The price of imported capital and consumption fluctuations in emerging economies

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ABSTRACT

We study the role played by fluctuations in the price of imported capital in determining the behavior of consumption fluctuations in developing countries. For this, we decompose the price of imported capital into common and country-specific components, where the common component is the price of capital in the US. Empirically, we document that, in contrast to small industrialized countries, consumption in developing countries responds more than output to unexpected changes in the price of capital in the US. As such, fluctuations in the price of capital in the US contribute to a high volatility of consumption relative to that of output in developing countries. We then show that a small open-economy real business cycle model driven by fluctuations in the price of imported capital can account for the responses of consumption and output to innovations of the price of capital in the US and for the high relative volatility of consumption observed in developing country. Finally, confronting the model to the data, we further find that fluctuations in the price of capital in the US contribute substantially to fluctuations of consumption in countries that display a low volatility of output and a large relative volatility of consumption.

1. Introduction

This paper makes two contributions to the literature regarding the puzzling large volatility of consumption observed in emerging countries. First, we use data to document that, in contrast to small industrialized countries, consumption in developing countries responds more than output to innovations that induce a permanent effect on the price of imported capital. These responses imply a higher volatility of consumption relative to that of output. Second, we use a small open-economy real business cycle model to explore a mechanism by which innovations that induce a permanent effect on the price of imported capital can explain the volatility of consumption observed in developing countries. This novel mechanism relies on the properties of the price of imported capital, instead of the properties of the productivity process (e.g. Aguiar and Gopinath, 2007) or

the existence of financial frictions (e.g. Neumeyer and Perri, 2005; Garcia-Cicco et al., 2010).[1]

For the first contribution, we exploit a rich sample of 20 developing countries and 20 small industrialized countries to document the relative volatility of consumption and the responses of consumption and output to changes in the price of imported capital. We use data on the growth rates of consumption and output to confirm that, in contrast to small industrialized countries, developing countries experience a high relative volatility of consumption. On average, consumption is 45% more volatile than output in developing countries, while it is 3% less volatile than output in small industrialized countries.

We further use the data to construct the price of imported capital. We decompose this price into a common component and a country-specific term, where the common component is the price of capital

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[1] Other notable papers that study the productivity process or financial frictions include Boz et al. (2011), De Resende (2006), and Fernandez-Martin and Gulan (2015). Also, other aspects have been investigated, including durable goods (Alvarez-Parra et al., 2013), labor market frictions (Boz et al., 2015), risk shocks (Fernandez-Villaverde et al., 2011), and household production (Gomme and Zhao, 2011; Restrepo-Echavarria, 2014).

in the US. Interestingly, the price of imported capital and the price of capital in the US share a downward stochastic trend. As such, we document the effects of innovations to the growth rate of the price of capital in the US and to the level of the country-specific component on the growth rates of consumption and output. We uncover a striking fact: a negative innovation of the growth rate of the price of capital in the US generates a significant positive impact response of consumption in all developing countries. Importantly, we establish that this positive impact response is significantly larger than the impact response of output in all, but one, developing countries. These responses suggest that fluctuations in the price of capital in the US contribute to the high relative volatility of consumption in developing countries. In contrast, a negative innovation of the growth rate of the price of capital in the US never induces a positive impact response of consumption that is significantly larger than that of output in small industrialized countries. We also find that a negative innovation to the country-specific component does not generate a positive response of consumption that is significantly larger than the response of output in most developing and industrialized countries.

For the second contribution, we use a small open-economy real business cycle model to explore a mechanism by which innovations of the growth rate of the price of capital in the US induces a larger response of consumption than that of output and, in turn, a higher relative volatility of consumption. Our model assumes that residents of the developing country face exogenous variations in the price of imported capital. As in the data, the price of imported capital has both a nonstationary common component (the price of capital in the US) and a stationary country-specific component. Our interpretation is that investment-specific technical progress ensures that the price of capital in the US displays a downward stochastic trend.[2] This technical progress is transmitted to the price of capital imported by the developing country.[3] In addition, transaction costs (e.g. tariffs and transportation costs) are chiefly responsible for the country-specific component.[4] Our model also includes other important drivers from the literature, namely nonstationary labor-augmenting productivity and stationary total factor productivity (see Aguiar and Gopinath, 2007).

We show that, in our model, a negative innovation of the growth rate of the price of capital in the US generates a positive impact response of consumption that is larger than the impact response of output. This occurs because the negative innovation entails a transitory reduction in the growth rate of the price of imported capital, but a permanent reduction in the level of the price of imported capital. In turn, this permanent reduction induces a considerable increase in wealth (relative to the case where the effect on the level of the price is transitory). As is standard, a large increase in wealth

allows consumers to substantially increase current consumption. This mechanism thus implies a larger relative volatility of consumption. In contrast, a negative innovation of the country-specific component generates a weak response of consumption. This occurs because negative innovation in the country-specific component only induces a transitory reduction in the level of the price of imported capital. This transitory reduction does not engineer a substantial increase in wealth and consumption. In addition, we uncover an interesting interplay between the growth rates of the price of capital in the US and labor-augmenting productivity. Specifically, the growth rate of the price of capital in the US contributes more to the variance of consumption in countries where labor-augmenting productivity is less volatile or less persistent. This may explain differences in the relative volatility of consumption across developing countries.

Finally, we formally verify whether the growth rate of the price of capital in the US contributes meaningfully to the fluctuations of consumption. For this exercise, we select a subset of 3 developing countries that display an interesting diversity of experiences in terms of the relative volatility of consumption, but that otherwise display standard business cycle statistics and conform to the specificity of our model. To proceed, we calibrate the parameters of the model to match key features of these countries, and estimate the parameters of the processes of the exogenous variables using Bayesian methods. This exercise is useful to estimate the persistence and volatility of labor-augmenting productivity (see Aguiar and Gopinath, 2007).

We find that accounting for variations in the price of imported capital improves the model's ability to match the conventional business cycle statistics. We also find that the growth rate of the price of capital in the US explains a sizeable portion of the variance of consumption growth: the contributions range from almost 6% to over 23%. The larger contributions occur in countries for which labor-augmenting productivity is less volatile and less persistent. In these countries, the growth rate of the price of capital in the US plays an important role to capture particular features of the business cycles: a smaller volatility of output and a larger relative volatility of consumption.

2. Stylized facts

We document a number of facts about the behavior of consumption (relative to output) and of the price of imported capital in developing countries, and compare these facts to those obtained in industrialized countries. That is, we investigate the business cycle fluctuations of consumption and of the price of imported capital. Then, we document the response of consumption to unexpected changes in the price of imported capital.

For this purpose, we exploit a post-1984 annual data set that covers 20 developing (and emerging) countries and 20 (small, open, and high income) industrialized countries.[5] The data for consumption and output are from the International Financial Statistics. The data for the price of imported capital are constructed using the quality adjusted relative import price series from Feenstra and Romalis (2014), as well as the price of capital in the US. The data are described in Appendix A.

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[2] This assumption is consistent with Fisher (2006) and Justiniano et al. (2011), as well as in the open economy settings of Dogan (2017), Mandelman et al. (2011) and Raffo (2010). Schmitt-Grohe and Uribe (2011) instead assume that the stochastic trend of investment-specific progress is shared with total factor productivity. Finally, Greenwood et al. (2000) model investment-specific technical progress as trend stationary.

[3] Others have noted that investment-specific technical progress can be transmitted across countries. Mandelman et al. (2011) document that the downward stochastic trend of the price of capital is shared among the US and a group of industrialized countries. Boileau (2002) studies the international transmission of investment-specific technical progress via trade in capital among industrialized countries, but assumes that investment-specific technical progress is stationary. Kose (2002) studies the business cycle implications of trade in capital for developing countries, but also assumes that fluctuations in the worldwide price of capital are stationary. Finally, other business cycle aspects of trade in capital (and more generally durable) appear in Boileau (1999) and Engel and Wang (2011).

[4] Alfaro (2009), Eaton and Kortum (2001), Feenstra and Romalis (2014), and Mutreja et al. (2016) all argue that important barriers to trade affect the price of capital in different countries.

[5] We consider a large set of countries, including all the countries in Aguiar and Gopinath (2007) as well as several others, but not South Africa for which we could not get the price of imported capital. Also, Israel and Korea appear in our list of industrialized countries, but appear in the list of emerging countries in Aguiar and Gopinath (2007).