



The effects of total factor productivity and export shocks on a small open economy with unemployment

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ABSTRACT

The paper analyzes the dynamic effects of a supply side shock and a demand side shock, which hit an open economy with unemployment. The supply side shock is modeled as a reduction in total factor productivity, whereas the demand side shock is caused by a drop in exports. The model builds upon the small one-sector two-good open economy framework described in Turnovsky (2000, chapter 11.3). In contrast to this standard framework, in which Walrasian labor markets are assumed, search unemployment and wage bargaining are introduced, and unemployment results from time consuming and costly matching of vacancies with searching agents. Using a plausible calibration of the model, the dynamic adjustments of unemployment, output, and other economic key variables are analyzed. We find that a negative export shock primarily has effects on consumption and welfare, but not on unemployment and output, whereas the supply side shock leads to considerable responses of unemployment, output, consumption and welfare. If both shocks together hit the economy, the changes in consumption and welfare almost double.

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1. Introduction

The 2007–2009 global financial crisis, which many economists view as the worst financial crisis since the one related to the Great Depression in 1930s, started 2007 with the burst of the USA housing bubble which quickly damaged financial institutions globally. The financial crisis escalated in September 2008 and has provoked an unprecedented contraction of economic activity as credit supply fell (“credit crunch”) and international trade declined. Industrial production plummeted in the fourth quarter of 2008 and continued to fall rapidly in the first part of 2009. Global GDP is estimated to have contracted by 6.25% (annualized) in the fourth quarter of 2008 and to have fallen almost as fast in the first quarter of 2009 (see IMF, 2009a, chapter 1). In 2009, output in advanced economies contracted by 3.2% (see IMF, 2010, Table A1).

The global financial crisis affected economies in at least two important ways. First, the financial crisis led to a “credit crunch” and the efficiency of financial intermediation suffered substantially. As the financial system may not be able to allocate loanable funds as productively as before the crisis and high-productivity firms may go under for lack of financing, the efficiency of the production process reduces and total factor productivity (TFP) falls (see IMF, 2009b, chapter 4). This view is supported by several recent studies (see, e.g., Estevão and Severo, 2010; Haugh et al., 2009; Meza and Quintin, 2005; Cole et al., 2005).¹

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¹ However, Petrosky-Nadeau (2010) comes to the opposite conclusion that TFP increases after a financial crisis, because the least productive jobs are destroyed.

Second, the worldwide economic downturn reduced international trade. Whereas the volume of world trade grew by 7.3% and 3% in 2007 and 2008, respectively (see IMF, 2009b, chapter 1), in the half-year encompassing the last quarter of 2008 and the first quarter of 2009 the annualized drop in world imports was more than 30%, with roughly equal declines experienced by advanced and emerging economies (see IMF, 2010, chapter 4). Export oriented countries suffered a collapse of exports by 30% and more.

Another example of a negative total factor productivity shock are earthquake disasters as recently occurred in Japan or Haiti.

An important issue in conjunction with such shocks is how unemployment is affected. This paper focuses on unemployment dynamics in open economies in the aftermath of such a crisis. Aside from unemployment dynamics, we investigate how other key economic variables such as capital, output, and consumption adjust and how economic welfare is affected.

To be able to analyze the dynamics of unemployment, we have to depart from the standard neoclassical approach with a Walrasian labor market, in which, by definition, unemployment does not exist, labor adjusts instantaneously, and the labor market always clears by proper adjustments of the real wage. We therefore augment and modify the standard representative agent model of a one-sector, two-good small open economy of the Turnovsky and Sen (1991) type by introducing search unemployment à la Mortensen and Pissarides² and wage bargaining in a similar way as in the closed economy models of Shi and Wen (1997, 1999) and Heer (2003), where unemployment results from time consuming and costly matching of vacancies with agents who search for a job.

To date, there is little literature on the dynamics of open economies in the presence of search unemployment. Papers employing static trade models with search unemployment include Davidson et al. (1991, 1999). Şener (2001) explores impacts of international trade on wages and unemployment in presence of skilled and unskilled workers and job-matching frictions along a balanced growth path. In a dynamic general equilibrium model of R&D-generated growth, Moore and Ranjan (2005) link sectoral search unemployment with trade theory and analyze the transition dynamics of unemployment and wage inequality in the case of skill based technological change. Azariadis and Pissarides (2007) apply the framework of an overlapping generations model to an open economy to analyze the response of the domestic unemployment rate to total factor productivity shocks. All these models differ substantially from the small open economy framework, and their scope is completely different from the issue analyzed in this paper. With respect to the analytical framework used in the literature so far, one rare exception is Shi (2001), who combines the Turnovsky and Sen (1991) framework and search unemployment to study the effects of a tariff under exogenous and endogenous terms of trade.

Our model differs from Shi (2001) and the closed economy versions of Shi and Wen (1997, 1999) and Heer (2003) in several important aspects. First, the representative agent's utility function is assumed to be non-separable with respect to consumption and leisure, allowing for richer consumption dynamics. Second, we introduce investment adjustment costs, giving rise to a Tobin q theory of investment. This enriches the dynamics and allows us to investigate the time profile of stock prices (the price of capital). Third, we depart from the assumption that the production function is Cobb–Douglas and use the more general constant elasticity of substitution (CES) specification. The reason for doing this is twofold. On the one hand recent empirical findings suggest that the elasticity of substitution is well below unity (see Papageorgiou, 2008; Chirinko, 2008). On the other hand, it allows us to analyze how the economy's transition changes with the degree of production flexibility.

We separately study (i) a negative export shock and (ii) a negative total factor productivity (TFP) shock. Finally, we combine both shocks and study how economic activity is reduced.

The macroeconomic equilibrium we derive is described by a dynamic system involving the interaction between the allocation of labor, the market price of capital, the accumulation of capital, unemployment, and the accumulation of net foreign assets. The complexity of the model requires its dynamics and the steady-state changes to be analyzed using numerical simulations. This allows us to perform a comprehensive sensitivity analysis with respect to structural parameters as the elasticity of substitution in production, the export–GDP ratio and the status of the economy as a creditor or debtor country.

We find that a pure negative export shock has little effect on GDP and unemployment, as the real exchange rate adjusts, but reduces consumption and welfare, and that the major part of adjustment occurs on impact. In contrast, a pure negative TFP shock, impinging on output, leads to considerable short-run unemployment as well as short-run consumption and welfare losses, followed by transitional dynamics, and unemployment shows hysteresis, i.e. it remains on a permanently higher long-run level, whereas long-run output, consumption and welfare are permanently lower. Our findings are in line with recent estimations of output and consumption losses due to the global financial crisis, and our model provides a theoretical underpinning of recent empirical work (e.g., Cerra and Saxena, 2008; Furceri and Mourougane, 2009; IMF, 2009b). Further, our analysis supports the empirical result that countries that suffer a financial crisis have done worse in terms of GDP declines than countries that suffer only a decline in exports.

The remaining part of the paper is structured as follows: Section 2 sets up the dynamic model. The model is calibrated in Section 3, and numerical simulations of the shocks as well as sensitivity analysis are performed. Section 4 summarizes our findings and concludes.

² See Pissarides (2000) for an overview.

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