Sectoral asymmetries in a small open economy ☆

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A B S T R A C T

This paper explores the sectoral dimension of emerging market business cycles by building a two-sector small open economy real business cycle model featuring a working capital requirement, variable capital utilization and imported inputs in production. The primary finding is that the price of imported inputs and nontradable sector productivity are the two most important sources of macroeconomic fluctuations in a typical emerging market economy. Interest rates and the price of imported final goods also play a significant role in driving investment and import fluctuations. The model also produces significant sectoral asymmetry, especially in response to interest rate shocks. Variable capital utilization acts as a strong propagation mechanism.

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1. Introduction

An important part of business cycle research agenda since the beginning of 2000s has been directed towards accounting for the differences in business cycle characteristics between emerging market economies and more advanced economies. Early research on business cycles in small open developed economies highlights the importance of interest rate shocks (Correia et al., 1995; Mendoza, 1991) or terms of trade shocks (Mendoza, 1995), in addition to productivity shocks. More recently, Elgin and Kuzubaş (2013) empirically analyse the relationship between current account balance and output volatility for a panel of 185 countries, and find that higher current account deficits are associated with higher output volatility, especially in emerging market economies.

Initial small open economy models laid the foundations of recent studies on emerging market business cycles. For example, both Neumeyer and Perri (2005) and Uribe and Yue (2006) start from the observation that emerging markets are prone to paying a (risk) premium over the world interest rate in their borrowing contracts. The interaction of this premium (the country spread) with other factors such as the fundamentals of the economy and world interest rates introduces a strong propagation mechanism. Moreover, a simple financial friction in the form of a working capital requirement also helps to strengthen the effect of interest rate fluctuations on the volatility of other macroeconomic variables.

Arellano and Mendoza (2003) and Mendoza (2006) emphasize the role played by endogenous credit constraints in differentiating business cycles in sudden-stop-prone economies. Aguiar and Gopinath (2007), on the other hand, find that the standard model enriched by shocks to the trend growth rate of the economy is able to differentiate business cycles between emerging market economies and more advanced small open economies. They argue that emerging markets are characterized by dominant trend growth rate shocks in contrast to the case of advanced economies in which stationary productivity shocks take the lead.

In this paper, our main objective is to look at the sources of macroeconomic fluctuations in an emerging market economy using a two-sector dynamic stochastic general equilibrium model. Literature on emerging market business cycles has been mostly concentrated on single-sector models to explain the differences from the business cycles of more advanced small open economies, and the effect of sectoral asymmetries on aggregate fluctuations has not been analysed in detail. Therefore, the main contribution of this paper is that it provides an extensive analysis of the causes and propagation of business cycles in emerging market economies in a setup which highlights the role of sectoral asymmetries and interactions. This will enable us to examine the contribution of each sector to the propagation of various shocks relevant for emerging market economies.

The model consists of tradable and nontradable sectors with a rich production structure involving the use of imported inputs at various stages of production of both tradables and nontradables. Domestic and imported goods are imperfect substitutes, which make the small open economy more vulnerable to changes in relative prices, or terms of trade. This relatively more complex structure aims to represent the input–output structure of the economy, albeit at a coarse degree of detail.

In the analyses by Neumeyer and Perri (2005) and Tiryaki (2011), the single-sector small open economy business cycle model with working capital requirement and stochastic disturbances to productivity and interest rate components cannot account for the countercyclicality of net exports in emerging markets, unless there is a feedback from total factor productivity to country spreads or there is a negative exogenous covariation between total factor productivity and country spread shocks. Solow residuals, as proxy for total factor productivity, are highly correlated with capacity utilization and terms of trade. Therefore, any model seeking to explain the role of various shocks in driving business fluctuations should ideally incorporate endogenous capacity utilization and terms of trade. It is for this reason that we build on the model of Neumeyer and Perri by adding tradable and nontradable sectors, variable capital utilization, and imported intermediate goods.

The primary finding of this paper is that the price of imported inputs and nontradable sector productivity are the two most important sources of macroeconomic fluctuations in a typical emerging market economy. Interest rates and the price of imported final goods also play a significant role in driving investment and import fluctuations. The model also produces considerable asymmetry between tradable and nontradable sectors, especially in response to interest rate shocks.

We also run an alternative model in order to examine the consequences of variable capital utilization. We find that variable capital utilization significantly improves the model's amplification capability. We also find that the amplification effect of variable capital utilization operates mainly through the tradable sector.

2. Descriptive statistics of business cycles

In this section, we present some key observations on business cycles in Turkey. Table 1 shows standard deviations, relative standard deviations, and first order serial correlations of Hodrick–Prescott-filtered series that represent log-deviations from trend. Table 2 shows contemporaneous correlation coefficients between pairs of Hodrick–Prescott-filtered series. The majority of business cycle statistics are computed using quarterly series between 1987 and 2006, but shorter samples are also used for some series due to data availability.

There is apparent distinction between relative volatilities of tradable and nontradable output. Volatility of gross tradable output (final value of tradable output including imported inputs) is greater than the gross domestic product (domestic value added), whereas volatility of gross

Table 1
Descriptive statistics of business cycles.

		Volatility	Relative volatility	Serial correlation
y	GDP	0.0350	1.00	0.66
y^{DT}	Gross tradable output	0.0461	1.32	0.62
y^N	Gross nontradable output	0.0201	0.57	0.70
c	Consumption	0.0229	0.63	0.75
i	Investment	0.1555	4.45	0.61
x	Exports	0.0548	1.57	0.56
m	Imports of final goods	0.1669	4.77	0.80
z	Imported inputs	0.0862	2.47	0.73
nx/y	Net exports/output	0.0329	0.94	0.66
u^N	Utilization (nontradable)	n.a.	n.a.	n.a.
u^T	Utilization (tradable)	0.0342	0.98	0.56
l	Hours worked	0.0139	0.40	0.48
l^N	Hours (nontradable)	0.0217	0.62	0.45
l^T	Hours (tradable)	0.0207	0.59	0.65
g	Government consumption	0.0388	1.11	0.55
p^M	Imports price	0.0922	2.64	0.81
p^Z	Imported inputs price	0.1128	3.22	0.64
r	Real interest rate	0.0038	0.11	0.67
r^*	World real interest rate	0.0023	0.07	0.86
s	Country spread	0.0034	0.10	0.66
y^W	World imports	0.0564	1.61	0.54

Table 2
Correlations between macroeconomic variables.

	Contemporaneous correlation with				
	y	p^M	p^Z	r	y^W
y	1.00	−0.35	−0.52	−0.39	0.21
y^{DT}	0.96	−0.53	−0.52	−0.47	0.55
y^N	0.85	−0.47	−0.37	−0.05	0.52
c	0.92	−0.43	−0.48	−0.33	0.24
i	0.82	−0.52	−0.57	−0.42	0.20
x	0.33	0.01	−0.12	−0.40	0.29
m	0.74	−0.75	−0.45	−0.35	0.60
z	0.84	−0.34	−0.47	−0.63	0.45
nx/y	−0.75	0.66	0.50	0.34	−0.21
u^N	n.a.	n.a.	n.a.	n.a.	n.a.
u^T	0.76	−0.12	−0.43	−0.46	0.13
l	0.23	0.02	0.37	0.41	0.43
l^N	−0.05	0.14	0.34	0.30	0.25
l^T	0.44	−0.18	0.04	0.17	0.32

nontradable output is only 57% of the GDP volatility. Nontradable output is more persistent than tradable output. Tradable output follows movements in GDP more closely than nontradable output does. Nevertheless, there is still strong co-movement between sectoral outputs, with a correlation coefficient of 0.73.

GDP is negatively correlated with the price of imported final goods, p^M, as well as with the price of imported intermediate goods, p^Z, while the latter correlation is stronger than the former. There is also negative correlation between GDP and real interest rate, as also documented in Tiryaki (2011), as well as in Neumeyer and Perri (2005). Notice that the negative correlation between real interest rate and GDP is, by and large, due to strong and negative correlation between country spreads and GDP. World interest rate is almost acyclical.

There are two asymmetries between tradable and nontradable sectors. First, output's correlation with the price of imported inputs is higher in the tradable sector; second, and more significantly, output's correlation with real interest rate is −0.47 in the tradable sector and −0.05 in the nontradable sector. A plausible explanation for the first asymmetry is that the tradable sector has a larger share of imported inputs in production (22%) relative to the share of imported inputs in the nontradable sector (4%). The second asymmetry may also be related to the fact that tradable goods are more capital-intensive than nontradable goods are (55% versus 36%). An alternative but not mutually exclusive explanation for the latter asymmetry is that the nontradable sector may be operating with less working capital due to differences in the structure of economic activity. This may be weakening the link between output and the cost of working capital finance.

All aggregate quantities, consumption, investment, exports, imports of both final and intermediate goods, are procyclical; and all are more volatile than GDP. These variables, except exports, are also negatively correlated with both import prices. As a result, the ratio of net exports to GDP is strongly countercyclical as also documented in Tiryaki (2011), and is positively correlated with both import prices and real interest rate. This suggests that simultaneous output drops, interest rate hikes, real exchange rate depreciation, and current account reversals are frequently observed characteristics of Turkish business cycles.

Capacity utilization in the tradable sector is almost as variable as GDP but smaller than tradable output variability. It is strongly procyclical, and also negatively correlated with both imported input price and real interest rate. Hours worked series is significantly smoother than output, and slightly procyclical. Unlike capacity utilization, the correlation of hours with the price of imported input or with the interest rate is positive. However, this is, to a large extent, a reflection of the correlations in the nontradable sector, as it employs relatively larger share of the labour supply. These correlations are much smaller in the tradable sector.