

## **The Historical Relation between Banking, Insurance and Economic Growth in Sweden: 1830 to 1998**

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## **The Historical Relation between Banking, Insurance and Economic Growth in Sweden: 1830 to 1998**

### **Abstract**

We examine empirically the dynamic historical relation between banking, insurance economic (income) growth in Sweden using time-series data from 1830 to 1998. We examine long-run historical trends in the data using econometric tests for cointegration and Granger causality. Our results indicate that the development of domestic banking, but not insurance, preceded economic growth in Sweden during the nineteenth century, while Granger causality was reversed in the twentieth century. We also find that the development of bank lending in the nineteenth century increased the demand for insurance as well as promoting economic growth. In later periods, the development of insurance fosters demand for banking services but only in times of economic prosperity. For the entire period of our analysis, we find that banking is the predominant influence on both economic growth and the demand for insurance. In contrast, the insurance market appears to be driven more by the pace of growth in the economy rather than leading economic development. Therefore, we conclude that financial intermediation, particularly banking, is an important prerequisite for stimulating economic growth and argue that our results could have important policy implications for contemporary emerging economies that are developing their financial and legal infrastructures.

JEL Classification: G22

Key Words: Sweden; History; Banking; Insurance; Economic Growth.

## **The Historical Relation between Banking, Insurance and Economic Growth in Sweden: 1830 to 1998**

### **1. Introduction**

In this paper we examine the dynamic historical relation between banking, insurance and economic (income) growth in Sweden using time-series data from 1830 to 1998. We believe that this is a particularly apt topic for research given that banks and insurance companies have historically played an important role in economic development as a result of their financial intermediary activities. For example, economic historians with an interest in both banking (e.g., Nygren, 1983; Jonung, 1992; Hansson and Jonung, 1997) and insurance markets (e.g., Pearson, 1992, 1993; Smith and Stutzer, 1995) have consistently reported that financial intermediation assisted economic development in the early years of mass industrialization in the eighteenth and nineteenth centuries by, amongst other things, mitigating risk and uncertainty, encouraging entrepreneurship, accumulating productive capital, and fostering the development of the national financial infrastructure. Outreville (1990, 1996), Arestis and Demetriades (1997), Adams and Zou (2004) amongst others, argue that, for similar reasons, there is likely to be a strong linkage between banking, insurance and economic growth in today's emerging economies. However, not many previous empirical studies have focused on the role played by financial intermediation (especially insurance) in the historical development of modern economies (e.g., see Sylla, 2002, 2003). Additionally, researchers (e.g., Pagano, 1983; Rousseau and Sylla, 2005; Sylla 2002, 2003) suggest that the conjoint effects of banking and other financial systems (like insurance) in relation to historical patterns of economic growth is not clear from the literature. Therefore, we believe that econometric work on the historical development of the financial services sector and its implications for the wider economy could usefully inform economic historians as well as industry regulators, legislators, and others with a contemporary policy interest in financial services, and its role in international economic development. For example, empirical studies, such as ours, can help to promote a better understanding of how financial

services facilitate risk-taking and entrepreneurship in developing economies. Furthermore, a country-specific approach (such as that adopted in the present study) helps to avoid the potentially confounding effects, such as differences in culture and regulatory environments that can arise in prior cross-country financial services-economic growth-based studies (e.g., see Ward and Zurbruegg, 2000)<sup>1</sup>.

Hansson and Jonung (1997), Wachtel and Rousseau (1995), Rousseau and Wachtel (1998), Ward and Zurbruegg (2000), amongst others, have pointed out that economic growth can be either supply-led as a result of development in financial intermediaries like banks and insurance companies, or alternatively, economic growth can promote the public demand for financial services. In fact, the question of whether the financial services sector preceded or followed economic growth has for a long time been debated in the economic history literature on Scandinavia (e.g., see Sandberg, 1978, 1979; Nygren, 1983; Hansson and Jonung, 1997; Schön, 1988, 1995) and other parts of the world such as the United Kingdom (UK) (e.g., see Pearson, 1992, 1993) and the United States (US) (e.g. see Rousseau and Sylla, 2005). However, in the financial economics literature, where studies have tended to be conducted on a cross-sectional country basis using short time-series data (typically less than 30 years), there is no clear empirical evidence on the direction of the causal relation between the development of banking and insurance markets and economic growth (e.g., see Outreville, 1990, p. 491 and Ward and Zurbruegg, 2000, p. 490). This study thus contributes to the literature by shedding light on the empirical linkage between banking and insurance separately and conjointly on Swedish economic growth over the 159 years from 1830-1998 – a period covering the early years of mass industrialization to the present day<sup>2</sup>.

We contend that Sweden is a potentially interesting domain in which to focus of our study not only because of the country's rich economic archives, but for other reasons too. For example, take the insurance industry: unlike UK and US-based insurance companies, which have invested heavily in equity markets since the 1920s (Scott, 2002), Swedish insurers have (due primarily to regulatory constraints) only

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<sup>1</sup> This attribute does not necessarily mean that our results do not have wider appeal. For example, our results could be generalized to the financial services sector of countries that have experienced a similar economic history and institutional legal-regulatory framework to Sweden – for example, other Scandinavian countries.

<sup>2</sup> Gårdlund (1947) suggests that the early 1830s mark the approximate beginning of Sweden's modern industrialization period. The 1830s also witnessed greater monetary stability (e.g., through the establishment of a silver standard currency) and the formation of the first commercial banks.

been active purchasers of equities since the late 1970s/early 1980s (Lindmark, Andersson and Adams, 2005). Indeed, Waldenström (2002) reports that high taxes on equity transactions during the first half of the twentieth century effectively ‘crowded out’ trading on the Stockholm Stock Exchange. In the post-1945 period, Swedish insurance companies were required by the Insurance Act 1948 to adopt a precautionary asset management strategy and work in partnership with government in the public management of the economy (Lindmark et al., 2005). This situation could have affected the financial intermediation function of insurance in Sweden during much of the twentieth century - for example, in terms of reducing the efficient allocation of capital in the economy, and thus restricting economic growth. Therefore, the historical relation between insurance and economic growth in Sweden could take on a different profile from that of other less regulated insurance markets such as the UK and US. This could potentially provide important insights as to the nature of the empirical relation between financial intermediation and economic growth in environments subject to different levels of regulation, particularly over time.

Our results suggest that banking, but not insurance, was an important prerequisite for stimulating economic growth in Sweden during the nineteenth century. Subsequently, improvements in economic growth increased the public demand for financial services (including insurance) as the economy matured over time. We also find that the development of bank lending in the nineteenth century increased the demand for insurance as well as promoting economic growth. In later periods, we find that the development of insurance fosters demand for banking services but only in times of economic growth. For the entire period of our analysis, we find that banking is the predominant influence on both economic growth and the demand for insurance. In contrast, the insurance market appears to be driven more by the pace of growth in the economy rather than leading economic development. These results have potentially important policymaking implications for State planners, legislators and regulators seeking to develop local financial systems as a prelude to implementing and supporting future strategies for economic development. Clearly, this issue is also important for policymakers in contemporary emerging economies and analysts at international economic organizations such as the Organization for Economic Cooperation and Development (OECD) and the International Monetary Fund (IMF).

The remainder of this paper is organized as follows. Section 2 provides background information on the historical development of the Swedish banking and insurance markets, while section 3 examines the theoretical linkages between banking, insurance and economic growth, and derives six hypotheses to guide empirical testing. Section 4 describes research methodology, including the sources of data, econometric specifications employed and measurement of our variables. Section 5 discusses our empirical results, while section 6 concludes the paper.

## **2. Development of the Swedish Banking and Insurance Markets**

In 2004 there were 22 banks operating in Sweden employing nearly 40,000 people. Total assets at December 2004 were valued at roughly SKr 2,390 billion (US\$ 360 billion) with approximately 86% of new loans being issued by joint-stock companies, 10% by foreign-owned banks and 3% by mutual forms of organization (SCB Statistiska Centralbyrån, 2005). In comparison, the Swedish insurance industry comprises about 440 (life and property-liability) companies. In 2003 these companies generated total annual premiums of approximately SKr144billion (US\$21 billion) (split roughly between life and non-life on a 2:1 ratio) and held assets valued at roughly SKr1607 billion (US\$ 235 billion) (split roughly between life and non-life on a 9:1 ratio). The insurance industry also directly employs nearly 20,000 people in Sweden (Swedish Insurance Federation, 2004). According to Larsson (1991) the national insurance market emerged in Sweden in the second-half of the nineteenth century with the formation of Skandia (a joint-stock composite insurance company established 1855)<sup>3</sup>. Indeed, the growth of the Swedish insurance market in the second half of the nineteenth century is contemporaneous with the development of a national network of private (sometimes mutual) savings banks and commercial joint-stock banks that also performed an important financial intermediation role in promoting rapid industrialization and economic development alongside the Swedish Central Bank (Sveriges Riksbank) (Sandberg, 1978). The second-half of the nineteenth century witnessed other financial developments, such as the increase in savings, rise of commercial credit (including mortgage) facilities by Swedish banks, the emergence

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<sup>3</sup> However, some local fire and marine insurance companies in Sweden can trace their origins back to the eighteenth century. For example, the present day Stockholm Fire Insurance Office (*Brandförsäkringskontor*) was founded in 1746.

of financial markets (like the Swedish bond market) and increased levels of foreign bank trading (Nygren, 1983). The Riksbank played a direct role in the management of the national financial system during the nineteenth century to ensure, amongst other things, adequate liquidity, bank solvency, and control of the national debt and money supply<sup>4</sup>. The Riksbank's central supervisory function was supported through standardized banking rules and regulatory inspections of banks (Jonung, 1992). Insurance company regulations were also introduced in Sweden from the 1880s with the passing of national (solvency-based) insurance laws in 1886 and 1903 (Lindmark et al. 2005). However, in contrast to some other emerging insurance markets of the nineteenth century, for example, Australia and New Zealand, the Swedish government did not directly participate in the domestic insurance market by providing insurance services through a State-owned insurance corporation. Instead, like in the UK, the Swedish government monitored and protected the public interest in the domestic insurance market through a system of insurance legislation and regulations that were primarily designed to protect consumers against corporate insolvency (Larsson, 1991; Lindmark et al., 2005). Therefore, what is according to Browne and Kim (1993) an important determinant of early industrialization and economic growth – a State-owned insurance company – did not exist in Sweden.

Throughout the second half of the nineteenth century the Swedish banking and insurance markets expanded rapidly. For example, the banks increased the volume of credit, particularly with regard to increasing the provision of personal and commercial savings and credit facilities, issuance of mortgages and the financing of equity stakes in new ventures (Nygren, 1983). At the same time, Swedish insurance companies entered new markets in private lines of insurance, such as life insurance, and expanded their business with the wider commercial sector particularly in property insurance lines, like fire and storm damage protection (Bergander, 1967). Additionally, some insurance services in Sweden at the time (and still are) were provided by customer (policyholder)-owned mutual organizations, particularly in fire and life insurance (Hägg, 1998)<sup>5,6</sup>. Like in the Swedish private savings bank sector,

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<sup>4</sup> From 1834 to the outbreak of World War I Sweden adopted a fixed exchange rate pegged to a silver standard (up to 1855) and a gold standard thereafter (e.g., see Gårdlund, 1947; Heckscher, 1954).

<sup>5</sup> Several reasons are given in the literature to explain the preponderance of customer-owned mutual organizations in parts of the financial services sector especially insurance. For example, Pottier and Sommer (1997) report that mutual insurers are likely to emerge where underwriting risks are more predictable (e.g., as a result of advances in actuarial technology) thus obviating the need for them to incur potentially high costs of raising new capital. Pottier and Sommer (1997) also report that by



mutual insurance companies were often established in the nineteenth century (and before) to serve the financial protection needs of local (particularly rural) communities, and in absolute terms, the number of mutual insurers in Sweden soon exceeded that of the national insurers. This industry feature exists today where mutual insurers comprise roughly 70 percent of the total number of insurance companies in the Swedish market (n = 225 companies), but they generate less than 20 percent of annual premiums (Swedish Insurance Federation, 2004). However, in the second-half of the nineteenth century it was the large (city-based) national joint-stock financial services companies, like the Stockholm-based Handelsbank and Skandia companies that came to dominate the Swedish financial services sector and its associated regulatory system, particularly in ways that blunted foreign competition<sup>7</sup>. The growth of an oligopoly market in the Swedish financial services sector at this time also emerged in other European states such as France (e.g., see Hautcoeur, 2004).

World War I created an export-led economic boom for (neutral) Sweden which stimulated development of the financial services sector, including credit, risk management services and insurance, particularly in relation to property investment, commercial and private mortgages and transportation (Hansson and Jonung, 1997). Nevertheless, the post-World War I economic recession led to industry rationalization with some corporate amalgamations and exits from the Swedish market (particularly by foreign financial companies) (e.g., see Larsson, 1991; Jonung, 1992). However, an important feature that characterized the post-World War I financial services sector in Sweden was that compared with financial companies in the UK and US that invested heavily in stock markets (Scott, 2002), Swedish banks and insurance companies held most of their assets in non-liquid assets such as property and low risk securities like government bonds (e.g., see Larsson, 1991). Waldenström (2002) also reports that high investment taxes during this time provided disincentives for Swedish institutional investors (like banks and insurance companies) to invest in equities. Scott

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merging the customer-owner functions mutual organizations can economize on the agency costs incurred in joint-stock companies in maintaining and monitoring the different economic interests of policyholders and shareholders. The ability of insurers to use actuarial technology to control and accurately price assumed risks could help to explain why to date the process of demutualization has not been as common in Sweden's insurance industry compared with its banking sector (see Lindmark et al., 2005).

<sup>6</sup> Mutual forms of organization in Sweden date back to the eighteenth century when community risk-sharing pools were established in cities and rural areas to cover (in the main) fire damage losses and widows and orphans pensions (e.g., see Hägg, 1998).

<sup>7</sup> For example, even today only 28 foreign insurers are licensed to operate in Sweden generating only about 2-3 percent of total annual premiums (Swedish Insurance Federation, 2004).

(2002), for example, suggests that a primary motivation for Anglo-American insurance companies shifting to a more equity-centred investment strategy was to stabilize cash flows through portfolio diversification. Additionally, the relative absence of (bonus-related) participatory rights life insurance policies in Sweden did not provide the same stimulus for domestic financial institutions to actively engage in portfolio management as it did for their counterparts in the UK and US. The upside was that this precautionary investment strategy enabled Swedish banks and insurance companies to survive the extremes of the 1920s stock market crash and the subsequent economic depression of the 1930s (Petersson, 1987; Larsson, 1991; Magnusson, 1997). On the other hand, the lack of equity-based institutional investment in Sweden during the inter-war years could have stifled the pace of development in the economy as a whole. Hautcoeur's (2004) analysis suggests that for similar institutional and regulatory reasons France also experienced a precautionary institutional investment strategy during the inter-war years with adverse consequences for new business development and the pace of economic growth.

The World War II period signalled far-reaching changes in the Swedish financial system particularly in terms of the increased demand for consumer credit and risk management services (Hansson and Jonung, 1997). For instance, in 1948 new insurance regulations were introduced in Sweden to ensure the maintenance of adequate reserving and liquidity levels, and also to direct insurance companies' investments into public sector projects and government-sponsored social welfare schemes. Post-World War II, the Swedish government also sought to stabilize the domestic credit market by controlling bank interest rates and levels of bank lending (Jonung, 1992). However, interest rate caps restricted returns on financial services companies' assets that led increasingly to greater direct institutional investment in the equities of Swedish and foreign companies in the late 1970s/early 1980s. In the 1980s, most of the stringent post-World War II regulations relating to the financial services sector were relaxed thereby enabling Swedish insurance companies to play a greater role in the provision of credit services (e.g., commercial mortgages), social insurance (e.g., pensions and private health care) and direct investment in both domestic and overseas-based companies than had hitherto been the case. In recent years Swedish banks have also formed insurance subsidiaries (bancassurers) to offer insurance products and risk management services to the public thus leading to a

convergence between the banking and insurance sectors of the economy (Lindmark et al., 2005).

### **3. Hypotheses Development**

In this section of the paper we examine the theoretical linkages between banking, insurance and economic growth.

#### **3.1. The Influence of Financial Intermediation on Economic Growth**

##### **3.1.1. Banks**

Several researchers (e.g., Rousseau and Wachtel, 1998; Rousseau and Sylla, 2005; Sylla, 2002, 2003) have emphasized the historical importance of banking market activity to economic growth. For example, Sylla (2003) reports that in the US in the nineteenth century banks (both national and foreign) were actively providing trade credit and venture capital for new business start-ups. Sandberg (1978, p. 666) and Nygren (1983, p. 61) also point out that towards the end of the nineteenth century it was common for Swedish banks to issue loans against the shares of both new start-ups and established companies and to be represented on the boards of publicly listed and non-publicly listed companies. Sylla (2003) reports that banks (like insurance companies) have comparative advantages over other forms of organization in assessing and pricing assumed risks (e.g., credit risk) and diversifying such risks by holding balanced portfolios of investments and having (particularly in the case of banks) joint-stock corporate structures protected by limited liability. Hägg (1994, 1997) contends that a supporting system of property rights law and contractual enforcement are also prerequisites for efficient and effective financial intermediation, and that by the end of the nineteenth century such a legal infrastructure was well developed in Sweden. In addition, Sandberg (1978) reports that during the second-half of the nineteenth century Swedish banks established a network of national branches that enabled them to expand their business activities especially in new industrial areas. A similar pattern of distribution networks further characterized the Swedish insurance industry in the second-half of the nineteenth century (Lindmark et al, 2005). Swedish banks also financed corporate investments by cooperating with each other (e.g., on setting interest rates) and providing large loans on a syndicated basis. The raising of equity for the banking sector was also facilitated by the

Companies Act 1863 that introduced limited liability that provided those Swedish banks that chose to become joint-stock companies to expand and spread their risks (e.g., see Sandberg, 1978, p. 663). The stability of the banking system in Sweden was further underpinned in the 1890s when the Riksbank became more of a modern central bank that acted as ‘lender of the last resort’ and active monitor of domestic financial systems (Nygren, 1983). Sandberg (1978, p. 680) further points out that from the 1870s Sweden’s commercial banking system was by international standards very sophisticated, particularly with regard to encouraging savings and investment in new technology, and that these attributes had a significant positive impact on the rate of economic growth. Indeed, Sylla (2003, p. 447) reports that a growing body of empirical evidence in the financial economics literature (e.g., Wachtel and Rousseau, 1995; Rousseau and Wachtel, 1998) that supports the view that banks directly influence economic growth. Therefore, we hypothesize that:

**H<sub>1</sub>: Other things being equal, the banking market directly influences economic growth.**

### 3.1.2. Insurance Companies

Ward and Zurbruegg (2000) and Kugler and Ofoghui (2005) report that in offering risk transfer, indemnification for unexpectedly large losses and financial intermediary services, insurance markets have had a significant productive impact within economies. For example, insurance can help to promote investment in productive assets by providing surety to investors and other contractual claimants (e.g., banks) that the value of the investment is protected against unanticipated severe losses (such as those arising from fire and flood damage). MacMinn (1987) reports that insurance can provide an important post-loss financing function and mitigate agency problems, such as the underinvestment incentive, that can occur in (particularly highly levered) companies that suffer a large asset-loss<sup>8</sup>. This leads to insurance having positive externalities in terms of employment creation, increased economic activity, and business innovation (technology) and risk-taking. Moreover, in efficient insurance markets, the setting of actuarially fair insurance prices will

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<sup>8</sup> The underinvestment problem arises because under limited liability rules shareholders have (a default put) option that allows them to choose not to reinvest in fixed assets damaged by severe mishap (e.g., due to fire). This is because the economic benefits of reinvestment could be greater for other claimants – for example, debtholders that hold fixed claims over the assets as collateral for loans granted. Insurance resolves this issue by indemnifying shareholders against the cost of asset reinstatement.

compensate for negative externalities such as the moral hazard problems arising from excessive risk-taking as a consequence of insurance (Rothschild and Stiglitz, 1976). Actuarial fair pricing should also help to facilitate the efficient accumulation of productive capital and provide a spur to economic growth (Ward and Zurbruegg, 2000). In Sweden, however, insurance industry regulation has in the past (for example, after the 1948 insurance regulations came into effect) placed limits on the rates of premiums that insurance companies can charge for assumed risks in order to facilitate the achievement of the State's wider social welfare objectives. The regulation of premium rates could therefore lead to the mis-pricing of assumed risks and the inefficient allocation of capital within insurance companies. The trade-off between social welfare benefits of premium controls and the (non-Pareto optimal) efficiency losses generated from State regulation of the Swedish insurance market could have wider macroeconomic ramifications – for example, by reducing funds available for institutional investment and limiting insurance companies' capacity for underwriting future business risks (Greenwald and Stiglitz, 1990). Additionally, Butler, Gardner and Gardner (1998) have shown that in the US, workers' compensation insurance and sickness benefits has had significant moral hazard consequences as a result of increased absenteeism and produced reduced levels of productivity in the economy. These findings could equally apply in Sweden as workers' compensation insurance has been around since 1913 (Larsson, 1991).

Larsson (1991) also notes that in the inter-war years Swedish insurance companies played an important role, in partnership with government in maintaining domestic economic stability through, for example, precautionary investment management and risk assessment, and direct involvement in underwriting public sector projects. Ward and Zurbruegg (2000) add that as major institutional investors, insurance companies not only help the efficient allocation of capital in an economy but also enhance returns on their investments through active monitoring of managerial activities and corporate governance. This reasoning leads us to hypothesize that:

**H<sub>2</sub>: Other things being equal, the insurance market directly influences economic growth.**

### **3.2. The Influence of Economic Growth on Financial Intermediation**

As noted earlier in section 1, the direction of causality between banking, insurance and economic growth can run both ways. That is, financial intermediation may not only facilitate economic growth by providing credit facilities, risk transfer, loss indemnification, and so on, but conversely, it could be the case that economic growth creates the demand for banking and insurance – for example, supplying investment funds and protecting accumulated productive capital against unanticipated losses (Fohlin, 2002). As Hansson and Jonung (1997) point out, both lines of reasoning are plausible theoretically and so empirical analysis is needed to resolve the issue. In the Swedish context, Sandberg (1978) contends that in the early/mid-nineteenth century the domestic system of financial intermediation was relatively more sophisticated than the system of industrial production. Consequently, Sandberg (1978) argues that financial intermediaries like banks and insurance companies stimulated economic growth in the early period of industrialization in Sweden by providing, amongst other things, capital for investment and risk protection services. With regard to insurance, Ward and Zurbruegg (2000) contend that the risk management and financial intermediary benefits of insurance, and their impact on economic growth could persist over time, particularly in relatively long-protected domestic economies such as Sweden. On the other hand, Rousseau and Wachtel (1998) contend that in developed economies financial intermediation may become a relatively less important influence on economic growth as financial markets become more advanced. Wachtel and Rousseau (1995) and Rousseau and Sylla (2005) provide empirical support for this view from their historical analysis of financial systems and economic development in Anglo-American countries. They find that in these economies there was a stronger relation between financial intermediation and economic growth prior to the Great Depression of the 1930s compared with the post-World War II period when financial systems and capital markets became more sophisticated due to, amongst other things, increased global trade and investment.

In the debate concerning the causal linkage between financial intermediation and economic growth, Kindleberger (1982) argues that in the nineteenth century the demand for banking (and indeed, insurance) services in Sweden emerged directly from the rapid industrialization in major urban centres such as Stockholm, Gothenburg, and Malmö. King and Levine (1993) also suggest that economic development (that may be prompted by public as well as private sector investment)

could stimulate the demand for ancillary services such as banking and insurance. The Swedish government has been actively interventionist in the management of the national economy in partnership with the private sector since at least the turn of the twentieth century (Heckscher, 1954; Hansson and Jonung, 1997; Magnusson, 1997). Moreover, Gelderblom and Jonker (2004) observe that to facilitate economic growth the demand for consumer and commercial credit has to be met by a ready supply of funds (savings). In their capacity as financial intermediaries insurance companies can also play an important role in the accumulation and investment of capital in the economy (Ward and Zurbruegg, 2000). Therefore, it is plausible that the growth of banking and insurance services was stimulated by economic growth throughout our period of analysis (1830-1998). That is, the demand for banking and insurance is income elastic. Using Swedish economic data from 1861 to 1910 Fisher and Thurman (1989) in fact find that that the growth of the banking sector was caused by, not the cause of, economic growth. We thus present two alternative test hypotheses:

**H<sub>3</sub>: Other things being equal, economic growth directly influences the banking market.**

**H<sub>4</sub>: Other things being equal, economic growth directly influences the insurance market.**

### **3.3. Conjoint Effects of Banking and Insurance and Economic Growth**

Sylla (2003) reports that financial intermediary systems interact closely in modern economies. This suggests that it is the conjoint effects of banking and insurance that stimulate economic growth. For example, Grace and Rebello (1993) argue that insurance encourages greater corporate bank borrowing by reducing companies' market cost of capital, which in turn influences economic growth by stimulating demand for financial services. Assets-based (property) insurance can also protect the value of collateral underpinning loans granted from losses due to fire, storm damage and so on. This attribute helps to reduce banks' credit risk exposures (and enhance shareholders' returns) and so promote higher levels of lending than would be the case without insurance (e.g., see Zou and Adams, 2006). In addition, banks also use deposit insurance to protect their investments against (systematic) market risks and liquidity crises arising from unexpected severe loss events (Diamond and Dybvig, 1983); in fact, in most developed countries banks have used deposit

insurance to protect against the risk of such losses since at least the early twentieth century (Hooks and Robinson, 2002). This aspect of insurance potentially helps banks to alleviate credit risk, increase corporate and private lending, and invest in potentially high yielding projects thereby stimulating economic development. Consequently, insurance helps to facilitate the supply of bank credit in the economy. Therefore, we hypothesize that:

**H<sub>5</sub>: Other things being equal, the interaction of the banking and insurance markets directly influence economic growth.**

On the other hand, high levels of economic activity can increase the market demand for bank loans to finance corporate growth opportunities and thus drive the demand for assets-based insurance cover. Additionally, the level of activity in an economy can affect the volume of deposits (investment funds) retained by financial intermediaries and thus the degree of institutional investment (Fohlin, 2002). Increases in the value of invested assets can also influence the need for banks to purchase (more) deposit insurance (Hooks and Robinson, 2002). This implies that:

**H<sub>6</sub>: Other things being equal, economic growth directly influences the interaction of banking and insurance markets.**

### 3.4. Other Considerations

To sum up, the direction of the causal relation between banking, insurance and economic growth remains an unresolved empirical issue. For example, using 1961-1996 data for nine OECD countries Ward and Zurbruegg (2000) found mixed results concerning the insurance-economic growth relation. Their causality tests revealed that for some countries (e.g., Canada and Japan) there was evidence that insurance market growth led to growth in the economy at large; for others (e.g., France) the results showed a causal effect from economic growth to insurance market development; and for four countries, including the UK and US, no significant results were produced in either direction. Ward and Zurbruegg (2000) attribute their findings to country-specific factors such as the relative state of regulatory development, the degree of insurance penetration<sup>9</sup> and the cultural propensity to insure versus self-insurance (e.g., through personal savings). Kugler and Ofoghi (2005) also provide mixed results using

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<sup>9</sup> Insurance penetration is defined as the ratio of total annual insurance industry premiums over gross domestic product (GDP) per capita (e.g., see Swiss Re, 2004).



disaggregate (line of insurance) data for the UK's property-liability insurance industry for 1971-2003. Arestis and Demetriades (1997) also report that the strength and direction of the relation between economic growth and financial intermediation could be cointegrated over time as a result of cyclical changes in the pace of human and physical capital development and economic growth, and competition between national and international financial services companies. Furthermore, it is possible that for certain periods within a long historical time series (as is the case in this study) the relation between banking, insurance and economic growth may be stationary and difficult to disentangle (Rousseau and Wachtel, 1998). Indeed, Hautcoeur's (2002) historical analysis of the French life insurance industry (1870-1939) points to stagnation in the insurance-economic growth relation due to such factors as precautionary insurance company investment strategies, managerial inertia, and oligopoly market-induced regulation that promoted the status quo and stifled the pace of product-market innovation and wider economic development. On the other hand, Rousseau and Wachtel (1998) report that for the same period covered by Hautcoeur (2002) Scandinavian insurance markets (like Sweden) commonly used the latest (actuarial) technology, and that this helped them to realize operational efficiencies and increased profitability, which in turn fostered growth in the insurance sector<sup>10</sup>. These issues will therefore be examined empirically in the remainder of this paper.

#### **4. Data and Methodology**

This section describes the research methodology that we employed including the description of the data, econometric specifications and definition of the variables.

##### **4.1. Data**

Our data covers the 159 years 1830-1998 and represents the earliest and latest years for which complete archival data were available at the time the study was carried out. Economic data are the GDP volumes and per capita estimates derived from Krantz (2001), which are based on the Swedish Historical National Accounts series published in Krantz (1986, 1987a, 1987b, 1991), Pettersson (1987), and Schön (1988, 1995). Data on bank loans and mortgages (private and commercial) granted up

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<sup>10</sup> Sweden has had a professional actuarial body since 1904. The role and responsibilities of Swedish actuaries (e.g., in terms of solvency management and financial reporting) has been enshrined in various insurance statutes since the passing of the Insurance Act 1903 (Hägg, 1998).

to 1860 were collected from the Sveriges Riksbank (1931) archive, after which time data were collected from the Swedish Official Statistics (SOS Statistisk Årsbok). Swedish savings banks were first established in the 1830s, but the period up to 1856 is covered by five-yearly benchmarks derived from other Swedish archives (i.e., Finanskomitén, 1863, Table 22). These benchmarks were linearly interpolated with commercial bank loans as a variation index. Thereafter, the loans were collected from the financial services periodical *Statistisk Tidskrift* until 1913, after which time data were obtained from the Swedish Official Statistics Office (SOS Statistisk Årsbok). Swedish mortgage banks were established in the 1840s and the periodical *Sveriges Statistik i sammandrag* provided annual data on bank issued mortgages from 1870 onwards. As the outstanding mortgage value, date of issue and duration (usually 40 years) and interest rate are included in the 1870 records we were able to estimate the annual value of bank mortgages issued by Swedish banks from for the 30 years or so prior to 1870. Data on annual aggregate (non-life and life) insurance premiums for the period 1830 to 1913 were collected from Bergander (1967) supplemented with data derived from Wrede (1882), Grip (1992), the Stockholm Stads Brandkontor (Almquist 1921) and the Allmänna Änke- och Pupillkassans archives<sup>11</sup>. From 1913 onwards all insurance premiums data were collected from the official Swedish insurance industry statistics (SOS Enskilda Försäkringsanstalter), supplemented from 1996 by the Financial Inspectorate (Finansinspektionen) online Swedish business reports

## 4.2. Specification

As in prior studies (e.g., Arestis and Demetriades, 1997; Hansson and Jonung, 1997; Ward and Zurbruegg, 2000; Arestis, Demetriades and Luintel, 2001) we construct a vector autoregressive (VAR) model to test for dynamic interactions (Granger causality) in a  $p$ -dimensional system, defined by:

$$X_t = \Pi_1 X_{t-1} + \Pi_2 X_{t-2} + \dots + \Pi_k X_{t-k} + \Phi D_t + \varepsilon_t \quad [1]$$

where  $X_t$  is a  $p$ -dimensional vector of the time series under study, the  $\Pi$ 's are  $P \times P$  matrices defining the relation between a variable and lags of another. The variable  $D_t$  is a vector of exogenous variables, in our case enabling estimation of

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<sup>11</sup> We aggregate non-life and life annual insurance premiums as risk transfer, indemnification and financial intermediation are functions common to both life and non-life insurance (see also Ward and Zurbruegg, 2000, p. 490).

intercept and trend. The Granger (1969) test for causality between the variables involves a joint F- or  $\chi^2$  - test to examine whether a variable, say  $X_{it}$ , can explain future values of another, say  $X_{j,t+k}$ . In this example, the null hypothesis ( $H_0$ ) of no Granger causality from  $X_{it}$  to  $X_{jt}$  is represented by stating that the (j,i)'th coefficients of the matrices  $\Pi_1, \Pi_2, \dots, \Pi_k$  are all zero. The concept can also be extended to allow for testing if a group of variables Granger causes another group of variables (Johansen, 1988). The most general use of the test in this paper will be to investigate whether two variables are Granger-causing a third variable.

If our time series are stationary, this would be a sufficient methodology and the equation [1] could be used for testing our hypotheses on Granger causality. We can then state our VAR-model in levels and thereby, use our observations directly without any transformation. However, like many statistical procedures, tests of Granger causality become more complicated when the series are non-stationary in a particular sense, namely that they are so called integrated of order d or I(d). In general terms, this means that they can be made stationary by differencing them d times. The reason for these difficulties is that quantities which otherwise follow the well-known t-, F- or  $\chi^2$  distributions take on other distributions which are more complicated to deal with. Sims, Stock and Watson (1990) and subsequently, Toda and Phillips (1993) investigated this problem. The latter authors concluded that the distribution of the test statistic for Granger causality in level VAR's relies on information that is difficult to obtain from the data. There are three main ways of performing the test: first, we can specify a VAR-model in differences and test for Granger causality in changes of the variables. In doing this, we ignore any possible long-run relation that might exist between variables. A second alternative is to use the levels in the way suggested by Toda and Yamamoto (1995). They show that, with a modification of the model selection procedure, a VAR-model in levels can be used to test for Granger causality and the test-statistics will behave as in the stationary case. The modification consists of first choosing the lag-length using some information criterion (in our case we use both the Akaike information criterion (AIC) and the Schwarz Bayesian criterion (SBC)), and then add the maximal possible order of integration,  $d_{\max}$ , to this lag length. The test is then a Wald test where a restriction is imposed on the first  $laglength - d_{\max}$  lags. This is a robust test in that it does not assume a priori

knowledge of the order of integration and cointegration of the process. The third approach, which is applicable when the variables are cointegrated, is to base the Granger causality test on the error correction (ECM) form of [1]. However, Toda and Phillips (1993) study this procedure and conclude that the distribution of the test statistic depends on nuisance parameters that have to be estimated from the data. We therefore choose to work with the robust method proposed by Toda and Yamamoto (1995) even though we loose test power compared with the case when the order of integration and cointegration are assumed known.

Cointegration analysis, however, can yield interesting results in other respects. The special case of cointegration that we are using here means that there exist linear combinations of I(1)-variables that are I(0). In the case when  $r$  such linear combinations exist, the ECM of [1] can be written as:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \Phi D_t + \varepsilon_t \quad [2]$$

where  $\Pi = \sum_{i=1}^k \Pi_i - I$  and  $\Gamma_i = -\sum_{j=i+1}^k \Pi_j$ . Cointegration is present in the system when the matrix  $\Pi$  can be decomposed into the product of two  $p \times r$  matrices  $\alpha$  and  $\beta$  (determining the stationary linear combinations) such that  $\Pi = \alpha\beta'$  (see e.g. Engle and Granger, 1987). Our model now becomes:

$$\Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \Phi D_t + \varepsilon_t \quad [3]$$

Johansen (1991, 1995) provides a unified approach to analyze cointegration within VAR models. Amongst other things, procedures for determination of  $r$  and estimation of the parameters in the model are given, while the elements of the vector  $\beta'X_t$  are the stationary linear combinations, which can be interpreted as in equilibrium. However, in order for cointegration to be revealing, the original variables in the system must be integrated. The stationarity of the variables is therefore investigated by means of the augmented Dickey-Fuller (ADF) test, which uses an autoregressive model, including intercept and trend to accommodate for these features in the data. The regression used in this test is:

$$\Delta x_t = \alpha x_{t-1} + \delta_0 + \delta_1 t + \sum_{k=1}^{p-1} \beta \Delta x_{t-k} + v_t \quad [4]$$

where  $v_t$  is a white noise process and the null hypothesis ( $H_0$ ) of non-stationarity, a so called unit root, is  $\alpha = 0$ . Rejection of the  $H_0$  means that there is statistical evidence that the time series is stationary.

Whether we are using VAR models in levels or differences, we need to predetermine the lag-length before commencing with the analysis (Arestis et al., 2001). Since no particular prior reasoning guides us here we let the AIC and SBC determine the lag length. Roughly, these methods uses the likelihood function (where a large value implies a good model) and penalizes it with a function that increases with the number of parameters. This means that we are weighting the two conflicting goals of having a good fit to the data and having few parameters (the so-called principle of parsimony). The way we are using these information criteria is that we let them give us ideas of the lag length, after which we test, jointly, for autocorrelation in the residual series. The latter is done using a multivariate Lagrange multiplier (LM) test (e.g., see Arestis et al., 2001).

### 4.3. Variables

First, our key variables are defined as follows:

Economic Growth ( $x_t$ ) (ECON): We use the log of annual per capita income growth in the rate of real GDP to measure economic growth.

Bank Credit (BANK): We use data for total (central, commercial and savings) real bank lending to the non-bank public on a per capita basis to represent this variable. The implicit GDP deflator was also used to convert prices to real terms.

Insurance Penetration (INS): This variable is measured as the real annual value of total annual premiums (life and non-life insurance) per capita. In deriving real values, current premiums are again deflated with the implicit GDP deflator.

Furthermore, due to the long time period covered by our study (159 years) we divided the time series into three distinct sub-periods, governed by a combination of historical institutional changes (e.g., regulatory), the need for sufficient period length for analysis and the results derived from the Granger causality tests. The sub-periods of analysis were: the early development period 1830-1888; 1889-1948, including the inter-war/war years up to the insurance regulation of 1948; and the post-World War II period 1949-1998.

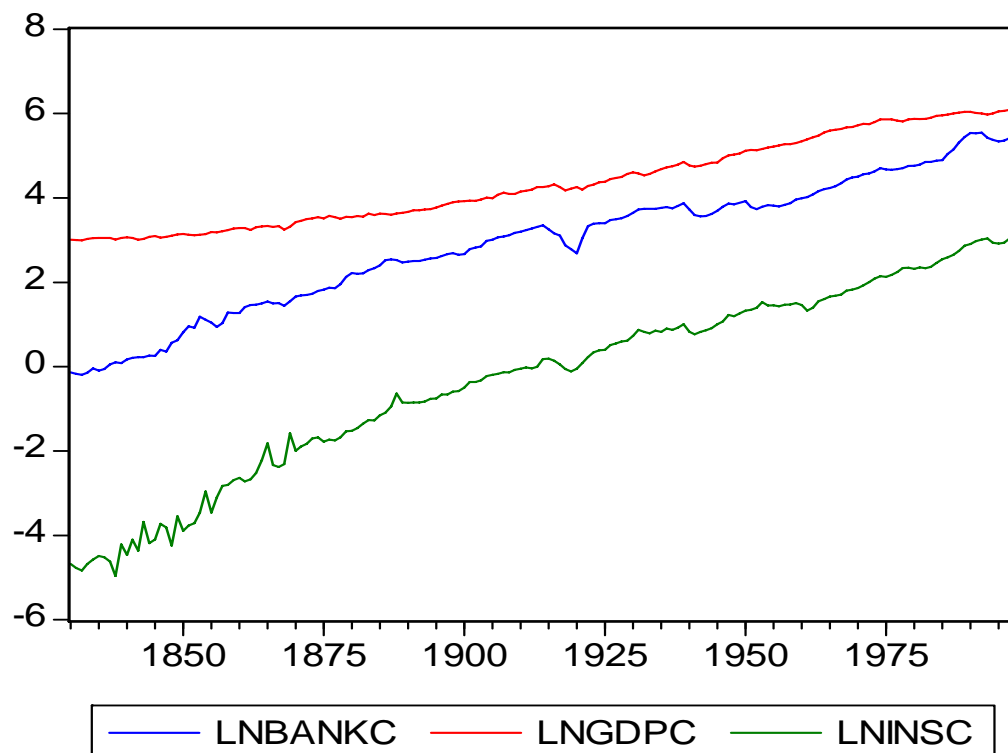
## 5. Empirical Results

In this section of the paper we outline and discuss the empirical results of our study.

### 5.1. Preliminary Tests

As can be seen from Figure 1, there are clearly upward trends in the logarithms of the three variables (ECON, BANK and INS) during the observed historical period, and these have to be accounted for in the analysis in order to get correct inference on the matters that interest us. We thus choose to approximate them by linear trends, which suggest that the three variables are, in some sense, moving together over time. However, whether this is due to a deterministic trend or to cointegration is a question that is formally analyzed below. Furthermore, the question of Granger causality, that is whether events in a variable are systematically preceding events in another, is not easy to get an idea of visually. The issue of Granger causality is therefore examined later in this section of the paper.

**Figure 1: Time plots of the logarithms of the variables BANK, ECON and INS.**



As in prior research (e.g., Ward and Zurbruegg, 2000) we conducted preliminary tests on our historical time series data set to determine the order of integration and lag length. First, we carried out unit root tests on the data to examine for non-stationarity in the historical time series using the augmented Dickey-Fuller test for the full sample (see Table 1). On the basis of the graph above, both the intercept and trend were included in the tests. The SBC was used to determine the lag length. There is no evidence for stationarity of the time series. In the sequel, we assume that all three variables are I(1).

[Insert Table 1 here]

The next step is the lag length determination of ECM VAR-models in levels for the full period. Table 2, which presents the AIC and SBC for lag length determination in VAR models, shows that the criteria give one and three lags respectively.

[Insert Table 2 here]

The null hypothesis is that all autocorrelations and cross autocorrelations of order Lag or less are zero. Accordingly, to the test statistics and p-values of the multivariate LM test of autocorrelation there is no evidence of autocorrelation in VAR (4) model of first differences. The choice was then based on the results of the autocorrelation tests of residuals, reported in table 3, showing the test statistics and p-values of the multivariate LM test of autocorrelation.

[Insert Table 3 here]

Accordingly, the VAR (4) in levels is an appropriate point of departure for further testing of both Granger causality and the long-term relation between the variables.

## **5.2. Granger Causality over the Full Period: 1830-1998**

As causality in the historical time series could be modelled as a VAR (4) in levels, we investigated causality between our key variables using the Granger causality Wald test described in Toda and Yamamoto (1995). Although it is unlikely that the same causality has prevailed throughout the entire time series, we

nevertheless started with a test for the whole historical time period (159 years). Table 4 gives the Granger Causality Wald Test Statistics for the entire historical time series (1830-1998). The tests also include pairwise Granger causality tests among the variables.

[Insert Table 4 here]

From Table 4 (tests 1 and 2) it is evident that for the 159 years of analysis as a whole ECON is only singularly Granger-caused by BANK at the 1% confidence level (2-tail), suggesting that, consistent with  $H_1$ , increased levels of bank credit drives economic development. In addition, BANK is Granger-causing INS (Table 4, test 5 at  $p \leq 0.01$ , 2-tail) with ECON in association with BANK also having a significant influence the growth of insurance markets (Table 4, test 6 at  $p \leq 0.01$ , 2-tail). These observations indicate that the development of the banking sector and economic growth together influence the demand for insurance probably as insurance provides surety for unanticipated asset losses after loans have been granted. Interestingly, this phenomenon has also been reported in contemporary emerging economies such as China (e.g., see Zou and Adams, 2006). However, as Jonung (1992) reports it is important to determine structural shifts in Granger causation in historical time-series data by examining the relation between the variables of interest in different sub-periods within the time series (see section 4.3). We thus conduct and report the results of these tests in 5.3 to 5.5 below.

### **5.3. Granger Causality over the Sub-Period: 1830-1888**

This sub-period covers the early industrialization phase of Sweden's economic development from 1830 to 1888 at which point high levels of claims (particularly in relation to fire damage) led Swedish insurance companies to report substantial losses and increase rates of premiums. It also prompted a wave of restructuring (consolidation) in the Swedish financial services sector and the introduction of new banking and insurance market regulations (Larsson, 1991; Jonung, 1992). The Granger Causality Wald tests covering the sub-period 1830-1888 are exhibited in Table 5.



[Insert Table 5 here]

Table 5 (test 2) suggests that BANK influenced ECON in Sweden in the early period of industrialization ( $p \leq 0.10$ , 2-tail) as predicted by  $H_1$ , while analyzed separately, INS responded positively to both growth in banking and the economy. This finding is consistent with Hansson and Jonung's (1997) historical analysis of the link between banking and financial development in nineteenth century Sweden and suggests that assets-based insurance coverage lagged behind the growth of bank credit in the promotion of economic development in the early years of industrialization and urban growth. The phenomenon of insurance lagging behind bank lending has also been witnessed in contemporary developing markets (such as China) (e.g., see Zou and Adams, 2006) and arises for various reasons. For example, the potential for large short-term investment yields from bank lending in periods of rapid economic growth can often take precedence over careful risk underwriting and loss mitigation. The result of tests 5 and 6 of Table 5 indicate that for the years 1830-1888 the growth of banking services and economic activity Granger-causes a corresponding increase in the demand for insurance (at  $p \leq 0.10$ , 2-tail), suggesting that eventually the risk protection qualities of insurance becomes increasingly important in both bank-based and corporate decision-making as the economy develops and becomes more complex and uncertain. Therefore, it appears that the insurance market initially lagged behind the banking sector in stimulating economic growth but then became more important as it became an integral part of the lending criteria of Swedish banks in the early period of rapid industrialization of the nineteenth century.

#### **5.4. Granger Causality over the Sub-Period: 1889-1948**

This sub-period covers the late nineteenth century industrialization consolidation phase of development through to the turbulent World War I and II period, and the depression years in the inter-war period. The Granger causality statistics are shown in Table 6 and again, the only statistically significant results (both 2-tail) are that BANK is Granger-causing INS (Table 6, test 5,  $p \leq 0.05$ ) and that BANK in association with buoyant economic growth also influences INS (Table 6, test 6,  $p \leq 0.10$ ). These results suggest that demand in the insurance market is dependent on the level of banking activity and the state of the economy during this

period. This result is not surprising as in periods of recession (such as the inter-war years) insurance is likely to be particularly price and income elastic.

[Insert Table 6 here]

Compared with the first sub-period, this phase of Sweden's economic development (despite the existence of a more mature financial system) appears to indicate important changes in the way the economy works. This is because the causal relation between BANK, INS and ECON revealed in tests 2 and 3 of Table 6 (and previously significant at the 10 % level) are now insignificant (contrary to  $H_1$  and  $H_2$ ). This may simply be a reflection of the global economic turmoil during the inter-war years, which makes the sub-period particularly difficult to analyze with certainty. On the other hand, we cannot rule out the possibility that there are important structural changes in the economy as it matures over time as the evidence suggests that the financial services sector at this stage may no longer be a prime mover of national economic growth. There are two main possible (non-mutually exclusive) explanations for this observation. First the insignificant relation between BANK, INS and ECON during this sub-period could be due to regulatory changes affecting the banking and insurance markets. For example, more stringent solvency-based regulations (e.g., the 1903 Insurance Act) could have meant that financial intermediaries had less capital to invest in prospective positive net present value projects and that this had a detrimental effect on economic growth (e.g., see Diamond and Dybvig, 1983). Second, financial intermediaries may also have had to retain high levels of liquid assets (e.g., cash) and strictly ration investment in emerging growth opportunities during the inter-war years because Sweden did not have a large (deep) and active domestic stock market (like the UK and US) (e.g., see Waldenström, 2002). In other words, the lack of active equity trading in Sweden could have contributed to a lack of liquidity in the economy thus stifling the impact of financial services companies on economic growth. Indeed, prior research (e.g., Arestis and Demetriades, 1997; Arestis et al., 2001; Rousseau and Sylla, 2005) suggests that well-developed financial markets are vitally important for efficient and effective financial intermediation and economic development.

### 5.5. Granger Causality over the Sub-Period: 1949-1998

The third sub-period covers the high economic growth years after World War II up to the present day. The Granger causality results are presented in Table 7.

[Insert Table 7 here]

Table 7, test 5 shows that BANK continues to influence INS ( $p \leq 0.05$ , 2-tail), and that the demand for insurance is also influenced by the combined effect of BANK and ECON, as reported in Table 7, test 6 ( $p \leq 0.01$ , 2-tail). Thus, there has been a reversion in the causal relation between banking in growth, from the nineteenth century when banking was causing economic growth, to a situation now where bank services appear to be demand driven through changes in average levels of per capita income. While INS does not Granger-cause BANK (Table 7, test 8), it does significantly influence BANK together with ECON (Table 7, test 9) at the 1% level of confidence (2-tail). This result suggests that during the turbulent post-World War II period the insurance market played an increasing important role in the Swedish economy in terms of its role in alleviating bank-related credit risks through loan protection and deposit insurance. Table 7, test 5, however, suggests that within the financial sector, it is banking that is in the main driving the growth in insurance ( $p \leq 0.05$ , 2-tail). That is, post-World War II growth in the demand for banking products, such as mortgages (e.g., to finance private home ownership) and other loan-based products has simultaneously increased the public demand for assets-based insurance protection such as property and life insurance. Since the early 1970s many Scandinavian financial services companies began to sell insurance products with significant savings components (e.g., investment-linked life insurance and pensions) (Lindmark et al., 2005). In addition, as a result of regulatory changes many banks began to offer their customers insurance products either directly through bancassurance subsidiaries or through partnerships with established insurance companies (e.g., see Knutsen, 1999)<sup>12</sup>. Therefore, product-market shifts and

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<sup>12</sup> Ward and Zurbrugg (2000) note that in some European insurance markets (e.g., France) major changes in the regulatory environment (e.g., due to EU harmonization requirements) and a movement away from State provision in health and life insurance could cause changes in the economic growth-relation. We therefore split our post World War II sample into two further sub-periods covering the

regulatory changes (deregulation) can help to explain the conjoint relation between ECON, INS and BANK during this latest period of analysis. Ward and Zurbruegg (2000) also note that short and long run dynamics in the insurance-economic growth relation could be explained by the degree of insurance penetration (i.e., the proportion of premiums written per capita) in a country. Swiss Re (2004) reports that amongst European countries Sweden is currently ranked twelfth in terms of aggregate insurance penetration and that the rate of change in insurance penetration has remained relatively stable since the end of World War II. This suggests that in Sweden the consumer demand for insurance is potentially buoyant particularly in periods of real economic growth and that structural economic shifts influence the economic growth-insurance relation. In fact, over the period 1961 to 1996 Ward and Zurbruegg (2000) find statistically significant Granger-causation between economic growth and insurance in European countries such as Italy that have relatively low levels of insurance penetration, while countries like the UK that have high insurance penetration do not exhibit such a causal relation. Now that Granger causality of the levels is studied we turn to the question what this relationship might look like in the long run.

### **5.6. The Long-Run Relation**

The long-run relation in the historical time series 1830-1998 can be further tested using the Johansen (1992) Cointegration Rank Trace Test. In this test, the cointegrating equations are assumed to have an intercept, but not a trend; we find three lagged first differences and so the  $H_0$  that the number of cointegrated equations is larger than  $r$  can be rejected. The results are presented in table 8 below.

[Insert Table 8 here]

In table 8, we find that the three variables are cointegrated over the full period and that one statistically significant long-run relation is reported at the 5% level (2-tail). We interpret this result as indicating that economic growth and financial intermediation through banking and insurance markets follows a common path. The interdependency between the variables indicates that the financial services sector in

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years before and after the mid-1960s when changes in consumer preferences for investment insurance products first emerged in Sweden (e.g., Larsson, 1991). However, this procedure did not change the Granger causality and so in the interests of brevity the results are not reported here.

Sweden is closely related to economic growth and *vice versa*. Turning the estimated cointegrating equation, based on an ECM-VAR model assuming three lags of the differences, we find further support for the interaction between the variables of interest. Table 9 gives the estimated cointegrating vector equations based on the ECM model (which assumes three lags of differences).

[Insert Table 9 here]

The coefficients reported in Table 9 are defining the cointegrating vector, where *INS* is the normalizing variable. From the results, the stationary relation between the variables can be written as:  $-3.39 + BANK - 0.76INS + 0. + 0.04ECON$  where the coefficients can be interpreted as reflecting an equilibrium relation between the variables. To check the model, a joint test of autocorrelation was carried out and the results are reported in Table 10.

[Insert Table 10 here]

Table 10 presents the test statistics and p-values of the multivariate LM test of autocorrelation, calculated with a small sample correction. The  $H_0$  is that all autocorrelations and cross autocorrelations of order lag or less are zero such that no significant autocorrelation remains in residuals. On basis of the results reported in Table 10 we therefore conclude that a long-run stationary relation between financial services and economic growth exists in our historical time series.

## 7. Conclusions

Our study examines empirically the dynamic historical relation between banking, insurance and economic growth and insurance in Sweden using a unique time-series data set for the period 1830 to 1998. The period of analysis covers the early years of mass industrialization to the present day and focuses on the overall time-series and three major sub-periods for which sufficient observations were available in order for us to conduct analysis. Our study advances the literature regarding the importance of financial intermediation and economic growth by focusing on a single country – Sweden. This enables us to control for potentially

confounding effects that can arise in cross-section country studies due to such factors as differences in regulatory history and patterns of economic development.

Our results indicate that the development of banking, but not insurance, preceded economic growth in Sweden during the nineteenth century, while Granger causality was reversed in the twentieth century. We also find that the development of bank lending in the nineteenth century increased the demand for insurance as well as promoting economic growth. In later periods, the development of insurance fosters demand for banking services but only in times of economic prosperity. For the entire period of our analysis, we find that banking is the predominant influence on both economic growth and the demand for insurance. In contrast, the insurance market appears to be driven more by the pace of growth in the economy rather than leading economic development. Therefore, we conclude that financial intermediation, particularly banking, is an important prerequisite for stimulating economic development and argue that our results could have important policy implications for contemporary emerging economies (such as China) that are developing their financial and legal infrastructures. We believe that our study provides a basis for further time-series econometric research of the historical and contemporary role of banking and insurance in economic development in other jurisdictions.

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**Table 1: Augmented Dickey-Fuller Test Statistics 1830-1998**

This table presents the Augmented Dickey-Fuller test (tau) statistics for stationarity in the historical time series (1830-1998).

<b>Variable</b>	<b>Tau</b>	<b>p-value</b>	<b>Lags used</b>
ECON	-2.552	0.303	0
INS	-2.002	0.595	2
BANK	-2.718	0.231	1

Notes:

1. ECON is the log of annual per capita growth in the rate of real GDP to measure economic growth; INS is the real annual value of total annual premiums (life and non-life insurance) per capita; BANK is the total (central, commercial and savings) real bank lending to the non-bank public on a per capita basis.
2. p-values are not significant at conventional levels ( $p \leq 0.10$  or less) indicating non-stationarity in the historical time series.

**Table 2: Lag length determination of VAR-model in levels 1830-1998**

This table presents the Akaike and Schwarz Bayesian criteria for lag length determination in VAR-models for the historical time series (1830-1998).

<b>p</b>	<b>AIC</b>	<b>SBC</b>
1	-7.160	-6.937
2	-7.352	<b>-6.959</b>
3	-7.395	-6.832
4	<b>-7.424</b>	-6.690
5	-7.361	-6.454

**Table 3: Joint test of autocorrelation in the VAR (4)-model in levels**

The table presents the test statistics and p-values of the multivariate LM test of autocorrelation. The null hypothesis is that all autocorrelations and cross autocorrelations of order Lag or less are zero.

<b>Lag</b>	<b>Test statistic</b>	<b>p-value</b>
12	6.936	0.644
24	4.158	0.901
36	3.586	0.937

**Table 4: Granger Causality Wald Test Statistics 1830-1998**

This table shows the Granger Causality Wald Test Statistics for the entire historical time series (1830-1998). The tests also include pair-wise Granger causality tests among the variables.

Test	Test statistic	df	p-value
1. INS=> ECON	4.158	4	0.385
2. BANK=> ECON	13.131	4	0.011***
3. INS, BANK=> ECON	17.480	8	0.026**
4. ECON=>INS	8.180	4	0.085*
5. BANK=>INS	33.118	4	0.000***
6. BANK, ECON=>INS	38.580	8	0.000***
7. ECON=>BANK	3.480	4	0.481
8. INS=>BANK	8.155	4	0.086*
9. INS, ECON=>BANK	11.402	8	0.180

Note:  $X^2$  critical values are at the 0.10 level. Wald test statistics marked \* are statistically significant at  $p \leq 0.10$ , \*\*  $p \leq 0.05$  and \*\*\*  $p \leq 0.01$  or less (2-tail).

**Table 5: Granger Causality Wald Test Statistics 1830-1888**

This table shows the Granger Causality Wald Test Statistics for the entire historical time series (1830-1888). The tests also include pair-wise Granger causality tests among the key variables.

Test	Test statistic	df	p-value
1. INS=> ECON	5.411	4	0.248
2. BANK=> ECON	9.184	4	0.057*
3. INS, BANK=> ECON	13.484	8	0.096*
4. ECON=>INS	9.293	4	0.054**
5. BANK=>INS	8.057	4	0.090*
6. BANK, ECON=>INS	14.686	8	0.066*
7. ECON=>BANK	0.519	4	0.972
8. INS=>BANK	5.105	4	0.277
9. INS, ECON=>BANK	6.104	8	0.636

Note:  $X^2$  critical values are at the 0.10 level. Wald test statistics marked \* are statistically significant at  $p \leq 0.10$ , \*\*  $p \leq 0.05$  and \*\*\*  $p \leq 0.01$  or less (2-tail).

**Table 6: Granger Causality Wald Test Statistics 1889-1948.**

This table shows the Granger Causality Wald Test Statistics for the entire historical time series (1889-1948). The tests also include pair-wise Granger causality tests among the variables.

Test	Test statistic	df	p-value
1. INS=> ECON	0.668	4	0.955
2. BANK=> ECON	3.910	4	0.419
3. INS, BANK=> ECON	6.348	8	0.601
4. ECON=>INS	4.526	4	0.340
5. BANK=>INS	9.958	4	0.041**
6. BANK, ECON=>INS	14.486	8	0.070*
7. ECON=>BANK	4.415	4	0.353
8. INS=>BANK	3.613	4	0.461
9. INS, ECON=>BANK	7.153	8	0.520

Note:  $X^2$  critical values are at the 0.10 level. Wald test statistics marked \* are statistically significant at  $p \leq 0.10$ , \*\*  $p \leq 0.05$  and \*\*\*  $p \leq 0.01$  or less (all 2-tail).

**Table 7: Granger Causality Wald Test Statistics 1949-1998**

This table shows the Granger Causality Wald Test Statistics for the entire historical time series (1889-1948). The tests also include pair-wise Granger causality tests among the variables.

Test	Test statistic	df	p-value
1. INS=> ECON	7.347	4	0.119
2. BANK=> ECON	9.440	4	0.510
3. INS, BANK=> ECON	14.623	8	0.067*
4. ECON=>INS	6.561	4	0.161
5. BANK=>INS	9.401	4	0.052**
6. BANK, ECON=>INS	19.319	8	0.013***
7. ECON=>BANK	15.913	4	0.003***
8. INS=>BANK	4.129	4	0.389
9. INS, ECON=>BANK	20.168	8	0.010***

Note:  $X^2$  critical values are at the 0.10 level. Wald test statistics marked \* are statistically significant at  $p \leq 0.10$ , \*\*  $p \leq 0.05$  and \*\*\*  $p \leq 0.01$  or less (all 2-tail).

**Table 8: Johansen's Cointegration Rank Trace Test Statistics 1830-1998**

This table shows the results of the Johansen Cointegration Rank Trace Test in the entire historical time series (1830-1998). The cointegrating equations are assumed to have an intercept but not a trend and the number of lagged first differences in the ECM was three. The alternative hypothesis is that the number of cointegrating equations is larger than  $r$ .

Rank at most	Trace statistic	p-value
$r=0$	30.196	0.045**
$r=1$	9.745	0.301
$r=2$	0.392	0.532

Note: t-values marked \*\* are statistically significant at  $p \leq 0.05$  (2-tail).

**Table 9: Estimated Cointegrating Vector from the ECM-VAR (4) Model**

This table shows the estimated cointegrating equation, based on a ECM model assuming three lags of the differences.

Variable	Coefficient	t-value
Constant	-3.328	0.000***
BANK	1.000	0.000***
INS	-0.761	-14.937
ECON	0.042	0.391

Note: t-values marked \*\*\* are statistically significant at  $p \leq 0.01$  (2-tail).

**Table 10: Joint Test of Autocorrelation in the ECM-VAR (4) Model**

The table presents the test statistics and p-values of the multivariate LM test of autocorrelation, calculated with a small sample correction. The null hypothesis is that all autocorrelations and cross autocorrelations of order lag or less are zero.

Lag	Test statistic	p-value
12	9.572	0.386
24	4.988	0.835
36	3.547	0.939