Financial Access and Consumption Smoothing *

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September 21, 2021

Abstract

Does improving access to financial institutions always facilitate consumption smoothing? I document new empirical evidence that emerging economies with better access to banks are worse at consumption smoothing, whereas developed economies with better access to banks are better at consumption smoothing. This result is robust to alternative measures of domestic and international financial access and controlling for level of income. A simple one-good small open economy model supplemented with trend shocks and financial access heterogeneity is calibrated to match business cycle moments of developed and emerging markets. The model can qualitatively account for the change in the ratio of consumption volatility to income volatility to financial access for both developed and emerging economies, as seen in the data. A two-sector extension of the model captures the non-targeted business cycle moments too.

Keywords: Business cycles, Financial access, Open economy macroeconomics

JEL Classification: E32, E44, F41

1 Introduction

Recent literature in macroeconomics (Agenor et al. (2000) and Aguiar and Gopinath (2007), henceforth referred to as *AG 2007*) has shown that aggregate consumption fluctuates less than aggregate income for developed countries, but the converse is true for developing countries. Increasing access to the formal financial sector (commercial or co-operative banks, micro-finance institutions, etc.) to improve risk-sharing has become a high priority objective for central banks and fiscal authorities in all developing economies.[1] Formal insurance arrangements include access to institutions that provide borrowing and saving facilities, insurance companies, and government transfer programs. Poorer economies have limited availability to formal and informal insurance arrangements as highlighted by Banerjee and Duflo (2007). Levine (1997) stresses that removing barriers to limited access to finance will help to mobilize savings, facilitate better risk management, and ease trading of goods and services. Burgess and Pande (2005) argues that the creation of rural banks can also reduce poverty.

*This is a heavily revised version of a paper previously circulated as "Business cycles in presence of exogenous financial exclusion with productivity shocks"

†I want to thank Michael Devereux, Viktoria Hnatkovska and Amartya Lahiri for their continuous guidance and support throughout the project. I thank Jesse Perla, and Michal Szkup for their helpful comments. I also thank seminar participants at 13th ACEGD and CAFRAL for their helpful suggestions. Any errors and shortcomings are mine.

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[1]More than 50 countries have committed to financial inclusion programs as of 2014, according to the World Bank. The World Bank is working with countries such as Ethiopia, Mexico, Pakistan, etc. to implement nationwide financial inclusion programs.

The lack of access to banks also makes it difficult for governments to provide health and life insurance effectively. But "over-lending" is a serious concern regarding these programs. Breza and Kinnan (2018) show that a sharp stop in credit disbursement led to a reduction in consumption and output of Indian districts exposed to excess lending by microfinance institutions. Thus, the effects of financial access on consumption smoothing might not necessarily be positive.

I provide empirical evidence that emerging countries with higher levels of financial inclusion have a significantly higher ratio of consumption volatility to income volatility. On the other hand, developed countries show a significant negative elasticity between the ratio of consumption volatility to income volatility and financial access. The results are robust to other measures, such as including mobile banking or the proportion of bank deposits to GDP. The results are also robust to access to capital markets rather than just domestic financial institutions. The crucial distinction among the countries is in the income classification category rather than the level of income. The results are robust to including GDP per capita as a regressor. Low-income countries display a negative correlation as well, but it is not significant, and magnitudes differ a lot across specifications. Incorporating low-income countries in a model is difficult since the actual relationship is unknown.

Owning a bank account is not the only instrument available to households to mitigate borrowing constraints. Households in developing economies can save in land or livestock (Rosenzweig and Wolpin (1993)). In agricultural settings, agents can alter labour supply in response to income shocks (Jayachandran (2006)) or insure through social networks (Kinnan and Townsend (2012)). However, friends and relatives might not be a relevant source to borrow funds if everyone has received a large negative shock too (Besley (1995)) or if friends and relatives live geographically far apart from each other (Fafchamps and Gubert (2007)). Livestock and jewelry are highly illiquid forms of asset, and it is difficult to exchange them for money given a bad income shock. The empirical analysis excludes labor supply due to the lack of reliable data. To the best of my knowledge, panel data on the use of financial services as insurance across countries is not available. As long as financial access is a good proxy for total risk-sharing, the main takeaway of my empirical results hold.

I expand a standard small open economy (SOE) model in two dimensions: segmentation in access to formal financial sector by the households and trend shocks, to rationalize the empirical facts. There are two types of agents; financially included and financially excluded consumers. Financially included consumers supply labour and participate in a risk-free international bonds market, and financially excluded agents also provide labour, but are hand-to-mouth consumers. The financial market segmentation is exogenous. Both types of agents receive the same productivity shocks at any point in time. Financially included agents use their ability to save and borrow when faced with an income shock. They save some income and consume the rest in response to a positive temporary productivity shock. This implies that consumption is less volatile than income given a transitory shock. They borrow against their permanently higher future income and increase consumption in response to a positive trend shock. Consumption then is more volatile than income. Instead, consumption adjusts one-for-one in response to an income shock for financially excluded agents. Thus, the ratio of aggregate consumption volatility to aggregate income volatility will be higher in the economy with more financially included agents in response to a permanent income shock. On the other hand, the ratio of consumption volatility to income volatility will be lower in the economy with more financially included agents in response to a transitory shock.

I calibrate the model to an average developed and emerging economy, and estimate the standard deviation

of trend shocks by matching the standard deviation of filtered output. Financial inclusion is calibrated to the average level of ownership of bank accounts, whereas other model parameters remain the same between the two sets of countries. The estimated variance of trend shocks is higher than the variance of transitory shocks for emerging economies. Developed economies have lower estimated variance of trend shocks than transitory shocks. Emerging and developed economies differ along only these two dimensions. Numerical simulations show that, firstly, developed economies have a lower ratio of consumption volatility to income volatility. Secondly, developed economies with higher financial access have a lower ratio of consumption volatility to income volatility, but emerging economies with higher financial access have a higher ratio of consumption volatility to income volatility. Thus, the model can capture both the empirical facts.

The benchmark model can qualitatively account for the observed correlations, but it struggles to match them quantitatively. Non-targeted business cycle moments like correlation of net exports to output for developed economies do not match well. Without capital in the model, consumption and production are very closely linked together. I extend the benchmark model into a two-sector model where financially included and excluded agents work in different sectors, but can trade with each other. Financially included agents supply labour, can participate in the bonds market and own capital. Financially excluded agents supply labour, do not own equity, and are hand-to-mouth consumers. The two-sector model performs better than the one-sector model in matching the magnitude of the correlation between the ratio of consumption volatility to income volatility and financial inclusion for emerging countries. The two-sector model also performs better than the one-sector model in matching the non-targeted business cycle moments.

The paper is related to various strands of research in financial development and macroeconomic volatility, business cycles in emerging markets, and models in international finance. The link between financial access and macroeconomic development has received less attention. Empirical studies at the household level show positive effects on savings when access is improved (Burgess and Pande (2005) and Kast and Pomeranz (2018)). Mehrotra and Yetman (2014) is the only paper to my knowledge that tries to look at the effect of financial inclusion on macroeconomic volatility. They find a negative unconditional correlation between access and the ratio of consumption volatility to income volatility. I contribute to this growing empirical literature by finding a robust effect of financial inclusion on the ratio of consumption volatility to income volatility. A similar point has been stressed by Buch et al. (2005), who show that the effect of macroeconomic shocks depends on the nature of financial openness.

Several empirical studies have tried to establish a link between financial depth and aggregate volatility. Denzier et al. (2002) argue that improving financial depth reduces aggregate volatility, but their results vary with the definition of financial depth. Some measures of financial depth exhibit a positive relationship with consumption volatility, whereas some others show a negative correlation. More recent papers (Dabla-Norris and Srivisal (2013), Ma and Song (2018), and Wang et al. (2018)) argue that there exists a nonlinear effect of financial development and volatility. However, financial depth and financial access measure different aspects of financial development. Financial depth measures the size of the financial system, whereas inclusion or access measure the presence of barriers to participate in the financial system. These concepts are related, but not equivalent.

This paper is closely related to the literature on the business cycle properties in developed and emerging

nations. Agenor et al. (2000), AG 2007 and Male (2011) show key empirical facts on differences in business cycle properties among low, middle, and high-income countries. On the modelling side, this literature has explored the consequences of adding different frictions to the basic dynamic stochastic model of Mendoza (1991). These frictions include information frictions and learning effects (Boz et al. (2011)), search frictions (Bora Durdu (2013), shocks to price of imported capital (Boileau and Normandin (2017)), and financial frictions (Bhattacharya and Patnaik (2015), Chang and Fernández (2013), and García-Cicco et al. (2015)). My benchmark model is similar to the one-sector model with domestic capital access in Bhattacharya and Patnaik (2015) calibrated for India and one-sector model with interest rate shocks and working capital frictions in Barrail (2020). Epstein and Finkelstein Shapiro (2021) show that increasing financial participation for firms rather than households can help to close the gap between advanced and emerging economies business cycle moments. I extend the benchmark model to a two-sector setting where financially included and excluded agents work in different sectors and calibrate it to explain the new empirical facts consistent for both developed and emerging countries.

Trend shocks have received extensive attention in the business cycle literature following AG 2007. García-Cicco et al. (2015) and Chang and Fernández (2013) argue against the importance of trend shocks and in favour of financial frictions in explaining the differences between business cycle moments of emerging and developed countries. The results of García-Cicco et al. (2015) appear to be influenced by their high reliance on country-premium risk shocks to explain the autocorrelation of the trade-balance to output ratio. Chang and Fernández (2013) argue in favour of interest rate shocks and working capital requirements as the important financial frictions in emerging countries, rather than trend shocks. But, high rate of working capital requirements (more than 50% of total cost) and interest rate shocks counter-cyclical to long-run productivity are necessary to arrive at those conclusions.[2] [3] Another common argument against trend shocks is that it leads to interest rates being procyclical rather than the countercyclical to output. Male finds that countercyclical real interest rates are a characteristic of only Latin American economies, and on average, developing economies display mildly procyclical interest rates. This paper also emphasizes that financial frictions amplify productivity shocks, but in contrast to previous papers, financial frictions take the form of limited financial market access.

Gao et al. (2014) argue that financial segmentation significantly improves the statistical performance of otherwise standard international business cycle models to solve the international comovement puzzle and quantity puzzle. Cociuba and Ramanarayanan (2019) use asset market segmentation to explain why asset prices display a high degree of international risk sharing, but aggregate consumption does not. Krueger et al. (2017) show the contribution of income, wealth, and preference heterogeneity in amplifying and propagating a macroeconomic shock. Heathcote and Perri (2018) highlight the relationship between wealth and output volatility. My paper emphasizes the role of financial access heterogeneity in amplifying the consequences of a technological shock on macroeconomic aggregates.

The rest of the paper has been organized as follows: Section 2 presents empirical evidence; Section 3 illustrates the model and impulse response functions. In Section 4, I discuss calibration, results and model

[2] Oviedo (2005) argues that the emerging market business cycle models perform much weaker unless the real interest rate is negatively correlated with factor productivity, and working capital requirements are high.

[3] Mendoza and Yue (2012) estimate working capital requirements to be 6% of total cost, much lesser than Chang and Fernández (2013).

performance, and the last section concludes.

2 Empirical fact

In this section, I document the empirical fact which will motivate the subsequent analysis. I use annual time-series from 1970-2014 data to compute business-cycle statistics for each country.[4] All of the time series variables are expressed in 2011 constant price local currency per capita unit.[5] Countries that have less than 20 continuous observations in the components of final expenditure or if the population is less than 1 million as in 2014 are dropped from the sample.[6] The cross-section sample includes 40 developed countries, 56 low or lower middle-income countries, and 35 upper middle-income countries, resulting in 131 countries in total. Log of consumption and output are detrended using an HP-filter with a smoothing parameter of 6.25.[7] To better capture the dynamic components of growth and time fixed effects which a cross-section regression cannot, I create a pseudo-panel by dividing the time series into three periods, 1973-1987, 1998-2002, and 2003-2014. It is an unbalanced panel with 322 observations since some control variables are not available for each country-time observation. The reason to construct such a panel is because the first World Bank classification started in 1987.

Financial access is defined as the percentage of respondents who have an account at a financial institution (individually or jointly) or a debit/credit card as per Global Findex Database 2014.[8] This measure is available for 116 countries in our sample, including 38 developed, 45 low or lower middle-income countries and 33 emerging economies. Financial access is smaller in low and middle-income countries than in developed countries. The average level of financial inclusion among developed, low and lower middle-income, and emerging countries is 89%, 21%, and 55% respectively. Consumption smoothing is defined as the ratio of standard deviation of detrended logged consumption and standard deviation of detrended logged output. A higher value implies that the country is doing poorly to insure aggregate consumption against an aggregate income shock. [9]

2.1 Link between consumption smoothing and financial access

I run the following model to precisely estimate the relationship between financial access and consumption smoothing:

$$\begin{aligned}\left(\frac{\sigma(c)}{\sigma(y)}\right)_i &= \beta_0 + \beta_1 * \text{L/LM}_i + \beta_2 * \text{UM}_i + \beta_3 * \text{H}_i * \text{Access}_i \\ &+ \beta_4 * \text{L/LM}_i * \text{Access}_i + \beta_5 * \text{UM}_i * \text{Access}_i + \beta_6 * X_i + \varepsilon_i\end{aligned} \tag{2.1}$$

where H, L/LM, and UM represents dummy for income classification high-income, low and lower middle-income, and upper middle-income countries. β_3, β_4, and β_5 are the coefficients of interest. They measure

[4] Appendix B contains details on the construction and data source of all variables.

[5] All of the results below are robust to expressing quantities in PPP units.

[6] Countries with a very high ratio of consumption volatility to income volatility have been excluded not to drive the results by outliers.

[7] All of the results below are robust to using first differences as a filter.

[8] This measure also includes having a bank account to receive only government transfers. See the Appendix B for the full definition.

[9] Consistent with AG 2007 and Male 2011, I show in Appendix Table A.1 that the ratio of consumption volatility to income volatility is higher for developing countries than developed countries

the change in the ratio of consumption volatility to income volatility to a unit change in financial access for high-income, low and lower middle-income, and upper middle-income countries respectively.

X_i controls for other factors that might affect this relationship. Schmitt-Grohé and Uribe (2017) show that countries that have higher GDP per capita and population size have a lower ratio of consumption volatility to income volatility. I include population size as a control. I also control for political regime, and fiscal impulse as Hnatkovska and Loayza (2005) show that countries that possess underdeveloped institutions or inability to conduct countercyclical fiscal policies can exacerbate the negative impacts of volatility on growth. I control for volatility of terms of trade and trade openness to capture exposure to international shocks. The exchange rate regime is included as a control to capture the flexibility in insuring against macroeconomic shocks. Other control variables include dummies for Banking crisis, Sovereign debt crisis, and Currency crisis since such crisis episodes are associated with significant fluctuations in macroeconomic variables. I also include region fixed effects to capture culture, consumption preferences, or economic policies that might differ by region and affect aggregate risk-sharing.

Table 1 displays the coefficients on the interaction between income classification and different measures of financial access. The coefficient of financial access in Column 1 is negative for developed countries and low-income countries. The estimate for developed countries is significant at 15% level of significance, whereas the estimate for low-income countries is not significant. But, the correlation between financial access and consumption smoothing is positive and significant in emerging countries. More importantly, the null hypothesis that $\beta_3 = \beta_5$ is rejected at 1% level of significance, but $\beta_3 = \beta_4$ cannot be rejected. This implies that developed and emerging countries differ significantly in how higher ability to insure affects risk sharing. On the other hand, consumption smoothing in low-income countries might be more sensitive to instruments other than financial access such as wealth or government programs.

A possible concern may be that the level of wealth is essential for consumption smoothing rather than access to finance. The estimates for emerging countries are biased because the income classification dummies do not control for the level of income. Thus, adding the log of per capita GDP will help to control for the bias. Table 1 column 2 displays the coefficients relating to financial access and log of income per capita. The coefficient on the high-income countries loses significance, but the estimate is still different from upper middle-income countries. This implies that the level of income is not capturing the underlying differences between developed and emerging countries. Instead, other reasons lead to differences in the relationship between consumption smoothing and financial access.

Mobile banking has become an effective medium for providing financial services, especially in Africa (Demirguc-Kunt and Klapper (2012)). I also re-run the OLS model on an alternate measure of financial access, which adds mobile banking to the original definition. These estimates shown in Table 1 Column 3 are quite similar to the original measure that excludes mobile banking. Thus, financial institutions is capturing the relevant margin of access to the financial system that is important for insurance.

Table 1: Consumption Smoothing and Financial Access

Dependent variable: Ratio of consumption volatility to income volatility			
	Financial Institution		With mobile
	(1)	(2)	(3)
H*Access (β_3)	-0.549^{+}	-0.192	-0.516^{+}
	(0.357)	(0.525)	(0.349)
L/LM*Access (β_4)	-0.531	-0.371	-0.366
	(0.512)	(0.543)	(0.484)
UM*Access (β_5)	0.706**	0.790**	0.740**
	(0.347)	(0.359)	(0.341)
Ln GDP per capita		-0.074	
		(0.084)	
N	116	116	116
R^2	0.39	0.39	0.38
Region Fixed Effects	Yes	Yes	Yes
H_0 : β_3=β_4	.97	.75	.79
H_0 : β_3=β_5	.00	.05	.00
H_0 : β_4=β_5	.03	.03	.04

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05 * indicates p <0.1 and + indicates p <0.15. The last three rows show the p-values of the corresponding null hypothesis. All regressions are log population weighted. The coefficients of the control variables are shown in Appendix Table A.2.

Access to international markets might help to smooth against domestic income shocks by giving access to more markets or worsen risk sharing against domestic income shocks by exposing an economy to external risk (Kose et al. (2003) and Bekaert et al. (2006)).[10]) I will perform the OLS regression as in equation 2.1 using the above three measures of financial access to estimate the impact of international financial market access. The first measure is the gross debt to GDP ratio. Gross debt comprises of bonds issued by the domestic country to international lenders. Any public or private institution in the home country could issue these bonds to a public or private institution in a foreign country. The second measure is the Chinn-Ito index (Chinn and Ito (2006)) of capital market openness. This measure focusses more on providing information about capital account restrictiveness across countries and so, speaks more about the extensive margin of financial openness.

[10]Both papers find weak or adverse effects of financial openness improving consumption smoothing in emerging countries

The third measure is the Financial market access taken from Svirydzenka (2016). This measure is a principal component of two factors: the proportion of market capitalization apart from the Top 10 companies and the gross issuers of debt, including both financial and non-financial. The first measure captures access to the stock market, and the second measure reflects access to the capital markets.

Table 2: Consumption Smoothing and International Market Openness

Dependent variable: Ratio of consumption volatility to income volatility

	Measure of Access to International Market		
	Debt to GDP	Chinn-Ito dummy	Financial markets
	(1)	(2)	(3)
H*Access (β_3)	-0.394**	-0.241**	-0.277^{+}
	(0.189)	(0.106)	(0.179)
L/LM*Access (β_4)	-0.369	-0.255**	-0.593
	(1.107)	(0.124)	(0.498)
UM*Access (β_5)	0.168	0.007	0.561**
	(0.482)	(0.115)	(0.281)
N	95	131	92
R^2	0.34	0.34	0.45
Region Fixed Effects	Yes	Yes	Yes
H_0 : β_3=β_4	.98	.93	.56
H_0 : β_3=β_5	.29	.15	.01
H_0 : β_4=β_5	.64	.12	.05

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05, * indicates p <0.1 and + indicates p <0.15. The last three rows show the p-values of the corresponding null hypothesis. All regressions are log population weighted. The coefficients of the control variables are shown in Appendix Table A.3.

Table 2 shows β_3, β_4, and β_5 for the three alternate measures of international financial market access. β_3 is significant when considering the debt to GDP ratio as the measure, and the other coefficients have the same signs as domestic financial access. Both the developing and low and lower middle-income countries have a negative coefficient for both the Chinn-Ito index and financial markets access. The coefficients for developed country is significant in both cases. Moreover, the null hypothesis that $\beta_3 = \beta_4$ is rejected in both cases. The coefficient of both measures is positive for the emerging economies, but is significant only to the international financial market access measure. The null hypothesis that $\beta_3 = \beta_5$ cannot be rejected at the 15% level of

significance for the Chinn-Ito index and at the 1% level for the financial markets access measure. The signs of the coefficients are consistent across the three definitions, and in line with the result of Kose et al. (2003) that access to international financial markets has perverse effects on consumption smoothing for emerging countries. Thus, access to both domestic and international financial markets worsens consumption smoothing for emerging countries.

2.2 Robustness checks

Traditionally, the literature on the impact of financial development on macroeconomic growth and volatility has used the ratio of Deposits to GDP (King and Levine (1993)) as its preferred measure of financial development. Financial access and financial depth are related concepts, but financial access explains the barriers to participate in the financial system, whereas financial depth describes the magnitude of the financial system. The correlation coefficient between the two measures is 51%, 34% and 51% among developed, upper middle and low income countries respectively. I test the robustness of my results using the ratio of deposits to GDP in cross-section and panel regression models to discuss how my estimates compare with the baseline results, and also how they compare with other papers.

The first column of Table 3 shows the coefficient on the interaction between income categorization and deposits to GDP in the cross-section model. β_3 is significantly less from zero, β_5 is positive, and the null hypothesis that $\beta_3 = \beta_5$ is rejected at 1% level of significance. The same conclusions hold in the Pooled OLS and Random effects model, with β_5 coefficient being higher in magnitude. In the Fixed effects model, the coefficients retain the same signs, though insignificant from zero.[11] These estimates are in line with the findings of Dabla-Norris and Srivisal (2013) who find a nonlinear and U-shaped correspondence between financial depth and output and consumption volatility. They do not do this separately for emerging countries, but in the linear specification, they do estimate it separately for emerging countries. For emerging countries, the coefficients on both consumption and output volatility are negative, but the coefficient on consumption volatility is smaller than output volatility. The developed countries display a negative coefficient of both consumption and output volatility, but the coefficient on consumption volatility is higher than output volatility. This signifies that the ratio of consumption volatility to income volatility could increase with financial depth for emerging countries, but decrease for developed countries.[12]

I do not discuss in detail the impact of financial access on low and lower middle-income countries because the magnitude of the coefficients changes rapidly across different specifications. Ungrouping them increases the standard errors of the coefficients, making the relationship less precise. If we look at within income country classification, the relationship between financial access and consumption smoothing still holds for developed and emerging countries (Appendix Table A.5). But, financial access explains very little difference in consumption between low and lower middle-income countries. Trade openness, Currency Crisis, and Sovereign Debt crisis accounts for most of the difference. The model calibration will not include low and lower middle-income countries since the exact link between financial access, and consumption smoothing is uncertain.

[11] The Hausman test did not reject the Random effects model

[12] Ma and Song (2018) get a nonlinear relationship as DDabla-Norris and Srivisal (2013), but on a much smaller sample and considering final consumption expenditure rather than household consumption expenditure. This makes it difficult to compare my estimates with their estimates.

To conclude, consumption smoothing among developed and emerging economies is quite distinct from each other. Emerging countries do worse at aggregate risk mitigation with increasing financial inclusion as opposed to developed countries. This is a perverse result if we believe in the Permanent Income hypothesis since households should always want to smooth consumption and so risk sharing should improve with increasing opportunities to participate in the financial system. In the next section, I will illustrate a model that can explain this phenomenon.

Table 3: Consumption Smoothing and Deposits to GDP

Dependent variable: Ratio of consumption volatility to income volatility

	Cross-Section	Panel		
Model	OLS	Pooled OLS	Random Effects	Fixed Effects
	(1)	(2)	(3)	(4)
H*Access (β_3)	-0.579***	-0.594**	-0.714***	-0.842
	(0.203)	(0.232)	(0.265)	(1.262)
L/LM*Access (β_4)	-0.544	-1.218^{+}	-0.558	-0.034
	(0.446)	(0.798)	(0.750)	(1.283)
UM*Access (β_5)	0.334	0.721	0.846	1.305
	(0.413)	(0.693)	(0.812)	(1.445)
N	115	303	303	303
R^2	0.33	0.19	0.26	0.06
Region Fixed Effects	Yes	Yes	Yes	No
Year Fixed Effects	No	Yes	Yes	Yes
H_0 : β_3=β_4	.94	.46	.85	.58
H_0 : β_3=β_5	.05	.05	.05	.15
H_0 : β_4=β_5	.19	.05	.18	.26

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05, * indicates p <0.1 and + indicates p <0.15. The last three rows show the p-values of the corresponding null hypothesis. All regressions are log population weighted except for Random effects regression. The coefficients of the control variables are shown in Appendix Table A.4.

3 Model

A single-good, small open economy is characterized by a continuum of agents of total mass equal to one. The economy consists of two types of representative agents, financially included, and financially excluded agents.

Financially included agents save and borrow in one-period international risk-free bonds, whereas financially excluded agents are hand-to-mouth consumers. λ governs the size of agents who cannot avail of the services of the financial market.I will assume that the financial segmentation is exogenous. An otherwise standard SOE model is further augmented to include trend shock. For notational convenience, I introduce the superscript "i" or "e" to distinguish between consumption, labour supply and income of financially included and excluded agents respectively. Aggregate level variables and bond holdings of financially included agents do not have any superscripts.

The production function and the process of the technological shocks are the following:

$$y_t^i = exp\left(z_t\right) \Gamma_t l_t^i \tag{3.1}$$

$$y_t^e = exp\left(z_t\right) \Gamma_t l_t^e \tag{3.2}$$

$$z_t = \rho_z z_{t-1} + \epsilon_t^z \; ; \; \epsilon_t^z \sim N\left(0, \sigma_z^2\right) \tag{3.3}$$

$$\Gamma_t = exp(g_t)\Gamma_{t-1} \tag{3.4}$$

$$g_t = (1-\rho_g)\mu_g + \rho_g g_{t-1} + \epsilon_t^g \; ; \; \epsilon_t^g \sim N\left(0, \sigma_g^2\right) \tag{3.5}$$

z_t and g_t follow an A.R.(1) process. I call z_t transitory shocks and g_t trend shocks following AG 2007. Trend shocks can be conceptualized as institutional or political economy frictions that affect productivity permanently. y_t denotes a backyard production technology where each agent works in their firm. Both types of firms exhibit constant returns to scale and have the same production function. Each type of agent will receive the same trend, and transitory productivity shocks every period. This assumption ensures that the focus of the exercise remains to understand the effects on the economy due to heterogeneity in access to financial markets rather than heterogeneity in the timing of productivity shocks.

The infinitely lived agents derive utility from consumption and disutility from labour. The per-period utility is a Cobb-Douglas in consumption and leisure. The agents are trying to maximize the presented discounted value of per-period utility which is given by the following expression:

$$U^j = \mathbb{E}_0 \left(\sum_{t=0}^{\infty} \beta^t \frac{\left[\left(c_t^j\right)^{\gamma} \left(1 - l_t^j\right)^{1-\gamma} \right]^{1-\sigma}}{1-\sigma} \right) \text{ where j = i,e} \tag{3.6}$$

and $0 < \gamma < 1$, $0 < \beta < 1$ and $\sigma > 0$.

The constraints which the financially included agents face while making their decisions are the production function (3.1) and the budget constraint given by:

$$c_t^i = y_t^i - b_t + q_t b_{t+1} \tag{3.7}$$

The level of bond holdings at time t is denoted by b_t, and the price of bonds is denoted by q_t. The price of debt depends on the level of outstanding debts and is given by:

$$\frac{1}{q_t} = 1 + r^* + \psi_b \left[exp\left(\frac{b_{t+1}}{\Gamma_t} - \bar{b} \right) - 1 \right] \tag{3.8}$$

where $\bar{b}$ is the steady state level of debt, r^* is the world interest rate, and ψ_b represents the elasticity of interest rate to debt holdings. This formulation follows Schmitt-Grohe and Uribe (2003) and ensures stationarity in bond holdings.

Output in this model is non-stationary with a stochastic trend since any value of g affects the trend component Γ permanently. For any variable x, let $\hat{x}$ denotes its detrended counterpart where $\hat{x}_t \equiv \frac{x_t}{\Gamma_{t-1}}$.

Agents choose consumption, labour supply, and bond holdings to solve the following problem in its detrended form:

$$V\left(z, g, \hat{b}\right) = \max_{\left\{\hat{c^i}, l^i, \hat{b'}\right\}} \left\{ \frac{\left[\left(\hat{c^i}\right)^{\gamma} \left(1 - l^i\right)^{1-\gamma} \right]^{1-\sigma}}{1-\sigma} + \beta e^{g\gamma(1-\sigma)} \mathbb{E} V\left(z', g', \hat{b'}\right) \right\} \tag{3.9}$$

subject to:

$$\hat{c^i} = \hat{y^i} - \hat{b} + q e^g \hat{b'} \tag{3.10}$$

$$\hat{y^i} = e^z e^g l^i \tag{3.11}$$

This leads to the following First order conditions:

$$\hat{c^i} = \frac{\gamma}{1-\gamma} \left(1 - l^i\right) \frac{\hat{y^i}}{l^i} \tag{3.12}$$

$$\left[\left(\hat{c^i}\right)^{\gamma(1-\sigma)-1} \left(1 - l^i\right)^{(1-\gamma)(1-\sigma)} \right] q e^{g(1-\gamma(1-\sigma))} = \beta \mathbb{E} \left[\left(\hat{c^{i\prime}}\right)^{\gamma(1-\sigma)-1} \left(1 - l^{i\prime}\right)^{(1-\gamma)(1-\sigma)} \right] \tag{3.13}$$

Equation (12) implies the marginal rate of substitution between labour and consumption equals the marginal product of labour, and Equation (13) is the standard Euler equation.

The constraints which the financially excluded agents face are the production function (3.2) and the budget constraint given by:

$$c_t^e = y_t^e \tag{3.14}$$

Agents choose consumption and labour supply to solve the following problem in its detrended form:

$$V\left(z, g\right) = \max_{\left\{\hat{c^e}, l^e\right\}} \left\{ \frac{\left[\left(\hat{c^e}\right)^{\gamma} \left(1 - l^e\right)^{1-\gamma} \right]^{1-\sigma}}{1-\sigma} + \beta e^{g\gamma(1-\sigma)} \mathbb{E} V\left(z', g'\right) \right\} \tag{3.15}$$

subject to:

$$\hat{c^e} = \hat{y^e} \tag{3.16}$$

$$\hat{y^e} = e^z e^g l^e \tag{3.17}$$

The financially excluded agents are essentially solving a static maximization problem. This leads to the following First order condition which defines the relation between optimal consumption and labour supply:

$$\hat{c^e} = \frac{\gamma}{1-\gamma}\left(1-l^e\right)\frac{\hat{y^e}}{l^e} \tag{3.18}$$

Net exports in the model is defined as the ratio of total bond holdings to total output:

$$nx = \frac{\hat{b} - qe^g\hat{b'}}{\left(1-\lambda\right)\hat{y^i} + \lambda\hat{y^e}} = \frac{\left(1-\lambda\right)\hat{y^i} + \lambda\hat{y^e} - \left(1-\lambda\right)\hat{c^i} - \lambda\hat{c^e}}{\left(1-\lambda\right)\hat{y^i} + \lambda\hat{y^e}} \tag{3.19}$$

Given an initial bonds holdings $\hat{b_0}$, the equilibrium of the economy is characterized by the first-order conditions (3.12), (3.13) and (3.18), the production functions (3.11) and (3.17), the budget constraints (3.10) and (3.16), prices of bonds (3.8), the exogenous process of the technology shocks (3.3), (3.5) and the transversality conditions.

3.1 Impulse Response functions

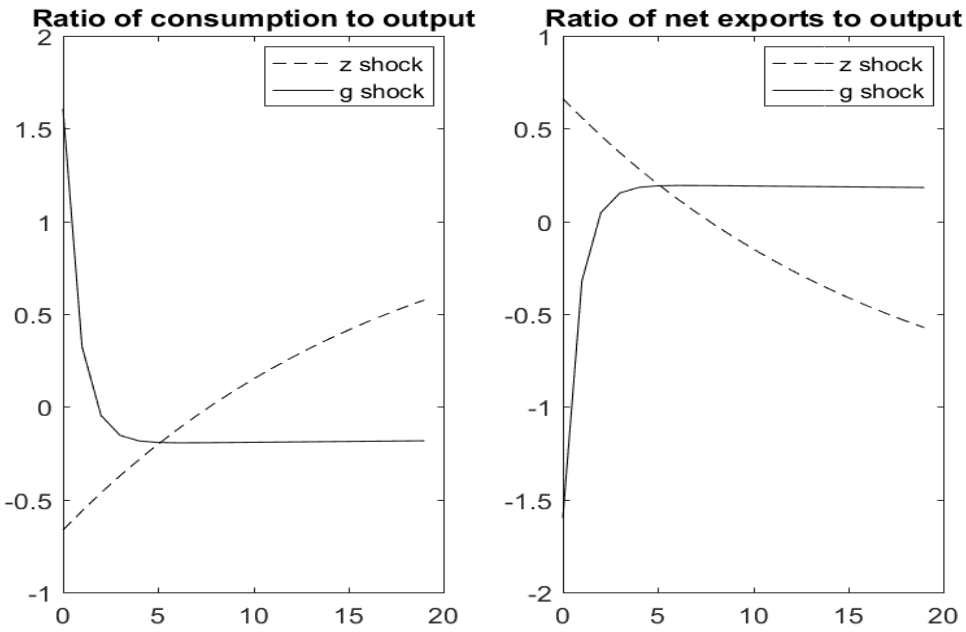

Figure 1: IRF of aggregate consumption and net exports to aggregate output to a standard deviation of transitory and trend shock.

Note: The y-axis represents the percentage deviations from the steady state, and the x-axis represents the yearly time horizon. The emerging economy parameters in Table 4 are used to generate the impulse responses.

Figure 1 shows the impulse responses to a positive 100% standard deviation transitory and trend shock. Financially included agents increase labour supply in response to a positive transitory shock. Output increases due to an increase in technology and labour supply. Under the Permanent Income Hypothesis framework, consumption increases in response to a positive transitory shock, but less than income as individuals choose to save some of the temporary increase in income. The figure shows that the steady state deviation of the consumption to income ratio is negative and trade balance improves. Both the output and consumption increases, but

consumption increases more than output as agents borrow today and repay the loan with the higher output in the future. Thus, net exports fall in response to a trend shock. Moreover, the ratio of standard deviation of net exports to standard deviation of output will provide similar information about trend versus transitory shocks as the ratio of standard deviation of consumption to standard deviation of output. Thus, the second moment of net exports will help distinguish between trend and transitory shocks.[13]

Financially excluded agents always supply γ, and their consumption increase is equal to the increase in income as they are financially constrained, irrespective of the nature of the shock. The assumption that financially excluded households are hand-to-mouth is extreme. The reasons are two-fold; firstly, it provides convenience in terms of solving the model, and secondly, the results do not change much if they are allowed to store some cash under their mattress. If agents are allowed to save some endowment, which decays at a constant rate, then given a positive technology shock, they will always respond by saving some of the extra endowment. But, savings will be less in response to a trend shock than transitory shock, as productivity improves permanently with a positive trend shock. Thus, consumption will be less volatile than income given either shock, but the ratio of consumption volatility to income volatility will still be higher against trend shocks than transitory shocks.

4 Calibration

One period in the model corresponds to a year. The model is solved using *Dynare*, and used, to generate a series of 100000 periods. Logged output, logged consumption and net exports are HP-filtered with a smoothing parameter of 6.25. First, I calibrate, and estimate model parameters for an average developed and emerging economy. The two categories will differ in the underlying productivity process (standard deviation of trend shock), and each country will differ in the level of financial inclusion it possesses. Accordingly, I will fix all other parameters to be the same across the two groups of countries.

Table 4 lists the parameter values used in the benchmark model, and reference to articles that use these values. Specification 1 represents the parameters for emerging income countries, and Specification 2 represents the parameters for developed countries. The discount rate is equal to 0.92 since this corresponds to a quarterly discount rate of 0.98. The risk-free rate is set to satisfy the condition that $\beta\left(1+r^{*}\right)=e^{\mu_g(1-\gamma(1-\sigma))}$. This condition is obtained from the Euler equation (13) evaluated at the steady state. The values of the steady state share of labour hours (γ), the parameter of risk aversion (σ), the elasticity of interest rate to debt (ψ_b), the persistence of the transitory productivity process ρ_z, and the persistence of the trend process ρ_g are 0.36, 2, 0.001, 0.95, and 0.29 respectively. All of the above values are used for calibration in AG 2007. The growth rate of the trend shock (μ_g) equals to the natural log of 1.03, and it matches the average trend growth rate for all countries observed in the data.

σ_z is set at 2.00 since what matters in such models is the ratio of the standard deviations of the two shock processes, i.e., σ_g/σ_z. σ_g is computed by minimizing the squared difference of the standard deviation of filtered logged output in the simulated sample and data. Emerging countries have a bigger standard deviation of trend shock than developed countries since output is more volatile in emerging countries. The parameter value is 4.28 and 1.14 for emerging and developed countries respectively. Ideally, the moment to target would be the ratio

[13] Financially included agents do not adjust labour supply much in response to a positive trend shock since with a Cobb-Douglas utility function, income effects on labour supply matter.

of net exports volatility to output volatility, but the model is too simplistic to generate big changes in this ratio. This will become clear when I discuss the business cycle moments generated from the model. The level of financial exclusion (λ) is identical to the average level observed in the sample. The average financial exclusion is 44.72 % and 11.31 % in Upper middle-income and high-income countries respectively.

Table 4: Benchmark Model Parameter values

Parameter	Specification 1	Specification 2	Source
(1)	(2)	(3)	(4)
β	0.92	0.92	Euler equation
σ	2	2	AG 2007
γ	0.36	0.36	AG 2007
$\overline{b}/\overline{Y}$	0.1	0.1	AG 2007
ψ_b	0.001	0.001	AG 2007
μ_g	1.03	1.03	Average growth
ρ_g	0.29	0.29	AG 2007
ρ_z	0.95	0.95	AG 2007
σ_z	2.00	2.00	Set
σ_g	4.28	1.14	Match ratio of $\sigma(Y)$
λ	0.45	0.11	Average financial exclusion in sample

4.1 Results

I simulate model economies among each group of income classification using the above parameter specifications and adjusting the level of financial inclusion, as observed in the data. For example, to generate the ratio of consumption volatility to income volatility for Mexico, Specification 1 is used with the financial exclusion parameter set at 61.30% as in the data. For Canada, Specification 2 is used with the financial exclusion parameter equivalent to 0.9%. Business cycle moments for 38 developed and 33 emerging economies are generated through the model. I regress the model generated ratio of consumption volatility to income volatility on dummy for emerging countries and interaction between financial access and income groups.

Table 5 displays the coefficients of the OLS specification for both the data and model. The coefficient of financial inclusion in the model is -27% and 19% for developed countries and emerging countries respectively, compared to -37% and 89% respectively, in the data. Emerging countries receive a larger variance of trend shocks compared to transitory shocks. Since consumption is more volatile than income against a trend shock, it implies that emerging countries with higher financial access do worse at consumption smoothing. On the other hand, developed countries face a larger variance of transitory shocks than trend shocks. Consumption is less volatile than income against a transitory shock, so developed countries with more financial access are better at consumption smoothing. In both cases, agents are displaying optimal behaviour, given the constraints and

productivity processes. Yet, given the underlying production process, excess volatility can be exacerbated by improving opportunities to risk sharing. Thus, the model can capture the data correlations.

Table 5: Benchmark Model OLS results

Dependent variable: Consumption volatility to income volatility		
Coefficients	Data	Model
	(1)	(2)
H*Access	-0.367	-0.265
	(0.446)	
UM*Access	0.893**	0.186
	(0.345)	

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05 and * indicates p <0.1. The data OLS excludes low and lower middle-income countries and so coefficients differ from Table 1.

Table 6 displays the average business cycle moments over each set of countries. The model can capture the differences in consumption smoothing between the emerging and developed countries. The ratio of consumption volatility to income volatility is higher in developed countries than in emerging countries in the model (0.72 and 1.13 respectively) which is consistent with the data.

The model targets the standard deviation of output for both developed and emerging countries, and matches it exactly. The non-targeted standard deviation of first differenced output is captured well. The correlation between consumption and output is much higher in the model than in the data since most of the output is used for consumption. The correlation between net exports and output is negative in the data, but the model specifies a positive correlation for developed countries.[14] With a positive transitory shock, financially included agents respond by saving rather than borrowing, which implies a positive relationship between income and net exports. The model could match the ratio of standard deviation of net exports to standard deviation of output for developed countries, but it could not for emerging countries. Increasing the variance of the trend shocks would increase the ratio, but only so much. Since consumption and output are so tightly linked, this ratio can only increase so much. In the next subsection, I present a two-sector model that can better capture the features of the data that the simple benchmark model could not.

[14] AG 2007 also find countercyclical net exports to be similar in developed and emerging countries in annual data while looking at a longer time horizon. Countercyclicality is higher in emerging countries only for the post-1980's period in their sample.

Table 6: Business Cycle Moments (Averages) - Benchmark Model

	Developed		Emerging	
Moments	Data	Model	Data	Model
	(1)	(2)	(3)	(4)
$\sigma(Y)$	1.83	1.83	2.84	2.85
$\sigma(\triangle Y)$	3.49	2.94	5.30	4.63
$\sigma(C)/\sigma(Y)$	0.99	0.72	1.24	1.13
$\sigma(NX/Y)/\sigma(Y)$	0.50	0.49	0.89	0.48
$\rho(Y)$	0.27	0.12	0.28	0.32
$\rho(\triangle Y)$	0.37	0.05	0.34	0.36
$\rho(C,\ Y)$	0.73	0.88	0.69	0.89
$\rho(NX/Y,\ Y)$	-0.29	0.73	-0.29	-0.05

Note: Model moments were generated using the parameters in Table 4 and data on financial access. Model moments are equally weighted, and data moments are log population weighted.

4.2 Two-sector model

One of the most commonly cited reason for not opening a bank account is geographical barriers to enter financial markets (Global Findex Database 2014). I will not incorporate the decision to participate in the financial sector explicitly, instead create two regions. Financial services do not exist in the rural region and are only available to urban households.[15] Financially included agents produce a good in their backyard using labour and capital. But there are adjustment costs to investment. Financially included agents can trade in a one-period international risk-free bond. Rural households produce a good different from urban households due to a lack of access to financial services and capital. Agents derive utility from consuming the two goods and disutility from labour. The agents trade their goods domestically, but only the good produced by the financially included agents is traded internationally through bonds. This does not mean that financially included produce "tradable goods", and financially excluded agents produce "non-tradables". Generally, goods and services such as transportation, communication services, water supply services, etc. are considered as non-tradable goods which are not typically low productivity sectors in emerging countries. The more appropriate interpretation is that there exists a high and a low productivity sector. Appendix C has more details about the model equations and calibrated parameters.

Sectoral heterogeneity has a prominent role to play. Financially excluded agents can smooth consumption through capital, if they have access to capital. Thus, they are not allowed to participate in both the capital and

[15] We can think that there exists huge relocation costs that prevent rural agents from shifting to the urban region and avail financial services.

bond markets. Participation in the capital market affects income generation more than participation in the bonds market, and so, financial exclusion affects an agent in this model more than the benchmark model. Moreover, income is used for consumption or investment purposes by financially included agents. Thus, productivity shocks have a potentially greater bite on consumption for financially included agents who have to choose between consumption and investment.

I simulate model economies using the calibrated parameters shown in Appendix Table C.6. I compute income and consumption volatility in real terms using the steady state price. Table 7 displays the model and data coefficients from the OLS of the ratio of consumption volatility to income volatility on the emerging income classification and interaction between financial access and income classification dummies. The change in the ratio of consumption volatility to income volatility against a unit change in financial inclusion is -7% and 22% for developed countries and emerging countries respectively.[16] Allowing financially included agents to access the capital market affects consumption volatility more than the benchmark model. In response to a trend shock, financially included agents borrow today to consume and invest more. But in the presence of adjustment costs, they borrow more for investment now and delay consumption a little. This leads to a higher correlation between financial inclusion and the ratio of consumption volatility to income volatility than the benchmark model.[17]

Table 7: Two-sector Model OLS results

Dependent variable: Consumption volatility to income volatility		
Coefficients	Data	Model
	(1)	(2)
H*Access	-0.367	-0.068
	(0.446)	
UM*Access	0.893**	0.224
	(0.345)	

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05 and * indicates p <0.1. The data OLS excludes low and lower middle-income countries and so coefficients differ from Table 1.

The two-sector model also performs better than the benchmark model in capturing the business cycle moments better. Table 8 shows that the targeted ($\sigma(Y)$, $\sigma(NX/Y)/\sigma(Y)$ and $\sigma(I)/\sigma(Y)$) and non-targeted moments in the model and data. The ratio of consumption volatility to income volatility is higher in emerging countries

[16]The results are qualitatively robust to the value of the elasticity of substitution between the two goods. The regression coefficients are -0.07 and 0.27 for developed and emerging economies respectively if elasticity is 10 and -0.04 and 0.12 for developed and emerging economies respectively if elasticity is 1.50.

[17]The elasticity between consumption smoothing to financial access is amplified if positive trend shocks lead to financial development. When more agents participate in the market, the effect on aggregate consumption is higher.

than in developed countries in the model. Volatility of the unfiltered first difference in output and correlation between investment and output matches closely with the data too. The other moments in the model are also well matched with their data counterpart.

Table 8: Business Cycle Moments (Averages) - Two-sector Model

	Developed		Emerging	
Moments	Data	Model	Data	Model
	(1)	(2)	(3)	(4)
$\sigma(Y)$	1.83	1.83	2.84	2.85
$\sigma(\triangle Y)$	3.49	3.08	5.30	4.93
$\sigma(C)/\sigma(Y)$	0.99	0.90	1.24	1.35
$\sigma(I)/\sigma(Y)$	2.49	2.49	2.79	2.78
$\sigma(NX/Y)/\sigma(Y)$	0.50	0.50	0.89	0.88
$\rho(Y)$	0.27	0.13	0.28	0.30
$\rho(\triangle Y)$	0.37	0.14	0.34	0.40
$\rho(C,\ Y)$	0.73	0.88	0.69	0.83
$\rho(I,\ Y)$	0.52	0.90	0.35	0.81
$\rho(NX/Y,\ Y)$	-0.29	0.02	-0.29	-0.29

Note: Model moments were generated using the parameters in Appendix Table C.6 and data on financial access. Model moments are equally weighted, and data moments are log population weighted.

5 Conclusion

In this paper, I document that developed and emerging countries respond differently to improvement in formal financial sector access. Developed countries with higher financial inclusion display a lower consumption volatility to income volatility ratio, but emerging countries with higher financial inclusion display a higher ratio of consumption volatility to income volatility. A simple small open economy is augmented with financially segmented households and permanent productivity shocks to generate such consumption patterns. Higher financial inclusion leads to higher productivity and consumption in the model. But in the presence of trend shocks, it leads to consumption being more volatile than income. To a social planner in an emerging country who cares about both high levels of risk sharing and consumption, ameliorating financial frictions may not necessarily lead to a welfare gain.

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A Appendix Tables

Table A.1: Consumption Smoothing across Income classification

Dependent variable: Ratio of consumption volatility to income volatility				
	Cross-Section	Panel		
Model	OLS	Pooled OLS	Random Effects	Fixed Effects
	(1)	(2)	(3)	(4)
L/LM	0.185*	0.456***	0.445***	0.122
	(0.104)	(0.109)	(0.124)	(0.259)
UM	0.153*	0.360***	0.383***	0.083
	(0.087)	(0.090)	(0.113)	(0.211)
sd_Termsoftrade	-0.007	0.004	-0.025	-0.005
	(0.021)	(0.030)	(0.028)	(0.039)
tradeopenness	0.043	-0.105	-0.110+	0.085
	(0.060)	(0.104)	(0.076)	(0.173)
sd_policy_change	-0.026	0.005	-0.016	-0.044
	(0.038)	(0.033)	(0.030)	(0.045)
ln_population	-0.053*	-0.074**	-0.091**	0.504
	(0.031)	(0.035)	(0.036)	(0.436)
democracy_dummy	0.000	-0.061	-0.073	-0.140
	(0.098)	(0.107)	(0.104)	(0.162)
SovereignDebtCrisis	-0.049	-0.119	-0.020	-0.018
	(0.087)	(0.107)	(0.109)	(0.168)
CurrencyCrisis	0.229***	0.112	0.035	-0.092
	(0.087)	(0.097)	(0.098)	(0.115)
SystemicBankingCrisis	-0.004	-0.125*	-0.102+	-0.015
	(0.097)	(0.073)	(0.066)	(0.090)
flexible_xr	0.040	-0.006	-0.080	-0.165+
	(0.074)	(0.068)	(0.064)	(0.111)
constant	1.081***	1.154***	1.264***	-0.069
	(0.223)	(0.195)	(0.178)	(1.266)
N	131	322	322	322
R^2	0.32	0.17	0.26	0.04
Region Fixed Effects	Yes	Yes	Yes	No
Year Fixed Effects	No	Yes	Yes	Yes

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05 * indicates p <0.1 and + indicates p <0.15. Except the random effects model, all regressions are log population weighted.

Table A.2: Consumption Smoothing and Financial Access

Dependent variable: Ratio of consumption volatility to income volatility			
	Financial Institution		Including mobile
	(1)	(2)	(3)
L/LM	-0.116	-0.084	-0.134
	(0.301)	(0.297)	(0.311)
UM	-0.702**	-0.562*	-0.704**
	(0.305)	(0.327)	(0.308)
H*Access	-0.549+	-0.192	-0.516+
	(0.357)	(0.525)	(0.349)
L/LM*Access	-0.531	-0.371	-0.366
	(0.512)	(0.543)	(0.484)
UM*Access	0.706**	0.790**	0.740**
	(0.347)	(0.359)	(0.341)
Ln GDP per capita		-0.074	
		(0.084)	
sd_Termsoftrade	0.011	0.011	0.012
	(0.029)	(0.030)	(0.029)
tradeopenness	0.109+	0.115*	0.111+
	(0.067)	(0.069)	(0.068)
sd_policy_change	-0.021	-0.024	-0.019
	(0.044)	(0.045)	(0.045)
ln_population	-0.033	-0.036	-0.034
	(0.033)	(0.033)	(0.033)
democracy_dummy	0.098	0.101	0.098
	(0.109)	(0.111)	(0.112)
SovereignDebtCrisis	-0.088	-0.069	-0.086
	(0.091)	(0.089)	(0.089)
CurrencyCrisis	0.241**	0.243**	0.246***
	(0.092)	(0.094)	(0.092)
SystemicBankingCrisis	0.018	0.032	0.023
	(0.100)	(0.100)	(0.102)
flexible_xr	0.030	0.035	0.029
	(0.082)	(0.081)	(0.081)
Constant	1.319***	1.777**	1.285***
	(0.421)	(0.678)	(0.425)
N	116	116	116
R^2	0.39	0.39	0.38
Region Fixed Effects	Yes	Yes	
H_0 : β_3=β_4	.97	.75	.79
H_0 : β_3=β_5	.00	.05	.00
H_0 : β_4=β_5	.03	.03	.04

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05 * indicates p <0.1 and + indicates p <0.15. The last three rows show the p-values of the corresponding null hypothesis. Both regressions are log population weighted.

Table A.3: Consumption Smoothing and Capital Market Openness

Dependent variable: Ratio of consumption volatility to income volatility			
	Measure of Capital Market Openness		
	Debt to GDP	Chinn-Ito dummy	Financial markets
	(1)	(2)	(3)
L/LM	0.074	0.057	0.063
	(0.187)	(0.143)	(0.161)
UM	0.092	-0.056	-0.111
	(0.143)	(0.135)	(0.149)
H*Access (β_3)	-0.394**	-0.241**	-0.277+
	(0.189)	(0.106)	(0.179)
L/LM*Access (β_4)	-0.369	-0.255**	-0.593
	(1.107)	(0.124)	(0.498)
UM*Access (β_5)	0.168	0.007	0.561**
	(0.482)	(0.115)	(0.281)
sd_Termsoftrade	0.021	-0.004	0.011
	(0.026)	(0.021)	(0.024)
tradeopenness	0.069	0.033	-0.028
	(0.070)	(0.059)	(0.052)
sd_policy_change	-0.080	-0.033	-0.070+
	(0.059)	(0.038)	(0.045)
ln_population	-0.049	-0.069**	-0.068**
	(0.038)	(0.031)	(0.034)
democracy_dummy	0.055	-0.027	-0.026
	(0.150)	(0.097)	(0.102)
SovereignDebtCrisis	-0.100	-0.088	0.025
	(0.107)	(0.095)	(0.093)
CurrencyCrisis	0.204*	0.208**	0.171*
	(0.106)	(0.086)	(0.090)
SystemicBankingCrisis	-0.010	-0.014	-0.097
	(0.138)	(0.092)	(0.128)
flexible_xr	0.060	0.071	0.030
	(0.094)	(0.082)	(0.087)
Constant	0.932***	1.432***	1.360***
	(0.263)	(0.209)	(0.236)
N	95	131	92
R^2	0.34	0.34	0.45
Region Fixed Effects	Yes	Yes	Yes
H_0 : β_3=β_4	.98	.93	.56
H_0 : β_3=β_5	.29	.15	.01
H_0 : β_4=β_5	.64	.12	.05

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05 * indicates p <0.1 and + indicates p <0.15. The last three rows show the p-values of the corresponding null hypothesis. All regressions are log population weighted.

Table A.4: Consumption Smoothing and Deposits to GDP

Dependent variable: Ratio of consumption volatility to income volatility				
	Cross-Section	Panel		
Model	OLS	Pooled OLS	Random Effects	Fixed Effects
	(1)	(2)	(3)	(4)
L/LM	0.049	0.397**	0.316+	0.033
	(0.188)	(0.182)	(0.199)	(0.343)
UM	-0.157	-0.009	-0.025	-0.297
	(0.179)	(0.162)	(0.183)	(0.331)
H*Access (β_3)	-0.579***	-0.594**	-0.714***	-0.842
	(0.203)	(0.232)	(0.265)	(1.262)
L/LM*Access (β_4)	-0.544	-1.218+	-0.558	-0.034
	(0.446)	(0.798)	(0.750)	(1.283)
UM*Access (β_5)	0.334	0.721	0.846	1.305
	(0.413)	(0.693)	(0.812)	(1.445)
sd_Termsoftrade	-0.004	-0.006	-0.030	-0.017
	(0.024)	(0.030)	(0.028)	(0.043)
tradeopenness	0.030	-0.120	-0.106	0.095
	(0.083)	(0.132)	(0.099)	(0.304)
sd_policy_change	-0.041	-0.009	-0.024	-0.048
	(0.037)	(0.036)	(0.036)	(0.055)
ln_population	-0.053	-0.070*	-0.087**	0.360
	(0.037)	(0.040)	(0.038)	(0.434)
democracy_dummy	0.013	-0.042	-0.090	-0.198
	(0.106)	(0.107)	(0.109)	(0.158)
SovereignDebtCrisis	-0.036	-0.057	0.064	0.014
	(0.093)	(0.112)	(0.110)	(0.169)
CurrencyCrisis	0.223**	0.088	-0.032	-0.087
	(0.101)	(0.098)	(0.099)	(0.124)
SystemicBankingCrisis	-0.057	-0.123+	-0.087	0.008
	(0.127)	(0.076)	(0.069)	(0.090)
flexible_xr	0.024	-0.017	-0.082	-0.182
	(0.104)	(0.073)	(0.067)	(0.127)
Constant	1.387***	1.359***	1.477***	0.517
	(0.293)	(0.232)	(0.195)	(1.333)
N	115	303	303	303
R^2	0.33	0.19	0.26	0.06
Region Fixed Effects	Yes	Yes	Yes	No
Year Fixed Effects	No	Yes	Yes	Yes
H_0 : β_3=β_4	.94	.46	.85	.58
H_0 : β_4=β_5	.05	.05	.05	.15
H_0 : β_4=β_5	.19	.05	.18	.26

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05 * indicates p <0.1 and + indicates p <0.15. The last three rows show the p-values of the corresponding null hypothesis. All regressions are log population weighted except for Random effects regression.

Table A.5: Relationship between financial inclusion and consumption for each income classification controlling for GDP per capita

Dependent variable: Ratio of consumption volatility to income volatility			
Sample	High	Upper Middle	Low and Lower Middle
Ln GDP per capita	-0.169	0.142	-0.162
	(0.123)	(0.437)	(0.143)
Financial Institution	-0.112	1.167^{+}	-0.675
	(0.538)	(0.674)	(0.774)
sd_Termsoftrade_1970_2014	0.007	-0.013	0.061
	(0.037)	(0.056)	(0.061)
tradeopenness_2014	-0.103	0.257	0.506^{+}
	(0.116)	(0.522)	(0.315)
sd_policy_change_1970_2014	0.056	-0.098	-0.023
	(0.099)	(0.099)	(0.054)
ln_population	-0.133***	-0.062	0.101
	(0.031)	(0.120)	(0.088)
democracy_dummy	-0.276	-0.100	0.126
	(0.434)	(0.359)	(0.135)
SovereignDebtCrisis	-0.022	-0.137	-0.260^{+}
	(0.118)	(0.289)	(0.162)
CurrencyCrisis	-0.140	0.141	0.637***
	(0.100)	(0.329)	(0.181)
SystemicBankingCrisis	0.120	0.781*	0.091
	(0.168)	(0.374)	(0.147)
flexible_xr	0.182	0.021	-0.146
	(0.138)	(0.231)	(0.171)
Constant	3.461***	-1.121	1.275
	(1.186)	(3.281)	(1.167)
N	38	33	45
R^2	0.60	0.37	0.49
Region Fixed Effects	Yes	Yes	Yes

Note: Standard errors in parentheses below the coefficients. *** indicates p <0.01, ** indicates p <0.05 * indicates p <0.1 and + indicates p <0.15. The last three rows show the p-values of the corresponding null hypothesis. All regressions are log population weighted.

B Data Appendix

Data Sources

The following list summarizes the data sources used and the variables that were collected from the data source.

- Penn Data: Data on output, consumption, investment, government expenditure, exports and imports at current, constant and PPP prices, population and exchange rate for the empirical section. Data on employment, average working hours, depreciation rate and share of labour income in total income for calibration.
- Global Findex 2014 Database : Measures of financial inclusion such as account at a financial institution only or with mobile banking.[18]
- Global Financial Development Database: Ratio of total deposits to GDP.
- Svirydzenka (2016): Measure of international financial market access.
- Bank of International Settlements (BIS): Measure of outstanding debt.
- World Development Indicators: Terms of trade
- World Bank Classification of economies by income: Classifying countries into the 4 income groups.
- Chinn-Ito Index: Degree of Capital Account Openness taken from Chinn and Ito (2006)
- Reinhart and Rogoff (2004): Exchange rate regime
- POLITY IV Data: Index of political regime
- Laeven and Valencia (2013): Data on Sovereign Debt, Banking crisis and Currency crisis episodes.

Definition and construction of variables

- GDP, Consumption, Investment, Exports and Imports are measured at constant national 2011 prices. Net exports to GDP is ratio of difference between exports and imports to GDP. GDP per capita is GDP divided by population and exchange rate relative to US dollar in 2011 prices.
- Income classification is taken from the World Bank Classification of economies by income. low and lower middle-income countries have been clubbed together to create one classification.
- Region: There are five region classifications used. Countries in North America are denoted by 1, in Europe by 2, in Middle east and Centra Asia by 3, in Asia and Pacific by 4, and in Africa by 5.
- Account is defined as the percentage of respondents (15+ age) who report having an account (by themselves or together with someone else) at a bank or another type of financial institution; having a debit card in their own name; receiving wages, government transfers, or payments for agricultural products

[18] See Beck et al. (2010) for more details about the dataset

into an account at a financial institution in the past 12 months; paying utility bills or school fees from an account at a financial institution in the past 12 months; or receiving wages or government transfers ; using a mobile phone to pay bills or to send or receive money through a Mobile Money for the Unbanked (MMU) service in the past 12 months.

- International debt to GDP ratio: The ratio of international debt to GDP. International debt includes debt issued by country excluding residents in all currencies, maturities and rate types expressed in US dollar.
- Capital Open Dummy: The dummy is based on KAOPEN Index which measures a country's degree of capital account openness. KAOPEN is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Again, the mean value is computed at year 2014 in cross-section and 1987 in panel. A country is Capital Open if the KAOPEN index value is higher than the mean value in the sample and Capital Closed otherwise.
- International financial market access (FMA) : This measures combines two indices. The first is the percent of market capitalization outside of top 10 largest companies and the second is the total number of issuers of debt (domestic and external, fin. and non- fin. corporations) per 100,000 adults.
- Deposits to GDP: Demand, time and saving deposits in deposit money banks and other financial institutions as a share of GDP.
- Terms of trade is defined as net barter terms of trade index is calculated as the percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000.
- Trade Openness: Compute the ratio of sum of exports and imports to GDP at end of year in sample. Value at 2014 used for cross-section sample and per period averages used for panel sample.
- Fiscal Impulse: HP-filter the ratio of government expenditure and output, both at constant prices, with smoothing parameter of 6.25. Then, the year where cyclical part is zero or closest to zero becomes the base year since it means that year government policy was invariant to output changes. Then for each year government policy is the cyclical part of base year. Government's in developing countries undertake more expansionary expenditure than developed countries so define fiscal impulse as the natural log of the standard deviation of government policy.
- Democracy dummy: Index value greater than 0 is categorised as democratic and receives 1 value and 0 otherwise.
- Crisis episodes: Currency crisis dummy, Sovereign crisis dummy and Banking Crisis dummy is 1 if country has ever experienced that crisis episode.
- Flexible exchange rate is defined using the Reinhart and Rogoff coarse indices classification (3, 4 and 5) as of 2014. This includes if the currency is within a moving band narrower than $\pm$ 2%, managed floating, freely floating, and freely falling.

C Two-Sector model

The production function is the following:

$$y_t^i = exp(z_t)\left(\Gamma_t l_t^i\right)^{\alpha} k_t^{1-\alpha} \tag{C.1}$$

$$y_t^e = exp(z_t)\Gamma_t l_t^e \tag{C.2}$$

$$z_t = \rho_z z_{t-1} + \epsilon_t^z \; ; \; \epsilon_t^z \sim N\left(0, \sigma_z^2\right) \tag{C.3}$$

$$\Gamma_t = exp(g_t)\Gamma_{t-1} \tag{C.4}$$

$$g_t = (1-\rho_g)\mu_g + \rho_g g_{t-1} + \epsilon_t^g \; ; \; \epsilon_t^g \sim N\left(0, \sigma_g^2\right) \tag{C.5}$$

z_t and $g_t$follows an A.R.(1) process. Each financially included type (referred to by superscript i) will produce good “m with their own labour and capital which is referred to as y_t^i. Each financially excluded type (referred to by superscript e) will produce good “n" with their own labour and without capital which is referred to as y_t^e.

The infinitely lived agents are trying to maximise the presented discounted value of utility which is given by the following expression:

$$U^j = \mathbb{E}_0 \left(\sum_{t=0}^{\infty} \beta^t \frac{\left[\left(u_t^j\right)^{\gamma}\left(1-l_t^j\right)^{1-\gamma}\right]^{1-\sigma}}{1-\sigma} \right) \text{ where j = i,e} \tag{C.6}$$

$$u_t^j = \left[\psi_m \left(m_t^j\right)^{\frac{s-1}{s}} + (1-\psi_m)\left(n_t^j\right)^{\frac{s-1}{s}}\right]^{\frac{s}{s-1}} \tag{C.7}$$

and $0 < \beta < 1$, $0 < \gamma < 1$, $\sigma > 0$, $0 < \psi_m < 1$, $s \in [0, \infty)$. Goods m and n combine in a CES utility function with elasticity of substitution “s" and share parameter of good m as “ψ_m". Good “m" will be the numeraire good. All agents are price-takers.

Problem of financially included agents

The constraints which the financially included agents face are the production function (6.1) and the budget constraint :

$$m_t^i + p_t n_t^i + x_t = y_t^i - b_t + q_t b_{t+1} \tag{C.8}$$

where m and n are the two goods produced in the economy and p_t is the relative price of n at time t. x_t is the amount of investment in capital which financially included agents want to undertake. Capital depreciates at rate δ and there is an adjustment cost to capital. The law of motion of capital is :

$$x_t = k_{t+1} - (1-\delta)\, k_t + \frac{\psi_k}{2}\left(\frac{k_{t+1}}{k_t} - e^{\mu_g}\right)^2 k_t \tag{C.9}$$

The level of bond holdings at time t is denoted by b_t and the price of bonds is denoted by q_t. The price of debt depends on the level of outstanding bond holdings and is given by:

$$\frac{1}{q_t} = 1 + r^* + \psi_b \left[exp\left(\frac{b_{t+1}}{\Gamma_t} - \bar{b} \right) - 1 \right] \tag{C.10}$$

where $\bar{b}$ is the steady state level of debt, r^* is the world interest rate and ψ_b represents the elasticity of interest rate to debt holdings.

In its detrended form, the agents will solve the following problem:

$$V\left(z, g, \hat{k}, \hat{b}\right) = \max_{\left\{\hat{m^i}, \hat{n^i}, \hat{l^i}, \hat{k'}, \hat{b'}\right\}} \left\{ \frac{\left[\left(\hat{u^i}\right)^{\gamma} \left(1 - l^i\right)^{1-\gamma}\right]^{1-\sigma}}{1-\sigma} + \beta e^{g\gamma(1-\sigma)} \mathbb{E} V\left(z', g', \hat{k'}, \hat{b'}\right) \right\} \tag{C.11}$$

subject to:

$$\hat{m^i} + p\hat{n^i} + e^g \hat{k'} = \hat{y^i} + (1 - \delta_k)\,\hat{k} - \frac{\psi_k}{2} \left(\frac{e^g \hat{k\prime}}{\hat{k}} - e^{\mu_g} \right)^2 \hat{k} - \hat{b} + q e^g \hat{b'} \tag{C.12}$$

$$\hat{u^i} = \left[\psi_m \left(\hat{m^i}\right)^{\frac{s-1}{s}} + (1 - \psi_m) \left(\hat{n^i}\right)^{\frac{s-1}{s}} \right]^{\frac{s}{s-1}} \tag{C.13}$$

$$\hat{y^i} = e^z e^{\alpha g} \left(l^i\right)^{\alpha} \hat{k}^{1-\alpha} \tag{C.14}$$

This leads to the following First order conditions:

$$\left(\frac{\psi_m}{1 - \psi_m} \right)^s p^s \hat{n^i} = \hat{m^i} \tag{C.15}$$

$$\frac{\gamma \psi_m}{1 - \gamma} \left(\frac{1 - l^i}{\hat{u^i}} \right) \alpha \frac{\hat{y^i}}{l^i} = \left(\frac{\hat{m^i}}{\hat{u^i}} \right)^{1/s} \tag{C.16}$$

$$\left\{ \left(\hat{u^i}\right)^{\gamma(1-\sigma)-1} \left(1 - l^i\right)^{(1-\gamma)(1-\sigma)} \right\} \left(\frac{\hat{u^i}}{\hat{m^i}} \right)^{1/s} \left(e^g + \psi_k \left(\frac{e^g \hat{k\prime}}{\hat{k}} - \mu_g \right) e^g \right) = \beta e^{g(1-\gamma)} *$$

$$\mathbb{E}\left[\left\{ \left(\hat{u^{i\prime}}\right)^{\gamma(1-\sigma)-1} \left(1 - l^{i\prime}\right)^{(1-\gamma)(1-\sigma)} \right\} \left(\frac{\hat{u^{i\prime}}}{\hat{m^{i\prime}}} \right)^{1/s} \left\{ (1 - \alpha) \frac{\hat{y^{i\prime}}}{\hat{k'}} + (1 - \delta) + \frac{\psi_k}{2} \left(\left(\frac{e^{g\prime} \hat{k''}}{\hat{k'}} \right)^2 - (e^{\mu_g})^2 \right) \right\} \right] \tag{C.17}$$

$$\left\{ \left(\hat{u^i}\right)^{\gamma(1-\sigma)-1} \left(1 - l^i\right)^{(1-\gamma)(1-\sigma)} \right\} \left(\frac{\hat{u^i}}{\hat{m^i}} \right)^{1/s} q e^g = \beta e^{g(1-\gamma)} \mathbb{E}\left[\left\{ \left(\hat{u^{i\prime}}\right)^{\gamma(1-\sigma)-1} \left(1 - l^{i\prime}\right)^{(1-\gamma)(1-\sigma)} \right\} \left(\frac{\hat{u^{i\prime}}}{\hat{m^{i\prime}}} \right)^{1/s} \right] \tag{C.18}$$

Problem of financially excluded agents

The constraints which the financially included agents face are the production function (6.2) and the budget constraint :

$$m_t^e + p_t n_t^e = p_t y_t^e \tag{C.19}$$

In its detrended form, the agents will solve the following problem:

$$V(z,g) = \max_{\{\hat{m^e},\hat{n^e},\hat{l^e}\}} \left\{ \frac{\left[\left(\hat{u^e}\right)^{\gamma}\left(1-l^e\right)^{1-\gamma}\right]^{1-\sigma}}{1-\sigma} + \beta e^{g\gamma(1-\sigma)}\mathbb{E}V\left(z',g'\right) \right\} \tag{C.20}$$

subject to:

$$\hat{m^e} + p\hat{n^e} = p\hat{y^e} \tag{C.21}$$

$$\hat{y^e} = e^z e^g l^e \tag{C.22}$$

This leads to the following First order conditions:

$$\left(\frac{\psi_m}{1-\psi_m}\right)^s p^s \hat{n^e} = \hat{m^e} \tag{C.23}$$

$$\frac{\gamma\psi_m}{1-\gamma}\left(\frac{1-l^e}{\hat{u^e}}\right)p\frac{\hat{y^e}}{l^e} = \left(\frac{\hat{m^e}}{\hat{u^e}}\right)^{1/s} \tag{C.24}$$

Total consumption is defined as:

$$\hat{c} = \lambda\left(\hat{m^e} + p\hat{n^e}\right) + (1-\lambda)\left(\hat{m^i} + p\hat{n^i}\right) \tag{C.25}$$

Total output is defined as:

$$\hat{y} = \lambda p\hat{y^e} + (1-\lambda)\hat{y^i} \tag{C.26}$$

Net exports is defined as:

$$nx = \frac{\hat{y} - \hat{c} - (1-\lambda)\hat{x}}{\hat{y}} \tag{C.27}$$

Market clearing for good n occurs when the following condition holds:

$$\lambda\hat{y^e} = \lambda\hat{n^e} + (1-\lambda)\hat{n^i} \tag{C.28}$$

The above condition implies that total output of good n should equal to the total consumption of good n by the financially included and excluded agents. By Walras Law, market for good m clears as well.

Given an initial bonds holdings $\hat{b_0}$ and capital stock $\hat{k_0}$, the equilibrium of the economy is characterized by the first order conditions (6.15) - (6.18) and (6.23) - (6.24), production functions (6.14) and (6.22), budget constraints (6.12) and (6.21), prices of bonds (6.10), the exogenous process of the technology shocks (6.3), (6.5) and the transversality conditions and the market clearing condition (6.27).

Calibration Parameters

The parameters used in the calibration are provided in Table C.6. Specification 1 represents the parameters for Emerging countries and Specification 2 represents the parameters for Developed countries. The elasticity of interest rate to debt has been set at 0.001. The elasticity of substitution is set at 3.5 which was taken from Cashin

and McDermott (2003). They estimate this elasticity of substitution for tradable and non-tradable goods. Even though, this is not the interpretation best suited to the model, but due to a lack of estimates for the parameter of interest, I use their estimates. $1-\psi_m$ is computed as the average share of food, alcohol, clothing and footwear expenditure in total consumption expenditure.

Table C.6: Two-Sector Model Parameters

Parameter	Specification 1	Specification 2	Source
(1)	(2)	(3)	(4)
β	0.92	0.92	Euler equation
σ	2	2	AG 2007
s	3.50	3.50	Cashin and McDermott (2003)
$1-\psi_m$	0.26	0.26	Average share of consumption expenditure on food, alcohol, clothing and footwear
γ	0.36	0.36	AG 2007
α	0.68	0.68	AG 2007
$\overline{b}/\overline{y^i}$	0.1	0.1	AG 2007
ψ_b	0.001	0.001	AG 2007
δ	0.05	0.05	AG 2007
λ	0.44	0.11	Average financial exclusion in sample
μ_g	1.03	1.03	Average trend growth
ρ_z	0.95	0.95	AG 2007
ρ_g	0.29	0.29	AG 2007
σ_z	2.68	2.48	Match $\sigma(Y)$, $\frac{\sigma(NX/Y)}{\sigma(Y)}$ & $\frac{\sigma(I)}{\sigma(Y)}$
σ_g	5.67	1.58	
ψ_k	4.20	3.09	