1. Introduction

The recent and on-going global financial crisis has stimulated renewed interest in the complex relationship between financial crises and health outcomes. Health care delivery has come under pressure as aid has decreased and budgetary revenues have become stretched; the collapse of enterprise and employment has pressured the capacity for individuals to purchase private insurance, while rising food and fuel prices have increased the vulnerability of the poor ((Lancet (2008)). Yet the relationship between financial crises and health is complicated; it is conditioned by the 'type' of financial crisis, by the prevailing macroeconomic environment and by domestic and international policy responses. The bulk of the existing research has tended to treat financial crises as homogenous and has concentrated on particular countries or regions, typically from the developing or transition world, but it is no less important to search for associations based on cross-national data, which can identify different linkages based on different type of heterogeneity and inform national and supranational policy. Accordingly, using a global database, this paper focuses on estimating the dynamic, short-run impact of different categories of financial shocks on adult working-age mortality.

2. Financial Crises and Health

Two important questions motivate our research: (i) what is the relationship between aggregate financial shocks and population health outcomes? and; (ii) does the type of financial shock itself condition the health-economy relationship?

(i) Economic cycles, shocks and health

Economic downturns impart conflicting health effects. The income effect directly reduces the consumption of privately funded medical care, private insurance and healthy behaviours, while indirectly increasing psychological costs, the likelihood of poor diets, and leading to the over consumption of demerit goods and the lowering of the tax base from which public provision is funded. In contrast, the substitution effect lowers the (opportunity) cost of time dedicated to healthy activities (leisure, meal preparation etc.), decreases the likelihood of work-related and traffic-related accidents, increases the time available to invest in individual and household health (Ruhm (2000)), and reduces job-related stress and the associated over-consumption of alcohol ((Ruhm and Black (2002)).

For the very poor, unfavourable income shocks associated with crises may push food consumption below subsistence levels and, in so doing, impact directly on nutritional and health-related outcomes. Indeed, increases in the incidence of malnutrition have been documented across numerous crisis episodes (Agenor (2002); Shkolnikov and Mesle (1996); Walton and Manuyelan (1998); Waters et al. (2003)). In Peru, the deterioration of publicly provided health services and the consumption of poorer diets resulted in worsening child health in the 1990s (Paxson and Schady (2005)). In Mexico, Cutler et al. (2002) found that the crisis of the late 1980s imposed a heavy burden, especially on the younger and older parts of the population. Following the 1997-8 Asian crisis, Indonesian households, particularly

poorer households, were faced with diminished purchasing power and allocated a smaller percentage of their total budgets to heath care (Waters et al. (2003)).

There are also numerous examples of less direct effects. Reduced incomes, psycho-social factors associated with unemployment, loss of status and uncertainty generated by crisis conditions result in heightened stress levels which could further exacerbate undesirable health outcomes (Cornia and Paniccià (1995); Marmot and Bobak (2000); Shapiro (1995); Shkolnikov et al. (1998); Zoohori et al. (1998)). Stress may additionally be associated with the break-up of social networks, of family dissolution and the need to form new social interactions following a crisis (Rose (2000); Rose and McAllister (1996)). Stress is further associated with promoting unhealthy behaviours, such as increased tobacco or alcohol consumption, which in turn impact on health outcomes relating to cardiovascular disease, deaths from external causes, suicides and homicides.

It has been documented that financial crises are often associated with budgetary pressures and the squeezing of public funds for spending on frontline health services (Lara et al. (1997); Wibulpolpraser (1999); Saltman and Cahn (2013)). The deterioration of the medical system has not been identified as a major cause of mortality change by many, though Cutler and Meara (2001) show that high-tech preventive and curative medical care has played an increasingly important role in determining changes in mortality in the post-World War II period. In contrast, the rapid increase in mortality in Russia was largely driven by the rising incidence of preventable diseases normally associated with deteriorating medical and sanitary services (Shkolnikov and Cornia (2000); Shkolnikov and Mesle (1996)). Similarly, in Indonesia, where total (real) public sector health spending fell by an estimated 9% in 1996-7, and a further 13% in 1997-8, shortages of antibiotics, iron supplements and contraceptive pills emerged in the public sector (Waters et al. (1997)).

The combination of these direct and indirect effects renders the net outcome as one likely to be country specific. However, while findings from across the world are rather indeterminate, some important general patterns begin to emerge. Recessions in developed countries, where the substitution effect appears to dominate, generally lead to better aggregate health outcomes (World Bank (2008)). For example, in the US, economic downturns are associated with improved aggregate health outcomes (Ferreira and Schady (2008); Laporte (2004); Gerdtham and Ruhm (2002); Ruhm (2000)) while in Western Europe, reductions in traffic accidents and lower use of alcohol and tobacco can lower overall mortality (WHO (2009)). Stuckler et al. (2009) found no evidence that all-cause mortality rates increased during European crises, although increases in unemployment were found to be associated with short-term increases in violent deaths, including suicide. Meanwhile, in lower-income and middle-income countries, declining income has more typically been associated with deteriorating health outcomes (Brainerd (1998); Brainerd and Cutler (2005); Cornia and Paniccià (2000); Cutler et al. (2002); Ferreira and Schady (2008); Horton (2009)). In their recent work, Stuckler and Basu (2013), claim that it is not crisis that is bad for your health, but austerity and the public sector response to crisis, but one struggles to understand how the latter may be separated as casual factors from the former.

(ii) Typologies of crisis and health outcomes

Although the impact of economic downturns on health has then been well documented (Schady and Schmitz, 2010) and patterns debated, we know relatively little about the impact on health of different types of financial crisis: currency, banking and debt. Treating economic downturns as homogenous events is surely too blunt an approach.

Currency crises result in devaluations which render imported goods more expensive while changing the cost structures faced by net importers of medical supplies (Walters et al., 2003; Walton and Manuyelan, 1998). Currency devaluation also increases the incentives for domestic producers to export, including food, exacerbating domestic inflation and exposing the vulnerable to heightened health risks.

In turn, debt crises pressure government financed health services (Saltman and Cahn (2013)).

In contrast to other types of crises, since the poor are typically operating around the fringes of the banking sector, we expect the impact of banking crises to be less visible and indirect, through their knock-on effects on inflation, output and the diversion of government funds towards saving failing banks.

3. The Data

Our primary indicators of health are the logarithm of the cumulative probabilities of dying between ages 15 and 60, obtained for the years 1970-2007 from the World Bank's 'World Development Indicators' data.[1] There are three main reasons for focusing on this variable. First, we expect a major crisis-health transmission channel to be centred on the labour market. Second, we expect the lagged effects of economic shocks to impact upon adults, infants and the elderly in distinctive ways. For example, during periods of economic crisis, behavioural changes, as discussed above, may have a negative effect on adult mortality, while also prompting households to postpone childbirth, thus potentially lowering aggregate infant mortality in crisis conditions. Similarly, ceteris paribus, we expect the elderly to be more vulnerable than working age adults and therefore meriting separate analysis. Third, and more pragmatically, we have a larger coverage of data on adult mortality. However, we are aware that infant mortality data may be the most reliable data (Deaton, 2006).

It is also worth explaining briefly why we estimate our model separately for males and females. It is well-known that, despite their inferior self-rated health, females are less likely to die than equivalent-aged males throughout their life (Case and Paxson (2005)). There are a number of explanations for this, but one key factor is important for our work. That is, males with chronic conditions are more likely to die than females with the same chronic conditions. These conditions (including cardiovascular disease, respiratory cancer and emphysema) are normally associated with health behaviours, particularly smoking, that males have subjected themselves to the negative effects of, for more sustained (and intense) periods. We interpret this as evidence that males are ceteris paribus more vulnerable to external shocks, both

[1] United Nations Population Division. World Population Prospects. New York, United Nations, Department of Economic and Social Affairs. Available at http://esa.un.org/wpp/unpp/panel_population.htm.

because they are in less good health but also because their consequent health behaviours may further exacerbate their inferior health conditions.

Data for banking, currency and debt crises is taken from Laeven and Valencia (2008) and has been previously used in other studies that have examined the impact of financial crises on human development (Nikoloski (2011)). When identifying the banking crisis, Laeven and Valencia (2008) build on prior work (Caprio and Klingebiel, 1996, and Caprio, Klingebiel, Laeven, and Noguera, 2005). However, unlike in that work, they exclude banking system distress events that affected isolated banks but were not systemic in nature. As a cross-check on the timing of each crisis, they examine whether the crisis year coincides with deposit runs, the introduction of a deposit freeze or blanket guarantee, or extensive liquidity support or bank interventions. This way, they were able to confirm about two-thirds of the crisis dates. Alternatively, they require that it becomes apparent that the banking system has a large proportion of non-performing loans and that most of its capital has been exhausted. This additional requirement applies to the remainder of crisis dates. Building on the approach in Frankel and Rose (1996), Laeven and Valencia (2008) define a "currency crisis" as a nominal depreciation of the currency of at least 30 per cent that is also at least a 10 per cent increase in the rate of depreciation compared to the year before. They also leave a window period of 5 years in order not to count the same crisis twice. Finally, Laeven and Valencia (2008) identify and date episodes of sovereign debt default and restructuring by relying on information from Beim and Calomiris (2001), World Bank (2002), Sturzenegger and Zettelmeyer (2006), and IMF Staff reports.

Our data on trade openness (sum of import and exports as per cent of GDP), on government spending (as per cent of GDP) and on (log) inflation are also obtained for the years 1970-2007 from the World Bank's 'World Development Indicators' data. We use these as control variables.

4. Empirical strategy

We estimate the following aggregate population health function:

$$Mit = \beta 0 + \beta 1 C0it + \beta 2 Xit + \varepsilon it \qquad (1)$$

In which, the logarithm of the cumulative probability of dying between ages 15 and 60 (M) in country i at time t is regressed on: a set of contemporaneous and lagged financial crisis indicator variables (C) and the vector of control variables (X). In estimating this equation we take into account first, that mortality rates are necessarily state dependent in that they must be a function of their own past values (Gerry 2012) and second, that some explanatory variables are endogenous. In particular, if government expenditure increases in response to economic crisis then the results are likely to positively correlate mortality and government spending. We therefore adopt the 'System GMM' dynamic approach (Bond 2002) in which we estimate

$$Mit = \beta 0 + \beta 1 Mi,t-1 + \beta 2 Cit + \beta 3 Xit + \varepsilon it \qquad (2)$$

using both levels and lagged differences of the endogenous variables as instruments in the difference and level parts of the estimator respectively. We treat GDP per capita, government spending, inflation and trade openness as endogenous; time and regional variables as exogenous; and in instrumenting we use all available lags. To ensure robustness we constrain the number of instruments (Roodman, 2006); confirm that our results are consistent with pooled OLS and fixed effects estimates; and obtain the same results when reducing the number of instruments, adjusting the specification, or estimating across different sub-periods.

5. Empirical evidence

Before progressing to our formal estimates we look at the raw data (Table 1) depicting mortality rates in the year preceding a crisis, the crisis year itself and then in the year after the crisis. For both females and males: where there is no crisis, mortality declines; where there is any type of crisis, the decline between the crisis year and the subsequent year stalls. Indeed, the evidence is broadly in line with our priors: banking crises appear not to disrupt the trend decline in mortality, whereas the occurrence of debt or currency crises is associated with an immediate post-crisis increase in mortality, disrupting the trend decline.

Table 1: Log mortality and financial crises

	Year *t-1*	**Year *t***	**Year *t+1***
No crisis – Female	4.49	4.48	4.46
No crisis – Male	5.19	5.18	5.17
Any crisis – Female	4.55	4.52	4.52
Any crisis – Male	5.36	5.34	5.34
Banking crisis – Female	4.60	4.57	4.56
Banking crisis – Male	5.45	5.44	5.43
Debt crisis – Female	4.77	4.75	4.77
Debt crisis – Male	5.64	5.61	5.62
Currency crisis – Female	4.53	4.49	4.54
Currency crisis – Male	5.35	5.33	5.34

We now turn to our core estimation results, as presented in Tables 2 (male) and 3 (female). In each estimate, we report the number of instruments, the number of countries, the AR(1) and AR(2) p-values and the Hansen test on over-identifying restrictions. Tests on second-order autocorrelation (null: no autocorrelation) and the Hansen test for appropriateness of instruments, based on the male mortality estimates, do not allow us to reject the null hypothesis that our specification and estimates are consistent.

Mortality is shown to be clearly persistent, in the sense that deaths in any given year for a particular country are highly dependent on deaths in the previous year. In fact, the coefficient on the lagged dependent variable is approaching 1, suggesting that our mortality data may be close to a random walk. This confirms that our system-GMM (rather than difference-GMM)

estimation method is appropriate since the past levels, used as instruments in the difference equation, contain limited information about the future, and so difference-GMM performs poorly by comparison with system-GMM.

When estimating the impact of financial crises, our tentative results suggest that, in line with our understanding of how crises operate, it is currency crises in particular that impact negatively (with a lag) on mortality for both males and females. Indeed, currency crises are associated with hikes in prices of traded goods (especially food and medicines), higher inflation and insecurities, giving rise to hazardous behaviours, such as abuse of alcohol and drugs. There is some weak evidence that debt crises impact female mortality, but the impact of banking crises is almost always insignificant. This may be because the poorest and most vulnerable groups are on the fringes of the banking sector, or, in the case of debt crises, may simply be that the effects operate through much less direct channels and the effects are more difficult to detect. We note also that, due to data constraints, there are only 5 debt crises in our data.

According to the World Bank (2008), male and female health responds differently during a period of economic distress. Aside from our contention above that males are more vulnerable to shocks than equivalent females, it is also argued that females experience stress differently and in addition to providing support to unemployed husbands also have to provide for their households. Finally, and also consistent with our hypothesis, their coping mechanisms and responses are slightly different than men's and so they are perhaps less likely to resort to negative health behaviours which perpetuate the effect of the economic crisis.

6. Conclusion

Using an international panel dataset of health and economic indicators, we have explored the impact of economic crises on health outcomes. We forward our results with caution as we are aware of the limitations of cross country studies and the constraints that stem from patchy data coverage, yet we also maintain that this approach can provide important policy insight at the aggregate level as well as stimulating further research on this important topic. We stylise our reading of the key empirical evidence of this paper in the following way - of three distinct types of financial crises, it is currency crises that have a direct short-term impact on the cumulative probability of dying between ages 15 and 60 and that this is particularly the case for males.

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Table 2- Male mortality

Variable	sys GMM	two step sys-GMM	diff-GMM	sys GMM	two step sys-GMM	diff-GMM	sys GMM	two step sys-GMM	diff-GMM
Lagged female mortality (log)	.994*** (.010)	.999*** (.008)	.875*** (.044)	.996*** (.012)	.996*** (.008)	.860*** (.069)	.983*** (.017)	.985*** (.019)	.852*** (.058)
Currency crisis	.015 (.023)	.001 (.016)	.008 (.034)						
Currency crisis (lagged)	.072*** (.026)	.065*** (.015)	.055** (.027)						
Currency crisis (second lag)	.047** (.024)	.023 (.021)	.057* (.031)						
Banking crisis				-.043 (.055)	.017 (.063)	.007 (.102)			
Banking crisis (lagged)				.055 (.056)	.011 (.043)	.009 (.049)			
Banking crisis (second lag)				.045 (.030)	.079** (.030)	.118 (.081)			
Debt crisis							.085 (.172)	.129 (.097)	- .066 (.198)
Debt crisis (lagged)							-.024 (.117)	-.081 (.096)	-.059 (.131)
Debt crisis (second lag)							.150* (.081)	.113 (.097)	.077 (.076)
Number of observations	1722	1722	1568	1722	1722	1568	1722	1722	1568
Number of groups	119	119	119	119	119	119	119	119	119
R squared									
Number of instruments	24	24	13	24	24	13	24	24	13
Hansen test	0.375	0.416		0.243	0.243		0.1	0.1	
AR(1)	0.047	0.044	0	0.06	0.034	0	0.021	0.017	0
AR(2)	0.46	0.404	0.81	0.765	0.318	0.12	0.024	0.15	0.647

Note: all models estimated using robust standard errors. In addition to the variables reported, the control variables included: GDP per capita (PPP), government expenditure, trade openness and inflation. In the case of GMM estimates, all regressors used as instruments for themselves. Furthemore, in system GMM estimates, instruments included dummies for geographic regions (ECA, EAP, LAC, SAR, AFR, MENA) and year dummies. *** significant at 1 percent level of significance, ** significant at 5 percent level of significance, * signficant at 10 percent level of significance.

Table 3 - Female mortality

Variable	sys GMM	two step sys-GMM	diff-GMM	sys GMM	two step sys-GMM	diff-GMM	sys GMM	two step sys-GMM	diff-GMM
Lagged female mortality (log)	1.014*** (.020)	1.014*** (.015)	.735*** (.183)	1.011*** (.020)	1.016*** (.015)	.755*** (.091)	.997*** (.025)	.999*** (.020)	.722*** (.099)
Currency crisis	.050** (.025)	.042** (.021)	.014 (.091)						
Currency crisis (lagged)	.132*** (.004)	.079** (.035)	.088 (.054)						
Currency crisis (second lag)	.022 (.041)	.011 (.028)	.061 (.079)						
Banking crisis				-.130 (.085)	-.029 (.081)	.025 (.100)			
Banking crisis (lagged)				.180* (.106)	.087 (.089)	.031 (.053)			
Banking crisis (second lag)				-.008 (.051)	.021 (.035)	.120 (.088)			
Debt crisis							.114 (.195)	.131 (.116)	- .23 (.255)
Debt crisis (lagged)							.064 (.150)	-.047 (.120)	.100 (.172)
Debt crisis (second lag)							.130 (.097)	.078 (.089)	.183* (.079)
Number of observations	1722	1722	1568	1722	1722	1568	1722	1722	1568
Number of groups	119	119	119	119	119	119	119	119	119
R squared									
Number of instruments	24	24	13	24	24	13	24	24	13
Hansen test	0.191	0.191		0.194	0.194		0.021	0.021	
AR(1)	0.028	0.032	0	0.073	0.04	0	0.025	0.023	0.059
AR(2)	0.198	0.161	0.351	0.194	0.23	0.077	0.014	0.078	0.58

Note: all models estimated using robust standard errors. In addition to the variables reported, the control variables included: GDP per capita (PPP), government expenditure, trade openness and inflation. In the case of GMM estimates, all regressors used as instruments for themselves. Furthemore, in system GMM estimates, instruments included dummies for geographic regions (ECA, EAP, LAC, SAR, AFR, MENA) and year dummies. *** significant at 1 percent level of significance, ** significant at 5 percent level of significance, * signficant at 10 percent level of significance.