423	0,539	0,443	0,367	0,383	0,331	0,515	0,527	0,328	0,430	0,494	0,600	0,365	0,308	0,355	0,410	0,315	0,481
1993	0,422	0,540	0,440	0,357	0,387	0,331	0,499	0,522	0,317	0,420	0,521	0,608	0,372	0,313	0,365	0,411	0,317	0,481
1994	0,425	0,539	0,435	0,349	0,390	0,333	0,489	0,511	0,311	0,418	0,524	0,605	0,376	0,314	0,377	0,413	0,317	0,477
1995	0,429	0,537	0,430	0,336	0,393	0,335	0,485	0,500	0,303	0,421	0,533	0,597	0,376	0,317	0,387	0,413	0,317	0,471
1996	0,430	0,530	0,428	0,329	0,396	0,339	0,479	0,498	0,300	0,420	0,538	0,596	0,374	0,319	0,396	0,414	0,317	0,468
1997	0,430	0,529	0,424	0,324	0,405	0,342	0,473	0,494	0,294	0,419	0,542	0,601	0,377	0,321	0,406	0,415	0,316	0,463
1998	0,431	0,525	0,418	0,324	0,410	0,347	0,472	0,486	0,287	0,417	0,546	0,599	0,377	0,322	0,413	0,415	0,315	0,464
1999	0,416	0,523	0,417	0,323	0,411	0,351	0,470	0,483	0,288	0,415	0,546	0,594	0,374	0,323	0,423	0,415	0,312	0,457
2000	0,419	0,519	0,413	0,317	0,413	0,357	0,467	0,473	0,285	0,413	0,543	0,596	0,377	0,323	0,433	0,418	0,311	0,454
2001	0,421	0,516	0,412	0,310	0,418	0,361	0,465	0,466	0,283	0,418	0,531	0,591	0,385	0,322	0,444	0,409	0,308	0,446
2002	0,422	0,511	0,411	0,302	0,422	0,366	0,457	0,463	0,280	0,414	0,515	0,591	0,394	0,319	0,450	0,403	0,305	0,447
2003	0,423	0,508	0,411	0,293	0,428	0,373	0,452	0,462	0,281	0,413	0,497	0,602	0,403	0,317	0,457	0,403	0,303	0,450
2004	0,415	0,503	0,409	0,286	0,435	0,378	0,432	0,458	0,284	0,406	0,478	0,610	0,412	0,316	0,460	0,402	0,302	0,449
2005	0,404	0,498	0,406	0,277	0,442	0,384	0,423	0,454	0,284	0,408	0,462	0,613	0,421	0,314	0,464	0,396	0,301	0,438
2006	0,400	0,496	0,400	0,275	0,448	0,389	0,416	0,455	0,286	0,403	0,450	0,619	0,429	0,312	0,467	0,388	0,299	0,431
2007	0,396	0,491	0,396	0,277	0,451	0,394	0,409	0,451	0,288	0,399	0,439	0,627	0,439	0,310	0,467	0,383	0,295	0,422
2008	0,388	0,486	0,392	0,278	0,453	0,397	0,402	0,446	0,288	0,394	0,425	0,633	0,449	0,308	0,466	0,375	0,290	0,415
2009	0,388	0,481	0,387	0,278	0,453	0,399	0,398	0,440	0,287	0,390	0,415	0,643	0,459	0,306	0,465	0,366	0,284	0,405
2010	0,385	0,477	0,383	0,276	0,454	0,402	0,394	0,443	0,288	0,385	0,405	0,641	0,468	0,303	0,464	0,359	0,279	0,400
2011	0,385	0,474	0,377	0,272	0,454	0,403	0,390	0,444	0,290	0,379	0,396	0,640	0,478	0,300	0,463	0,353	0,274	0,394

Table 4: 2 -Informal Economy Estimates, Poor Countries, 1950-1980

year	MNG	MRT	MWI	NER	RWA	SEN	SLE	TGO	MDG	MOZ	NPL	SDN	UGA	BGD	CHN	IDN	IND	PAK	PHL
1950																			
1951																			
1952																			
1953																			
1954																			
1955																			
1956																			
1957																			
1958																			
1959																			
1960			0,560	0,347		0,514			0,395	0,567			0,570	0,495	0,276	0,314	0,385	0,593	0,557
1961			0,554	0,348		0,523			0,395	0,570			0,574	0,506	0,266	0,319	0,378	0,580	0,553
1962			0,540	0,352		0,530			0,397	0,573			0,572	0,516	0,267	0,321	0,372	0,562	0,547
1963			0,538	0,353		0,537			0,400	0,577			0,574	0,523	0,270	0,323	0,365	0,545	0,543
1964			0,535	0,348		0,541			0,401	0,580			0,572	0,531	0,271	0,326	0,359	0,525	0,535
1965			0,537	0,347		0,544			0,400	0,582			0,562	0,538	0,271	0,330	0,351	0,507	0,528
1966			0,524	0,346		0,547			0,401	0,582			0,556	0,543	0,268	0,331	0,345	0,485	0,520
1967			0,505	0,346		0,552			0,402	0,580			0,551	0,548	0,265	0,333	0,340	0,474	0,513
1968			0,496	0,345		0,558			0,401	0,578			0,542	0,551	0,264	0,336	0,335	0,465	0,506
1969			0,483	0,343		0,561			0,398	0,574			0,537	0,550	0,263	0,336	0,332	0,459	0,500
1970			0,467	0,345		0,563			0,395	0,565		0,490	0,527	0,550	0,262	0,335	0,327	0,456	0,494
1971			0,444	0,347		0,561			0,393	0,555		0,501	0,523	0,551	0,257	0,330	0,324	0,449	0,490
1972			0,427	0,348		0,559			0,390	0,544		0,513	0,519	0,555	0,252	0,324	0,321	0,444	0,482
1973			0,410	0,344		0,555			0,391	0,534		0,524	0,516	0,566	0,248	0,316	0,319	0,442	0,485
1974			0,404	0,339		0,552			0,392	0,525		0,534	0,513	0,572	0,243	0,309	0,316	0,441	0,476
1975			0,394	0,332		0,551			0,391	0,518		0,540	0,511	0,556	0,240	0,299	0,313	0,438	0,470
1976			0,381	0,329		0,549			0,391	0,511		0,541	0,509	0,554	0,235	0,291	0,311	0,435	0,463
1977			0,375	0,327		0,547			0,393	0,504		0,541	0,508	0,545	0,232	0,284	0,308	0,430	0,443
1978			0,370	0,333		0,544			0,395	0,498		0,543	0,507	0,538	0,229	0,278	0,306	0,425	0,445
1979			0,356	0,332		0,543			0,398	0,493		0,545	0,508	0,532	0,224	0,267	0,301	0,423	0,435
1980	0,170	0,352	0,351	0,332	0,494	0,541	0,404	0,283	0,393	0,490	0,540	0,548	0,510	0,519	0,221	0,259	0,299	0,419	0,424

Informal Sector, Business Cycles, and Fiscal Policy

Table 5: 2 -Informal Economy Estimates, Poor Countries, 1950-1980 (cont.)

year	MNG	MRT	MWI	NER	RWA	SEN	SLE	TGO	MDG	MOZ	NPL	SDN	UGA	BGD	CHN	IDN	IND	PAK	PHL
1981	0,174	0,353	0,348	0,325	0,477	0,539	0,397	0,277	0,391	0,485	0,530	0,556	0,513	0,502	0,218	0,252	0,297	0,415	0,421
1982	0,168	0,349	0,350	0,323	0,472	0,541	0,392	0,277	0,393	0,481	0,520	0,556	0,516	0,489	0,215	0,246	0,294	0,412	0,412
1983	0,163	0,345	0,351	0,321	0,456	0,538	0,390	0,279	0,397	0,476	0,512	0,556	0,517	0,483	0,212	0,238	0,292	0,405	0,412
1984	0,159	0,341	0,352	0,325	0,447	0,533	0,389	0,283	0,401	0,484	0,504	0,562	0,516	0,477	0,207	0,232	0,289	0,400	0,406
1985	0,158	0,341	0,354	0,333	0,431	0,532	0,390	0,289	0,404	0,488	0,496	0,576	0,521	0,471	0,205	0,228	0,287	0,395	0,406
1986	0,156	0,345	0,357	0,337	0,419	0,533	0,391	0,290	0,408	0,491	0,485	0,587	0,522	0,466	0,200	0,226	0,284	0,388	0,412
1987	0,153	0,347	0,362	0,340	0,412	0,530	0,392	0,292	0,410	0,491	0,477	0,590	0,523	0,454	0,197	0,221	0,281	0,385	0,414
1988	0,152	0,348	0,368	0,345	0,405	0,527	0,396	0,299	0,412	0,488	0,470	0,599	0,519	0,448	0,194	0,217	0,278	0,379	0,417
1989	0,151	0,352	0,373	0,347	0,397	0,522	0,397	0,302	0,409	0,482	0,460	0,595	0,515	0,444	0,190	0,214	0,274	0,374	0,417
1990	0,145	0,358	0,375	0,352	0,391	0,522	0,396	0,302	0,407	0,477	0,454	0,599	0,510	0,440	0,187	0,211	0,271	0,372	0,414
1991	0,157	0,361	0,377	0,357	0,384	0,519	0,393	0,300	0,401	0,475	0,450	0,604	0,507	0,437	0,184	0,207	0,267	0,364	0,411
1992	0,159	0,365	0,372	0,360	0,378	0,518	0,392	0,305	0,407	0,475	0,445	0,604	0,504	0,435	0,180	0,203	0,265	0,363	0,412
1993	0,161	0,364	0,371	0,365	0,372	0,514	0,387	0,308	0,408	0,475	0,439	0,589	0,501	0,431	0,176	0,200	0,262	0,358	0,411
1994	0,160	0,368	0,370	0,375	0,371	0,515	0,391	0,318	0,409	0,468	0,432	0,594	0,498	0,427	0,171	0,197	0,260	0,355	0,409
1995	0,160	0,370	0,375	0,378	0,379	0,516	0,390	0,322	0,411	0,470	0,424	0,588	0,492	0,422	0,166	0,191	0,256	0,350	0,406
1996	0,161	0,372	0,379	0,381	0,384	0,514	0,393	0,326	0,414	0,464	0,414	0,583	0,482	0,417	0,161	0,189	0,251	0,347	0,406
1997	0,161	0,375	0,382	0,384	0,396	0,508	0,394	0,330	0,414	0,459	0,406	0,554	0,473	0,410	0,156	0,184	0,248	0,346	0,399
1998	0,161	0,379	0,386	0,388	0,405	0,498	0,401	0,333	0,415	0,454	0,399	0,527	0,466	0,403	0,152	0,180	0,244	0,346	0,393
1999	0,161	0,379	0,391	0,389	0,411	0,489	0,409	0,336	0,414	0,444	0,395	0,478	0,458	0,395	0,147	0,180	0,240	0,344	0,393
2000	0,160	0,378	0,394	0,393	0,416	0,478	0,416	0,340	0,413	0,425	0,392	0,460	0,450	0,387	0,144	0,180	0,236	0,341	0,392
2001	0,160	0,376	0,397	0,398	0,416	0,466	0,422	0,342	0,409	0,413	0,385	0,444	0,445	0,381	0,141	0,181	0,233	0,339	0,395
2002	0,162	0,369	0,399	0,400	0,415	0,455	0,426	0,343	0,404	0,406	0,380	0,422	0,440	0,376	0,137	0,181	0,230	0,336	0,394
2003	0,165	0,369	0,403	0,400	0,411	0,450	0,429	0,344	0,405	0,399	0,377	0,397	0,434	0,370	0,134	0,181	0,227	0,337	0,390
2004	0,165	0,364	0,406	0,403	0,407	0,441	0,433	0,345	0,403	0,395	0,374	0,372	0,427	0,363	0,130	0,181	0,224	0,337	0,388
2005	0,165	0,348	0,407	0,405	0,403	0,434	0,434	0,346	0,397	0,392	0,369	0,352	0,420	0,356	0,127	0,180	0,219	0,337	0,386
2006	0,166	0,326	0,403	0,402	0,397	0,424	0,430	0,345	0,393	0,388	0,364	0,332	0,411	0,348	0,123	0,179	0,213	0,338	0,383
2007	0,164	0,315	0,394	0,399	0,390	0,417	0,429	0,345	0,385	0,385	0,359	0,320	0,403	0,341	0,119	0,179	0,207	0,336	0,383
2008	0,162	0,307	0,387	0,397	0,381	0,407	0,427	0,345	0,378	0,381	0,355	0,310	0,394	0,334	0,115	0,178	0,200	0,331	0,383
2009	0,158	0,298	0,376	0,392	0,367	0,400	0,425	0,345	0,363	0,373	0,347	0,303	0,385	0,327	0,111	0,177	0,195	0,330	0,381
2010	0,157	0,292	0,366	0,388	0,356	0,397	0,422	0,343	0,357	0,366	0,339	0,296	0,377	0,321	0,107	0,176	0,190	0,327	0,381
2011	0,156	0,285	0,357	0,382	0,347	0,395	0,410	0,339	0,354	0,361	0,328	0,290	0,370	0,316	0,103	0,175	0,185	0,325	0,378

2.2 Emerging countries

Table 6: 1 -Informal Economy Estimates, Emerging Countries, 1950-1980

year	ALB	BGR	BHR	BOL	BWA	CHL	CRI	CYP	DOM	ECU	FJI	GAB	GRC	GTM	HUN	ISR
1950				0,752			0,429			0,465				0,504		
1951				0,759		0,301	0,427			0,462			0,482	0,512		
1952				0,750		0,306	0,429			0,457			0,486	0,520		
1953				0,727		0,306	0,430			0,454			0,496	0,531		
1954				0,730		0,310	0,419			0,448			0,499	0,541		
1955				0,734		0,311	0,416			0,437			0,507	0,550		
1956				0,711		0,306	0,402			0,427			0,512	0,556		
1957				0,695		0,307	0,399			0,419			0,510	0,556		
1958				0,699		0,307	0,397			0,413			0,507	0,556		
1959				0,694		0,304	0,391			0,408			0,500	0,558		
1960				0,696		0,304	0,386	0,397	0,523	0,401			0,493	0,562		0,353
1961				0,693		0,302	0,379	0,397	0,527	0,395			0,486	0,567		0,346
1962				0,694		0,299	0,375	0,394	0,533	0,390			0,468	0,574		0,340
1963				0,686		0,298	0,370	0,386	0,533	0,386			0,457	0,581		0,332
1964				0,678		0,294	0,365	0,379	0,527	0,382			0,441	0,582		0,328
1965				0,672		0,289	0,366	0,382	0,515	0,378			0,425	0,581		0,320
1966				0,669		0,285	0,360	0,378	0,523	0,375			0,408	0,579		0,312
1967				0,662		0,277	0,355	0,376	0,520	0,372			0,393	0,581		0,303
1968				0,664		0,272	0,351	0,371	0,517	0,366			0,382	0,579		0,306
1969				0,653		0,266	0,348	0,367	0,515	0,361			0,371	0,573		0,299
1970	0,400	0,471	0,175	0,652		0,261	0,343	0,359	0,508	0,357			0,358	0,572	0,321	0,283
1971	0,395	0,468	0,176	0,650		0,256	0,338	0,354	0,498	0,355			0,347	0,572	0,318	0,278
1972	0,390	0,465	0,178	0,646		0,251	0,332	0,348	0,486	0,351			0,336	0,568	0,314	0,272
1973	0,385	0,461	0,178	0,637		0,250	0,328	0,342	0,474	0,350			0,324	0,570	0,312	0,256
1974	0,381	0,456	0,178	0,635		0,250	0,322	0,324	0,458	0,344			0,311	0,568	0,309	0,249
1975	0,377	0,451	0,178	0,636		0,245	0,314	0,323	0,443	0,336			0,305	0,560	0,305	0,241
1976	0,373	0,444	0,182	0,629		0,247	0,311	0,326	0,429	0,328			0,301	0,556	0,300	0,240
1977	0,369	0,438	0,178	0,627		0,249	0,307	0,329	0,420	0,321			0,295	0,547	0,296	0,242
1978	0,366	0,432	0,175	0,623		0,250	0,300	0,327	0,410	0,314			0,293	0,536	0,291	0,239
1979	0,362	0,425	0,173	0,609		0,250	0,294	0,323	0,402	0,307			0,289	0,526	0,284	0,242
1980	0,358	0,419	0,171	0,604	0,525	0,245	0,288	0,318	0,394	0,301	0,354	0,445	0,288	0,520	0,281	0,238

Table 7: 1 -Informal Economy Estimates, Emerging Countries, 1981-2011 (cont.)

year	ALB	BGR	BHR	BOL	BWA	CHL	CRI	CYP	DOM	ECU	FJI	GAB	GRC	GTM	HUN	ISR
1981	0,357	0,413	0,166	0,605	0,511	0,241	0,279	0,312	0,386	0,296	0,348	0,442	0,288	0,518	0,278	0,237
1982	0,353	0,404	0,162	0,600	0,496	0,233	0,276	0,309	0,382	0,294	0,341	0,435	0,286	0,514	0,276	0,238
1983	0,348	0,398	0,161	0,610	0,483	0,236	0,277	0,306	0,382	0,292	0,339	0,429	0,286	0,514	0,274	0,238
1984	0,345	0,393	0,159	0,622	0,476	0,240	0,282	0,303	0,381	0,294	0,340	0,426	0,286	0,518	0,273	0,235
1985	0,345	0,386	0,156	0,629	0,472	0,243	0,280	0,299	0,379	0,296	0,341	0,423	0,286	0,517	0,272	0,234
1986	0,344	0,382	0,157	0,634	0,466	0,246	0,280	0,297	0,378	0,297	0,342	0,420	0,286	0,519	0,271	0,237
1987	0,343	0,377	0,158	0,636	0,461	0,248	0,279	0,293	0,378	0,297	0,340	0,421	0,285	0,524	0,270	0,235
1988	0,344	0,372	0,161	0,642	0,457	0,248	0,276	0,291	0,374	0,299	0,344	0,428	0,288	0,526	0,269	0,236
1989	0,345	0,363	0,162	0,649	0,461	0,248	0,274	0,290	0,370	0,301	0,349	0,430	0,287	0,530	0,269	0,238
1990	0,341	0,355	0,163	0,658	0,437	0,245	0,273	0,286	0,364	0,302	0,350	0,436	0,287	0,531	0,267	0,237
1991	0,334	0,342	0,165	0,660	0,418	0,242	0,271	0,283	0,363	0,306	0,347	0,441	0,286	0,533	0,262	0,238
1992	0,341	0,340	0,164	0,659	0,405	0,240	0,272	0,281	0,365	0,307	0,347	0,444	0,286	0,533	0,259	0,235
1993	0,351	0,345	0,164	0,658	0,396	0,236	0,270	0,280	0,361	0,308	0,347	0,449	0,285	0,527	0,257	0,231
1994	0,356	0,351	0,166	0,656	0,390	0,230	0,267	0,278	0,356	0,310	0,348	0,453	0,287	0,526	0,258	0,229
1995	0,358	0,358	0,166	0,658	0,386	0,226	0,264	0,277	0,350	0,310	0,349	0,457	0,287	0,522	0,258	0,227
1996	0,360	0,363	0,168	0,658	0,381	0,219	0,262	0,274	0,347	0,308	0,349	0,459	0,287	0,519	0,258	0,223
1997	0,361	0,366	0,169	0,658	0,379	0,213	0,263	0,272	0,346	0,310	0,350	0,461	0,286	0,520	0,257	0,219
1998	0,366	0,369	0,170	0,651	0,375	0,207	0,262	0,271	0,345	0,308	0,350	0,457	0,286	0,519	0,257	0,216
1999	0,368	0,365	0,169	0,637	0,365	0,202	0,259	0,270	0,336	0,305	0,349	0,454	0,284	0,513	0,255	0,214
2000	0,370	0,361	0,170	0,632	0,358	0,200	0,259	0,271	0,328	0,309	0,348	0,457	0,281	0,508	0,253	0,213
2001	0,358	0,358	0,170	0,628	0,351	0,199	0,257	0,270	0,318	0,314	0,343	0,461	0,278	0,503	0,250	0,210
2002	0,354	0,354	0,167	0,625	0,344	0,196	0,253	0,269	0,313	0,314	0,341	0,464	0,276	0,500	0,248	0,207
2003	0,350	0,351	0,162	0,630	0,337	0,195	0,250	0,269	0,307	0,310	0,339	0,465	0,274	0,495	0,246	0,206
2004	0,345	0,347	0,158	0,631	0,331	0,192	0,247	0,270	0,307	0,314	0,338	0,468	0,271	0,488	0,244	0,206
2005	0,340	0,343	0,158	0,635	0,322	0,191	0,246	0,269	0,307	0,310	0,337	0,471	0,269	0,485	0,241	0,207
2006	0,335	0,335	0,161	0,634	0,322	0,189	0,243	0,266	0,308	0,308	0,330	0,474	0,268	0,483	0,238	0,207
2007	0,329	0,327	0,165	0,635	0,319	0,185	0,240	0,265	0,305	0,304	0,326	0,473	0,265	0,479	0,237	0,207
2008	0,326	0,318	0,168	0,634	0,314	0,182	0,236	0,262	0,302	0,300	0,326	0,474	0,262	0,475	0,234	0,206
2009	0,314	0,305	0,170	0,628	0,308	0,176	0,231	0,256	0,298	0,295	0,323	0,474	0,258	0,474	0,231	0,204
2010	0,308	0,297	0,170	0,622	0,304	0,177	0,231	0,254	0,296	0,292	0,323	0,476	0,257	0,477	0,232	0,204
2011	0,305	0,293	0,168	0,615	0,301	0,173	0,229	0,251	0,293	0,289	0,319	0,475	0,256	0,479	0,232	0,204

Table 8: 2 -Informal Economy Estimates, Emerging Countries, 1950-1980

year	JOR	MLT	MUS	NAM	NZL	PAN	PRT	PRY	SLV	SUR	SWZ	TTO	TUN	URY	ARG
1950					0,175		0,479								0,400
1951					0,172		0,478								0,404
1952					0,171		0,477								0,394
1953					0,170		0,475								0,399
1954					0,171		0,470								0,399
1955					0,169		0,466								0,401
1956					0,168		0,463								0,396
1957					0,167		0,461								0,399
1958					0,166		0,456								0,399
1959					0,165		0,451								0,390
1960	0,300	0,454			0,164		0,447					0,449	0,567	0,511	0,391
1961	0,302	0,444			0,163		0,438					0,435	0,560	0,509	0,387
1962	0,300	0,436			0,162		0,427					0,427	0,549	0,506	0,378
1963	0,297	0,429			0,161		0,419					0,417	0,535	0,506	0,368
1964	0,299	0,426			0,160		0,410					0,412	0,519	0,507	0,371
1965	0,296	0,420			0,159		0,401					0,407	0,503	0,509	0,371
1966	0,292	0,414			0,157		0,390					0,401	0,490	0,511	0,365
1967	0,290	0,406			0,154		0,380					0,397	0,479	0,514	0,362
1968	0,285	0,398			0,152		0,373					0,398	0,471	0,514	0,358
1969	0,280	0,386			0,153	0,881	0,365					0,397	0,464	0,517	0,359
1970	0,270	0,372			0,152	0,851	0,363	0,541				0,397	0,457	0,516	0,355
1971	0,270	0,364			0,152	0,815	0,354	0,535				0,393	0,451	0,514	0,350
1972	0,263	0,362			0,150	0,778	0,346	0,527				0,381	0,445	0,512	0,345
1973	0,253	0,362			0,150	0,746	0,338	0,519				0,374	0,433	0,510	0,339
1974	0,248	0,363			0,148	0,723	0,334	0,507				0,372	0,427	0,510	0,336
1975	0,243	0,363			0,144	0,693	0,324	0,492	0,519	0,391		0,360	0,419	0,510	0,329
1976	0,236	0,365			0,144	0,679	0,324	0,483	0,512	0,384		0,352	0,413	0,507	0,328
1977	0,230	0,365			0,142	0,664	0,322	0,469	0,505	0,384		0,345	0,406	0,501	0,326
1978	0,216	0,363			0,142	0,670	0,317	0,456	0,491	0,380		0,338	0,402	0,492	0,319
1979	0,206	0,361			0,142	0,670	0,314	0,441	0,480	0,374		0,325	0,397	0,482	0,316
1980	0,201	0,355	0,283	0,275	0,142	0,666	0,310	0,425	0,469	0,371	0,392	0,314	0,392	0,471	0,313

Table 9: 2 -Informal Economy Estimates, Emerging Countries, 1981-2011 (cont.)

year	JOR	MLT	MUS	NAM	NZL	PAN	PRT	PRY	SLV	SUR	SWZ	TTO	TUN	URY	ARG
1981	0,193	0,351	0,284	0,269	0,142	0,657	0,304	0,407	0,467	0,365	0,390	0,302	0,386	0,462	0,311
1982	0,187	0,344	0,283	0,265	0,142	0,645	0,298	0,391	0,467	0,355	0,390	0,296	0,380	0,451	0,312
1983	0,183	0,334	0,284	0,265	0,140	0,643	0,296	0,384	0,468	0,355	0,390	0,290	0,375	0,449	0,312
1984	0,180	0,328	0,286	0,267	0,140	0,646	0,293	0,383	0,469	0,355	0,384	0,285	0,369	0,451	0,312
1985	0,178	0,322	0,286	0,270	0,139	0,649	0,292	0,381	0,470	0,356	0,382	0,280	0,366	0,459	0,311
1986	0,178	0,319	0,286	0,276	0,137	0,653	0,292	0,380	0,475	0,356	0,384	0,277	0,364	0,467	0,313
1987	0,177	0,317	0,284	0,284	0,136	0,656	0,293	0,379	0,477	0,356	0,387	0,275	0,365	0,476	0,316
1988	0,176	0,314	0,280	0,288	0,135	0,651	0,291	0,378	0,480	0,357	0,384	0,277	0,367	0,478	0,317
1989	0,175	0,309	0,274	0,292	0,133	0,668	0,287	0,376	0,481	0,366	0,380	0,280	0,370	0,482	0,315
1990	0,177	0,305	0,270	0,294	0,132	0,683	0,285	0,374	0,479	0,370	0,374	0,283	0,373	0,484	0,322
1991	0,179	0,300	0,265	0,290	0,131	0,681	0,281	0,370	0,482	0,372	0,370	0,290	0,373	0,486	0,326
1992	0,182	0,294	0,261	0,293	0,132	0,689	0,276	0,366	0,484	0,379	0,365	0,294	0,375	0,487	0,326
1993	0,183	0,292	0,257	0,292	0,132	0,681	0,271	0,365	0,485	0,379	0,360	0,297	0,373	0,484	0,325
1994	0,182	0,288	0,253	0,297	0,133	0,668	0,268	0,363	0,484	0,380	0,356	0,303	0,373	0,482	0,323
1995	0,181	0,284	0,249	0,297	0,133	0,655	0,264	0,362	0,477	0,371	0,354	0,307	0,374	0,477	0,321
1996	0,180	0,279	0,247	0,298	0,132	0,637	0,262	0,360	0,471	0,375	0,351	0,311	0,375	0,469	0,320
1997	0,178	0,275	0,246	0,297	0,130	0,628	0,260	0,360	0,468	0,366	0,352	0,315	0,374	0,463	0,317
1998	0,179	0,270	0,242	0,298	0,129	0,617	0,257	0,358	0,467	0,366	0,351	0,317	0,373	0,452	0,313
1999	0,179	0,267	0,238	0,296	0,128	0,605	0,252	0,359	0,460	0,362	0,348	0,317	0,371	0,444	0,309
2000	0,179	0,264	0,234	0,295	0,127	0,588	0,248	0,361	0,455	0,356	0,351	0,321	0,368	0,439	0,308
2001	0,180	0,261	0,231	0,295	0,127	0,583	0,244	0,360	0,453	0,361	0,354	0,324	0,366	0,438	0,308
2002	0,180	0,262	0,230	0,294	0,126	0,587	0,240	0,358	0,445	0,364	0,355	0,324	0,363	0,434	0,301
2003	0,180	0,263	0,227	0,292	0,125	0,589	0,237	0,360	0,443	0,368	0,355	0,326	0,361	0,434	0,308
2004	0,181	0,264	0,224	0,292	0,124	0,590	0,235	0,366	0,437	0,375	0,360	0,325	0,359	0,439	0,313
2005	0,181	0,266	0,222	0,292	0,123	0,590	0,233	0,362	0,434	0,367	0,367	0,323	0,357	0,441	0,316
2006	0,175	0,265	0,221	0,289	0,121	0,587	0,231	0,362	0,432	0,357	0,373	0,316	0,356	0,460	0,316
2007	0,172	0,265	0,219	0,285	0,120	0,585	0,230	0,365	0,430	0,351	0,380	0,315	0,354	0,461	0,312
2008	0,169	0,264	0,217	0,280	0,118	0,577	0,229	0,366	0,424	0,341	0,388	0,315	0,352	0,458	0,308
2009	0,168	0,263	0,214	0,273	0,117	0,568	0,226	0,365	0,419	0,331	0,396	0,315	0,349	0,451	0,301
2010	0,169	0,266	0,213	0,268	0,116	0,555	0,225	0,363	0,420	0,326	0,398	0,317	0,347	0,447	0,297
2011	0,169	0,268	0,212	0,263	0,116	0,543	0,224	0,360	0,419	0,325	0,412	0,317	0,342	0,442	0,293

Table 10: 3 -Informal Economy Estimates, Emerging Countries, 1950-1980

year	COL	ESP	IRN	KOR	MAR	MYS	PER	SYR	THA	TUR	VEM	ZAF	BRA	EGY	MEX
1950	0,527	0,466					0,793			0,683	0,408		0,649		0,488
1951	0,519	0,465					0,794			0,689	0,401		0,639		0,487
1952	0,517	0,462					0,786			0,692	0,394		0,628		0,483
1953	0,512	0,460					0,776			0,690	0,381		0,608		0,477
1954	0,507	0,457					0,765			0,684	0,371		0,608		0,473
1955	0,496	0,451					0,760			0,678	0,363		0,599		0,467
1956	0,487	0,444					0,752			0,666	0,357		0,589		0,461
1957	0,478	0,437					0,740			0,661	0,349		0,587		0,451
1958	0,474	0,431					0,726			0,651	0,338		0,577		0,442
1959	0,474	0,422					0,718			0,634	0,334		0,570		0,435
1960	0,471	0,416	0,280	0,701	0,520	0,669	0,716	0,305	1,200	0,625	0,327	0,325	0,555	0,743	0,430
1961	0,467	0,412	0,280	0,712	0,512	0,667	0,710	0,304	1,187	0,616	0,326	0,323	0,549	0,740	0,424
1962	0,463	0,405	0,280	0,715	0,517	0,664	0,707	0,302	1,175	0,607	0,327	0,322	0,541	0,732	0,418
1963	0,460	0,395	0,278	0,721	0,512	0,656	0,698	0,296	1,153	0,599	0,327	0,321	0,532	0,720	0,414
1964	0,459	0,385	0,276	0,710	0,508	0,648	0,693	0,293	1,123	0,590	0,330	0,318	0,530	0,710	0,409
1965	0,456	0,375	0,271	0,709	0,511	0,641	0,686	0,289	1,097	0,581	0,327	0,314	0,528	0,695	0,402
1966	0,455	0,366	0,266	0,705	0,508	0,633	0,680	0,288	1,071	0,574	0,323	0,308	0,522	0,680	0,393
1967	0,452	0,355	0,259	0,685	0,508	0,626	0,668	0,285	1,034	0,560	0,322	0,305	0,514	0,669	0,386
1968	0,450	0,347	0,253	0,668	0,499	0,618	0,655	0,282	0,999	0,549	0,322	0,299	0,511	0,664	0,379
1969	0,446	0,339	0,245	0,643	0,494	0,611	0,652	0,279	0,967	0,536	0,318	0,295	0,504	0,661	0,371
1970	0,443	0,330	0,237	0,623	0,504	0,605	0,652	0,270	0,933	0,529	0,315	0,290	0,492	0,655	0,366
1971	0,436	0,322	0,233	0,608	0,493	0,595	0,647	0,270	0,897	0,517	0,310	0,284	0,484	0,649	0,362
1972	0,431	0,317	0,229	0,594	0,486	0,580	0,643	0,269	0,861	0,509	0,307	0,279	0,475	0,644	0,360
1973	0,427	0,311	0,224	0,591	0,485	0,567	0,642	0,263	0,847	0,499	0,304	0,276	0,471	0,643	0,358
1974	0,423	0,304	0,216	0,578	0,479	0,549	0,632	0,261	0,805	0,489	0,305	0,272	0,456	0,636	0,354
1975	0,417	0,295	0,204	0,558	0,475	0,526	0,613	0,256	0,788	0,467	0,308	0,266	0,442	0,618	0,349
1976	0,416	0,288	0,195	0,551	0,450	0,516	0,600	0,248	0,767	0,450	0,307	0,262	0,429	0,601	0,344
1977	0,417	0,283	0,183	0,536	0,430	0,506	0,591	0,238	0,768	0,436	0,306	0,260	0,422	0,574	0,341
1978	0,414	0,279	0,172	0,518	0,412	0,493	0,590	0,228	0,755	0,430	0,299	0,258	0,413	0,552	0,338
1979	0,412	0,275	0,169	0,494	0,405	0,482	0,592	0,220	0,726	0,429	0,291	0,257	0,401	0,534	0,336
1980	0,409	0,271	0,167	0,467	0,402	0,467	0,587	0,217	0,716	0,429	0,285	0,256	0,391	0,513	0,332

Table 11: 3 -Informal Economy Estimates, Emerging Countries, 1981-2011 (cont.)

year	COL	ESP	IRN	KOR	MAR	MYS	PER	SYR	THA	TUR	VEM	ZAF	BRA	EGY	MEX
1981	0,404	0,268	0,164	0,455	0,397	0,454	0,580	0,211	0,709	0,425	0,283	0,252	0,384	0,489	0,325
1982	0,395	0,266	0,164	0,446	0,394	0,440	0,570	0,206	0,697	0,420	0,283	0,248	0,381	0,472	0,316
1983	0,387	0,265	0,164	0,436	0,390	0,426	0,564	0,202	0,688	0,416	0,281	0,247	0,377	0,455	0,311
1984	0,381	0,263	0,162	0,424	0,388	0,415	0,567	0,198	0,676	0,415	0,283	0,245	0,379	0,442	0,313
1985	0,376	0,261	0,160	0,415	0,386	0,402	0,569	0,197	0,661	0,412	0,288	0,244	0,384	0,434	0,314
1986	0,375	0,261	0,160	0,406	0,383	0,397	0,576	0,195	0,655	0,409	0,293	0,245	0,382	0,426	0,313
1987	0,374	0,261	0,161	0,399	0,381	0,397	0,583	0,196	0,653	0,405	0,297	0,247	0,379	0,422	0,316
1988	0,372	0,261	0,161	0,388	0,380	0,397	0,586	0,198	0,651	0,395	0,301	0,249	0,378	0,419	0,317
1989	0,368	0,258	0,164	0,377	0,379	0,394	0,587	0,198	0,627	0,389	0,295	0,250	0,375	0,415	0,318
1990	0,373	0,256	0,164	0,364	0,377	0,390	0,591	0,201	0,618	0,382	0,302	0,250	0,375	0,409	0,319
1991	0,376	0,252	0,164	0,351	0,374	0,383	0,596	0,203	0,591	0,375	0,307	0,252	0,376	0,401	0,319
1992	0,374	0,247	0,161	0,337	0,371	0,372	0,595	0,205	0,574	0,369	0,309	0,254	0,375	0,396	0,317
1993	0,372	0,243	0,159	0,326	0,368	0,364	0,589	0,206	0,551	0,358	0,308	0,256	0,376	0,395	0,314
1994	0,367	0,241	0,160	0,319	0,368	0,353	0,579	0,207	0,532	0,353	0,310	0,260	0,377	0,393	0,312
1995	0,355	0,240	0,162	0,310	0,367	0,341	0,570	0,206	0,516	0,351	0,314	0,262	0,377	0,386	0,306
1996	0,348	0,239	0,164	0,302	0,368	0,333	0,561	0,205	0,498	0,346	0,315	0,262	0,372	0,381	0,309
1997	0,341	0,239	0,166	0,294	0,367	0,322	0,558	0,204	0,484	0,339	0,317	0,262	0,369	0,375	0,311
1998	0,337	0,239	0,167	0,283	0,366	0,311	0,551	0,203	0,472	0,333	0,317	0,263	0,365	0,369	0,309
1999	0,335	0,238	0,169	0,282	0,363	0,310	0,545	0,203	0,476	0,327	0,317	0,263	0,362	0,365	0,306
2000	0,339	0,237	0,170	0,280	0,359	0,311	0,539	0,202	0,480	0,322	0,317	0,263	0,365	0,358	0,303
2001	0,343	0,235	0,172	0,276	0,355	0,307	0,535	0,202	0,484	0,316	0,317	0,264	0,363	0,351	0,298
2002	0,343	0,232	0,173	0,273	0,352	0,305	0,534	0,202	0,488	0,316	0,314	0,263	0,363	0,346	0,295
2003	0,346	0,230	0,174	0,268	0,351	0,303	0,532	0,200	0,491	0,313	0,315	0,262	0,363	0,343	0,293
2004	0,345	0,228	0,175	0,265	0,347	0,301	0,532	0,197	0,492	0,305	0,320	0,261	0,366	0,341	0,292
2005	0,345	0,227	0,175	0,262	0,341	0,299	0,532	0,194	0,490	0,302	0,318	0,258	0,367	0,339	0,290
2006	0,339	0,225	0,174	0,259	0,336	0,298	0,537	0,188	0,485	0,297	0,315	0,255	0,367	0,334	0,290
2007	0,335	0,222	0,173	0,256	0,331	0,296	0,537	0,185	0,482	0,291	0,309	0,252	0,366	0,331	0,288
2008	0,330	0,218	0,170	0,253	0,325	0,293	0,527	0,182	0,479	0,286	0,301	0,249	0,365	0,324	0,286
2009	0,326	0,212	0,168	0,249	0,317	0,291	0,507	0,176	0,475	0,280	0,295	0,243	0,360	0,316	0,283
2010	0,324	0,210	0,166	0,249	0,311	0,293	0,502	0,174	0,475	0,283	0,292	0,239	0,360	0,312	0,282
2011	0,319	0,209	0,163	0,247	0,307	0,290	0,490	0,171	0,472	0,282	0,289	0,236	0,357	0,306	0,282

2.3 Rich countries

Table 12: 1 -Informal Economy Estimates, Rich Countries, 1950-1980

Year	AUT	BEL	CHE	DNK	FIN	HKG	IRL	ISL	LUX	MAC	NLD
1950	0,170	0,348	0,116	0,279	0,299		0,280		0,145		0,208
1951	0,169	0,346	0,117	0,277	0,299		0,279		0,142		0,207
1952	0,167	0,344	0,117	0,278	0,295		0,276		0,142		0,205
1953	0,166	0,342	0,118	0,278	0,290		0,276		0,140		0,200
1954	0,167	0,340	0,118	0,278	0,289		0,274		0,138		0,196
1955	0,167	0,338	0,118	0,277	0,286		0,273		0,137		0,193
1956	0,165	0,336	0,117	0,277	0,281		0,270	0,000	0,136		0,191
1957	0,163	0,333	0,116	0,277	0,277		0,268	0,248	0,135		0,189
1958	0,161	0,328	0,113	0,276	0,273		0,269	0,244	0,133		0,190
1959	0,160	0,326	0,113	0,277	0,270		0,270	0,240	0,131		0,188
1960	0,159	0,325	0,112	0,276	0,268	0,275	0,269	0,235	0,130		0,187
1961	0,156	0,323	0,111	0,272	0,264	0,269	0,268	0,232	0,129		0,185
1962	0,153	0,319	0,109	0,268	0,258	0,275	0,267	0,230	0,127		0,183
1963	0,151	0,314	0,107	0,264	0,253	0,272	0,265	0,229	0,125		0,181
1964	0,148	0,312	0,106	0,262	0,251	0,270	0,262	0,226	0,124		0,177
1965	0,146	0,306	0,103	0,258	0,248	0,260	0,258	0,222	0,122		0,175
1966	0,143	0,301	0,102	0,253	0,243	0,252	0,253	0,217	0,121		0,174
1967	0,140	0,296	0,100	0,249	0,238	0,253	0,250	0,211	0,119		0,171
1968	0,137	0,292	0,099	0,245	0,233	0,252	0,247	0,205	0,119		0,168
1969	0,134	0,289	0,098	0,241	0,232	0,256	0,243	0,203	0,119		0,165
1970	0,132	0,283	0,097	0,236	0,229	0,257	0,236	0,202	0,120		0,162
1971	0,130	0,279	0,096	0,231	0,224	0,254	0,232	0,203	0,120		0,160
1972	0,127	0,275	0,094	0,229	0,221	0,251	0,226	0,199	0,119		0,159
1973	0,125	0,272	0,093	0,225	0,218	0,247	0,222	0,197	0,118		0,156
1974	0,122	0,269	0,092	0,221	0,214	0,243	0,217	0,194	0,118		0,155
1975	0,119	0,263	0,090	0,217	0,209	0,240	0,212	0,188	0,117		0,154
1976	0,118	0,261	0,089	0,217	0,205	0,237	0,209	0,186	0,116		0,152
1977	0,117	0,257	0,089	0,214	0,202	0,233	0,207	0,185	0,116		0,151
1978	0,115	0,255	0,089	0,212	0,200	0,230	0,204	0,182	0,116		0,151
1979	0,114	0,252	0,089	0,210	0,201	0,225	0,201	0,181	0,116		0,150
1980	0,112	0,250	0,089	0,207	0,200	0,221	0,196	0,180	0,116	0,160	0,149

Table 13: 1 -Informal Economy Estimates, Rich Countries, 1981-2011 (cont.)

Year	AUT	BEL	CHE	DNK	FIN	HKG	IRL	ISL	LUX	MAC	NLD
1981	0,111	0,246	0,088	0,206	0,198	0,216	0,192	0,179	0,115	0,157	0,149
1982	0,111	0,244	0,088	0,206	0,197	0,209	0,188	0,177	0,114	0,155	0,149
1983	0,110	0,243	0,087	0,206	0,195	0,203	0,185	0,174	0,114	0,152	0,148
1984	0,110	0,244	0,087	0,207	0,193	0,201	0,183	0,175	0,114	0,149	0,147
1985	0,109	0,243	0,087	0,206	0,192	0,197	0,181	0,174	0,114	0,150	0,146
1986	0,109	0,243	0,087	0,205	0,190	0,195	0,179	0,175	0,114	0,148	0,145
1987	0,108	0,243	0,087	0,202	0,189	0,193	0,180	0,177	0,113	0,144	0,145
1988	0,108	0,243	0,086	0,199	0,188	0,190	0,180	0,174	0,113	0,141	0,144
1989	0,107	0,242	0,086	0,198	0,187	0,186	0,180	0,171	0,111	0,140	0,143
1990	0,106	0,240	0,085	0,196	0,183	0,183	0,180	0,170	0,110	0,136	0,142
1991	0,105	0,236	0,085	0,194	0,179	0,180	0,177	0,169	0,109	0,136	0,142
1992	0,104	0,234	0,084	0,193	0,176	0,176	0,176	0,168	0,107	0,131	0,141
1993	0,103	0,231	0,083	0,191	0,175	0,173	0,176	0,167	0,106	0,129	0,141
1994	0,102	0,229	0,083	0,191	0,176	0,170	0,176	0,167	0,105	0,128	0,140
1995	0,101	0,228	0,083	0,190	0,177	0,166	0,177	0,168	0,104	0,127	0,139
1996	0,100	0,226	0,082	0,188	0,177	0,163	0,177	0,168	0,104	0,129	0,138
1997	0,099	0,225	0,082	0,187	0,178	0,161	0,176	0,167	0,103	0,129	0,138
1998	0,099	0,223	0,082	0,185	0,178	0,157	0,176	0,168	0,103	0,131	0,137
1999	0,098	0,222	0,081	0,183	0,178	0,154	0,174	0,166	0,102	0,132	0,135
2000	0,098	0,221	0,081	0,181	0,177	0,154	0,171	0,164	0,101	0,130	0,135
2001	0,097	0,219	0,081	0,179	0,176	0,153	0,168	0,162	0,100	0,130	0,134
2002	0,096	0,217	0,081	0,177	0,175	0,151	0,166	0,159	0,099	0,127	0,134
2003	0,096	0,216	0,081	0,174	0,173	0,149	0,163	0,158	0,097	0,122	0,134
2004	0,096	0,216	0,081	0,173	0,172	0,149	0,161	0,157	0,096	0,116	0,133
2005	0,095	0,215	0,081	0,171	0,171	0,148	0,160	0,156	0,095	0,115	0,132
2006	0,095	0,214	0,081	0,170	0,171	0,148	0,157	0,154	0,094	0,113	0,131
2007	0,095	0,213	0,081	0,169	0,170	0,147	0,154	0,150	0,094	0,111	0,130
2008	0,095	0,211	0,081	0,167	0,169	0,146	0,150	0,147	0,093	0,111	0,130
2009	0,094	0,209	0,081	0,164	0,166	0,144	0,146	0,144	0,092	0,110	0,130
2010	0,094	0,209	0,081	0,164	0,166	0,143	0,146	0,145	0,092	0,103	0,130
2011	0,094	0,208	0,081	0,164	0,166	0,143	0,146	0,147	0,091	0,098	0,129

Table 14: 2 -Informal Economy Estimates, Rich Countries, 1950-1980

Year	NOR	SGP	SWE	AUS	CAN	FRA	GBR	ITA	DEU	JPN	USA
1950	0,302		0,279	0,218	0,244	0,260	0,181	0,484		0,253	0,134
1951	0,300		0,277	0,216	0,240	0,259	0,182	0,484		0,259	0,132
1952	0,296		0,275	0,213	0,238	0,257	0,181	0,484		0,257	0,131
1953	0,290		0,272	0,214	0,237	0,256	0,182	0,484		0,258	0,130
1954	0,287		0,267	0,214	0,236	0,255	0,183	0,482		0,259	0,129
1955	0,286		0,265	0,213	0,236	0,254	0,183	0,480		0,259	0,130
1956	0,284		0,262	0,211	0,234	0,252	0,183	0,474		0,258	0,130
1957	0,281		0,260	0,210	0,231	0,249	0,182	0,469		0,257	0,128
1958	0,279		0,258	0,209	0,228	0,246	0,182	0,463		0,251	0,127
1959	0,276		0,254	0,207	0,226	0,242	0,181	0,459		0,248	0,127
1960	0,273	0,270	0,253	0,206	0,228	0,240	0,181	0,455		0,245	0,127
1961	0,268	0,266	0,249	0,203	0,225	0,235	0,180	0,447		0,239	0,125
1962	0,266	0,262	0,246	0,202	0,224	0,231	0,178	0,437		0,231	0,125
1963	0,263	0,255	0,242	0,201	0,223	0,228	0,176	0,427		0,223	0,124
1964	0,259	0,260	0,238	0,200	0,222	0,224	0,175	0,417		0,217	0,124
1965	0,255	0,256	0,235	0,198	0,221	0,219	0,173	0,409		0,210	0,123
1966	0,252	0,249	0,234	0,197	0,219	0,216	0,170	0,403		0,204	0,121
1967	0,248	0,242	0,230	0,195	0,215	0,211	0,167	0,400		0,198	0,119
1968	0,246	0,233	0,228	0,193	0,213	0,207	0,165	0,394		0,192	0,118
1969	0,243	0,225	0,225	0,191	0,211	0,204	0,163	0,389		0,185	0,118
1970	0,242	0,217	0,222	0,189	0,208	0,200	0,161	0,384	0,193	0,177	0,116
1971	0,238	0,211	0,221	0,187	0,207	0,196	0,158	0,372	0,191	0,169	0,115
1972	0,235	0,205	0,219	0,185	0,205	0,192	0,156	0,364	0,189	0,162	0,115
1973	0,232	0,200	0,217	0,184	0,205	0,189	0,156	0,359	0,187	0,157	0,114
1974	0,230	0,199	0,216	0,182	0,202	0,185	0,154	0,351	0,184	0,151	0,112
1975	0,227	0,197	0,215	0,180	0,199	0,181	0,152	0,342	0,182	0,146	0,111
1976	0,225	0,195	0,214	0,180	0,198	0,180	0,151	0,340	0,180	0,143	0,111
1977	0,223	0,192	0,214	0,178	0,195	0,178	0,150	0,334	0,179	0,141	0,111
1978	0,221	0,188	0,213	0,177	0,194	0,176	0,149	0,331	0,178	0,139	0,110
1979	0,219	0,186	0,211	0,176	0,193	0,174	0,149	0,329	0,177	0,136	0,109
1980	0,217	0,182	0,210	0,175	0,191	0,173	0,147	0,326	0,176	0,134	0,108

Table 15: 2 -Informal Economy Estimates, Rich Countries, 1981-2011 (cont.)

year	NOR	SGP	SWE	AUS	CAN	FRA	GBR	ITA	DEU	JPN	USA
1981	0,216	0,178	0,210	0,173	0,189	0,171	0,146	0,321	0,174	0,132	0,107
1982	0,216	0,175	0,209	0,170	0,185	0,169	0,145	0,317	0,173	0,130	0,105
1983	0,213	0,172	0,208	0,169	0,184	0,168	0,145	0,315	0,173	0,129	0,105
1984	0,210	0,168	0,206	0,168	0,184	0,167	0,145	0,313	0,172	0,128	0,105
1985	0,208	0,168	0,205	0,167	0,184	0,167	0,145	0,311	0,172	0,126	0,104
1986	0,207	0,167	0,204	0,166	0,183	0,166	0,144	0,309	0,171	0,125	0,103
1987	0,206	0,164	0,202	0,165	0,182	0,165	0,144	0,306	0,171	0,123	0,102
1988	0,206	0,161	0,201	0,164	0,180	0,165	0,144	0,304	0,170	0,122	0,102
1989	0,204	0,157	0,200	0,163	0,178	0,164	0,142	0,301	0,170	0,120	0,101
1990	0,202	0,155	0,200	0,161	0,175	0,162	0,141	0,299	0,168	0,118	0,100
1991	0,200	0,154	0,199	0,159	0,172	0,160	0,138	0,296	0,168	0,116	0,099
1992	0,198	0,152	0,198	0,158	0,170	0,159	0,137	0,292	0,165	0,114	0,099
1993	0,196	0,147	0,197	0,157	0,170	0,157	0,136	0,288	0,163	0,112	0,098
1994	0,194	0,144	0,195	0,157	0,170	0,157	0,136	0,286	0,162	0,111	0,098
1995	0,193	0,139	0,194	0,156	0,169	0,157	0,135	0,285	0,161	0,110	0,097
1996	0,190	0,140	0,193	0,154	0,168	0,156	0,134	0,284	0,159	0,109	0,096
1997	0,189	0,138	0,191	0,153	0,168	0,155	0,134	0,282	0,158	0,108	0,095
1998	0,188	0,139	0,190	0,151	0,166	0,155	0,133	0,281	0,158	0,107	0,094
1999	0,187	0,136	0,188	0,149	0,165	0,155	0,132	0,279	0,157	0,106	0,093
2000	0,185	0,132	0,187	0,148	0,164	0,155	0,130	0,278	0,156	0,105	0,091
2001	0,184	0,134	0,187	0,147	0,162	0,153	0,129	0,277	0,155	0,104	0,090
2002	0,183	0,132	0,186	0,145	0,161	0,152	0,128	0,275	0,154	0,104	0,088
2003	0,182	0,129	0,184	0,144	0,160	0,151	0,127	0,273	0,153	0,103	0,087
2004	0,181	0,126	0,182	0,142	0,159	0,150	0,125	0,271	0,153	0,103	0,087
2005	0,180	0,124	0,181	0,140	0,157	0,149	0,124	0,270	0,153	0,103	0,086
2006	0,180	0,124	0,180	0,139	0,155	0,148	0,123	0,269	0,153	0,103	0,085
2007	0,180	0,122	0,179	0,137	0,153	0,147	0,122	0,268	0,153	0,103	0,084
2008	0,181	0,124	0,180	0,135	0,151	0,145	0,120	0,266	0,152	0,103	0,083
2009	0,182	0,125	0,182	0,133	0,148	0,143	0,119	0,263	0,151	0,102	0,082
2010	0,182	0,121	0,179	0,132	0,147	0,143	0,118	0,263	0,152	0,102	0,082
2011	0,181	0,120	0,178	0,130	0,146	0,143	0,118	0,263	0,152	0,102	0,082