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Can collapsing business networks explain economic downturns?

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ABSTRACT

In this paper we argue that major economic downturns should be seen as collapses in the client and supplier relations between production entities, i.e., collapses in the trade network. In a model where individual units like firms and workers produce more if they have a larger network, but where they have to break up with existing links within their network in order to upgrade technologically, we find endogenous network cycles. In the upswing part of the cycle, productive units increase their links allowing them to specialise more completely at current technologies, whilst in the downward part of the cycle, some units deliberate down-size in order to upgrade their technology, but this leads to a recession due to the negative externality on trading partners. We argue that network collapse is likely to have been an element of three major downturns (the Great Depression in the US of the 1930s, the collapse of the Russian economy following the reforms in 1990, and the downturn in the Indonesian economy after the Asian crisis in 1997). Simulations show that various features of downturns are replicable with the basic model.

1. Introduction

Can collapsing networks explain the advent and severity of recessions within production function models?[1,2] In this paper we develop a very simple macroeconomic model of the endogenous formation and collapse of business networks, and we present simulations to ascertain whether collapsing networks are at least qualitatively able to fit real world growth cycles.

The main motivation comes from basic economics: if there are no market frictions then workers should only be unemployed if formal employment is not worth the foregone leisure; capital should never be idle as there is a pareto gain from using it; bankruptcies should have no real effects since the idle production factors freed up by bankruptcies should instantaneous be used again by productive agents; debts should have no effect as they do not affect the productivity of production factors; and financial markets in general would have no role as the lack of frictions meant there would be nothing to inter-mediate and coordinate. Hence the large scale unemployment, capacity under-utilisation, importance of financial institutions, and untaken investment opportunities in large recessions by necessity must involve some market friction.

Within the lens of production functions, which is the dominant economic model to describe cycles, this means that we need a production factor to explain business cycles that is related to a market friction related to employment and capacity utilisation. This paper is an exploration of one possible such market friction, i.e. search costs between production factors leading to productive networks that can be destroyed during recessions, to be built up again afterwards.

What case is there for business links to be this missing production factor? Business links have emerged in game theory (Goyal, 2004), financial markets (Gale and Kariv, 2007), and the management literature (Meier and O'Toole, 2007) as an important input into market transactions and the activity of financial and corporate managers. They fit the requirements of Stiglitz (1995) and Summers (1986) of being the market's answer to transaction costs: building links is important in order to procure inputs, sell output, match heterogeneous workers together into productive units, and new links are needed to use new technology and to sell the new products. More than this, the two-sided nature of links makes network collapse a prime candidate for an explanation of the advent and severity of recessions: a link can be broken up unilaterally and yet affect both sides. This negative externality in turn allows for output declines too large to be explained by individual optimisation. Unemployment, bankruptcy, and restructuring would be the empirical consequences of production factors 'left idle' because of the destruction of the links with the factors they were previously connected to.

What characteristics would business links need to have to be able to have collapsing networks explain recessions? Our motivating data is the

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[2] The frontier in current theoretical models is exemplified by Audretsch and Keilbach (2004); Atkeson and Kehoe (2007), Comin and Gertler (2006); Durlauf et al. (2008), Francois and Lloyd-Ellis (2003); Harrison and Weder (2006); Kehoe and Prescott (2007); Ngai and Pissarides (2007); Ranciere et al. (2008), and Smets and Wouters (2007). Whilst none of these use the same formulation as the original Solow-Swan model, nearly all are based on the three production factors of the Solow-Swan model (physical capital, human capital, and technology). The exceptions are Audretsch and Keilbach (2004) and Atkeson and Kehoe (2007) whom we will discuss at length later.

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0264-9993/

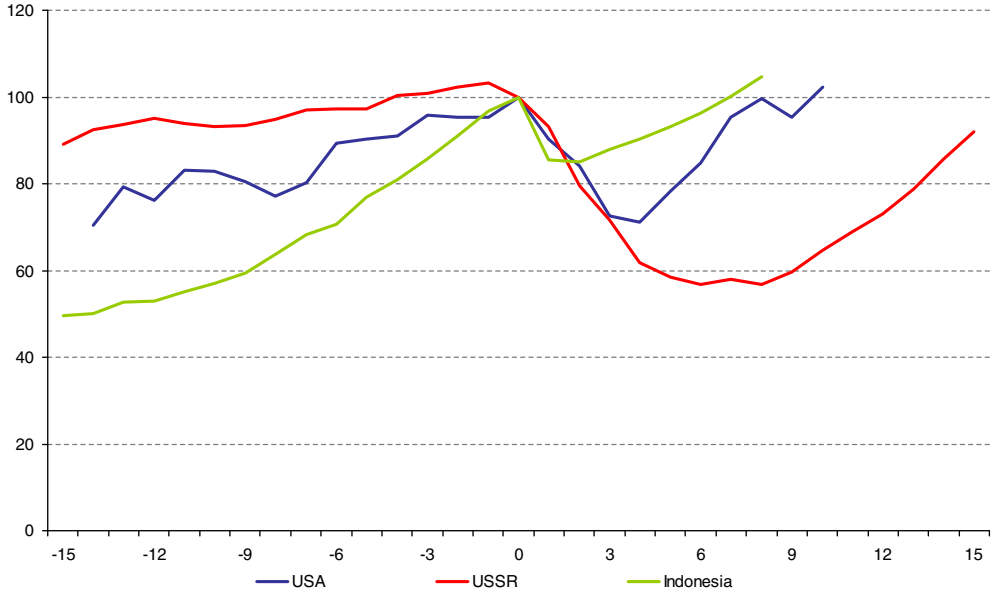

Fig. 1. The real GDP decline of the US in 1929, USSR in 1991 and Indonesia in 1997.

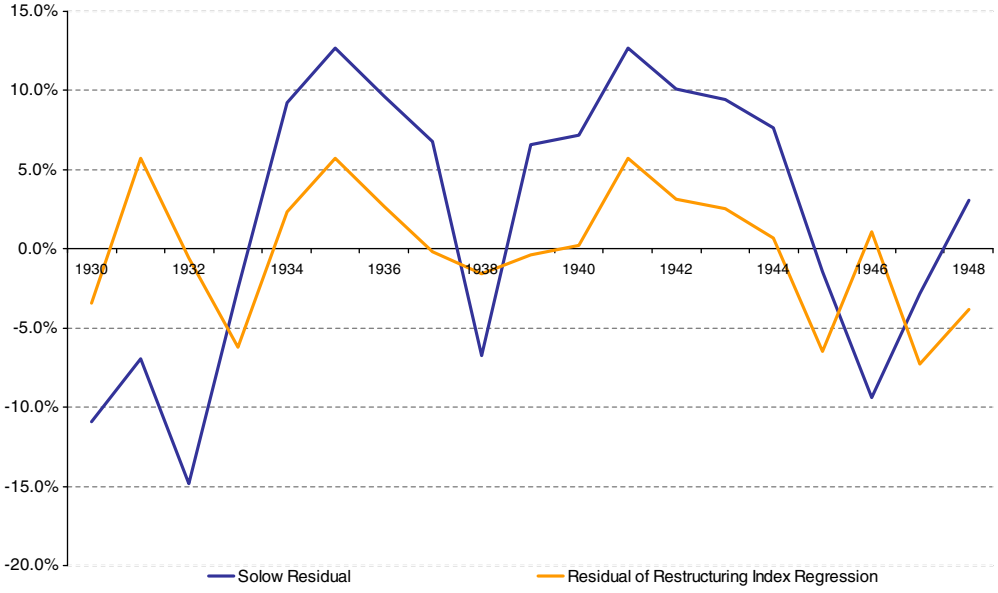

Fig. 2. TFP and Residual Plots for US.

large decline in Total Factor Productivity during large recessions. In Fig. 1 we show three of the largest economic downturns of the 20th century that capture a diversity of times, countries, and economic systems: the Great Depression in the US, the collapse of the Russian economy after the fall of communism, and the downturn in GDP in Indonesia following the Asian financial crisis.[3] This graph shows the 15 years leading up to the downturn and the ensuing period of recovery. The Great Depression, which started in 1929, followed a period of reasonably fast growth. When the recession struck, the US economy took some 4 years to bottom out, at which point GDP had dropped some 30%, involving widespread misery, bankruptcies, and intervention programmes. The Russian Collapse followed a long period of virtual stagnation in the economy, but saw an even more dramatic downturn, with production halving in the space of about 4 years. The eventual recovery took some years to begin and even after 15 years GDP had yet to revisit its pre-downturn level. The Indonesian crisis followed a period of very rapid growth, after which its GDP witnessed the sharpest drop (15% in one year), was fastest to start recovering, but still took about 8 years to reach its former level.

What we know of these recessions is that there was no decline in the stock of Labour, Physical Capital, or Human Capital that fits the sharp initial decline in GDP. Figs. 2 and 3 show the TFP decline (defined as the Solow residuals) for both the US and Indonesia, with a large negative spike in the first year of the recession. These two figures also show a residual curve in which the contribution of negative changes in capacity utilisation and employment has been taken out of TFP. The smaller variance of that residual and the absence of any remaining

[3] Data Sources: the Maddison world tables (for Russia and the US); the Kehoe and Prescott (2007) online data files (for the US); the Indonesian GDP data set of Pierre Van der Eng whom we thank for generous access to his data. The Appendix A details the construction of all data series in this paper, as well as the manipulations underlying Figs. 2 and 3.